Essays on the Econometric Analysis of Electronic Banking in Greece

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Declaration

‘Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.’

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Abstract

Economic integration within and across countries, deregulation, advances in telecommunications and the growth of the Internet and other communication technologies have dramatically changed the nature and structure of financial services (Claessens et al., 2003).

This study examines the adoption of electronic banking (e-banking) services offered by commercial banks in Greece. This is the first empirical investigation on the adoption of e-banking using a logit econometric model which contains a set of new independent variables such as high branch fees, branch dissatisfaction and access to banks' web pages. The findings are as follows: (i) Greek male customers are less likely to adopt e-banking while the opposite is true for young customers, (ii) higher education and income both have a positive impact on the adoption of e-banking in Greece, and (iii) homeowners are less likely to perform complex transactions, and hence they are less likely to adopt e-banking in Greece. Other variables such as the access to banks' web pages, the branch dissatisfaction as well as the high branch fees do not show any impact on customer's probability of adopting e-banking services. It is concluded that Greek customers prefer most the traditional banking because they worry about possible high electronic risk that comes with the foray into e-banking.

Moreover, we examine the economic performance of Greek 'click and mortar' banks in relation to the adoption of Internet banking services using econometric models (Logit, OLS and GLS).We report that 'click and mortar' banks in Greece overall have higher profits, but when technology-based scale and technology-based experience effects are considered these banks exhibit lower profitability. This could be attributed to the higher overhead expenses that these banks may suffer, due to the heavy investments in IT.

We also study the effect of Automated Teller Machines (ATMs), Information Technology (IT) investments and other determinants on the efficiency and profitability of Greek commercial banks. We find that profitability (Return on Average Assets, and Return on Average Equity), ATMs and capitalisation show a negative impact on the efficiency of Greek banks. We also report that banks' size, capitalisation, IT investments and ATMs do not have any effect on the ROAA or the ROAE but they have a positive effect on the fees and commissions. However, we find that ATMs have a negative effect on the net interest income.

Finally, we assess the effect of ATMs on the competitive and equilibrium conditions of the Greek banking system using the Panzar Rosse model. Our results reveal that the Greek banking system is in equilibrium and is operating under perfect monopolistic conditions, while we find no significant relationship between the investment in ATMs and revenues or profit.

Our results provide recommendations to the Greek bank managers and help customers in improving relationships with new technologies and services. We report that Greek banks can attract their customers to electronic services if they design their marketing offers or value propositions according to the needs of these groups.

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Abbreviations

AE- Allocative efficiency

ATM – Automated Teller Machine

CRS- Constant Returns to Scale

DEA- Data envelopment analysis

DMUs- Decision making units

E-banking – Electronic banking

ECB – European Central Bank

EMU- European Monetary Union

OTE- Overall Technical efficiency

ROA- Return on assets

ROAA- Return on average assets

ROE- Return on equity

ROAE- Return on average equity

SE- Scale Efficiency

SFA- Stochastic Frontier Analysis

TE- Technical efficiency

VRS- Variable Returns to Scale

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Articles published

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Chapter 1

Introduction

1.1 The rationale and importance of this research

The banking sector has been substantially influenced by the development of the Internet (Flavian et al., 2006). Nowadays, banks offer their products and services electronically apart from within branch banking, as the banking industry is constantly responding to customers' needs and preferences. Customers are now able to perform various banking transactions quicker and easier after closing time, through the Automated Teller Machines (ATMs), the mobile, telephone and Internet banking. With the developments made in the Electronic Finance (E-Finance) sector, Internet banking is gaining ground day by day and is expected to grow in future years, even though the penetration rate of Internet banking is low in comparison to other E-finance services (Banks, 2001). The popularity of electronic banking (e-banking) can be attributed to all the advantages that it is offering to both banks and customers, like convenience and ease of use combined with low fees. Banks are able to reduce any excessive personnel and branching costs, by offering services at lower cost, and increase their profits through IT systems. A secure and profitable banking sector is better able to survive negative shocks and contribute to the stability of the financial system (Athanasoglou et al., 2008).

There are a limited number of studies that examine the adoption of e-banking in relation to banking performance and efficiency in Greece. This study examines the adoption of e-banking services in Greece and the impact of banks' IT investments on their performance and profitability, using recent econometric models. To the best of our knowledge, this is the first PhD thesis on the adoption of e-banking and performance of Greek banks.

1.2 Research context and Questions

The past decades have witnessed a string of regulatory changes, mergers and technological advances that have all re-shaped Europe's banking markets (Bos and Schmiedel, 2007). In particular, the Greek banking system has experienced the establishment of the single EU market, the internationalisation of competition, as well as the deregulation and the liberalisation of the interest rates. Greece had to adopt macroeconomic and structural policies after joining the Economic Monetary Union (EMU), which led to reductions in inflation and interest rates (Tsionas et al., 2003). Furthermore, several Greek banks were involved in mergers and acquisitions, which allowed them to have easier access to international money and capital markets (Pasiouras and Zopounidis, 2008). Moreover, since the post-Olympics period (2004) there was significant growth in communication and banking technologies, as Greek banks have invested heavily in electronic distribution channels, such as ATMs, mobile and Internet banking, and this has lead to major improvements in the services they are offering to their customers as well as to their profitability.

The aim of this study is to assess the impact of the investment in IT and ATMs on the performance and efficiency of Greek banks. We therefore need to examine the factors that affect e-banking adoption by customers and the performance of banks that offer electronic services.

We hypothesise that branch banking fees will have a positive effect on the adoption of e-banking services, since Internet banking services are offered at a fraction of branch fees. We also hypothesise that access to banks' web pages will influence positively customers' adoption rates and if customers are not satisfied with the services they receive in physical branches then they might decide to adopt e-banking. We also believe that investments in IT and ATMs will have a positive impact on the adoption, the performance and profitability of Greek banks. To this end, we address the following research questions (RQ):

- RQ1) Are Internet banking fees lower that branch banking fees and ATM fees in Greece?
- RQ2) What is the effect of branch fees, access to banks' web pages and branch dissatisfaction on the e-banking and Internet banking adoption?
- RQ3) Is there a positive relationship between the adoption of Internet banking and the performance of Greek banks?
- RQ4) Do Greek banks exhibit technology-based scale and experience effects?

- RQ5) Is there a significant change in the performance of Greek banks with the adoption of electronic services?
- RQ6) What is the impact of IT investments and ATMs on the efficiency and profitability of Greek banks?
- RQ7) What is the effect of ATMs on the competitive and equilibrium conditions that exist in the Greek banking system during the period 2004-2009?

1.3 Methodological Approach

The research strategies that are available to researchers are distinguished between quantitative and qualitative research strategies (Bryman, 2008). Quantitative and qualitative research differ with respect to their epistemological foundations, which can be identified as the 'positivism' and 'interpretivism' paradigms. ''*Positivism' is an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond'* (Bryman, 2008). The main assumptions made in the 'positivism' position is that objective knowledge that is confirmed by direct observation can only be justified as knowledge available to science and science is based on quantitative data that is collected under strict rules and procedures. Hypotheses can then be formulated and tested in order to provide explanations to theories under consideration (Robson, 2002). The alternative position to 'positivism' is 'interpretivism', where the social scientists need to grasp the subjective meaning of social action (Bryman and Bell, 2003). 'Interpretivism' is associated with qualitative research such as interviews or examination of case studies and emphasises words rather than quantification in the collection and analysis of data. The scientist then can derive results that can formulate theories (Bryman, 2008). This thesis is associated with 'positivism' rather than the 'interpretivism' paradigm and consequently adopts the quantitative research methodology.

1.4 Theory of Internet Economics

Internet economics studies the market for Internet services and considers key ideas such as competitive equilibrium, utility, demand, supply, monopolistic pricing, internet commerce and externalities (McKnight and Bailey, 1997). Internet growth occurs in three dimensions: the amount of traffic, the number of users, and the number of applications. Recent

developments in networking and computer technology allow for faster and lower-costs in inputs that drive the system (Bailey, 1997).

Technological advances are rapidly blurring traditional industry boundaries and foster competition between firms that were not competing with one another (Gong and Srinagesh, 1997). Major Internet Service providers (ISPs) are expected to lease their infrastructures to smaller firms. The large providers will have sunk costs since they would need to pay a minimum amount for a fixed period to their carriers. Hence, competition will appear as an increase in the number of contracts and carriers that operate within the industry. In terms of profitability, the carrier might consider expanding into new areas of business, in competition with other carriers, in order to maximise their profits (Anania and Solomon, 1997). Internet Economics also considers the pricing of Internet services. Pricing the Internet allows users to select services and they can pay according to the service they are receiving. We focus on the consumers' preferences, where two different notions of efficiency can be applied, network efficiency, which refers to the utilisation of network resources and economic efficiency, which refers to the valuations users attach to their network service (MacKie-Mason et al., 1997).

Another aspect of Internet Economics is externalities. This category of goods falls between pure private and pure public goods. The unintended spillover of any good is called an externality. In the case the spillover is positive, then there are significant benefits; otherwise, if the spillover is negative, then a negative externality exists, which is a cost to society (Hallgren and Mc Adams, 1997). It is further added, that the basic principle for efficient pricing, is that the price should be equal to the marginal costs (the cost of providing the good to the next user) (Hallgren and McAdams, 1997).

Internet Economics also studies the economics of congestion; this implies that the network is experiencing degradation. Once congestion occurs, a decision point has been reached, where decision-makers might choose to transform the private good externality into that of a public good or they might impose a constraint, in order to make this resource 'excludable'. Hence, enough users would need to be excluded for the network to tackle congestion. Moreover, this is considered to be a process of introducing one characteristic of a private good (excludability) in exchange for removing depletability. This process is called the creation of an 'impeded public good'. The advantage of this transformation is that a true public good has been re-established, its capabilities have been enhanced and it can be efficiently priced at zero, through asymmetric pricing (Hallgren and McAdams, 1997).

1.5 Theory of Electronic banking

E-banking is an innovative product that banking institutions offer all over the world with superior benefits for the customers. In other words, an (e-banking) innovation is '*an idea, practice, or object that is perceived as new by an individual or other unit of adoption*'(for more information see Rogers, 2003; Dewey, 1910 ; and Zeithalm and Bitner, 2003).

E-banking is an umbrella term for the process by which customers can conduct various banking transactions 24 hours a day, 7 days a week electronically without the need to visit a 'brick and mortar' institution (physical branch). E-banking consists of Internet banking, telephone banking, PC Banking, mobile banking, TV based banking and ATMs. All the above distribution channels which involve the use of the internet or technology have enabled banks to offer to their customers access to their accounts as well as the ability to perform any banking activity, such as paying utility bills, transferring amounts between accounts, applying for credit or debit cards as well as applying for loans or even mortgages.

In the Business to Consumer (B2C) segment, the Internet banking services that are being offered to customers include transfers of funds, viewing of account balances, payments of credit cards and bills, set ups of direct debits and standing orders, applications for loans and cheque books as well as requests for new personal identity numbers (pins).

In the last decades, banking over the internet has attracted increased attention from bankers and bank customers. This popularity can be attributed to all the advantages that Internet banking is offering to both banks and customers. For instance, customers can have access to their accounts around the clock, from all over the world. In addition, they have access to up to date information on their accounts. Banks on the other hand can employ fewer personnel, as Internet banking encourages customers to perform banking transactions electronically at a lower cost. Automated e-banking services, offer banks a perfect opportunity for maximising profits. The main economic benefit is the positive impact of communication technologies on the entire economic growth of banking institutions. Banks are able to offer their services at lower costs, with fewer staff. Banks which offer e-banking services are perceived as leaders in technology implementation and they would have a better brand image (Lustsik and Sorg, 2003). Moreover, there is easy publicity for banks, which can pass the information they want over the Internet, so there is significant reduction in banks' costs. Opposed to the above advantages, there are also some down sides related to Internet banking. These include security concerns, along with insufficient knowledge of the technology used and lack of personal computers (Lustsik and Sorg, 2003).

Nowadays, banking institutions face various policy issues. A key policy could be considered to be the management of risks that are associated with the implementation of e-banking technologies and services (Kondabagil, 2007). The risks fall under six main categories: credit risk, liquidity risk, legal risk, operational risk, reputational risk and systematic risk (Sivaram, 2004). In particular, credit risk arises when customers cannot meet their financial obligations. Similarly, liquidity risk arises in the case of customers' insufficient funds (Kondabagil, 2007). Legal risk arises due to the existence of a poor legal framework or legal uncertainties that lead to credit or liquidity risk. Moreover, operational risk arises in the case of operational mistakes or malfunctions that could possibly lead to credit or liquidity risks (Kondabagil, 2007). Further, systematic risk refers to the inability of a participant to meet the obligations; this might be in the form of a disruption which leads to a failure of the participants, within the financial system, to meet their obligations. Reputational risk is the risk of receiving significant negative public opinion, which might result in a loss of customers (Sivaram, 2004). Additionally, there is the money laundering risk and the identity theft risk. All the above risks have influenced the overall risk profile of banking. It is crucial for banks to have flexible and responsive operating processes, in addition to sound and robust risk management systems that recognise, address and manage these risks in a prudent manner according to basic characteristics and challenges of e-banking services (Kondabagil, 2007).

Banking institutions might use a generic risk management model modified for an e-banking environment. An effective approach could be the separation of frameworks for each major category of risk that manifests in e-banking. An effective risk management framework includes a well-defined process for identification and management of risks, policies and procedures, supporting internal controls and audit and should underpin all the e-banking business activities of the bank. It should be built on a formal governance process, rely on individual responsibility and collective oversight, use advanced analysis techniques, and be backed by comprehensive reporting. Risk mitigation involves creating a sound control environment that reduces internal and external threats to the bank's tolerance level and establishes a structured environment for the risk management process. Central banks might have policies regarding e-banking risks, which provide broad guidance in addressing risk tolerance and management, whereas banks' procedures describe the process used to meet the requirements of the risk management policies. Policies and procedures lay the foundation for how all e-banking operations and controls operate. Without effective, controlled and enforced policies and procedures, there is no benchmark to compare performance or ensure security of

operations. The policies and procedures should cover all material risks associated with e-banking business (Kondabagil, 2007).

Banks which have a formal risk identification process and mechanisms in place to identify and assess the wide range of risks that impact their e-banking business are well placed to react quickly and put measures in place to reduce potential losses. Risk identification depends on the experience and knowledge of the analysts, and it is prudent to assign this exercise to competent people with the necessary qualifications, experience and credentials. Further research on the risks associated with the e-banking technologies and services could be helpful on resolving these risks. This could be done with research undertaken on the enhancement of IT security levels and authenticity of the banks' networks, with firewalls or other software authentication. As far as the strategic risks are concerned, banks also need to conduct surveys, consult experts from various fields, establish achievable goals and monitor their performance. Supervisory and regulatory authorities are further required to develop methods for identifying new risks, assessing risks, managing risks and controlling risk exposure (Kondabagil, 2007).

1.6 Overview of the thesis

This thesis consists of five interconnected essays on the econometric analysis of e-banking in Greece. Firstly, we describe the Internet banking services that Greek banks provide and we also examine the fees that these banks charge to customers for using banking services. Next, we investigate the personal characteristics of customers that are more likely to adopt e-banking/Internet banking services in Greece, as well as examine the impact of the high branch fees on this adoption. Furthermore, from the banks' side, we investigate the performance of Greek banks that are offering e-banking services. Since there are more customers that adopt e-banking services, this will have a positive impact on the performance of Greek banks. Moreover, we extend the analysis of the performance of Greek banks by examining the efficiency of the Greek banking institutions that offer electronic services. Finally, we further expand the analysis of the performance of Greek banking institutions by assessing the competitive and equilibrium conditions that exist in Greece.

Chapter 2 critically reviews the literature related to the adoption of e-banking services by customers and banks as well as the efficiency, profitability and competition of banks that have adopted these services. Chapter 3 attempts to analyse the EU and Greek banking

systems as well as provides a qualitative investigation of the Internet, PC and Internet Banking usage in Greece.

Chapter 4 aims to investigate the main Internet banking services that Greek commercial banks are offering in Greece, as well as the fees that they are charging to customers for using these services in comparison to branch and ATM fees.

Chapter 5 examines the adoption of e-banking and Internet banking services by customers and banking institutions in Greece. In particular, it provides an understanding of customers' characteristics and other factors that affect the adoption of e-banking.

Chapter 6 examines the Greek banking institutions' profitability in relation to Internet banking services and customers' adoption rates. Moreover, we test whether Greek 'click and mortar' banks exhibit any technology-based scale and any technology-based experience effects. In addition, we examine the effect of Internet banking on the financial performance of Greek banking institutions, after and before the adoption of these services.

Chapter 7 studies the effect of efficiency and banking investments on the profitability of Greek banks. More specifically, we obtain efficiency scores for the Greek banking system and we examine the determinants of ATM efficiency over the period 2004-2009. Further, we assess the performance of Greek banks based on models proposed by Kondo (2008) and Pasiouras (2007). In Chapter 8, we assess the competitive and equilibrium conditions for the Greek banking system based on models by Hondroyiannis et al. (1999) and Aktan and Masood (2010) and we compare our findings with other recent studies.

Finally, Chapter 9 summarises our findings and provides recommendations and policy implications for banking institutions. Moreover, we consider further topics for future research on IT and ATM investments.

Chapter 2

Literature Review

2.1 Introduction

This chapter critically reviews the literature related to the adoption of e-banking services by customers and banks as well as the efficiency and profitability of banks that have adopted these services. More specifically, 2.2 reviews the Internet banking services that banks are offering all over the world and 2.3 reviews the fees that banks are charging for these services. Section 2.4 and 2.5 examine the literature of the e-banking and Internet banking adoption respectively, while 2.6 reviews the performance of banks' that have adopted the internet banking services. Moreover, Section 2.7 examines the determinants of bank efficiency and 2.8 reviews the determinants of banks' profitability. In addition, Section 2.9 examines the competitive conditions between banks, and finally 2.10 summarises the literature findings. There are only a few studies on the e-banking and Internet banking in Greece and this thesis aims to add to the existing literature of the economics of e-banking.

2.2 Internet Banking Services

Since the early 1980s, banking institutions have made significant investments in e-banking systems, so as to provide easier, quicker and more convenient banking services to their customers. The majority of these banking institutions offer basic and more advanced banking services.

There are various studies which describe the Internet banking services that banking institutions offer all over the world. In 1998, in the USA, the national banks offered balance enquiry and fund transfers, bill payments, credit applications, new account set up, brokerage, cash management, fiduciary, bill presentment and insurance services. It was shown that 77% of the banks were offering the basic services (balance inquiry, fund transfers and bill payments) and only 23.9% offered premium (basic services and at least three other services) banking services (Furst et al., 2000).

Similarly, it was reported that in 2002, US federally-insured credit unions offered account balance inquiry services, share draft order, payments of loans, viewing account history and fund transfers between shared accounts (Sciglimpaglia and Ely, 2002).

In 2000, the most important Internet banking services that were being provided by Jordanian banks services include balance inquires, account statement demand, chequebooks and transferring funds between accounts. The less important services are selling and purchasing real estate, cars funding and payment of phone bills (Siam, 2006).

In 2002, banking customers in Romania could access their bank accounts 24/7 and perform the following transactions: see the balance of their accounts, obtain and print statements, fund transfers in Romanian lei to the state budget and other beneficiaries, purchase and sell foreign currency as well as make debit/credit cards and salary payments. It is stated that the services offered have two operating models-the online and the offline. In this way, customers can reduce the costs of communication, which is actually the only cost of this service. The study concluded that the online banking services are a major penetration strategy for the foreign bank branches in Romania which forces local banks to implement various online banking services (Gurau, 2002).

In Hong Kong, the basic services, that were offered by banking institutions, included account balance inquiries, bill settlements, account transfers and interest rate/exchange rate/stock quote inquiries, while the more advanced services are, account opening, mortgage/loan applications, credit card applications and property evaluations (Yiu et al., 2007).

Furthermore, Sayar and Wolfe (2007) compared the Internet banking services that 18 Turkish and UK banks were offering in the spring of 2005. It was found that Turkish banks offer a wider range of banking services from their internet branches compared to the UK internet branches, in spite of the fact that the UK has a better environment for Internet banking services in terms of its developed banking sector and technology infrastructure. In addition, it was found that the two countries have different approaches in the issue of security. Turkish banks rely on technology to avoid fraud, whereas British banks used some more conventional methods to discourage fraud. Likewise, Maenpaa et al. (2008) presented the Internet banking services that the majority customers perform in Finland. These services include the payment of bills and transfers of funds between accounts, check balance of loans and mortgages, making credit card transactions (payment and viewing the balance), in addition to the option viewing the price of shares/funds and buy or sell them.

2.3 Pricing Policy

Banking institutions earn profits by charging fees to customers for using the services that they provide. These fees include fees for transactions conducted within bank branches, but also for transactions performed over the telephone, the Internet, mobile devices or ATMs. There are only a few studies that examine the pricing policy that banking institutions follow, with the majority of them being focused in the USA.

More specifically, in the USA in 2000, the ATM owners collected over $5 billion in interchange fees and $3 billion in surcharges (Balto, 2000). McAndrews (2003) explained that the surcharges of ATMs are expected to increase accordingly to the number of banks in the market, the costs of travel, the number of depositors, the lower the interchange fees, the distance between the ATMs as well as the bank's market share. These two charges have increased the costs of ATM transactions made by customers. On the other hand, in Canada, the dominant online debit card network existed without any interchange fees (Balto, 2000). Similarly, Hannan (2007) after examining the pricing policy of US ATMs in 1999 and 2001, reported that banks in a more concentrated market tend to charge higher fees, with the exception of ATMs charges, where lower fees are being charged to customers. As far as Internet banking services are concerned, Bauer and Colgan (2001) reported that US banks charge lower fees for Internet banking services compared to branch banking or ATM services,

In Sweden, Bergendahl and Lindblom (2007) found that banks were not charging fees on paper-based and electronic payments. However, they charged a fixed annual fee to customers for using paper based and electronic banking services. They also reported that the more transactions made electronically the lower would be the fees.

2.4 Determinants of e-banking adoption by customers

E-banking services aim to provide easy access to banking services for customers. Banks and customers benefit from the provision of e-banking services, since banks offer their services at much lower cost, while the customers have access to these services from any location at any time (Koskosas, 2011).

Thornton and White (2001) compared the electronic distribution channels in the US and reported that customers perceptions on convenience, service technology, change and knowledge about computers and the Internet, affect the usage of the various electronic

banking channels. Howcroft et al. (2002) added that lower fees, reduced paper work and human error are important factors that encourage customers in the United Kingdom to adopt e-banking services. Similar results are also reported by Gerrard and Cunningham (2003) and Kaleem and Ahmad (2008) for Singapore and Pakistan respectively.

Several authors have investigated customers' personal characteristics that affect their decision to adopt e-banking. These studies have employed a variety of methods for analysing the data, with the most common being the logistic regression or probit models and they were primarily motivated by the increased popularity of e-banking and the lack of similar studies on the adoption of e-banking.

In particular, for the USA, Kolodinsky et al. (2004) examined the adoption of e-banking technologies, for the years 1999 and 2003. They employ the ordered probit econometric model and their results show that customers with higher income and higher education levels had an increased probability in adopting e-banking or they are already using e-banking technologies. Senior customers, over the age of 65 years are less likely to adopt phone banking and PC banking. Single male households are also less likely to adopt phone banking than married households. Similarly, Lassar et al. (2005) examined the adoption of e-banking in the US by employing the logistic regression and found that high income levels have a positive impact on the adoption of e-banking, while the factors that did not affect the adoption of e-banking were the age and education variables. Furthermore, Sciglimpaglia and Ely (2002) employed probit models and found that in the US, apart from the demographic, financial and technology characteristics of customers, an important role in the prediction of e-banking adoption played the perceived usefulness of services offered online.

Moreover, Gan et al. (2006) used the logistic regression, to identify the factors that consumers use when deciding whether they will adopt e-banking in New Zealand. They used data from 2003, and found that senior citizens are risk averse and prefer a personal banking relationship. Therefore, they are less likely to adopt e-banking. High-income respondents perform complex transactions and they prefer personal banking. Furthermore, they found that unemployed people, students, or house persons are more likely to adopt e-banking. The gender and marital status seems that do not have any impact on the decision of the adoption of e-banking. Likewise, Mavri and Ioannou (2006) employed the logistic regression and they found that younger customers, who are more familiar with technology, personal computers and the internet, are more likely to adopt e-banking in Greece.

There are a number of studies that examine the adoption of e-banking by customers and they employ other methods than logistic or probit models. More specifically, Gurau (2001) examined the adoption of e-banking services in Romania by conducting semi-structured interviews. He found that the adoption of e-banking is positively related with the profession, the level of education and the level of internet knowledge. Furthermore, Sohail and Shanmugham (2003) studied the factors that influence customers' adoption of electronic banking by employing factor analysis for Malaysia. The results showed that the younger generation in Malaysia is more computers savvy and in combination with high literacy rate they are more likely to adopt e-banking.

In China, Li and Zhong (2005) applied factor analysis and reported that the major factors that affect e-banking adoption are internet and computer accessibility, in addition to convenience.

2.5 Determinants of Internet banking adoption by customers

This section presents the studies that have examined the characteristics of Internet banking customers. As in 2.4, the decision to adopt Internet banking depends on customers' personal characteristics, such as age, gender, education, occupation but also on the familiarity of computers and the Internet.

Gounaris and Koritos (2008) employed a logistic regression and they found that current and potential Internet banking users are male, with a college or university education, working as private or public employees and being innovators and utilitarian shoppers. Another study conducted for Brazil, employed a multinomila logistic regression and found that while the actual adoption of Internet banking is influenced by certain individual characteristics (ownership of a PC, higher education and age between 21 and 40), these variables do not play an important role in determining whether customers intend or will continue to use Internet banking services (Hernandez and Mazzon, 2007). Similarly to Hernandez and Mazzon (2007), it was found that in Korea, the demographic variables are not significant for the adoption of Internet banking, with the exception of the age variable, where it is found that the group 45 years old and more are more likely to adopt Internet banking. Furthermore, it was found that people with higher education are less likely to adopt Internet banking than those with less education. In addition, the study reported that people with higher income and an alternative marital status than single or married, are less likely to adopt Internet banking. Furthermore, it is reported that outright home owners in Korea are less likely to adopt internet

banking. This is due to the fact that they have less complex transactions than those in rental schemes, as they do not need to pay monthly instalments for their mortgages (Chang, 2006).

Apart from the above studies that employed logistic regressions, there are a number of studies that assess customers' personal characteristics that affect the adoption of Internet banking, and employ other methods, such as factor analysis, cluster analysis and the means end approach.

For instance, Polatoglu and Ekin (2001) investigated the acceptance of Internet banking services of Turkish customers using factor analysis and cluster analysis. The results indicated that Internet banking has added benefits in terms of attracting and retaining a young, profitable and upscale customer base. It also leads to higher competitiveness by introducing new products and services through alternative delivery channels. Furthermore the study showed that due to the low costs of Internet banking services for the bank there will be a reduction in the workload of the branches and therefore customers who wish to visit physical branches will be satisfied. Similarly, Lawson and Todd (2003) employed factor analysis and found that customers who are more likely to adopt Internet banking services in New Zealand are male above 40 years old, married, have university education, are self-employed or retired, earn more than $90,000 and are success driven extroverts with traditional values. In addition, employing the factor analysis, it was revealed that the major factors which affected the adoption of Internet banking in Malaysia are internet accessibility, awareness, attitude towards change, computer and internet access costs, trust in one bank, security concerns, ease of use as well as convenience (Sohail and Shanmugham, 2003). Using the same method, Wan et al. (2005) reported that in Hong Kong customers of middle age, with a moderate level of wealth, moderate level of education and high time cost, are more likely to adopt Internet banking.

Moreover, Kuisma et al. (2007) showed that the main reasons for refusal to adopt Internet banking services in Finland are the following: lack of computer, frequent usage of ATMs, lack of information on new technology, absence of an official receipt, absence of bar code reader, changeable passwords and unclear procedures. To this list can be added factors such as economy, safety, control, efficiency, convenience and general resistance to change. The above factors are the most important reasons which lead to the rejection of using the Internet banking services. Likewise, Li and Zhong (2005) conducted a survey in 2002 in order to determine the factors that are affecting the adoption of Internet banking services in China.

After analysing 300 responses using factor analysis, it was found that awareness, internet accessibility, attitudes toward changes, computers and internet connection costs, security concerns, convenience and ease of use are the major factors that affect the adoption of Internet banking in China. A more recent paper by Gao and Owolabi (2008) examined the factors that influence the adoption of Internet banking in Nigeria. The results showed that these factors include convenience, privacy, costs, level of awareness, accessibility to computers and internet, and finally the availability of knowledge and support concerning Internet banking. It is also reported that the adoption of Internet banking increases consumers' surplus (Jenkins, 2007) as these services offer convenience to customers, and therefore they are willing to pay higher fees for using Internet banking services.

Other similar studies which examine factors that affect the adoption of e-banking (relative advantage, performance expectancy, self-efficacy, perceived ease of use, perceived usefulness and perceived risks) use other than logit models, factor or cluster analysis, such as the Technology Acceptance Model (TAM). According to Davies (1979), '*TAM' suggests that a prospective user's overall feelings or attitudes toward using a given technology-based system or procedure represent major determinants as to whether or not he/she will use the system*'.

Davis (1989) first developed two new variables, perceived usefulness and perceived ease- of -use, which are hypothesised to have an impact on the acceptance of Information Technology by users. In his research it is found that perceived usefulness has a significantly greater impact on the acceptance of IT than perceived ease-of-use. In addition it is suggested that perceived ease-of-use may be antecedent to perceived usefulness, opposed to a direct determinant of system usage.

There are a number of studies, which have found that perceived usefulness and perceived ease-of-use have a positive impact on the adoption of Internet banking services. These studies include Cheng et al. (2006) for Hong Kong, Amin (2007) for Malaysia, Rigopoulos and Askounis (2007) for Greece, Cai et al. (2008) for the USA, Casalo et al. (2008) for Spain, Lee (2009) for Taiwan and Al-Somali et al. (2009) for Saudi Arabia.

2.6 Internet banking adoption and financial performance of banks

The study of the economics of diffusion of new technologies has received growing attention in recent years. *'Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system*' (Rogers, 2003). When new ideas are invented, diffused and adopted or rejected, they lead to certain consequences. Therefore, diffusion is a kind of social change, as alteration occurs in the structure and function of a social system. According to Antonelli (1990) '*the diffusion of IT is characterised by a series of complex inter-relationships sparked off at the moment of adoption and introduction'*. This appears to result in important changes in the industrial organisation and location of firms, as efficiency and profitability are set off within firms and regions (Antonelli, 1990). Similarly, Hellegers et al. (2010) explain that the adoption of new technologies is the major contributor to positive changes in productivity. Furthermore, Canepa and Stoneman (2004) find that rank models of diffusion have three main predictions: i) that the cost of adoption affects the number of adopters, ii) banks' characteristics have an impact on the return to adoption and iii) expected changes in the costs of adoption will have an impact on the dates of adoption.

The end of the Information Technology (IT) boom has led to a consolidation of online technologies, as well as in the banking sector (Arnaboldi and Claeys, 2010). The developments in IT have had an enormous effect in the development of more flexible payment methods and more user–friendly banking services (Akinci et al., 2004). In addition, the adoption of IT plays an important role in the reduction of costs and the increase in total factor productivity and competitive advantage (Antonelli, 1990). The diffusion and development of Internet banking and other electronic payment systems by financial institutions is expected to result in more efficient banking systems. Internet banking is not just a process innovation that allows existing banks to centralise back office operations and increase their efficiency; the existence of virtual and branch offices has important effects on the interaction between customers and the bank (Arnaboldi and Claeys, 2010). Nowadays, banking institutions can offer their products and services through such electronic banking channels, more conveniently and economically without reducing the quality of the existing levels of service.

M'Chrirgui (2005) explains that banks compete with themselves in order to be the first to innovate and offer more technologically advanced products, and therefore this will lead to profits once they will be marketed. Majumdar (2010) also adds that the diffusion of

broadband technology in banks will have a positive impact on the performance of these banks. Broadband access enables improved connectivity and therefore, it permits a higher speed of transactions, a more efficient organisation of activities and reduction in costs (Bertscheck and Kaiser, 2004). The European Central Bank (ECB) (1999) reported a significant reduction of the costs per transaction, with costs of internet banking transactions ranging between 1 and 25 per cent and telephone banking costs between 40-71 percent of the costs of transactions that are handled in a bank branch. Thornton and White (2001) also add that the increased availability of alternative banking delivery channels help banks reduce their expensive branch network and the staff overheads, as the transactions process is simplified. Birch and Young (1997), Geyskens et al. (2000) and Kiang et al. (2000) explain that banks will experience reductions in paperwork, human errors and customer disputes and will also be able to use the office space, which is released from the reduction of bank branches, for more profitable ventures. Lymperopoulos and Chaniotakis (2004) argue that there might be a reduction in the number of bank branches in the future due to the provision of electronic services. However, they explain that the electronic services will be a complement rather than a substitute for physical branches, as banks place emphasis on cross-selling products within the branch environment in order to justify the existence of the human tellers and the bank branches (Prendergast and Marr, 1994).

The availability of Internet banking affects the financial products offered by banks and their financial performance (DeYoung et al., 2007). Few studies have examined the effect of Internet banking adoption on the performance of banking institutions.

For instance, Carlson et al. (2001) found that there is no significant relationship between Internet banking adoption and the profitability of US banks. Similarly, credit unions in the USA offering Internet banking services had significantly higher costs than the credit union that did not offer Internet banking; however, it is also found that there was no reduction in their profitability of these credit unions due to the high operating costs (Dandapani et al., 2008). Likewise, DeYoung (2001) showed that pure Internet banks earned lower profits than traditional banks in the US in terms of ROA and ROE. Similarly, Malhotra and Singh (2007) found that there is no significant relationship between the adoption of Internet and the performance of public sector banks in India in terms of Returns on Assets (ROA) and Return on Equity (ROE). They also explain that Internet banking has a negative impact on the profitability of private sector banks in terms of ROA, and a positive impact on the

performance of foreign banks in terms of ROE. Delgado et al. (2007) find that Internet banks worldwide have underperformed traditional banks, mainly due to the higher operating costs.

On the other hand, DeYoung et al. (2007) found that the adoption of the Internet delivery channel by an existing network of US bank branches increases the profitability of these banks. Likewise, Sullivan (2001) showed that banks that have introduced Internet banking in the US may be able to generate revenue, since they are able to offset added expenses from the fee income. In Italy, it is reported that report that 'click and mortar' banks exhibit higher performance ratios in terms of ROA and stock returns (Ciciretti et al., 2009). In addition, Hernando and Nieto (2007) explain that the adoption of Internet as a banking delivery channel for Spanish banks results to a decrease in the overhead expenses and therefore, there is an increase to the profitability of banks that have adopted Internet banking. Moreover, it is reported that Internet banks show significant technology-based scale economy effects, as they are able to control the operational expenses more efficiently than traditional banks (DeYoung, 2005 and Delgado et al., 2007). Additionally, studies have found that there is a positive relationship between Internet adoption and the profitability of multichannel banks, in terms of returns on assets (ROA) and return on equity (ROE) (Hasan et al., 2005 and Hernando and Nieto, 2006). As far as the lending activity and experience are concerned, Internet banks do not show any better lending capability, while traditional banks show increased lending capability as they accumulate experience (Delgado and Nieto, 2004 and Delgado et al., 2007). However, Berger (2003) found that there are improvements in the costs and the lending capability due to improvements in 'back office technologies'. Further, the literature does not report a significant relationship between the profitability of a bank and the adoption of new technologies such as the ATMs (Espitia Escuer et al., 1991) due to the absence of liquidity constraints on the technological strategies of banks.

2.7 Determinants of bank efficiency

There are several approaches that could be used examining the efficiency of banks, such as the Stochastic Frontier Analysis[1] (SFA), the thick frontier approach[2] (TFA), the distribution

[1] SFA is a parametric econometric method that examines the relationship between outputs and input levels in productivity analysis, and use two error terms; one error term is the traditional normal error and the other error term represents technical inefficiency (Wagenvoort and Schure, 1999).
[2] TFA is a parametric distribution free econometric method, appropriate for panel data that estimates the frontiers by using the lowest and the highest average costs of firms (Wagenvoort and Schure, 1999).

free approach[3] (DFA) and the Data Envelopment Analysis[4] (DEA). The majority of studies that have influenced this thesis employ the non-parametric DEA method, whereas a few important studies employ the parametric SFA approach.

For instance, Noulas (1997) studied the productivity growth for state and private Greek banks for years 1991 and 1992. The Malmquist productivity index[5] was employed with three inputs which are physical capital, labour and deposits and three outputs, which are liquid assets, loans and advances and investments. This study used the intermediation approach[6] as banks are considered to be financial intermediaries, and it assumed Constant Returns to Scale (CRS), as this would allow a comparison between small and larger banks. Overall, the results showed that state banks experienced technological progress, while there was no change for private banks. As far as Technical Efficiency (TE) is concerned, private banks' efficiency increased while the opposite happens for state banks.

A similar study by Isik and Hassan (2002) investigated the efficiency of the Turkish banking sector over the years 1988-1996. This study employed the DEA intermediation method, by considering three inputs as labour, capital and loanable funds, and four outputs, short-term and long-term loans, off balance sheet items and other earning assets. The findings showed a positive and significant correlation between Return on Assets (ROA), Return on Equity (ROE) and efficiency in Turkey. Likewise, Casu and Molyneux (2003) investigated whether there was improvement in the productive efficiency of European banks since the creation of the Single Internal Market. Following the intermediation approach and the DEA model, the outputs specified are total loans and other earning assets, while the two inputs specified are total costs and total deposits. Moreover, the determinants of European bank efficiency were assessed by employing the Tobit regression and the efficiency scores derived from the DEA model. The results showed that Return on Average Equity (ROAE) and Equity over Total Assets have a positive and significant relationship with efficiency. However, country specific factors are also considered to be important determinants in explaining differences in bank efficiency levels across Europe.

[3] DFA is a parametric econometric method, appropriate for panel data, that examines the relationship between outputs and input levels in productivity analysis, and assumes that no specific distribution for the inefficiency is chosen (Wagenvoort and Schure, 1999).

[4] DEA is a non-parametric method which examines how Decision Making Units (DMUs) operate relative to other DMUs (Pasiouras, 2007).

[5] The Malmquist productivity index measures productivity changes over time and can be decomposed into two basic components; one measuring technical changes and the other measuring technological changes (Noulas, 1997).

[6] In the intermediation approach, banks are viewed as financial intermediaries, who collect funds and use labour and capital to transform these funds into loans and other assets (Berger and Humphrey, 1997).

Moreover, Casu and Girardone (2004) estimated TE and scale efficiency (SE) scores for Italian banking groups, by implementing a DEA input-oriented cost minimising model that assumes Variable Returns to Scale (VRS). This study employed the intermediation approach with inputs being labour, deposits and capital and the two outputs, total loans and other earning assets. The efficiency score are then regressed on a number of determinants, where it was reported that Return on Average Assets (ROAA) has a negative relationship with the efficiency, while the equity to total assets ratio was positively related to efficiency, confirming that the higher the equity capital the more efficient Italian banking groups will be. However, it is reported that overall the Italian banking groups have not experienced a clear improvement in cost efficiency and productivity.

Also, the efficiency differences between large German and Austrian for the period 1995-1999 were explored by Hauner (2005). By employing the DEA method and the intermediation approach, the two inputs considered are, funds and labour, and the three outputs, are interbank loans, customer loans and fixed-income securities. In order to examine the cost-efficiency differences among the banks in the sample, the cost-efficiency scores were pooled for the five year period and were regressed on a number of explanatory variables. Results showed that the size of banks (measured by total assets) had a positive impact on the cost-efficiency, and therefore it can be concluded that Increasing Returns to Scale (IRS) exist in this model, that might stem from fixed costs. Moreover, the risk variable (measured by the standard deviation of ROA) had a negative relationship with cost-efficiency, implying that banks that are bad at managing their risks are also bad at managing their costs.

The study by Havrylchyk (2006) investigated the efficiency of the Polish banking sector between 1997 and 2001. As previously, this study applied the intermediation DEA method; the inputs employed are capital, labour and deposits and the outputs are loans, government bonds and off-balance sheet items. The findings showed that ROA has a positive effect on the efficiency and riskier banks are more efficient and profitable in Poland. Likewise, Pasiouras (2007) applies the input-oriented DEA method assuming VRS, to examine the efficiency of Greek commercial banks over the period 2000-2004. He employed a mix of inputs and outputs, where inputs are fixed assets, customer deposits and short-term funding and the number of employees. The outputs are loans, other earning assets and off-balance sheets. The Tobit regression was then applied in order to investigate the determinants of bank efficiency. Results showed that well-capitalised banks are more efficient both in terms of TE and SE. It was also reported that ROAA has a positive relationship with the efficiency measures,

explaining that profitable banks are more efficient. However, it was found that ATMs do not have a statistically significant relationship with the efficiency measures. Pasiouras (2007) explained that this might be due to the fact that Greek banks have invested heavily on branches as a distribution network, and ATMs are considered supplementary to branches.

Pastor and Serrano (2006) examined the cost efficiency for 10 EU countries over the period 1992-1998. By employing the DEA input-oriented approach with two outputs, loans and other earning assets and three inputs, customer and short-term funding, fixed assets and personnel expenses, they found that Greece and Spain exhibit high cost inefficiencies. The specialisation of the Greek and Spanish banking system towards retail banking reveals that bank branches and ATMs are of great importance. It is reported that Greece, Spain, Belgium and Italy have a high number of ATMs per inhabitant and per square kilometre as well as a high number of bank branches. It might be that high cost inefficiencies are attributed to the heavy investments in ATMs. More recently, Delis and Papanikolaou (2009) analysed the efficiency estimates derived from DEA on a number of bank-specific, industry-specific and macroeconomic determinants for 10 newly acceded EU countries. This study followed the intermediation approach with two outputs, total loans and total securities and two inputs, operating expenses and total deposits and short-term funding. The results showed that when a bootstrapping procedure was applied for regressing efficiency on determinants instead of a Tobit regression, banks' size has a positive and significant relationship with efficiency.

There are a number of studies that employ methods other than the non-parametric DEA, such as the SFA. In particular, Berger (2003) examined the economic effects on technological progress of the U.S. banking industry. He argued that advances in IT appear to have increased productivity and economies of scale in processing electronic payments and thus costs were reduced significantly; in some cases more than 50% during the 1990s. The findings also reported that bank cost productivity declined while profit productivity increased; this is attributed to the fact that technological progress resulted in improved quality and variety of banking services that increased the costs for banks. However, banks were able to cover the higher costs for new technologies and still make profits, since customers were willing to pay for these services as they offered convenience. Likewise, Fu and Heffernan (2009) examined the effect of the TE and SE on the profitability of Chinese banks over the period 1985-2002. In order to measure the efficiency of Chinese banks the parametric SFA was adopted. The results indicate that SE has a positive and significant relationship with the profitability of Chinese banks in terms of ROA.

In addition, Beccalli (2007) investigated the effect of IT investments on the performance of European banks in terms of ROA, ROE, profit efficiency and cost efficiency, for the period 1995-2000. Profit and cost efficiency scores were estimated by employing the standard stochastic frontier approach (SFA) for panel data with firm effects which are assumed to be distributed as truncated normal random variables. The intermediation approach was followed, in which inputs are used to produce earning assets; this study employs three inputs which are labour, loanable funds and physical capital, while the three outputs considered are total loans, securities and off-balance sheet items. The paper found little relationship between IT investments and bank efficiency or improved bank profitability, indicating the existence of a profitability paradox[7]. However, it reported that investments in IT services from external providers have a positive relationship with ROA, ROE and the profit efficiency, while the acquisition of software and hardware have a negative impact on banks' profit performance.

2.8 Determinants of bank profitability

Various academic studies have identified the determinants of banks profitability as the Structure Conduct Performance (SCP) hypothesis and the relative efficiency hypothesis. More specifically, according to Evanoff and Fortier (1988), the SCP hypothesis states that the higher the market concentration in EU banks, the higher is the probability of larger profits, while the relative efficiency hypothesis states that larger banks in the UK are more efficient than smaller banks and hence they are more profitable (Clarke et al., 1984).

An early study by Smirlock (1985) examined the relationship between concentration and profitability for U.S. banks over the period 1973- 1978. The findings suggest that total assets have a negative relationship with banks' profitability, while the market structure and the market concentration affect positively the profitability of U.S. banks. Similarly, Goldberg and Rai (1996) assessed the relationship between concentration, efficiency and profitability for a sample of banks across 11 European countries, over the period 1988-1991. They applied the SFA to derive measures of X-inefficiency[8] under the assumption that the errors are distributed half-normally. Their study used two outputs, loans and other earning assets and three inputs, defined as the price of labour, capital and borrowed funds. They tested the effect

[7] The IT profitability paradox is suggested by Hitt and Brynjolfsson (1996), who find that there is a positive impact of technology on productivity and consumer surplus for the US banks; this is in contrast with Beccalli (2007) who reports that there is no significant positive correlation between IT spending and profitability for the EU banking industry.

[8] X-inefficiency is the difference between efficient behaviour of firms, assumed or implied by economic theory, and their observed behaviour in practice (Pasiouras, 2007).

of cost and SE on performance, the market structure and concentration in the market, while they also tested the effect of concentration and market structure on cost and SE scores separately. Their findings suggested that x-efficiency and SE do not play a role in explaining changes in the profitability of European banks in terms of ROE. However, they found that the Relative Market Power hypothesis[9] existed, since the market structure variable had a positive and significant effect on ROE. Similarly, Kosmidou (2008) found that there was a positive and significant relationship between the size of Greek banks and their performance over the period 1990-2002. However, Pasiouras and Kosmidou (2007) reported that there was a negative relationship between EU foreign and domestic commercial banks' size and their profitability. This indicated that larger banks earn lower profits, while smaller banks earn higher profits. More recently, it was revealed that the profitability, measured by ROA, of commercial banks of Pakistan, was positively affected by the size of banks, while when ROE is considered, it was negatively affected by the size of banks (Ali et al., 2011).

In addition to the above determinants, papers have identified the following factors that affect bank profitability: Evanoff and Fortier (1988) identified that in the US, as far as the market size is concerned, it was easier for larger banks to dominate in a small market and to achieve higher profits. Regarding the growth in market size, they explained that larger banks are benefited from growth in the market and they were more profitable. Molyneux and Teppett (1993) also identified that the cost of funds can be one of the determinants of bank profitability for European banks, due to the fact that profitability was affected by the type of deposits, as deposit accounts pay higher interest rates to customers than current accounts.

Moreover, it was stated that the capital risk might also be one of the profitability determinants for European banks, as a low level of financial capital risk resulted in a high level of profits (Molyneux, 1993). Pasiouras and Kosmidou (2007) reported that the equity to assets ratio for EU domestic and foreign commercial banks had a highly significant and positive relationship with the profitability in terms of ROAA. This supported the argument that well-capitalised banks reduce their costs of funding, as they face lower costs of going bankrupt, or they have lower needs for external funding, which results in higher profitability. Similarly, Abreu and Mendes (2001) reported that the equity to assets ratio for Portugal, Spain, France and Germany had a positive impact on profitability. Furthermore, Naceur and Goaeid (2001) for Tunisia and Rhoades and Rutz (1982) for the US, reported that highly capitalised banks,

[9] The Relative Market Power hypothesis states that firms with larger market shares are able to exercise market power and therefore can earn higher profits (Goldberg and Rai 1996).

banks with higher levels of productivity and banks that issue more loans (and hence generate profits through the interest rates received) were more profitable. Allen and Rai (1996) added that one other important determinant of bank profitability is the portfolio composition, because higher total deposits to total assets ratios means that banks have more funds to invest or lend to customers, and they can increase their profitability in terms of ROA.

There are only a few studies that examine the effect of ATMs and IT investment in bank profitability and efficiency. Hence, it is vital for this study to examine the effect of ATMs and IT investments on Greek banks' profitability and efficiency. Holden and El-Bannany (2004) reported that investments in IT, and more specifically ATMs, had a positive effect on the profitability of UK banks over the period 1976-1996. However, a more recent study by Kondo (2008), reported that the number of ATMs had no effect on the profitability of Japanese banks for the period 2000-2003.

2.9 Competition

The theory of contestable markets assumes that firms can freely enter or exit the market since no barriers exist and that potential competitors have the same cost functions as the existing firms in the market. Further, firms face highly price elastic demand curves for their products. These characteristics imply that in a contestable market the threat of potential entry restricts firms to price their products competitively. This means that a contestable market is effectively competitive even if it consists of a few active participants (Hondroyiannis et al., 1999). In order to assess these competitive conditions the majority of studies have employed the Panzar-Rosse model, where the H statistic is calculated from reduced form revenue equations and measures the sum of the elasticities of total revenues with respect to input prices (Hondroyiannis et al., 1999). Most of these studies have identified that the banking markets were operating as if under monopolistic competition, where there if free entry or exit, but due to the slight differentiation of the products offered by banks, there is still control over the prices imposed.

In particular, an early study by Hondroyiannis et al. (1999) applied the non-structural Panzar-Rosse model to assess the competitive conditions in the Greek banking system over the period 1993-1995. They reported that revenues were earned as if under conditions of monopolistic competition within the Greek banking system. They explained that this might

have been affected by the elimination of the exchange controls, the liberalisation of capital movement as well as all the arrangements for the entrance to the EMU and the adoption of the single currency. Similarly, Bikker and Haaf (2002) applied the Panzar-Rosse model and obtained a measure of competitive conditions for 23 countries over the period 1998- 1999. The H-Statistic provided strong evidence that the particular banking markets under consideration were characterised by monopolistic competition, with the exception of a few cases where perfect competition could not be ruled out. In particular, they reported that competition was stronger in Europe, compared to Canada, Japan or the USA. Similarly, Al-Muharrami (2009) investigated the market structure of the banking system of Saudi Arabia and evaluated the monopoly power of these banks over the period 1993 and 2006, by using the Panzar-Rosse model. The results of this study showed that Saudi Arabia had a moderately concentrated market and was moving to a less concentrated position, while the Panzar-Rosse H-Statistic revealed that the banks in Saudi-Arabia operated under monopolistic competition.

In addition, Aktan and Masood (2010) examined the competitive structures of the Turkish banking system over the period 1998-2008. The results indicated that the Turkish banking system was in a long-run equilibrium state and the banks were operating under conditions of monopolistic competition. Similarly, Hamza (2011) investigated the market structure of the banking system in Tunisia for the period over 1999 to 2009. The results revealed that the Tunisian banking system was in a long-run equilibrium for the period under consideration, as well as that there was evidence of monopolistic competition. Likewise, Maudos and Solis (2011) studied the competitive conditions of the Mexican banking system over the period 1993-2005. They applied the Panzar-Rosse H-statistic and report that the Mexican banking system is under monopolistic competition for the period under consideration. Masood and Sergi (2011) examined the competitive conditions of the Chinese banking system for a panel of 16 banks for the period 2004-2007. They applied the Panzar-Rosse H-statistic and reported that the banking system in China was under monopolistic competitive conditions, as well as that banks were not able to achieve high levels of profitability under these particular conditions.

However, there are a number of studies that report competitive conditions other than monopolistic competition. For example, Yuan (2006) examined the competitive conditions of the Chinese banking system during 1996-2000 and found that the banking system in China was operating during this period as if under a near state of perfect competition. Likewise, Bikker et al. (2007) examined the competitive conditions of 101 countries for the period

between 1986 and 2005, using the Panzar-Rosse model. Their results showed that in 28 countries monopoly prevailed, where in another 38 countries perfect competition existed within their banking systems.

There are also a number of studies that report mixed results about the competitive conditions that existed. For instance, Molyneux et al. (1996) studied the competitive conditions of the Japanese banking system using the Panzar-Rosse methodology for the years 1986 and 1988. The results showed that the Japanese banking system behaved as if under oligopolistic conditions in 1986, though in 1988 behaved as if under monopolistic competition. Moreover, De Bandt and Davis (2000) assessed the effect of the EMU on the market conditions for EU countries which adopt the single currency, between 1992 and 1996. This study provided evidence that the behaviour of large banks was not fully competitive, compared to US banks. In the case of small banks, the level competition is even lower, especially in the cases of France and Germany. In addition, Al-Muharrami et al. (2006) investigated the market structure of the Arab Gulf Cooperation Councils banking industry during the period of 1993 to 2002, using the H-Statistic to evaluate the monopoly power of banks over the period under consideration. The results revealed that Kuwait, Saudi Arabia and UAE had moderately concentrated markets and the H-Statistic suggested that banks in the above countries operated under perfect competition, whereas banks in Bahrain and Qatar operated under monopolistic competition. Similarly, Delis et al. (2008) compared the estimates of two widely used non-structural models, for the measurement of market power in the Greek banking industry over the years 1993 to 2004. These two models were the conduct parameter method and the revenue test (Panzar-Rosse model). In the first model, the estimate of market power was very close to zero, which indicated that the Greek banking system was characterised by perfect competition. This meant that the high degree of concentration characterising the Greek banking system reflected the efforts by the most efficient banks to take advantage of economies of scale and scope and did not necessarily influence competition in a negative way. As far as the Panzar-Rosse was concerned, this study obtained a value of the H-statistic between 0.214 and 0.605 and the H-statistic hypothesis of non equality with one and zero rejected the hypothesis of perfect competition. In this model, the dominant market that was suggested was monopolistic competition and when the ROA was used as the dependent variable in the model, a long-term equilibrium was confirmed (Delis et al., 2008).

More recently, Rezitis (2010) examined the competitive conditions for the Greek banking system over the period 1995-2004. The empirical results of the Panzar-Rosse model for the

whole period indicated that the Greek banks operated under perfect competition, while when the sub-period 1999-2004 was considered, monopolistic conditions existed in the Greek banking system. Similarly, Delis (2010) studied the competitive conditions in the banking systems of 22 Central and Eastern European countries for the years between 1999 and 2006, by implementing the Panzar-Rosse model. The results suggested that there was a wide variation in the competitive conditions of the banking systems under consideration, with some exhibiting monopolistic competitive conditions, while others were considered to be non-competitive. Further, Masood and Aktan (2010) assessed the market structure and the competitive conditions of the Saudi Arabian banking system with the application of the Panzar-Rosse model, on 12 banks over the period 1999-2007. They reported that the Saudi Arabian banking system was under short-run oligopoly, as the perfect competition or monopolistic competition conditions were rejected. Finally, Mensi (2010) examined the competitive conditions among Tunisian banks over the period 1990-2007. This study applied the Panzar-Rosse model and reported that Tunisian banks evolved with an oligopolistic competition context in a contestable market and thus confirmed the presence of a competitive environment.

2.10 Summary

To summarise, in this Chapter we review several empirical studies on the adoption of e-banking/ Internet banking and the performance of Greek banks offering electronic services. In particular, we concentrate on the following topics:

(i) *Internet Banking Services:* Almost all studies report that the basic internet banking services offered by banks are the following: account balance inquiry, share draft order, payments of loans, viewing account history and fund transfers between shared accounts.

(ii) *Pricing Policy:* Most studies find that Internet banking and ATM fees are lower compared to branch banking fees.

(iii) *Determinants of e-banking adoption:* The majority of the studies under review find that male customers, with higher education, high income and previous experience with communication technologies are more likely to adopt e-banking services.

(iv) *Determinants of Internet banking adoption:* Most of the studies report that younger customers, with higher income, higher education and familiarity with personal computers and the Internet are more likely to adopt Internet banking services.

(v) *Internet banking adoption and financial performance:* Most papers report that Internet banks show significant technology-based scale economy effects, as they are able to control the operational expenses more efficiently than traditional banks. Moreover, most of the papers find that there is a positive relationship between Internet adoption and the profitability of multichannel banks, in terms of returns on assets (ROA) and return on equity (ROE).

(vi) *Determinants of bank efficiency:* Most studies apply the non-parametric DEA method to assess the determinants of bank efficiency and they report that profitability in terms of ROA, has a positive effect on the efficiency of banking institutions.

(vii) *Determinants of bank profitability:* The majority of studies, which examine the determinants of bank profitability, report that well-capitalised banks with higher assets, are more profitable in terms of ROA.

(viii) *Competition*: Most of the papers that assess the competitive and equilibrium conditions, find that banking institutions are in equilibrium and they operate as if under monopolistic competition.

Chapter 3

The EU and Greek Banking Systems

3.1 Introduction

In recent years the EU and Greek banking systems have experienced significant changes, such as the establishment of the monetary union and the European Central Bank (ECB), the common currency and developments in IT. This chapter attempts to analyse the EU and Greek banking systems as well as provide a qualitative investigation of the Internet, PC and Internet Banking usage in Greece. In particular, section 3.2 presents the structure of the EU banking sector and in section 3.3 the Greek banking market with extensive information on the Greek banking institutions is considered. In section 3.4 we analyse the Internet and PC usage in Europe and Greece, the Internet Banking penetration and the risks that prevent customers from using Internet Banking, while in section 3.5 we summarise our findings.

3.2 The EU Banking Sector

The past decades have witnessed a string of regulatory changes, mergers and technological advances that have all re-shaped Europe's banking markets (Bos and Schmiedel, 2007). These changes were caused by modifications that occurred mainly in the external environment, especially as a result of the increasing monetary and fiscal integration. More specifically, the liberalisation of capital flows, the rapid pace of developments in IT, the product/service innovation in financial markets, the introduction to the euro, the internationalisation of banking activities and the phenomenon of disintermediation are undoubtedly some of the most prominent structural features characterising the European banking system (Staikouras et al., 2008).

In 1998, the ECB was established after the formation of the Economic Monetary Union. Initially, it was in the early 1960s, when the six member states of the European Economic Community (EEC), Belgium, France, Germany, Italy, Luxemburg and the Netherlands, cooperated to achieve a monetary integration. However, this was not realised until 1969, and

after a series of exchange rate and balance of payment crises, the leaders of the above six member states of the EEC decided to put together a plan for an economic and monetary union. This led to the 'Werner Report' in 1970, which planned the creation of the economic and monetary union in three stages, by 1980. Nonetheless, due to the downfall of the Bretton Woods fixed exchange rate regime and the constant fluctuations on the exchange rates of the EU countries, the plan of forming a monetary union was soon dropped. In 1972, an initial step (called 'the snake') was taken to stabilise the exchange rates, but it failed due to the further currency unrest and the international recession that followed in 1973 after the oil crisis. By 1977, 'the snake' system was reduced to a 'Deutsche Mark Area', consisting of Germany, the Benelux countries[10] and Denmark. Eventually, in 1979, France and Germany promoted again the idea of the financial integration and this led to the creation of the Economic Monetary System (EMS), which lasted until 1999, when the common currency (the euro) was launched (ECB, 2011).

During this period, a series of important macroeconomic policies were followed; there was a further reinforcement of the links between central banks and realignment of the exchange rates were made conditional on the convergence policy commitments, so as to reduce the frequency and impact of disruptive devaluations. In addition, capital controls were removed and low inflation policies prevailed in every EU country. Towards the end of the 1980s, the European Council authorised a committee of experts, under the chairmanship of Jacques Delors, to make proposals for the realisation of the Economic Monetary Union. The 'Delors Report' plan laid the foundations for the Maastricht Treaty, which was signed in 1992 by the Heads of State or the government of each member state and was approved by all EU countries by 1993. This laid the foundation for the introduction of the single currency. In 1994, the European Monetary Institute started preparing the regulatory, organisation and logistical framework for the new supranational central banking system. This was essential for the establishment of the ECB and the European System of Central Banking (ESCB). In May 1998, the European Union Council decided that 11 countries had fulfilled the convergence criteria, which are the set of conditions for joining the euro and within the next month (June 1998) the ECB and ESCB were established. The ECB together with the ESCB formed the Eurosystem, a collective monetary authority for all the European Central banks that use euro as their official currency (ECB, 2011).

[10] The Benelux countries are Belgium, the Netherlands and Luxembourg.

Nevertheless, the ECB and the Eurosystem faced some challenges; these new institutions had to gain the credibility and the confidence of the public in order to maintain financial stability. Further, they had to create a framework that would work successfully with the National Central Banks (NCBs) of the Eurosystem. The euro was introduced as a currency in 1999 for 11 member states and today, the euro is the official currency of the 17 members of the EMU. The EMU consists of Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. In addition, the currency is used by another five European countries which are Montenegro, Andorra, Monaco, San Marino and Vatican City (ECB, 2011).

The new EU member countries have to fulfil the Maastricht Criteria, in order to enter the third stage of the EMU and adopt the euro as their currency. These criteria include rules or targets for inflation rates, limits for government deficit and debt, exchange rates and long-term interest rates. According to the Maastricht Criteria, the inflation rate should not be more than 1.5% from the three best performing (with low inflation) member states. Moreover, as far as the deficit and the debt are concerned, the ratio of government debt to GDP should not exceed 60% and the ratio of the annual government deficit should not exceed 3%. Nevertheless, a country with a high level of debt can still adopt the euro currency, given the fact that its level of debt is steadily decreasing. Further, the Maastricht criteria state that the applicant country should have joined the Exchange-Rate mechanism (ERM) under the European Monetary System (EMS) for two consecutive years and should not have devaluated its currency during the period under consideration. In addition, the long-term interest rates should not be more than 2% above the interest rates of the three EU countries, which exhibited the lowest inflation over the past year prior to the application of joining the EMU (Maastricht Criteria, 2011).

In 2004, the recent enlargement of the EU involved 9 East European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia) and 2 Mediterranean countries (Malta and Cyprus). According to Staikouras et al. (2008), this enlargement posed challenges for the new and the old EU member states, mainly in relation to the operation of the European financial system, the level of competition and the process of financial integration. At the beginning of the transition period, the new EU member states had to create a two-tier banking system, where the central bank ensure macroeconomic stability and commercial banks are responsible for the efficient credit allocation. During this period, emphasis was put on strengthening and restructuring the financial sectors, as well as on the

improvement of supervision and regulation of banking and financial services, so as to cope with market forces and sustain economic stability and growth. Nevertheless, despite all the steps that were taken for the smooth convergence with the old EU member states, there was still a low level of financial intermediation, a strong dominance of the banking system within the financial sector and a high degree of foreign involvement in most financial sector segments (Staikouras et al., 2008). A further enlargement is expected to take place, with potential countries such as Turkey, Croatia and the Former Yugoslav Republic of Macedonia (ECB, 2008).

Table 3.2-1 depicts the number of credit institutions and branches in the European Union for the period between 2004 and 2008. In this table, only the branches that belong to credit institutions are included. The country with the highest number of credit institutions and branches is Germany, while Estonia has the least number of credit institutions and Malta the least number of branches. According to ECB (2011), the number of credit institutions in each member state includes the credit institutions under the jurisdiction of that country, regardless of whether they are subsidiaries or not of foreign banks, as well as the branches of foreign institutions in that member state.

It should be noted that if a foreign bank has several branches in a given member country, then these are counted as a single bank branch. However, if the same bank has several subsidiaries, the branches are counted separately, as they are considered to be separate legal entities. The credit institutions that depend on a central organisation, such as groups of co-operative banks, are counted separately.

Table 3.2-1 Number of Credit Institutions and Branches in the European Union

	Number of credit institutions					Number of branches				
Country	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Belgium	104	100	105	110	105	4837	4564	4574	4425	4316
Bulgaria	35	34	32	29	30	5606	5629	5569	5827	6080
Czech Republic	70	56	57	56	54	1785	1825	1877	1862	1993
Denmark	202	197	191	189	171	2119	2122	2452	2194	2192
Germany	2148	2089	2050	2026	1989	45331	44044	40282	39777	39531
Estonia	9	11	14	15	17	203	230	245	266	257
Ireland	80	78	78	81	501	909	910	935	1158	895
Greece	62	62	62	63	66	3403	3543	3699	3850	4095
Spain	346	348	352	357	362	40603	41979	43691	45500	46065
France	897	854	829	808	728	26370	27075	40013	39560	39634
Italy	787	792	807	821	818	30950	31504	32334	33230	34139
Cyprus	405	391	336	215	163	977	951	941	921	923
Latvia	23	25	28	31	34	583	586	610	682	658
Lithuania	74	78	78	80	84	758	822	892	970	973
Luxembourg	162	155	156	156	152	253	246	234	229	229
Hungary	271	214	212	206	197	2987	3125	3243	3387	3515
Malta	16	19	18	22	23	99	109	110	104	111
Netherlands	461	401	345	341	302	3798	3748	3456	3604	3421
Austria	796	818	809	803	803	4360	4300	4258	4266	4243
Poland	744	730	723	718	712	8301	10074	10934	11607	12914
Portugal	197	186	178	175	175	5371	5422	5618	6055	6391
Romania	40	40	39	42	43	3031	3533	4470	6340	7375
Slovenia	24	25	25	27	24	706	693	696	711	698
Slovakia	21	23	24	26	26	1113	1142	1175	1169	1258
Finland	363	363	361	360	357	1585	1616	1756	1693	1672
Sweden	212	200	204	201	182	2018	2003	2004	1988	2025
United Kingdom	407	394	394	396	391	13386	13130	12880	12514	12514
MU15	6848	6681	6511	6365	6568	169552	170704	182597	185083	186363
EU27	8956	8683	8507	8354	8509	211442	214925	228948	233889	238117

Source: ECB (2011)

Table 3.2-2 illustrates the number of employees and the total assets of the EU credit institutions for the years between 2004 and 2008. The first indicator refers to the average number of staff employed during the reference years and it excludes employees of financial institutions, which are not credit institutions, even if they belong to the same group as credit institutions. Credit institutions in Germany have the highest number of employees, whereas Estonia's credit institutions have the least number of employees. Regarding the total assets, UK is the leading banking system, while the banking System with the least total assets it that of Estonia.

Table 3.2-2 Number of employees and Total Assets for European Union Credit Institutions for 2004-2008

	Number of employees of CIs					Total Assets of CIs (EUR millions)				
Country	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Belgium	71347	69481	67957	67080	65246	914391	1055270	1121905	1297788	1272147
Bulgaria	22467	22945	26738	30571	34930	13224	17447	22302	31238	36825
Czech Republic	38666	37943	37825	40037	39882	87104	100902	114878	140168	155056
Denmark	46372	47579	46394	49644	52830	629587	746589	822024	978264	1091806
Germany	712300	705000	692500	691300	685550	6584388	6826558	7121039	7562431	7875402
Estonia	4455	5029	5681	6319	6144	8586	11876	15379	20603	22039
Ireland	35564	37702	39154	41865	40507	722544	941909	1178127	1337357	1412191
Greece	59337	61295	62171	64713	66165	230454	281066	315081	383293	461982
Spain	246236	252831	261890	275506	276497	1717364	2149456	2515527	2945262	3381187
France	432326	442230	484557	497384	492367	4419045	5073388	5728127	6682335	7225140
Italy	336354	335726	339091	340443	340463	2275628	2509436	2793244	3331830	3628272
Cyprus	10617	10799	10845	11286	12554	46540	62553	76623	92897	118142
Latvia	9655	10477	11656	12826	13905	11167	15727	22694	30816	32249
Lithuania	7266	7637	8624	10303	11080	8553	13162	17347	23817	26542
Luxembourg	22549	23224	24752	26128	27208	695103	792418	839564	915446	931564
Hungary	35558	37527	39302	41905	43640	n.a.	78289	93679	108504	124678
Malta	3371	3383	3515	3756	3915	20838	27195	30034	37807	42283
Netherlands	118032	120165	116500	114424	116000	1677583	1697781	1843176	2176197	2235179
Austria	72858	75303	76323	77731	78754	635348	721159	789770	890747	1067860
Poland	150037	158130	162125	173955	188969	141571	163421	189739	233938	263098
Portugal	53230	54035	58213	60979	62369	345378	360190	397123	439461	482332
Romania	49702	52452	58536	66039	71622	23200	35400	51911	72095	84541
Slovenia	11602	11726	11838	12051	12284	24462	30135	34841	43493	49010
Slovakia	19819	19773	19633	19779	20598	30834	37834	49151	58053	65509
Finland	25377	23644	24769	25025	25699	212427	234520	255055	287716	383906
Sweden	44242	44943	47069	48457	50115	599682	653176	773736	845958	899769
United Kingdom	490436	461654	453045	505690	495917	7085205	8526508	9868683	10094508	8840131
MU15	2211100	2226544	2274075	2309671	2305578	20521493	22763034	25039236	28424060	30566597
EU27	3129775	3132633	3190703	3315196	3335210	29160206	33163365	37080759	41062022	42208840

Source: ECB (2011)

3.3 The Greek Banking System

Over the last 30 years, the Greek banking system witnessed significant changes; until the mid 1980s, the Greek banking system was operating under strict state control, with numerous legislations and a very bureaucratic framework (Chatzoglou et al., 2010). More specifically, the Greek banking system experienced a tough regulatory system and contemporary macroeconomic conditions such as high inflation and interest rates, low money circulation and reduced investment activity (Siriopoulos and Tziogkidis, 2010). This led to inefficiency and serious distortions in the functioning of the country's financial system (Christopoulos et al., 2002). However, the need for a modern, flexible and market-oriented financial system,

led to a gradual and substantial deregulation of the Greek banking system (Kosmidou and Zopounidis, 2008). At the end of the 1990s and prior to the accession in the EMU, the Greek banking system had the form of perfect competition. This is justified by the high market concentration which ranges from 81.91% in 2003 to 91.49 % in 1997[11] (Siriopoulos and Tziogkidis, 2010). Therefore, consistent macroeconomic policies had been adopted, in view of the country's prospects of joining the Economic and Monetary Union (EMU) (Christopoulos et al., 2002). These policies included the 'Greek convergence Programme', that was successfully implemented, aiming at achieving the Maastricht Criteria by the end of the 1990s. Therefore, the Greek Banking system experienced the transition from a strict framework to an operation that was characterised by freedom in funds transfers, loans supply and interest policy. This led to the promotion of new banking products and has changed Greek banks' operations and the marketing policy they are following.

Furthermore, there was involvement to mergers and acquisitions that allowed banks to have easier access to international money and capital markets, and therefore they could exhibit economies of scale (Pasiouras and Zopounidis, 2008). Pasiouras et al. (2011) add that mergers and acquisitions serve as a means to increase market power, replace insufficient management and decrease risk through geographic and product diversification.

Moreover, there were major improvements in communication and computing technologies, where Greek banking institutions invested heavily in electronic distribution networks, especially in the mobile and Internet banking (Karatzas, 2003). These developments have increased competitive pressures, urging Greek banks to reduce their operating costs (Kardaras and Papathanassiou, 2001). For all the above mentioned reasons, Greek banking institutions were forced to generate new products and seek new customers, as competition is increased in terms of range, quality and pricing of these services (Gaganis et al., 2009).

3.3.1 The structure of the Greek Banking Sector

In 2009, the Greek banking sector consisted of the Bank of Greece, 20 commercial banks, 29 foreign banks and 16 cooperative banks (see Table 3.3-2) (Hellenic Bank Association, 2011). It also comprised a large network of ATMs (see Table 3.3-3) and employees (see Table 3.3-

[11] It should be noted that, market concentration deposits, the number of branches and size, consist significant figures of the Greek banking industry, as they are negatively related to the acquisition likelihood of a target bank (Siriopoulos and Tziogkidis, 2010)

4); however, it is observed that despite the increase in the number of Greek commercial bank branches, there was a small decrease in the number of employees in 2009. This could be explained by the fact that banks have invested heavily in electronic banking services and therefore the need for staff is less. Despite the crisis in the Athens Stock Exchange market in 1999[12], a healthy expansion of the Greek banking sector was achieved during the period between 1999 to 2003, possibly boosted by the entrance of Greece in the EMU (Siriopoulos and Tziogkidis, 2010).

Table 3.3-1 presents the aggregate figures for the Greek banking system, for years between 2008 and 2010. It is clear from the figures that there is a reduction in interest income and in operating profits in 2010. This could be explained by heavy investments in IT that banks have made in recent years. Personnel expenditure was reduced in 2010, indicating that e-banking technologies can reduce banks' costs, since less staff is needed. In addition, the fees and commissions were reduced significantly, which could be attributed to the fact that more customers adopt e-banking services and they pay less fees for these transactions, compared to what these cost within the bank branch. Since income and profits were reduced, so the ROA and ROE were reduced as well.

Table 3.3-1 Aggregate Figures for the Greek banking system (EUR billions)

	2008	**2009**	**2010**
Interest Income	30.90	25.62	23.89
Personnel Expenditure	4.80	5.00	4.84
Operating Profits	7.00	7.15	6.08
Total Assets	458.00	490.10	493.06
Total Equity	24.70	33.60	31.96
Fees and commissions	2.81	2.40	2.18
General and admin expenditures	3.12	3.04	3.06
ROA	0.067	0.052	0.048
ROE	1.251	0.763	0.747

Source: ECB (2011)

The banking sector is the dominant segment of a country's financial system (Asimakopoulos et al., 2008). Chatzoglou et al. (2010) mention that in spite of the large number of banks operating in Greece, only a small number dominate the Greek banking system. These banks

[12] According to Siriopoulos and Tziogkidis (2010) the great rise of the Greek Stock Market during the 1999, drove stock prices to be overpriced and thus, there was a downward movement during the next period. More specifically, from 6400 points the stock market dropped to 3000 points and it was estimated that small investors lost almost 100 billion of euros.

are mainly the National bank of Greece, Alpha bank, EFG Eurobank-Ergasias, Emporiki bank, Piraeus bank and Bank of Cyprus, which represent about 80% of the total Greek banking market. In the past decade, the Greek banking sector was reorganised, as more than 15 Greek banks became parts of larger-sized and emerging banking groups. At the same time, Greek banks merged their networks and businesses with many significant foreign banks (Chatzoglou et al., 2010). Thus, many Greek banks reinforced their position and improved the competitive advantage in the domestic market (Kosmidou, 2008).

Table 3.3-2 Number of banks, branches and employees for year-end 2009

	Number of banks		Number of branches		Number of employees	
	2008	**2009**	**2008**	**2009**	**2008**	**2009**
Greek commercial banks	20	20	3634	3644	58296	57737
Foreign banks	30	29	286	327	6665	5605
Cooperative banks	16	16	169	126	1204	1293
Bank of Greece			65	65	2494	2334
Total	66	65	4154	4162	68659	66969

Source: HBA (2011)

Table 3.3-3 Number of ATMs for year-end 2009

Number of ATMs		
	2008	**2009**
Greek commercial banks	6906	6959
Foreign banks	441	437
Cooperative banks	228	228
Total	7575	7624

Source: HBA (2011)

Table 3.3-4 presents the network of branches and employees for the Greek credit institutions, including commercial, investment and deposit banks. It should be noted that a fairly big proportion of the bank branches are located in the region of Attica, as Athens is the capital city of Greece. However, Greek banks make every effort to maintain an extensive branch and ATM network in rural areas and that depends upon the number of residents in the area.

Table 3.3-4 Number of branches and employees per region for year-end 2009

	Network				Personnel
	Region of Attica	Region of Thessaloniki	Rest of Greece	Total	
National Bank of Greece	212	52	311	575	12534
Alpha Bank	190	49	192	431	7501
Emporiki Bank	144	36	188	368	5206
EFG Eurobank-Ergasias	207	49	176	432	7573
Bank of Piraeus	152	44	161	357	5049
Geniki Bank	60	16	63	139	1752
Marfin-Egnatia Bank	93	22	71	186	2753
Agricultural Bank	115	34	333	482	6488
Attica Bank	41	10	29	80	1134
Millenium Bank	92	26	45	163	1494
PROTON Bank	22	2	8	32	533
Probank	59	6	37	102	1100
Panellinia Bank	11	6	14	31	145
First Business Bank	10	2	7	19	279
Aspis Bank	34	8	31	73	1020
Postbank	57	17	80	154	2419
Deposits &Loans Fund	2	1	1	4	474
Investment Bank of Greece	1	1	3	5	243
Aegean Baltic Bank	1	n.a.	n.a.	1	40
Total	1503	381	1750	3634	57737

Source: HBA (2011)

Table 3.3-5 and Table 3.3-6 depict the network of foreign EU and non- EU credit institutions that operate in Greece as at the end of 2009. Hondroyiannis and Papapetrou (1996) distinguish foreign banks in Greece into three forms; representative offices, subsidiaries and branches. In Greece, representative offices were established in 1973 and they constitute the cheapest and most flexible form of foreign banks while subsidiaries were established after 1986. However, the most common method that foreign banks conduct business in Greece is through branches. The establishment of foreign branches in Greece involves higher costs than representative offices and subsidiaries, but compared to the other two forms of foreign banks, they can be treated like Greek domestic banks, as they are able to provide loans and accept all types of deposits.

Table 3.3-5 Network of Foreign EU Credit Institutions for 2009

	Network				Personnel
	Region of Attica	Region of Thessaloniki	Rest of Greece	Total	
Bayerische HVb	1	n.a.	n.a.	1	68
HSBC Bank	18	1	n.a.	19	538
BNP Paribas	1	n.a.	n.a.	1	117
INTESA SANPAOLO	3	1	n.a.	4	12
CITIBANK	68	5	11	84	1570
F.C.E. Bank Plc	1	n.a.	n.a.	1	33
EUROHYPO AG.	1	n.a.	n.a.	1	4
Union de Creditos Inmobiliarios	1	1	n.a.	2	45
Cyprus Bank	72	16	78	166	2979
BNP Securities	1	n.a.	n.a.	1	44
Fortis Bank	1	n.a.	n.a.	1	27
Daimlerchrysler Bank Polska	1	n.a.	n.a.	1	12
Deutsche Bank	1	n.a.	n.a.	1	14
Unicredit Bank	1	n.a.	n.a.	1	67
Total	171	24	89	284	5530

Source: HBA (2011)

Table 3.3-6 Network of Foreign non-EU Credit Institutions for 2009

	Network				Personnel
	Region of Attica	Region of Thessaloniki	Rest of Greece	Total	
Bank of America National Association	1	n.a.	n.a.	1	33
KEDR	1	n.a.	n.a.	1	20
Bank Saderat Iran	1	n.a.	n.a.	1	22
Total	3			3	75

Source: HBA (2011)

In Greece, during the period 1981-1992, foreign banking activity was increased significantly, as it was influenced by the changes in the institutional relationship of the country with the EU, as well as the economic and political development within Greece. In particular, when Greece joined the EU, the Treaty of Accession of Greece to the EU was signed, and this recognised the freedom to establish credit and other financial institutions without any discrimination, opposed to domestic banking institutions (Hondroyiannis and Papapetrou, 1996). Moreover, Hondroyiannis et al. (1999) point out that despite the non-significant

expansion of the foreign banks network in Greece during the 1990s, the international competition was stronger, due to the ability to offering banking products and services on a cross-border basis. In addition, the introduction of liberalisation measures seemed to have improved the degree of competitiveness of the Greek banking system and decrease its oligopolistic character (Hondroyiannis et al., 1999). In 2009, 17 foreign banking institutions are operating in Greece, with a branch network of 287 branches (see Table 3.3-5 and Table 3.3-6).

Table 3.3-7 Network of Cooperative Banks in Greece for 2009

	Network			
	Region of Attica	**Region of Thessaloniki**	**Rest of Greece**	**Total**
of Evros	n.a.	n.a.	5	5
of Achaia	n.a.	n.a.	11	11
of the Dodecannese	1	n.a.	18	19
of Chania	1	n.a.	23	24
Pagritia	5	1	54	60
of Epirus	n.a.	n.a.	4	4
of Lamia	n.a.	n.a.	6	6
of Trikala	n.a.	n.a.	7	7
of Karditsa	n.a.	n.a.	1	1
of Peloponese	n.a.	n.a.	10	10
of Evia	n.a.	n.a.	9	9
of Pieria	n.a.	n.a.	1	1
of Drama	n.a.	n.a.	2	2
of Lesvos	n.a.	n.a.	11	11
of Seres	n.a.	n.a.	2	2
of western Macedonia	n.a.	n.a.	5	5
Total	7	1	169	177

Source: HBA (2011)

Table 3.3-7 presents the network of cooperative banks that exist in Greece as of the end of 2009. As Pasiouras et al. (2007) explain, despite their relatively small market share in comparison to commercial banks, Greek cooperative banks play an important role in the development of the local economy. These banks focus mainly on small and medium enterprises and private customers, by providing support and encouraging the development of local enterprises. Greek cooperative banks attempted to be established as reliable, friendly and flexible banks, by offering competitive banking products that are adjusted to local

conditions and to customers' needs. In Greece, the cooperative bank industry has a history of over 10 years. Until the early 1990s, cooperative banks were operating as credit cooperatives and they obtained a licence to operate as cooperative banks. Those credit cooperatives that raised the minimum capital required and fulfilled certain conditions could apply for a permit from the Bank of Greece, in order to operate as credit institutions, allowing them to offer all banking activities within the borders of the area that they are activated. In 2009, there are a total of 16 cooperative banks with a network of 177 branches and 1293 employees (see Table 3.3-7). The cooperative banking industry has experience an increase of around 12 % in the number of employees compared to 2008, while the number of branches remains unchanged

The Hellenic and Foreign Credit Institutions that offer e-banking services (ATM services and Internet Banking/Telephone Banking) in Greece are the following: National Bank of Greece, Alpha Bank, Emporiki Bank, EFG Eurobank, Piraeus Bank, Geniki Bank, Agricultural Bank of Greece, Marfin Egnatia Bank, Bank of Attica, Millenium Bank, Proton Bank, Probank, Panellinia Bank, Aspis Bank, First Business Bank, Postbank, HSBC, Citibank, Bank of Cyprus and Intesa Sanpaolo S.P.A. All banks that offer electronic banking services have user friendly and simple standardised websites. The majority of banks in Greece offer advanced as well as basic services. Basic services include viewing of account balance, transfer of funds, and payment of utility bills while advanced services include buying/selling of shares in real time, provision of extra pin generators and applications for mortgages and loans.

3.3.2 The Greek Banking Institutions under consideration

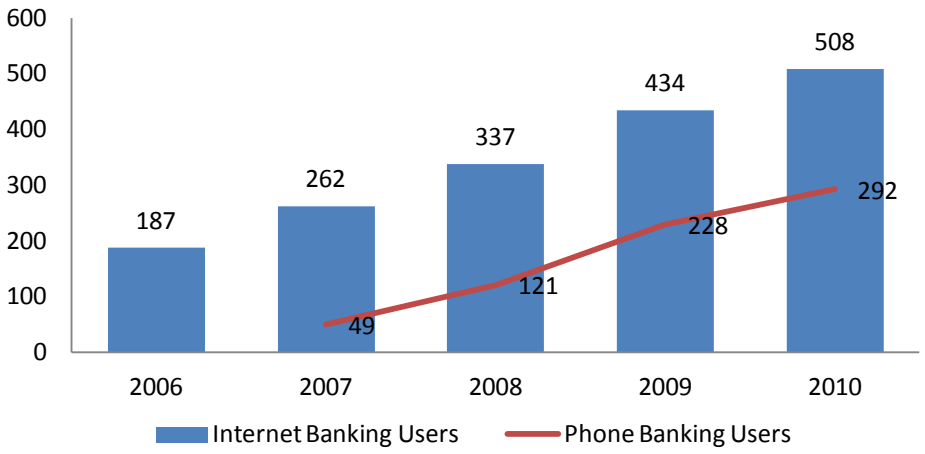
In this section, we present the brief history of each Greek credit institution that is considered in our study. More specifically, we review the involvement of each institution in mergers and acquisitions, the expansion of their network, as well as the investment in new technologies, such as Internet banking, ATMs, Phone banking, Telephone banking and Mobile banking. The 11 Greek banking institutions that we consider are the National Bank of Greece, Alpha Bank, Emporiki Bank, Attica Bank, Aspis Bank, ATE Bank, Eurobank EFG, Geniki Bank, Marfin Egnatia Bank, Millennium Bank and Piraeus Bank.[13]

[13] The banking institutions were selected based on the provision of Internet banking services.

National Bank of Greece

The National Bank of Greece (NBG) was founded in 1841 as a commercial bank and is the oldest and largest among Greek banks. NBG heads the strongest financial group in Greece and also boasts internationally a dynamic profile in the South-eastern Europe and the Eastern Mediterranean. The NBG Group provides a full range of products and services, such as investment banking, insurance, brokerage, leasing, asset management and factoring. The Bank's branch and ATM networks are the largest in Greece, with 562 branches and 1485 ATMs. Various improvements, changes and automatic operations were implemented in an effort to reduce congestion in the back-office operations. NBG uses special software to monitor and measure teller productivity, aiming at reducing customers' waiting time and enhancing front-line services. Recent results revealed a small increase in productivity as well as a reduction in waiting times. NBG started offering Internet banking services in 2000 and in 2009 launched its new i-bank trademark, as the part of their growth of alternative banking delivery channels. Now customers can enjoy faster access to the banks' services. The continued improvements in the alternative delivery channels resulted in an increase in the numbers of users year by year, with over half a million users in 2010. There was approximately a 28% increase in the phone banking users and a 17% increase in the Internet banking users (see Figure 3.3-1).

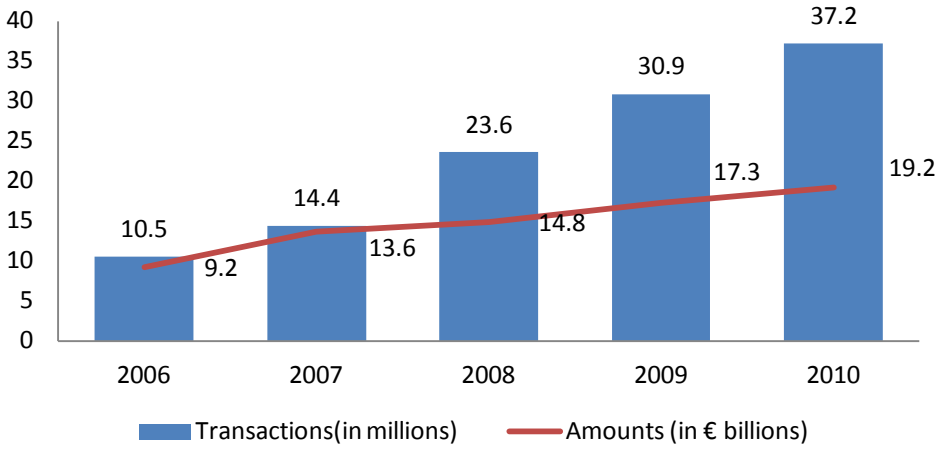
Figure 3.3-1 Internet banking and Phone banking users



Source: NBG (2011)

During 2010, new transaction categories were incorporated into the Internet banking functions. Now, NBG is offering mobile banking services via almost all smart phones (i.e. iPhone, Blackberry, Symbian and Windows mobile). Over 37 million transactions were carried out via the alternative delivery channels (Internet, phone and mobile banking), that were worth over €19 billion (see Figure 3.3-2).

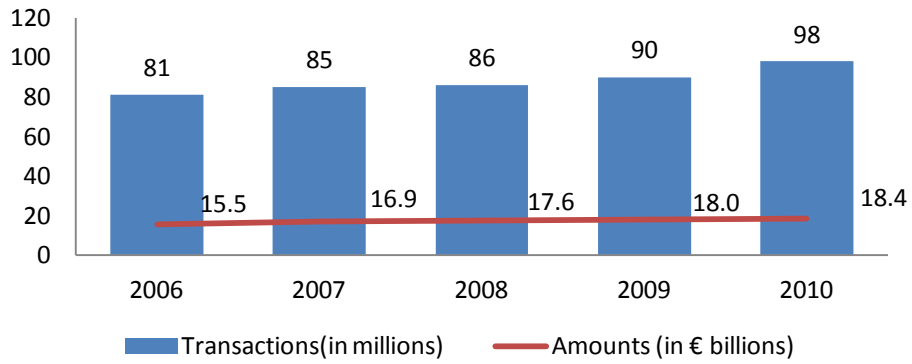
Figure 3.3-2 Internet, Phone and Mobile Banking transactions



Source: NBG (2011)

Similarly, there is a steady increase in the number of transactions carried out via ATMs, with 98 million transactions in 2010 that were worth over €18 billion (Figure 3.3-3). In 2010, NBG achieved a significant reduction in indirect greenhouse emissions, caused by its operations, due to the registration of over 67,000 new e-banking users (National Bank of Greece, 2011).

Figure 3.3-3 ATM transactions



Source: NBG (2011)

Alpha Bank

Alpha Bank was founded in 1879 by John F. Costopoulos, after the establishment of a commercial firm in Kalamata, Greece. Throughout its history, the Bank grew considerably, as it has developed a major Group and offers a wide range of products and services in Greece, as well as abroad in the South-Eastern Europe.

Recently, Alpha Bank has been following a business development policy, which aims at the improvement of services and products offered by increasing productivity and by keeping operational risks at the minimum. During 2010, the Bank extended its policy in order to include new projects that support operational requirements and upgrades in the IT infrastructure, so as to adopt new modern methods and technologies of operation. The alternative networks offered by Alpha Bank are ATMs, Automated Cash Transaction Centres (ACTCs) and e-banking services, such as Alpha Web banking, Alpha Web International Trade, Alpha Line, Alpha Mobile banking, Alpha Phone Banking, Call centre, E-Commerce services and mass collections/payments services with electronic file transfer.

Alpha Bank installed the first ATM in 1981 and was the first to lead modern banking technologies in Greece. In 2010, the Bank had a total of 851 ATMs, where 518 are installed in bank branches and the remaining 333 are off-site machines. The Bank holds the second position in the Greek Banking market based on the average monthly rate transactions per ATM, where 80% of cash withdrawals were performed in ATMs and the value of fund transfers was over €8 billion. In addition, in 2010, 150 feasibility studies were carried out in relation to off-site ATMs and 16 new machines were installed, aiming at the provision of better quality services to customers. Alpha Bank was the first to introduce Internet Banking services in 1996 and since then more than 126,000 customers use these services. In 2010, there was a 12% increase in the number of Internet Banking users compared to 2009 and more than 63.5 million transactions were carried out, with an increase of 5.8% compared to 2009. In 2007, the Bank introduced the Alpha Web International Trade, which aims at the possibility of monitoring the progress of settlement files, sending electronic requests for settlements and Letters of Credits for imports, for those customers working with the Bank in the import/export business. At the end of 2010, more than 400 companies had joined this service, with a 30% increase compared to 2009 and over 10 thousand international trade files

that have been sent electronically. Further, Alpha Bank offers banking services through the Alpha Line application, which is installed on customers' computers and counts over 700 subscribed companies. Moreover, Alpha Bank is offering its services via mobile phones, a service that was upgraded in 2010, in order to be compatible with new technology smart phones. Since 2009, there was a 550% increase in the number of mobile banking subscribers and over 400,000 transactions were carried out, a 300% increase compared to 2009 (Alpha Bank, 2011).

Emporiki Bank

The 'Gr. Empedoklis' Bank was established in 1987 and in 1907 the bank changes its status from 'Gr. Empedoklis' Limited Partnership to that of a Societe Anonyme (S.A.) company, under the business name 'Commercial Bank of Greece'. In 2001, the Bank was rebranded as 'Emporiki Bank'. Following other competitor banks, Emporiki Bank starts offering Internet Banking services in 2001. Recently, there was an improvement in the Bank's infrastructure and a simplification of the banking procedures in order to meet customers' expectations. More specifically, Emporiki Bank had to restructure its branch network based on the customer population and at the end of 2009 the Bank consists of 351 branches, 751 ATMs and 6 Currency Exchange points. In addition, 16 development centres were established for the better service of corporate customers and the provision of services through alternative delivery channels, such as Emporiki Bank Secure service, E-banking services, Emporiki e-secure Commerce service and Mobile Banking services. Moreover, in 2009, Emporiki Bank offered its customers the ability to receive email or SMS (short message system) notifications of deposit account and credit card transactions. Further, the Bank, installed 3 Automatic payment systems at 3 branches, to offer its customers faster services as they would save time from performing these transactions over the counter. Emporiki Bank Secure service ensures safe web purchases. The number of credit card holders, who activated this service in 2009, has increased by 80% compared to 2008 and the volume of online transactions through credit cards increased by 33% compared to 2008. For the E-banking services, the number of registered users in 2009 increased by 18% compared to 2008, while the number of customers for the e-Secure Commerce services increased by 47%, the value of transactions increased by

28% and the volume of transactions increased by 11% compared to 2008. The annual number of capital transfers was increased by 83%; this service was enhanced with the option to transfer funds in euro abroad within the Single Euro Payments Area (SEPA). Emporiki Bank also invested in the re-design and redevelopment of new mobile technologies, in order to make banking services available through an iPhone application, which can be expanded in the future for all smart phones (Emporiki Bank, 2011).

Attica Bank

Attica Bank is a Society Anonyme and was established in 1925. The Bank offers a full range of banking and investment products and services to individual customers, Small and Medium Enterprises and large companies. These services are offered via the branch network, which consists of 80 branches and alternative delivery channels, such as ATMs and Internet banking. Attica Bank has a modern network with 90 ATMs, 80 of which are installed in the branches and 10 ATMs are installed in other places of interest. The Bank's objective for 2011 is to continue to improve the number of services that are available via the ATMs, aiming at faster and easier transactions for their customers. In addition, in 2006, Attica Bank offers Internet Banking services, which are user friendly and are constantly improved with new functionalities, for fast and reliable services. In 2010, the number of Internet Banking users was increased by 26% compared to 2009, with the majority of customers using this delivery channel to view the balance of their accounts (Attica Bank, 2011).

Aspis Bank

Aspis Bank was established in 1992 under the name 'Aspis Mortgage Bank' and was the first private mortgage bank operating in Greece. In 2001, the Bank extended its operations and was converted from a mortgage to a commercial bank with the name 'Aspis Bank'. In the

same year, Aspis Banks is offering its banking services through new delivery channels such as Internet Banking and Phone Banking. In 2002, Aspis Bank acquired the retail network of the ABN Amro Bank in Greece and all the respective ABN Amro companies (Leasing and Insurance brokerage). Further, the Bank completes the installation and operation of a new information system, for the better service of its customers. During 2006-7, the branch network was expanded with the operation of new branches in rural areas of Greece. In 2008, Aspis Bank established and operated business centres as well as established the division of private banking for the media and for high income customers that require investment advisory services. In 2010, the Bank increases its share capital by €48.37 million and the 'Postal Saving Bank Limited Banking' company enters the Bank with a 32.9% capital stake. On May 7th 2011, Aspis Bank was renamed as 'TBank', as an attempt to make a new beginning in the Greek Banking system. Since 2010, TBank has completed a series of actions, to strengthen the Bank capital, the equity and improve its operations and functions. Hence, the Bank launched a new modern website and a new e-banking platform.

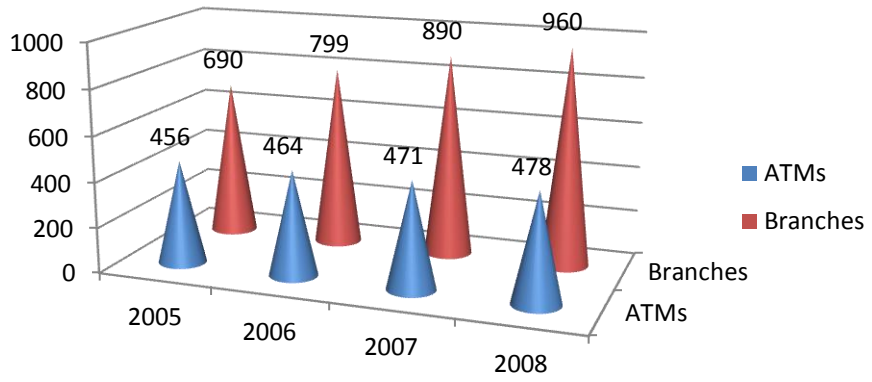
The new website offers easy access to products and services, via all the new modern internet browsers with an easy and direct management of the content. In addition, the website has a mobile version for access via mobile smart phones. The new features of the TBank e-banking include apart from the normal Internet Banking services, the provision of products and services to corporate customers, bulk payments and Mobile banking (TBank, 2011).

ATE Bank

The Agricultural Bank of Greece (ATE) was founded in 1929 as a non- profit credit provider to the agricultural sector. Initially, the Bank aimed at enhancing the country's rural development. During 2004-2006, ATE Bank focused on strengthening its image and position, by developing the competitiveness of its branch network and productivity. ATE Bank invested heavily on upgrading its distribution network and introduced an operational model

that transformed every branch into an efficient sales centre, aiming at fulfilling every customer's needs.

Figure 3.3-4 ATE Bank Branches and ATMs



Source: ATE Bank (2011)

ATE Bank has expanded significantly its branch and ATM network since 2005; it has the second largest network in Greece, with 478 branches and 960 ATMs in 2008 (Figure 3.3-4). In 2006, ATE Bank offered its services through the Internet and via mobile phones and in 2008, introduced the new ATE Bank Group's technology and innovation centre for quick, safe and easy access to these services. In addition, it has added new services that are available through the Internet and Mobile banking, such as the option to view the balance and list of transactions of ATE Bank credit cards (ATE Bank, 2011).

Eurobank EFG

Eurobank EFG Bank was established in 1990 under the name 'Euromerchant Bank S.A.' and offered mainly private and investment banking products and services. Eurobank EFG Bank is offering banking products and services via its branch network but also via alternative delivery channels, such as the Internet Banking, ATMs, Mobile Banking and Phone Banking. Initially, in 2000, the Bank began offering services through electronic delivery channels, by providing a complete range of technical equipment for rapid and easy access to the Internet, for a

monthly fee and for a period of 48 months. Moreover, the Bank's Internet Banking services received a 94% customer satisfaction rate and in 2009, the Bank received an award for their 'Top Performance' on the provision of electronic services. Despite the economic climate in Greece, in 2010 the Bank invested in modern technologies and offered electronic banking services under a single umbrella called 'Live Banking', aiming at the provision of superior and easy to use services. Through the 'Live Banking', customers can access all the banking products and services electronically, in addition to new innovative services such as SMS and e-mail alerts. Further, customers are able to open new deposit accounts over the internet, as well as they have the option of 24-hour support by Bank representatives, through free-of-charge phone calls and Live chat. 'Live Banking' offers banking services through Internet Banking, Mobile Banking, Europhone Banking and ATMs. In 2010, the Bank's network consists of 467 branches, 750 ATMs and 9663 employees. Recently, on August 29 2011, Eurobank EFG Bank and Alpha Bank announced their merger, in order to create a banking force in Greece and in South-Eastern Europe. The new banking group will be among the largest 25 banking groups in Europe, with enhanced capital base and outstanding value creation for shareholder. It is believed that the consolidation of these two private banks will play a vital role in the Greek economic recovery (Eurobank EFG, 2011).

Geniki Bank

Geniki Bank was established in 1937 under the name 'Bank of the Army Pension Fund' and in 1966, its name was changed to 'General Hellenic Bank S.A.'. In 1998, the Bank was renamed to 'General Bank of Greece S.A.'. Geniki Bank offers retail banking, corporate banking, investment banking, factoring, leasing, private banking and Geniki Finance services. In particular, the Bank offers its modern banking products and services to individuals, small companies, larger corporations, as well as financial products and consultancy to companies. In addition, Geniki Bank offers various deposit and investment products as well as a wide range of insurance products to its customers. Further, the Bank enhances the safety of its customers by applying security practices for its debit/credit cardholders. The Bank offers its banking services and products via bank branches and alternative delivery channels such as Internet Banking, ATMs, Mobile Banking and Phone Banking. In 2010 the Geniki Bank

network consists of 119 branches and 176 ATMs; this network ensures geographical coverage throughout Greece. Recently, aiming at the control of operational costs, a geographical restructure of the network was implemented and 20 branches were closed and merged with the operations of nearby branches. As a consequence, due to the branch mergers, there was a need for personnel restructure. In 2010, Geniki Bank invested heavily in the provision of high quality electronic services. Since 2006, when Geniki Bank began offering Internet Banking services, the Bank has added new functionalities and more options for utility bill payments. According to its annual report, the number of e-banking users has doubled compared to 2009 and the number of registered users has increased by more than 300%. Further, the number of transactions performed has increased by more than 100% compared to 2009. Geniki Bank is also offering its services via ATMs and taking into consideration customers' safety concerns, installed new anti-skimming card reader devices in its whole ATM network. Some further functionalities added to the existing e-banking services include mobile banking services, new transactions, new payments, security enhancements and mobile applications for Internet Banking access via smart phones (Geniki Bank, 2011).

Marfin Egnatia Bank

Marfin Egnatia Bank was created in 2007, after the merger of Laiki Bank, Marfin Bank and Egnatia Bank.

Marfin Egnatia Bank offers a wide range of banking products and services via its branch network and via alternative banking channels. In 2010, the Bank launched its upgraded electronic banking platform called 'Marfin Direct' and offers Internet Banking, Mobile Banking and Phone Banking Services. The Bank consists of 186 branches, 2753 employees and 248 ATMs, which are installed in branches and in other points of interest, such as hotels, ships, supermarkets, shops, airports etc. The Bank offers Internet Banking services since its establishment, as Egnatia Bank was one of the first banks to offer electronic services in 1997. In addition, Marfin Egnatia Bank offers its services through mobile devices, with a mobile version of its website but also through an application developed for iPhones, iPods, iPads and Blackberry. Moreover, the Bank offers Phone Banking, which is access to banking services

through the telephone and Voice Banking, which is an automatic voice system and customers can conduct transactions with voice commands and without the need to press buttons or the intervention of the customer representative. Further, Marfin Egnatia Bank give its customers the possibility to benefit from the provision of stock exchange services via its eBrokerage system and the ePay service, for safer online purchases via credit/debit cards (Marfin Egnatia Bank, 2011).

Millennium Bank

Millennium Bank was established on September 21, 2000, under the name 'Nova bank', with a network of 45 branches.

In 2009, Millennium Bank consists of 163 branches, 1494 employees and 281 ATMs, which are installed in branches and in off-site places. The bank offers Internet Banking and Phone Banking services, apart from the provision of ATMs. The Bank has invested heavily in the safety of the transactions by installing security systems in the Electronic Banking platforms (Millennium Bank, 2011).

Piraeus Bank

Piraeus Bank was founded in 1916 and went through a period of state-ownership and management (1975-1991) before it was privatised at the end of 1991.

In 2000, Piraeus Bank launched the first integrated platform for Internet Banking in Greece, the Winbank, and since then, there were major investments and improvements in the functionality of the platform. Piraeus Bank has optimised all the internal procedures in order to upgrade the speed and quality of completion of transactions, while at the same time keeping the operational costs at minimum. Hence, new IT systems were installed, aiming at safer and effective operations, as well as at higher quality services for Banks' customers. In

2010, the number of registered users increased by 21%, compared to 2009 and this represents 16% of the total bank customers. Phone banking users rose by 55% compared to the preceding year, whereas the number of registered calls exceeded 10,000. Further, e-banking services offered by Piraeus Bank outperformed in 2010 compared to 2009. In particular, the number of registered customers to the alert service increased by 30%, the 'Instant Cash' services completed over 45,000 requests for cash transfers and the 'easypay.gr' remains the most pioneering remote payment system on the Greek Banking market, with an increase of 44% users compared to 2009. At the end of 2010, the Bank's ATM network consists of 682 ATMs, of which 359 are installed in bank branches, while the remaining 323 are installed in other points of interest. In addition, the volume of ATM transactions reached the €25 million, while the value of total transactions was €4.7 billion. In May 2010, Piraeus Bank introduced the 'Winbank- Direct', which is a new banking method and was created in order to attract new customers through the Internet channel and more specifically those that are already Internet Banking users. One of the products that Winbank-Direct offers is a deposit product, which combines the characteristics of a checking account and a time deposit and has over 1,200 new customers, just within a few months of its operation. Moreover, Piraeus Bank has invested in environmentally friendly technologies and activities, due to the global introduction of a strict legal framework on environmental issues. Thus, the Bank adopted a 'Green' culture and introduced the term 'Green Banking'. This culture aims at the reduction of the Bank's environmental footprint and the promotion of Electronic banking transactions through alternative delivery channels such as ATMs, Internet stations, Winbank e-banking and iPads (Piraeus Bank, 2011).

3.4 Qualitative Analysis of Internet and Internet banking in EU and Greece

In this section, we analyse the Internet usage and PC usage in Greece, in comparison with other European countries, as well as the level of Internet Banking activities and the associated security concerns.

The Scandinavian countries, Belgium, France, Luxembourg, Slovakia and the UK are the leader countries in PC usage, with rates between 80-94%. Romania exhibits the highest increase in the PC usage since 2004, with a 155% increase, even though, this country along with Bulgaria (48%) and Greece (49%) are the EU countries with the least PC usage. It

should be added that in 2009, PC usage for the EU27 was increased by almost 35%, compared to 2004 (see table 3.4-1).

Table 3.4-1 Percentage Computer Usage in Europe (Eurostat, 2011)

Country/Year	2004	2005	2006	2007	2008	2009	2010
European Union(27 countries)	55	61	62	66	68	71	74
European Union(25 countries)	58	61	65	67	70	72	75
European Union(15 countries)	61	64	67	69	72	74	77
Belgium	n.a.	n.a.	69	72	74	77	80
Bulgaria	25	n.a.	33	37	43	47	48
Czech Republic	46	45	n.a.	58	67	67	71
Denmark	85	87	89	87	86	88	90
Germany	73	76	79	80	82	83	85
Estonia	56	63	64	67	71	72	76
Ireland	44	48	61	66	70	70	72
Greece	29	31	40	43	47	49	49
Spain	52	55	57	60	64	66	70
France	n.a.	n.a.	n.a.	72	74	74	81
Italy	41	42	44	45	48	51	56
Cyprus	44	43	46	49	50	55	57
Latvia	47	51	57	61	65	67	69
Lithuania	39	43	48	53	58	62	63
Luxembourg	75	79	77	81	84	89	91
Hungary	43	43	56	60	66	65	67
Malta	n.a.	47	45	50	53	61	65
Netherlands	n.a.	84	86	88	89	91	92
Austria	63	66	70	75	78	76	78
Poland	44	48	52	56	58	63	65
Portugal	40	43	45	48	49	54	58
Romania	18	n.a.	33	38	38	44	46
Slovenia	52	n.a.	61	62	62	67	72
Slovakia	62	66	66	68	76	78	82
Finland	77	78	82	83	85	85	89
Sweden	88	87	90	89	90	92	93
United Kingdom	73	76	76	81	82	86	87
Iceland	87	89	91	92	93	94	n.a.
Norway	82	85	87	91	92	93	94
Croatia	n.a.	n.a.	n.a.	49	48	53	58
Former Yoguslav Republic of Macedonia	34	n.a.	38	n.a.	54	58	58
Turkey	18	20	n.a.	31	36	38	41
Serbia	n.a.	n.a.	n.a.	44	n.a.	52	n.a.

Source: Eurostat (2011)

In 2006, Greece introduced its new digital strategy and incorporated the European Electronic communication framework within its legislation. Since then, Greece has made significant progress in the Information and Communication Technologies (ICT) field and more specifically, in the growth rates of broadband technology.

Table 3.4-2 Internet access and broadband connections in Europe for 2006 and 2010

	Internet Access		Broadband connection		Internet Access by type of household	
	2006	2010	2006	2010	Households with children	Households without children
European Union(27 countries)	49	70	30	61	84	65
Belgium	54	73	48	71	89	67
Bulgaria	17	33	10	26	62	29
Czech Republic	29	61	17	54	80	53
Denmark	79	86	63	8	97	83
Germany	67	82	34	75	97	79
Estonia	46	68	37	64	92	59
Ireland	50	72	13	58	84	64
Greece	23	46	4	41	66	39
Spain	39	59	29	57	73	52
France	41	74	30	67	90	65
Italy	40	59	16	49	74	53
Cyprus	37	54	12	51	79	41
Latvia	42	60	23	53	82	52
Lithuania	35	61	19	54	84	52
Luxembourg	70	90	44	70	98	87
Hungary	32	60	22	52	77	54
Malta	53	70	41	69	95	62
Netherlands	80	91	66	u	99	88
Austria	52	73	33	64	94	66
Poland	36	63	22	57	83	54
Portugal	35	54	24	50	80	44
Romania	14	42	5	23	50	37
Slovenia	54	68	34	62	92	59
Slovakia	27	67	11	49	86	60
Finland	65	81	53	76	99	75
Sweden	77	88	51	83	98	85
United Kingdom	63	80	44	u	91	75
Norway	69	90	57	83	99	86
Croatia	n.a.	56	n.a.	49	80	47
Turkey	n.a.	42	n.a.	34	43	41

Source: Eurostat (2011)

In 2009, new initiatives were taken in Greece for the extension of the connectivity, as well as the acceleration of the adoption of new technologies by SMEs and public administration. According to Eurostat (2009), 770 broadband access points were introduced in more than 400 enterprises within the tourism sector and 12 new action areas under the 'Digital Convergence' programme were introduced, which targeted businesses, citizens and the public administration. In addition, optical fibre lines were introduced and a new programme called

'the ΔΟΡ.Υ' was launched, in order to enable the use of satellite broadband and to provide free high speed connections throughout the country.

Table 3.4-3 Broadband and Internet Usage in Greece

Broadband	**2006**	**2007**	**2008**	**2009**	**EU27**	**ranking**
Total DSL coverage(as % of total population)	18.0	86.3	88.0	91.0	94.0	21
DSL coverage in rural areas (as % of total population)	10.0	50.0	55.0	60.0	79.7	21
Broadband penetration (as % of population)	4.4	9.1	13.4	17.0	24.8	23
Speed- % of broadband subscriptions above 2 Mbps	n.a.	n.a.	n.a.	100.0	n.a.	1
3G coverage (as % of total population)	n.a.	n.a.	89.0	n.a.	n.a.	10
% of households with an internet connection	23	25	31	38	65	25
% of households with an internet connection	4	7	22	33	56	25
% of enterprises with a (fixed) broadband access	58	72	74	84	83	13
% of pop. using a mobile phone via UMTS (3G) to access the internet	0	1	1	1	4	23
% of pop. Using a laptop via wireless connect. away from home/work to access the internet	n.a.	1	3	3	17	25
Internet Usage						
% of pop. who are regular internet users (using the internet at least once a week)	23	28	33	38	60	26
% of pop. who are frequent internet users (using the internet every day or almost every day)	13	19	23	27	48	26
% population who have never used the internet	65	62	56	53	30	26
Take up of internet services (as % of population)						
looking for informaiton about goods and services	23	28	31	33	51	n.a.
uploading self-created content	n.a.	n.a.	4	9	20	n.a.
reading online newspapers/magazines	14	16	19	21	31	n.a.
intenet banking	2	4	5	5	32	n.a.
playing or downloading games, images, films or music	11	15	n.a.	19	26	n.a.
seeking health information on injury, disease or nutrition	6	8	10	15	33	n.a.
looking for a job or sending a job application	4	5	5	6	15	n.a.
doing an online course	n.a.	2	2	2	4	n.a.
looking for informaiton about education, training or course offers	n.a.	12	13	12	24	n.a.

Source: Eurostat (2010)

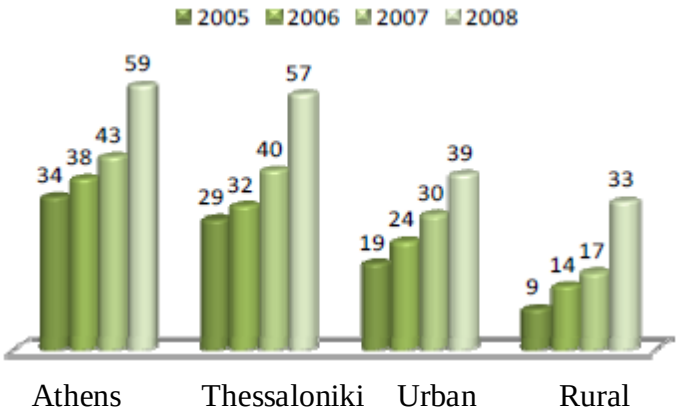
According to Eurostat (2010), the broadband performance of the country has increased significantly in the last few years. This might be attributed to the implementation of a regulatory framework for electronic communications, which encouraged the competition within telecommunication companies and attracted broadband investment (Table 3.4-3).

However, as it is clear from the figures (Table 3.4-2 and Table 3.4-3), Greece's broadband penetration is only 17%, a percentage which is far below the EU average. The majority of Greek citizens have been using the internet to look for information about products and services and read online newspapers and magazines. Only a small proportion of internet users looked for a job over the internet, performed internet banking or completed an online course For instance, in 2009, only 5 % of the population performed Internet banking transactions, 6% looked for a job online or sent a job application and only 2% did an online course (see Table 3.4-3).

Figure 3.4-1 depicts the spread of internet usage within Greece. Athens, which is the capital city of Greece, has the highest number of internet users, while rural citizens exhibit the least

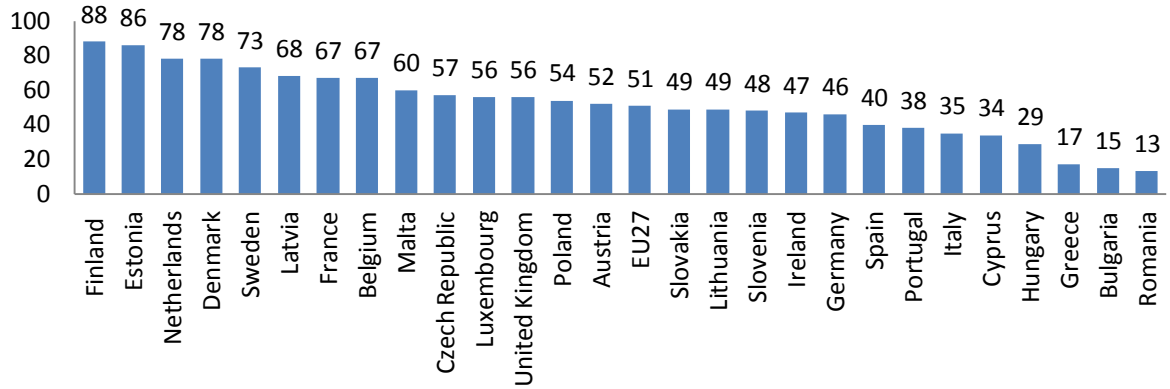
internet usage in the country. However, it should be noted that since 2005, rural cities have experienced the highest increase of internet usage, possibly due to investments in new internet lines, which made this more attractive for rural residents.

Figure 3.4-1 Internet Usage in Greece per region



Source: Observatory for the Greek IS, 2008

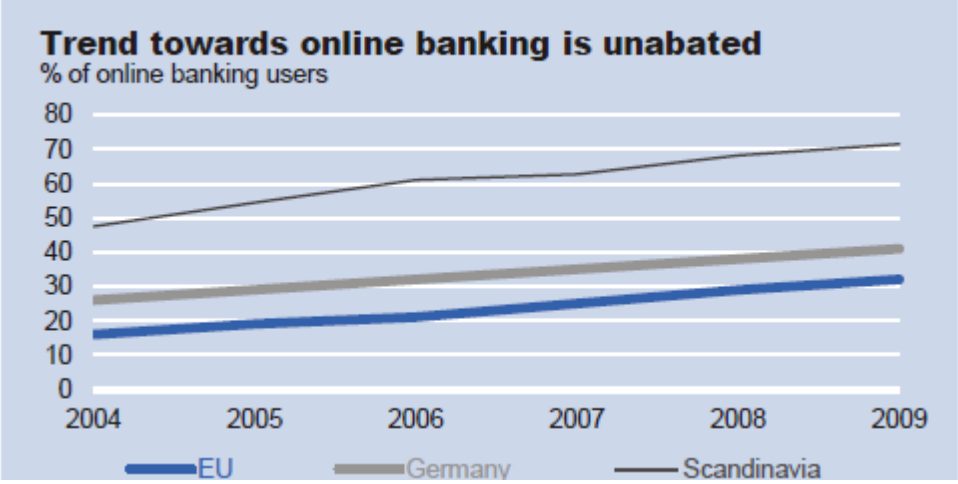
Figure 3.4-2 Internet Banking in the EU



Source: Flash Eurobarometer(2008)

As far as Internet banking is concerned, the countries that have the highest internet banking adoption rates in 2008 are Finland, Estonia, the Netherlands and Denmark. On the other hand, the countries with the lowest internet banking adoption rates are Romania, Bulgaria and Greece (see Figure 3.4-2).

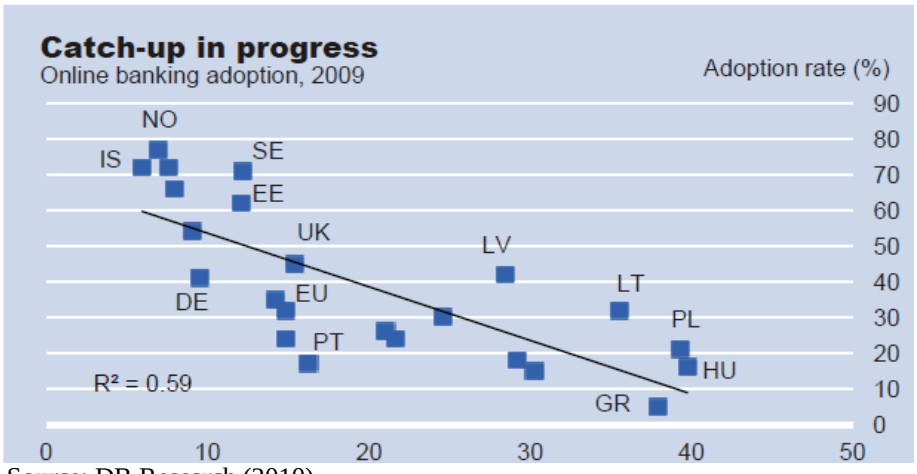
Figure 3.4-3 Growth of online banking services



Source: DB Research (2010)

Figure 3.4-3 presents the constant increase in the percentage of internet banking users, with Scandinavian countries being well above Germany and the average of the rest EU countries. Since there are no signs of slowdown in the internet banking adoption, e-banking snapshot (2010) has forecasted that by 2020 more than 60% of Europeans may use internet banking services. The internet banking adoption rate in relation to the catch up growth rate of internet banking, within the next four years, is presented in Figure 3.4-4. The horizontal axis measures the catch up growth rate, while the vertical axis measures the adoption rate. Although South and South-Eastern countries have low rates of Internet banking adoption, they have potential for catching up in the growth of Internet banking.

Figure 3.4-4 Catch-up progress of online banking adoption for 2009



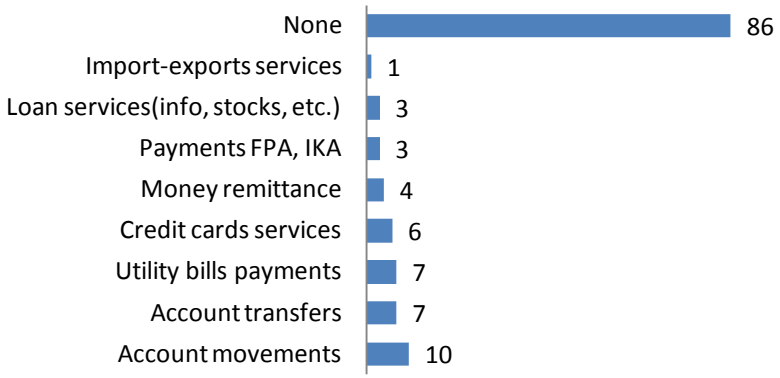
Source: DB Research (2010)

In particular, Poland, Hungary and Greece have a low adoption rate, but in the next four years their adoption growth is expected to be 40% compared to the average EU adoption rate, which is just only 15%.

According to the E-banking snapshot report (2010), in 2009, the Northern countries are still more enthusiastic on using internet banking services, with adoption rates of 62-77%. The medium cluster of adopters consists of countries such as Germany, France and the UK, with rates of 35 to 54%. Yet, Southern and Eastern European countries (i.e. Greece and Hungary) fall below the 32% of internet banking adoption (see Figures 3.4-3 and 3.4-4).

The Observatory for the Greek IS (2008), reports that vast majority of individual in 2008 did not use the internet for banking transactions. The small proportion of e-banking customers prefers to use the account movement service, fund transfers and to make payments for utility bills (Figure 3.4-5).

Figure 3.4-5 E-banking services that Greek customers used in 2008



Source: Observatory for the Greek IS (2008)

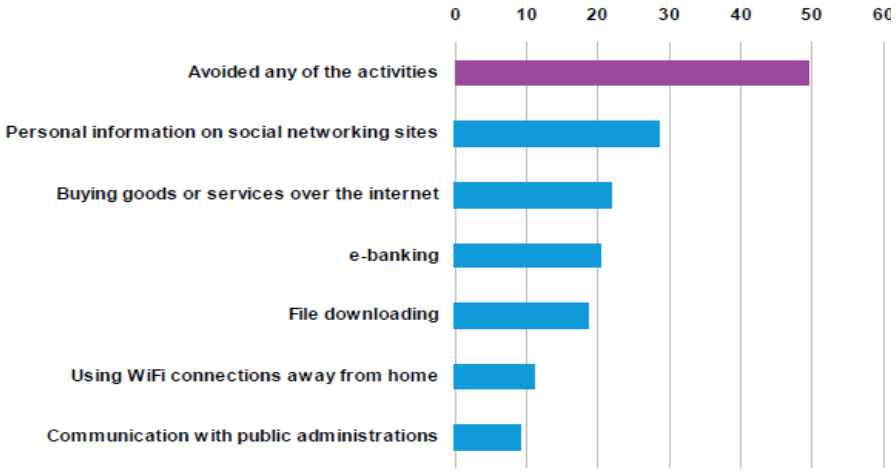
Online security is a critical issue that concerns the majority of internet users; 31% of the average EU27 had a virus or other computer infection, while 56% received spam emails. Fortunately, the percentage of financial loss due to 'phishing', 'pharming' and payment card misuse is very low for the average EU27 (3%), with only a few exceptions, which are Latvia (8%) and the UK (7%) (Table 3.4-4). In 2010, the majority of internet users avoided revealing personal information on social network websites as well as refrained from buying goods and services over the internet. Moreover, customers avoided using e-banking services, as they were concerned with the possible financial loss, due to 'phishing', 'pharming' and card details misuse (Figure 3.4-6).

Table 3.4-4 Security incidents reported by % of internet users in EU27 for 2010

	Had a virus or other computer infection	received 'spam' e-mails	abuse of personal information	financial loss due to 'phising', 'pharming', payment card misuse	incidents involving children
EU-27	31	56	4	3	3
Belgium	32	68	3	3	4
Bulgaria	58	55	7	1	5
Czech Republic	26	47	1	1	0
Denmark	29	54	4	3	3
Germany	22	68	2	3	2
Estonia	42	68	4	2	4
Ireland	15	18	2	4	u
Greece	34	29	3	2	1
Spain	33	50	7	4	2
France	34	70	5	2	3
Italy	45	54	6	4	7
Cyprus	34	25	1	2	1
Latvia	41	44	5	8	8
Lithuania	34	40	2	1	1
Luxembourg	28	58	5	3	4
Hungary	46	58	4	2	4
Malta	50	58	4	5	2
Netherlands	23	68	6	3	3
Austria	14	20	3	5	2
Poland	30	41	3	1	2
Portugal	37	52	4	2	3
Romania	10	26	5	2	3
Slovenia	37	51	1	1	3
Slovakia	47	63	3	1	4
Finland	20	61	1	2	3
Sweden	31	53	1	2	3
United Kingdom	31	54	4	7	2
Croatia	33	25	2	2	4
Turkey	36	32	4	3	2
Norway	28	70	3	3	4

Source: Eurostat (2010)

Figure 3.4-6 Activities avoided by internet users due to security concerns in the EU27 for 2010



Source: Eurostat (2010)

3.5 Conclusion

In the past decades, a series of significant changes occurred with the EU; free capital movements, the establishment of the ECB, the monetary integration, the introduction to the euro, and developments in IT and e-banking services.

Similarly, Greece experienced important transformations due to the gradual deregulation of its banking system and the various macroeconomic policies that had to be followed, so that the country could fulfil the necessary conditions to join the monetary union.

Within the last decade, due to the significant developments in IT and computer technology, Greek banks have invested heavily in new technologies. In particular, Greek banks apart from offering services such as Internet banking, ATMs, phone banking and mobile banking, have also developed applications for smart phones and tablets. However, Greece has very a low internet, pc usage and internet banking adoption rates, compared to other EU countries (Eurostat, 2010); it is clear from Section 3.4, that there is a high correlation between the country's broadband penetration and the internet banking adoption. This could be explained by the security risks that are involved with transactions over the internet, such as 'phishing', 'pharming' but also stolen debit/credit card numbers. Moreover, Greek customers, have recently started to familiarise themselves with new internet technologies, due to the evolvement of smart phones and internet tablets. It is hoped that within the next four years, Greece can catch up with other EU countries in the internet usage, broadband penetration and in the internet banking growth rate.

Chapter 4

Electronic Banking Services and banking fees

4.1 Introduction

This study aims to investigate the main Internet banking services that Greek commercial banks are offering in Greece, as well as the fees that they are charging to customers for using these services in comparison to branch and ATM fees. The research questions are the following: 1) which banking transactions are offered to customers through Greek Banks' websites? 2) What are the charges that customers face when they make transactions over the internet, within a branch or through an ATM? Are Internet banking fees lower compared to branch and ATM fees?

Section 4.2 examines the theory of Internet banking and fees, while Section 4.3 presents the Internet banking services that are offered in Greece and the fees that are charged for using these services, in addition to branch and ATM fees. Section 4.4 presents the comparison between Internet banking fees and branch banking/ATM fees while Section 4.5 is the concluding section and it summarises all our findings.

4.2 Theory

4.2.1 Internet banking Theory

According to a World Bank Study (2000), e-finance has the potential to improve the quality of the financial services that are provided, as well as expand the opportunities for covering any trade risks that might appear. It is also reported that, through e-finance, the access to more cost effective services financial services can be widen for more retail and commercial clients (Joshi, 2004).

E-finance is the provision of electronic services through electronic channels. It is formed by the e-banking portal and other financial services and products such as insurance and online trading and brokering. *'E-finance has a great potential to improve the quality and scope of financial services and expand opportunities for covering trading risks and can widen access*

to financial services for a much greater set of retail and commercial clients by offering more cost effective services' (World Bank, 2000 (in Joshi, 2004)).

E-banking, as a part of e-finance, consists of Internet banking, telephone banking, ATMs, PC banking, mobile banking and TV banking. According to Kalakota and Frei (1998) the transactions that are offered online can fall into three categories: Basic, Intermediate and Advanced. In the Basic Products and services category are included services such as checking and savings accounts statement reporting and 24/7 account management. Also included are services like household budgeting, updating stock portfolio values and a list with the most recent transactions. In the Intermediate products and services section are included services such as paying bills, status of payments, or stop-payment requests, and management of consumer and mortgage loans. In addition, there are the options of loans applications, historical performance data, prospectus download and stock and mutual funds information. The third category, which is the advanced products and services include services such as stock and mutual funds trading services, foreign exchange currency trading and cash management, tax return and some other services like electronic submission of income tax filings and payments for individuals and corporations to state, federal and international taxing authorities.

Nath et al. (2001) identify the main benefits of Internet banking to banks being the cost savings, loyalty of customers, and internet integration by offering additional services, internet profit generation and profitability due to high-profit customers. The benefits of Internet banking to consumers are first of all the saving in costs, access to additional services and convenient shopping through the banks' internet branch.

Smith (2006) explores the security and comfort issues associated with Internet banking. The main findings are that basic increases in technology accessibility appear to be associated with increases in customer services and retention, as well as that men were found to be more confident that e-signatures and more secure passwords can prevent theft. In addition, it is shown that higher security levels would increase the usage of Internet banking services. Similarly, Cranitch et al. (2007) investigated the approach followed by Australian banks regarding privacy issues for their Internet banking customers. Findings showed that customers are reassured from the banks on this privacy issue, even though there are still some areas of concern and these have implications for providers, consumers, and regulators of e-finance services.

4.2.2 Fees Theory

According to the banking institutions, one of the main benefits of Internet banking to consumers is the lower fees or higher interest rates on deposits. This implies that the costs of online banking are much lower than the branches costs. As a result, the fees imposed to customers for online banking would have to be lower compared to the fees charged within the normal branches. However, banks are not able to reduce the costs of providing online services, due to the fact that they have to make investments in infrastructure and in customer support. Furthermore, banks are not able to reduce the traditional delivery channels as much as they can, because customers prefer the 'click and bricks' rather than pure online banking services. This leads banks to maintain both their costly traditional and online banking channels, and therefore these costs are passed to customers as a form of fees for using these services (Keeton, 2001).

When banks achieve efficiency in the operation of payment systems, the prices they charge should reflect marginal costs of production and capacity. It is therefore found that for efficient customer prices, these prices should consist of two parts; a fee proportional to the marginal production cost and a capacity fee to cover joint costs. Joint costs cover costs of transactions delivered through any channel like the branch network, online banking, and ATM (Bergendahl and Lindblom, 2007).

Banks earn non-interest income by providing traditional and non-traditional financial services. The non-interest income earned from depositors, comes from fees charged on the various banking transactions that customers perform. Recently, the advances in technology, have allowed banks to provide their financial services more efficiently. These efficiencies reduced the costs per transaction, increased the customer convenience and the fee income for banks. More specifically, due to the introduction of new products, such as ATMs and online banking services, customers are more willing to pay fees for these products, as they offer convenience to them, and therefore banks' revenues are increased (DeYoung and Rice, 2004).

When ATM machines were first introduced, they were only accessible to customers of the bank owning the machine. Banks soon realised that the transaction cost of the provision of ATM services declined with an increasing number of transactions, and the value of an ATM network to customers increased with the number of the ATMs within that network. Therefore, this led to creation of shared ATM networks, where ATM machines of several

banks are linked and customers can access their accounts from any ATM within the network. The rules that are operating in the network allow the banking institutions which deploy the ATM machine used by another bank's customer to be compensated for its costs, by collecting an interchange fee from the customer's bank. Then the customer's bank will charge the customer with a foreign fee for using the ATM machine of another bank. In the case that these surcharges are high for using another bank's ATM, customers will be more likely to open an account within this particular bank, to avoid these costs. The willingness to use another bank's ATM is affected by the fact that it might have a convenient location for customers (Hannan et al., 2003).

4.3 Internet banking Services and Fees: the case of Greece

The banks which have been included in our sample are Greek commercial banks that are offering banking services apart from within their physical branches, over their websites too. It should be noted that the online banking penetration is quite low in Greece, as only 5% of Internet users have performed banking transactions over the internet. This can be explained by the fact that in Greece the number of internet connections is very low with only 4% of broadband connections in 2006. These banks are the following: Alpha Bank, Aspis Bank, Attica Bank, Marfin Egnatia Bank, National Bank of Greece, Emporiki Bank, EFG Ergasias Bank, Piraeus Bank, Millennium Bank, Geniki Bank and the Agricultural Bank of Greece. All the information about the Internet banking services and the pricing policy that the banks are following were obtained from their websites and after interviews with bank managers.

Table 4.5-1(see table in p.70) presents the Internet banking transactions that are offered by the above 11 Greek banks in Greece, as at March 2008. These banks offer similar Internet banking services, with some banks offering basic services(Aspis, Attica, ATE, Marfin Egnatia, and Geniki bank) and other banks offering advanced services (National Bank of Greece, Piraeus, Eurobank, Millennium, Alpha Bank, and Emporiki Bank). Basic Internet banking services include viewing of account balance, transferring funds and payments of utility bills, while advanced services include the buying or selling of shares, and the provision of extra pin generator or tan lists. All the above Greek banks are offering information on the customers' balances and last transactions statement, in addition to the facility of transferring funds between own or third party accounts held within the specific bank or to another domestic or foreign bank. The only three exceptions where customers can not make fund

transfers to foreign banks are through Aspis, Attica and Emporiki banks' websites. Moreover, it is found that there are only a small number of banks which are offering purchase and sales of shares within their Internet banking portal, and other banks which are offering the online trading services separately from the Internet banking services.

In addition, it is reported that all banks are offering the option of making payments for own or third party credit cards issued by each particular bank, and the majority of them with two exceptions are offering the payments of credit cards issued by other Greek Banks.

As far as payments to public organisations are concerned, all banks offer payments to the employees' public insurance (IKA, TEVE, TAE), and for public utility bills such as OTE (telephony), EYDAP (water) and DEI (electricity). Apart from the above, mobile phone payments can be made and further payments to companies such as: Lannet, Forthnet, Tellas, Cosmoline, BMWAustria, Volkswagen Bank, Plaisio Computers, Michelin Tyres, and Insurance companies such as ING Insurance and Allico AIG.

Lastly customers, can amend their personal details, change their pins and make applications for loans, credit cards, chequebooks and foreign exchange currency.

The most popular Internet banking services in Greece include information on account balance, transfer of funds, payment of loan instalments, payment of credit cards and payment of utility and mobile phone bills.

4.4 Results

4.4.1 Internet Banking Fees

The fees that Greek Banks are charging to their customers for the Internet banking services are presented in Table 4.5-2 (see p.72). The majority of the banks are not charging customers for registration fees to their Internet banking websites, apart from Marfin Egnatia Bank, which charges €4 and Piraeus Bank, which charges €5. Customers of Alpha Bank, ATE Bank and National Bank of Greece who want the extra pin generator have to pay €7, in addition to Millennium bank which charges €23.44 for the extra code generator.

It is shown that banks are not charging their customers for transfer funds between own or third party accounts with the only exception of ATE bank which charges for transfers between euro and foreign currency accounts for amounts more than 2,000 Euros. For transferring funds to another domestic bank, each bank is following a different pricing policy, where certain banks charge a one-off amount, whereas other banks charge a percentage on the amount transferred plus some costs for DIASTRANSFER. The purpose of the DIASTRANSFER system is to process the orders of bank customers for the transfer of funds from the principal's bank to the beneficiary's bank, for account crediting or cash payment. Principals and beneficiaries are physical or legal persons of the public and private sector. Banks in our sample are all participating in DIASTRANSFER. It is obvious that the banks which charge the more fees for this service are Emporiki Bank, Millennium Bank, and ATE bank.

The payments of own credit cards are free of charge for all the banks, whereas payments for credit cards issued by other Greek Banks (participating in the DIASTRANSFER System) have different charges for each bank, with the minimum fee imposed by EFG Ergasias €0.30 and the maximum fee charged by Attica Bank is €1.5 plus DIAS charges €0.07 per transaction (€1.57 in total).

As far as standing orders are concerned, they are provided free of a charge for the majority of the banks examined, with the exception of Marfin Egnatia bank, which charges €0.30 for each payment to DEI and EYDAP, €0.5 to Wind, and €0.29 to Vodafone. Piraeus Bank charges €0.30 for DEI and €0.85 for EYDAP and Millennium bank charges €0.40 for each payment of a DEI or an EYDAP bill.

Payments made to IKA, TEVE, TAE and the income tax are free of charge. All the other payments for public utility bills, mobile telephony and further payments are free of charge with the only following exceptions: Marfin Egnatia is charging €0.50 for payments to DEI and Wind, €0.29 to Vodafone and €1 to Tellas, Volkswagen Bank, Plaisio and Michelin Tyres. Emporiki bank is charging €0.10 for payments made to DEI and Piraeus bank is charging €0.30 for payments to DEI and EYDAP and €0.5 to Wind and €0.44 to Vodafone respectively. It should be noted that all Greek banks, with the exception of Piraeus Bank, have information about the pricing policy they are following.

4.4.2 Branches and ATM fees: Results

Table 4.5-3 (see p.75)[14] presents the fees imposed to customers for transactions performed within bank branches. For deposits to third party accounts the minimum fee imposed is by Aspis Bank €1 and the maximum is €1.5 and is charged by Emporiki and EFG bank. Fund transfers to a third party account within the bank have a minimum fee of €0.30 for Aspis and ATE bank, while the maximum fee is imposed by National Bank of Greece, where the fee is a percentage of the amount transferred. Additionally, for fund transfers to a third party account held by another domestic bank, the minimum and the maximum charge is both imposed by Geniki Bank. When customers withdraw cash within a bank branch they face a €1 fee from Emporiki bank and a €1.50 fee from Attica Bank. In the case customers withdrawing cash within a branch by using a credit card issued by another domestic bank, they will pay a minimum fee of €3.75 for Attica bank and a maximum fee of €20 for National Bank of Greece.

As far as standing order payments for utility bills are concerned, there are variations in the fees imposed, with Aspis bank offering services free of charge and Emporiki Bank is offering the services free of charge, with the exception of Wind €0.44 and Vodafone €0.29. Eurobank is charging the maximum fees, €0.60 for DEI and EYDAP and €0.44 for Wind bills. The standing order payments for IKA and TEVE are offered free of charge from the National Bank of Greece, while Attica bank charges a €5 fee.

For direct payments to IKA and TEVE, Emporiki bank is offering these services free of charge, while the majority of banks offer these services free of charge for the first 25 days of a calendar month, and for the remaining days they impose a fee. The minimum fee in this case is charged by Aspis bank and the maximum by National Bank of Greece. The income tax payment is free of charge for Geniki and ATE bank, while the electricity bill is free of charge for Emporiki bank and €1 for Aspis Bank.

Direct payments for public utility bills are charged at €1 for Aspis Bank, OTE payments at €0.29 for Attica Bank, while National Bank of Greece offers Cosmote and Vodafone payment free of charge, but imposes a fee of €1.50 for Lannet, BMW Austria Bank and SFS Finance, €1 for Forthnet bills and €1.10 for Tellas. Eurobank charges €1 for bill payments to Wind and Tellas, and €1.50 to Lannet and Forthnet. Geniki Bank imposes a fee of €0.70 for payments to Forthnet, while ATE bank is charging €1 for the same payment. The minimum

[14] Blank cells indicate that the information was not available.

charge for chequebook orders per cheque is €1, imposed by Alpha, Geniki and ATE bank, and the maximum fee €1.5 is charged by Aspis, Attica and Emporiki Bank.

The fees that are imposed for the use of ATMs in Greece are presented in Table 4.5-4 (see p. 77)[15]. For cash withdrawals using other banks' ATMs the minimum fee imposed is €1.5 and the maximum fee is €3.5 imposed by Alpha Bank. Cash withdrawals with own bank credit cards are charged with a minimum fee of €3 from National bank of Greece and the maximum imposed is €29 from Emporiki Bank. For cash withdrawals from credit cards using other banks' ATMs, the minimum fee is €1 by Aspis Bank and the maximum is €3.25 by Attica Bank. Customers checking their balance enquires from other banks' ATMs face a minimum cost of €0.44, charged by National Bank of Greece, and a maximum fee of €0.60 by ATE bank.

For the payment of the electricity bill, the minimum fee imposed is €0.40 by Emporiki bank, while the maximum fee is €0.70 by Aspis Bank. National Bank of Greece and Emporiki bank, offer the payment of OTE free of charge, while Aspis Bank charges a €0.70 fee. Vodafone bill payments are free of charge for National Bank of Greece, and €0.70 for Aspis Bank. Furthermore, Forthnet bill is offered free of charge for Emporiki and ATE bank.

When we compare the fees imposed by banks within their branches and over their ATMs, we can see that ATM fees are lower in every case of public utility payments. For example, Aspis Bank charges €0.70 for payments to public utility bills made over ATMs, while the charges for payments within the branches are €1. Also, ATE bank charges €1 for payments to Forthnet made within branches, while over the ATM are free of charge.

4.5 Conclusion

Our analysis indicates that the Greek commercial banks offer convenience and reduction of costs to customers, by providing their products and services over the internet, apart from within physical branches and ATMs. These products and services are similar for the most of banks, except for some cases where a number of banks offer only standard services whereas other banks offer more advanced services. However, it is identified that there are disparities in the fees that Greek commercial banks impose to their customers for performing banking transactions over the internet, where fund transfers between own and third party accounts

[15] Blank cells indicate that the information was not available.

held by the same bank are offered free of charge, and fees for fund transfers to other domestic or foreign banks are up to €300. The majority of payments of utility bills are offered free of charge with some exceptions where the maximum fee is €1.

Finally, we conclude that Internet banking fees are lower than both Branch and ATM fees. For instance, fund transfers to third party accounts within the same bank or to another domestic bank are offered free of charge through Internet banking, while customers face fees for within branch fund transfers. In addition, standing order payments for utility bills and direct payments for IKA contributions are offered free of charge over the internet, while a fee is imposed for within branch payments. Direct public utility bills are free of charge over the internet, however there is a minimum fee imposed for payments within the physical branch.

With the technological progress, banks can insure that customers are able to perform banking transactions with the highest level of security. Banks offer secure access to their Internet banking services, either with e-tokens, TAN lists or secret questions. Therefore, customers in Greece will not consider Internet banking security as a factor for not using these services. It is expected that banking fees will be reduced in the near future, so that more customers will be attracted to use the Internet banking services offered by Greek commercial banks.

Greek banks should maximise customer satisfaction in order to meet their customers' needs, as well as they should reduce banking fees to the minimum charges, so as to give the opportunity to more customers to use services at their own convenience. Furthermore, banks should design simple websites which are easy to use due to the fact that ease-to-use increases the level of customers' satisfaction and therefore increases the probability of adopting Internet banking. In addition, banks should offer the highest level of security during the performance of Internet banking transactions, and maintain the high level of security at all times. Bank managers should also consider effective approaches to advertise the Internet banking services they are offering, as Internet banking offers to banks significant reduction in costs from the fact that they need less staff for physical branches and the costs from maintaining a high number of ATMs.

Table 4.5-1 Internet Banking services offered by Greek Banks (March, 2008)

Appendix 4	***Alpha Bank***	***Aspis Bank***	***Attica Bank***	***Marfin Egnatia Bank***	***National Bank of Greece***	***Emporiki Bank***	***E.F.G. Eurobank***	***Piraeus Bank***	***Millennium Bank***	***Geniki Bank***	***ATE Bank***
INFORMATION											
DEPOSITS											
Deposit account balances	√	√	√	√	√	√	√	√	√	√	√
Savings account's statement	√	√	√	√	√	√	√	√	√	√	√
Checks' status	√	√	√	√	no	no	√	√	√		√
LOANS											
Personal loans balances	√		√		√		√	√			√
Personal loans statement	√		√		√		√	√			√
Housing loans balances	√				√	no			√		√
Housing loans statement	√			√	√	no			√		√
CARDS											
Card balance	√	√	√	√	√	√	√	√	√	√	√
Last Card statement	√	√	√	√	√	√	no	√	√	√	√
PORTFOLIOS											
Mutual funds portfolio inquiry	√	√	no	no	√	√	√	√	√	no	√
Initial Public Offerings	√	√	no	no	√	no	√	√	√	no	√
Purchase order	√	√	no	no	√	no	√	√	√	no	√
FUND TRANSFERS											
TO BANK											
Immediate fund transfer between deposit accounts	√	√	√	√	√	√	√	√	√	√	√
Immediate fund transfer to a deposit account	No	√	√	√	√	√	√	√	√	√	√
Fund transfer order between deposit accounts	√	√		√	√	√	√	√	√	no	√
TO ANOTHER BANK											
Fund transfer order to an account of another domestic bank	√	√	√	√	√	√	√	√	√	√	√
Fund transfer order to an account of another foreign bank	√	√		√	√	no	√	√	√	no	√
PAYMENT ORDERS											
CARDS - LOANS											
Own Cards	√	√	√	√	√	√	√	√	√	√	√
Other Bank's Cards (DIASTRANSFER)	√	no	√	√	√	no	√	√	√	√	√
STANDING ORDERS											
OTE (fixed telephony)	No	√	√	√	no	√	√	√	√	no	no
DEH (electricity)	No	√	√	√	no	√	√	√	√	no	no
EYDAP (water)	No	√	√	√	no	√	√	√	√	no	no
GREEK PUBLIC SECTOR											
V.A.T., IKA's contribution fees, O.A.E.E. (TEBE.-TAE-TSA)	√	√	√	√	√	√	√	√	√	√	√
Income Tax	√	√		√	√	√	√	√	√	√	√
PUBLIC UTILITY BILLS											
Electricity bills (ΔΕΗ)	√	√	no	√	√	√	√	√	√	no	√
Water Supply bills (EYDAP)	√	√	no	√	√	√	√	√	√	no	√
TELEPHONY (fixed, mobile)											

Table 4.5-1 contd.	***Alpha Bank***	***Aspis Bank***	***Attica Bank***	***Marfin Egnatia Bank***	***National Bank of Greece***	***Emporiki Bank***	***E.F.G. Eurobank***	***Piraeus Bank***	***Millennium Bank***	***Geniki Bank***	***ATE Bank***
OTE (fixed)	√	√	no	√	√	√	√	√	√	√	no
COSMOTE (mobile)	√	√	no	√	√	√	√	√	√	no	no
Wind (mobile)	√	√	no	√	o	√	√	√	√	no	√
VODAFONE (mobile)	√	√	no	√	√	√	√	√	√	no	√
Lannet (fixed)	√	no	no	no	√	√	√	no	no	no	√
Forthnet (fixed)	√	no	no	√	√	√	√	no	no	no	√
Cosmoline (fixed)	√	no	no	no	√	no	no	no	no	no	√
On Telecoms (fixed)	No	no	no	no	√	no	no	no	no	no	no
Altec Telecoms (fixed)	No	no	no	no	√	no	no	no	no	no	no
Tellas (fixed)	√	no	no	√	√	√	√	√	no	√	no
Vivodi (fixed)	√	no	no	√	√	no	no	no	no	no	no
OTHER PAYMENTS											
BMW AUSTRIA BANK	√	no	no	√	√	√	√	no	no	√	no
Volkswagen Bank		no	no	√	√	no	√	no	no	√	no
PLAISIO COMPUTERS	√	no	no	√	√	no	√	no	no	no	no
E.T.A.O (Economists' Occupational Funds)	No	no	no	√	√	no	√	no	no	no	no
MICHELIN TYRES	No	no	no	√	√	√	√	no	no	no	no
SFS HELLAS FINANCE CONSUMER	No	no	no	√	√	no	√	no	no	no	no
IATA Transport Association	No	no	no		√	√	no	no	no	no	no
Aligo AIG Insurance	√	no	no	√	√	no	√	√	no	no	√
ING insurance	√	no	no	√	√	no	√	√	no	no	√
APPLICATIONS											
Block/Unblock of deposit account	No	no	no	√	√	no	√	√	√		
Submission/Cancellation of a fixed amount standing order	√	no	no	√	o	√	√	√	√	no	no
Cheque book application	No	no	√	no	no	√	no	no	no	no	√
Cheque book order status	√	√	√	√	√	no	√	√	√		√
Change of User ID (username)	√	√	no	no	√	√	√	√	√	√	no
Change of Password (PIN)	√	√	√	no	√	√	√	√	√	√	no
Add accounts, cards etc.	√	√	√	no	√	√	√	√	√	√	no
Additional Password device order	√	no	no	√	√	no	no	√	√	no	no
Update personal details	No	√	√	no	√	no	no	no	√	no	
Messages to bank	No	no	√	no	no	√	no	no	no	no	√
GENERAL INFORMATION											
Foreign exchange rates information	No	√	no	no	√	no	√	√	√	no	no
Selected share prices and share indices	No	√	no	no	√	no	√	√	√	no	no
Mutual Funds Prices	No	no	no	no	√	no	√	√	√	no	no
pricing policy	√	√	√	√	√	√	√	no	√	√	√

Data obtained from Banks' official websites (http://www.alpha.gr/, https://ebanking.aspisbank.gr/, http://www.atebank.gr/, http://www.nbg.gr/, http://www.eurobank.gr/, https://ebank.emporiki.gr/, http://www.geniki.gr/, https://ebanking.marfinegnatiabank.gr/, http://www.millenniumbank.gr/, https://www.winbank.gr/, https://ebanking.atticabank.gr/) **and after interviews with bank managers.**

Table 4.5-2 Internet Banking Fees in Greece (March, 2008)

	Alpha Bank	*Aspis Bank*	*Attica Bank*	*Marfin Egnatia Bank*	*National Bank of Greece*	*Emporiki Bank*	*E.F.G. Eurobank*	*Piraeus Bank*	*Millennium Bank*	*Geniki Bank*	*ATE Bank*
FUND TRANSFERS											
TO BANK											
Immediate fund transfer between deposit accounts	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge
Fund tranfer to a third party account held within the bank	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	transfer from Euro account to foreign currency account for up to €2,000 free of charge, over €2,000 0.08% plus min payment €6
TO ANOTHER BANK											
Fund transfer order to an account of another domestic bank	€ 0.30	free of charge	€0.07 per transaction plus: €1.20 for up to €12,500, €3for up to50,000 and €15 for €50,001 and above	for up to €12,500 €1.5, for more than €12,500 ,€3 per transaction	€0.5	for up to €12,500 € 6 +1.2 OUR from €12,500 up to €30,000 1% of the remittance +€3 OUR	up to €12,500 €1.20 from 12,501-50,000 €3 and from €50,000 €15	up to €1,000 €0.30 from €1,001 up to €12,500 €0.50 and over €12,501 €5	within EU 0.10% on the amount min €5 and max €125 Foreign currency: 0.10% on the amount min €7.5 and max €125	BEN: 0.5% on the amount min €1.08 max €60.08 OUR: 0.5% min €4.08 max €60.08	0.06% with min €7
Fund transfer order to an account of another foreign bank	€ 0.30	No	no	for up to €12,500 €1.5, for more than 12500 3 euros per transaction	€0.5 to Euro zone	no	€0.30 within EU €10E outside EU	For EU(up to €1,000 €0.30 from €1,001 up to €12,500 €0.50and over €12,501 €5 For outside EU(up to €100 €6.84 and €101 and up 0.114% of the amount sent min €6.84/max €114	outside EU.0.30% on the amount min €20 max €300	BEN: 0.5% on the amount min €1.08 max €60.08 OUR: 0.5% min €4.08 max €60.08	EU:0.06% with min €7, Non EU: €18+swift expenses €12
PAYMENT ORDERS											
CARDS - LOANS											
Own Cards	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge

Table 4.5-2 contd.	***Alpha Bank***	***Aspis Bank***	***Attica Bank***	***Marfin Egnatia Bank***	***National Bank of Greece***	***Emporiki Bank***	***E.F.G. Eurobank***	***Piraeus Bank***	***Millennium Bank***	***Geniki Bank***	***ATE Bank***
Other Bank's Cards (DIASTRANSFER)	€ 0.50	No	€1.5 plus DIAS €\0.07 per transaction	€1.5	€0.5	no	€0.30	€0.50	no	€0.48	No
Sales/Purchases of Shares					0.35% min €8.80			up to €14,600 1% of the amount with min €5 and over €14,601 0.6% of the amount	up to €5,0001% with min €5,up to €30,000 0.70%, over €30,000 0.50%		No
STANDING ORDERS											
OTE	no	free of charge		free of charge	no	free of charge	no	free of charge	free of charge	no	No
DEH	no	free of charge	free of charge	€0.3	no	free of charge	no	€0.3	€0.4	no	No
EYDAP	no	free of charge	free of charge	€0.3	no	free of charge	no	€0.85	€0.4	no	No
COSMOTE		free of charge		free of charge	no	no	no	no	no	no	no
Wind		free of charge		€0.5	no	no	no	no	no	no	no
VODAFONE		free of charge		€0.29	no	no	no	no	no	no	no
Forthnet				free of charge							
GREEK PUBLIC SECTOR											
V.A.T., IKA's contribution fees, O.A.E.E. (TEBE.-TAE-TSA)	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge
TSAY- TSMEDE	no	No	free of charge	no	no	free of charge	no	no	no	no	no
TEE	no	No	free of charge	no	no	no	no	no	no	no	no
Income Tax	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge
PUBLIC UTILITY BILLS											
Electricity bills (ΔΕΗ)	free of charge	free of charge	no	€0.5	free of charge	€0.10	free of charge	€0.3	no	free of charge	free of charge
Water Supply bills (EYDAP)	free of charge	free of charge	no	no	free of charge	free of charge	€0.5	€0.3	no	free of charge	free of charge
TELEPHONY (fixed, mobile)											
OTE	free of charge	No	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge
COSMOTE	free of charge	No	no	free of charge	free of charge	free of charge	free of charge	free of charge	free of charge	no	no
Wind	free of charge	No	no	€0.5	free of charge	free of charge	free of charge	€0.5	free of charge	no	no
VODAFONE	free of charge	No	no	€0.29	free of charge	free of charge	free of charge	€0.44	free of charge	no	no
Lannet	free of charge	No	no	no	free of charge	free of charge	free of charge	no	no	no	free of charge
Forthnet	free of charge	No	no	free of charge	free of charge	free of charge	free of charge	no	no	no	free of charge
Cosmoline	free of charge	No	no	no	free of charge	no	no	no	no	no	no
Tellas	free of charge			€1	free of charge			free of charge		free of charge	

Table 4.5-2 cntd.	***Alpha Bank***	***Aspis Bank***	***Attica Bank***	***Marfin Egnatia Bank***	***National Bank of Greece***	***Emporiki Bank***	***E.F.G. Eurobank***	***Piraeus Bank***	***Millennium Bank***	***Geniki Bank***	***ATE Bank***
OTHER PAYMENTS											
BMW AUSTRIA BANK	free of charge	No	no	€1	free of charge	free of charge	free of charge	no	no	free of charge	free of charge
Volkswagen Bank		No	no	€1	free of charge	no	free of charge	free of charge	no	free of charge	free of charge
PLAISIO COMPUTERS	free of charge	No	no	€1	free of charge	no	no	no	no	no	no
MICHELIN TIRES	no	No	no	€1	free of charge	free of charge	free of charge	no	no	no	no
INTERASCO	no	No	no	€1	free of charge	free of charge	free of charge	no	no	no	no
SFS HELLAS FINANCE CONSUMER	no	No	no	€1	free of charge	no	free of charge	no	no	no	no
IATA	no	no	no	€1	free of charge	free of charge	no	free of charge	no	no	no
APPLICATIONS											
Cheque book order	no	no	√	no	no	free of charge	no	no	10 cheques: €12,25 cheques: €25	√	no
Cheque revocation				€15					€30		
Foreign Exchange application				€5							
Buying/Selling Foreign Exchange									0.05% with min €3 and max €20		
Registration Packet	free of charge	free of charge	free of charge	€4	free of charge	free of charge	free of charge	€5	free of charge	free of charge	free of charge
reissue of pin								€2			
e-code generator	€7				€7			free of charge		€23.44	€7
Expenses of security token replacement because of loss				€15				within a year €14.5after 2 years €6.5			€11

Data obtained from Banks' official websites (http://www.alpha.gr/, https://ebanking.aspisbank.gr/, http://www.atebank.gr/, http://www.nbg.gr/, http://www.eurobank.gr/, https://ebank.emporiki.gr/, http://www.geniki.gr/, https://ebanking.marfinegnatiabank.gr/, http://www.millenniumbank.gr/, https://www.winbank.gr/, https://ebanking.atticabank.gr/) **and after interviews with bank managers.**

Table 4.5-3 Branch Fees in Greece (March, 2008)

	Alpha Bank	*Aspis Bank*	*Attica Bank*	*National Bank of Greece*	*Emporiki Bank*	*E.F.G. Eurobank*	*Geniki Bank*	*ATE Bank*
Deposit to third party accounts	€ 1.20	€ 1.00		€1.20 in cash,€ 0.30 by debiting account	€ 1.50	€ 1.50		€ 1.20
Fund transfer to a third party account held within the bank	€ 0.40	€ 0.30		up to €50,000, 2% min €12 plus charges €5,over €50,000 0.25% min €15 plus charges €15	€ 0.50		min €6,max €120	€ 0.30
TO ANOTHER BANK								
Fund transfer order to an account of another domestic bank					0-€12,500 €20 ,€12,501 and over 25€ min and 250€ max	€9 plus 0.10% on the amount	min €5,max€300	
Cash withdrawals			€ 1.50		€ 1.00			
withdraw cash with own credit card					0-€200, €7,€201-€600,€16,€601-€1000,€22 and over €1001, €30			
withdraw cash with a another bank's credit card	€ 5.00		€4.75 plus0.33%	min €5 max €20				
STANDING ORDERS								
OTE	€ 0.30	free of charge		free of charge	free of charge		free of charge	€ 0.40
DEH	€ 0.30	free of charge	€ 0.29	€ 0.29	free of charge	€ 0.60		€ 0.50
EYDAP	€ 0.30		€ 0.29	€ 0.29	free of charge	€ 0.60		€ 0.25
COSMOTE	€ 0.30	free of charge		free of charge	free of charge			
Wind	€ 0.30	free of charge		€ 0.29	€ 0.44	€ 0.44		
VODAFONE	€ 0.30	free of charge		€ 0.29	€ 0.29			
Forthnet				free of charge	free of charge		€ 0.30	free of charge

Table 4.5-3 **cntd.**	***Alpha Bank***	***Aspis Bank***	***Attica Bank***	***National Bank of Greece***	***Emporiki Bank***	***E.F.G. Eurobank***	***Geniki Bank***	***ATE Bank***
IKA/TEVE			€ 5.00	free of charge				
GREEK PUBLIC SECTOR								
V.A.T., IKA's contribution fees, O.A.E.E. (TEBE.-TAE-TSA)	last 3 days of month 0.15%	€ 5.00	€0.29(TEVE)	until 25th of month free of charge, otherwise €15	free of charge		until 25th of month free of charge, otherwise €10	
Income Tax							free of charge	free of charge
PUBLIC UTILITY BILLS								
Electricity bills (ΔΕΗ)		€ 1.00					€ 0.40	
Water Supply bills (EYDAP)		€ 1.00					€ 0.40	€ 0.50
TELEPHONY (fixed, mobile)								
OTE		€ 1.00	€ 0.29				€ 1.00	
COSMOTE		€ 1.00		free of charge				
Wind		€ 1.00				€ 1.00		
VODAFONE		€ 1.00		free of charge				
Lannet				€ 1.50		€ 1.50		
Forthnet				€ 1.00		€ 1.50	€ 0.70	€ 1.00
Tellas				€ 1.10		€ 1.00		
OTHER PAYMENTS								
BMW AUSTRIA BANK				€ 1.50				
SFS HELLAS FINANCE CONSUMER				€ 1.50				
APPLICATIONS								
Cheque book order(per cheque)	€ 1.00	€ 1.50	€ 1.50	€ 1.17	€ 1.50	10 cheques €15, 25 cheques €35	€ 1.00	€ 1.00

Empty cells indicate that information is not available.

Table 4.5-4 ATM fees in Greece (March, 2008)

	Alpha Bank	*Aspis Bank*	*Attica Bank*	*National Bank of Greece*	*Emporiki Bank*	*E.F.G. Eurobank*	*Geniki Bank*	*ATE Bank*
Cash withdrawals using other banks' ATMs	up to 100€ €1.50, €101 and more min €1 max€ 3.5	min €1.5 max €3	€ 1.50	€1.5 + 0.5% on the amount	min €0.91 max €3	up to €150 €1.5, over €150 1% on the amount with max €3	min€1.5, max €3	
Cash withdrawal with credit cards		€ 6		min €3, max €20	0-€200 €6, €201-€600 €15, €601-€1000 €21, €1001 and over, €29			
Cash withdrawal from credit cards by using another bank's ATM		1% on the amount with min€ 1 and max €3	€ 3.25					
Balance Enquiry using other bank's ATM	€ 0.50	€ 0.50		€ 0.44	€ 0.50	€ 0.50	€ 0.60	
GREEK PUBLIC SECTOR								
V.A.T., IKA's contribution fees, O.A.E.E. (TEBE.-TAE-TSA)				€0.29 (VAT)				
Income Tax				free of charge				free of charge
PUBLIC UTILITY BILLS								
Electricity bills (ΔΕΗ)	€ 0.50	€ 0.70		€ 0.50	€ 0.40			€ 0.50
Water Supply bills (EYDAP)		€ 0.70						
TELEPHONY (fixed, mobile)								
OTE		€ 0.70		free of charge	free of charge			
COSMOTE		€ 0.70						
Wind	€ 0.29	€ 0.70		0.9% min €0.29				
VODAFONE		€ 0.70		free of charge				
Forthnet					free of charge			free of charge
OTHER PAYMENTS								
IATA				free of charge				

Empty cells indicate that information is not available.

Chapter 5

Electronic Banking Adoption by customers

5.1 Introduction

The aim of this study is to examine the personal characteristics of bank customers that affect the probability of e-banking adoption and Internet banking adoption in Greece. Following modern banking theory, we consider traditional as well as new adoption factors (high branch fees, branch dissatisfaction and access to banks' web pages) to empirically test the effect of these factors on the e-banking adoption. In particular, we employ a logit model to econometrically pinpoint determinants of the adoption status (see Polasik and Wisniewski, 2009). Hence, this study contains new information on the adoption of e-banking by considering the above factors. We empirically test the link between 1) demographic characteristics, 2) economics (income and fees factors), 3) PC ownership and Internet connection and 4) Satisfaction with branch banking using data from Greece. Further, we compare our results with those from other countries.

Another aim of this research is that (1) it extends previous papers of the same area (Gan et al., 2006 and Mavri and Ioannou, 2006) by considering the above factors and (2) it is the first one that examines the adoption of Greek e-banking using a logit econometric model; our suggested model considers independent variables that have not been included in previous papers of the same topic (such as high branch fees, access to banks' webpage and branch dissatisfaction). Mavri and Ioannou (2006) examine internet banking adoption for Greece using data from 2002. Our study extends the paper of Mavri and Ioannou (2002) in the form that it uses data from a recent survey and considers all Greek banks offering e-banking services.

This study is organised as follows: Section 5.2 explains the theory and Section 5.3 describes the methodology employed and presents the data and results. Section 5.5 concludes our research and summarises our findings.

5.2 Theory of Choice Analysis

Choice analysis was developed with the intention of finding a way to measure an individual's preferences, what is called 'sources of preferences'. The preferences of an individual across alternatives will vary and this is likely to occur across other individuals. Choice analysis deals with the explanation of heterogeneity in preferences across a sample of individuals, given the choice set (Hensher et al., 2005).

According to Louviere et al. (2000) the most important factor in choice analysis is to have awareness of the ways to identify individuals' preferences for specific alternatives and the types of constraints that might limit the alternatives that can be chosen by an individual. It is challenging for analysts to identify, capture and use as much as possible of the information individual have they are in the process of making a choice. Unfortunately, there is a lot of information that an analyst is unlikely to observe. It is assumed that the alternatives, which define the choice set, are mutually exclusive and therefore the individual can choose only one of them. In addition, it is assumed that individuals have full knowledge of the factors which influence their choice decision (Hensher et al., 2005).

The level of utility needs to be identified, which is a relative measure and it is associated with an alternative relative to that of another alternative in the same choice set. The overall utility associated with the i-th alternative can be divided into the contributions that can be observed by the analyst and those that are not observed by the analyst. The relative utility can be denoted by V_i, U_i is utility and ε_i is the disturbance term, which refers to unobserved influences. In choice analysis both V_i and ε_i have to be treated with great significance in the analysis of the sources of variability in the behavioural responses of individuals in both parts of the utility expression. The utility expression is the following:

$$U_i = V_i + \varepsilon_i \qquad \textbf{Equation 5.2-1}$$

In the case that there are alternative option, there will be the same number of equations, and these will be defined this as a choice of j =1, 2, 3…., j alternatives, where j is the number of alternatives in the choice set available to individuals.

Vi is the 'representative component of utility', because it is where the set of attributes are observed and measured by analysts. V_i can be defined as a linear expression in which each

attribute is weighted by a unique weight, called parameter or coefficient, to account for that attribute's marginal utility input. Therefore the following functional form is derived:

$$V_i = \beta_{0i} + \beta_{1i}f(X_{1j}) + \beta_{2i}f(X_{2j}) + \beta_{3i}f(X_{3j}) + \ldots.. + \beta_{Ki}f(X_{Kj}) \quad \textbf{Equation 5.2-2}$$

Where β_{1i} is the weight associated with attribute X_i and alternative i and β_{0i} is a parameter not associated with any of the observed and measured attributes, called the alternative-specific constant, which represents on average the role of all the unobserved sources of utility.

In this expression are k = 1 ,2 , ..K attributes in (5.2-2) and has included subscripts on every element in order to recognise that the weights, the attribute levels and the constant are specific to the i-th alternative.

If we substitute equation (5.2-2) into (5.2-1) we will obtain the following equation:

$$U_i = \beta_{0i} + \beta_{1i}f(X_{1j}) + \beta_{2i}f(X_{2j}) + \beta_{3i}f(X_{3j}) + \varepsilon_i \quad \textbf{Equation 5.2-3}$$

Equation (5.2-3) can be expanded by defining OB as observed and U as unobserved

$$U_i = (\beta_{OB1}X_{OB1} + \beta_{u1}X_{u1}) + (\beta_{OB2}X_{OB2} + \beta_{u2}X_{u2}) + (\beta_{OB3}X_{OB3} + (\beta_{u3}X_{u3}) + \varepsilon_i \quad \textbf{Equation 5.2-4}$$

If it is assumed that all the unobserved effects are not related with the observed effects, then these effects can be removed them from the equation and therefore have the following equation:

$$U_i = \beta_{OB1}X_{OB1} + \beta_{OB2}X_{OB2} + \beta_{OB3}X_{OB3} + \varepsilon_i \quad \textbf{Equation 5.2-5}$$

By defining a utility function of the above form in (5.2-5) for each alternative, and imposing the assumption that the unobserved influences have the same distribution and are independent across alternatives, we can remove the subscript i which is attached to ε. This is the functional form for the utility expressions of a multinomial logit model (Hensher et al., 2005).

Each individual will evaluate every alternative as represented by U_j ; j = 1,…,j alternatives. The decision rule on which choice will be made is based on the comparison of U_1, U_2, U_3, U_j and finally the alternative with the maximum utility will be chosen.

The probability of an individual choosing the alternative i is equal to the probability that the utility of the alternative i is greater than or equal to the utility associated with alternative j

after the evaluation of every alternative in the choice set j =1, 2, 3, 4…J alternatives. More specifically:

$$Prob_i = Prob\ (U_i \geq U_j)\ \forall\ j\ \in j = 1, \dots, J; i \neq j) \qquad \textbf{Equation 5.2-6}$$

This is also equivalent to $Prob_i = Prob\ (V_i + \varepsilon_i \geq \mathbf{Vj}\ +\ \boldsymbol{\varepsilon j})\ \forall\ \boldsymbol{j}\ \in \boldsymbol{j} = \mathbf{1}, \dots, \boldsymbol{J}; \boldsymbol{i} \neq \boldsymbol{j})$ **Equation 5.2-7**

It will be useful to rearrange equation (5.1-7) in order to reflect the fact that the analyst lacks of full information and this limits the modified behavioural choice rule which states that 'the information available to the analyst conditions the individual decision maker's utility maximisation rule to be a random utility maximisation rule'.

$$Prob_i = Prob\ [\ (\varepsilon_j - \varepsilon_i) \leq (V_i - V_j\ )\ \forall\ \boldsymbol{j}\ \in \boldsymbol{j} = \mathbf{1}, \dots, \boldsymbol{J}; \boldsymbol{i} \neq \boldsymbol{j}) \qquad \textbf{Equation 5.2-8}$$

Equation (5.2-8) represents that the probability of an individual choosing alternatives i is equal to the probability that the difference in the unobserved sources of utility of alternative j compared to i is less than (or equal to) the difference in the observed sources of utility associated with alternative i compared to alternative j after evaluating each and every alternative in the choice set j= 1, ….i,…J alternatives.

5.2.1 Choice Data

After deriving a basic choice model, which is related with the concept of utility, analysts need to decide the data that they will employ. As was mentioned before each decision maker will derive an amount of utility for each of the alternatives within a set of alternatives. This utility is likely to exist for every alternative even if the individuals did not have the chance to use one or more alternatives. An assumption in choice analysis is that the decision maker will choose the alternative that provides him/her the highest level of utility, provided that there are no choice constraints. Therefore, the direct measure of utility needs to be measure and the most common method to do so is to use a form of rating or ranking for the alternatives. In this case however, the decision maker is not asked to make a choice, but to rank or rate alternatives. The data collected by using ratings or ranking data pose problems at the time of estimation and the most common form of estimation technique used to model this type of data are regression analysis, where the rating or ranking is the dependent variable within the model (Louviere et al., 2000).

Choice data are data collected on choices made by individuals. These choices are observed being made within constraints imposed on individuals. The response mechanism for choice data is binary (0 or 1). Each individual has to choose between one choice; either 0 or 1. However, with choice data we do not observe directly the utilities that are derived for every alternative by every decision maker. In order to observe the utility for every alternative an assumption is introduced that within constraints by the decision maker, the alternative that will be selected will be the alternative that produces the highest level of utility. Therefore, the analyst can understand what the most preferable alternatives are for the individuals, but no information is given about the order of preference among the non–chosen alternatives. In order to overcome this issue, we need to collect also information on the attribute levels of the alternatives as well as the Socio-Demographic characteristics of the individuals. Researchers can collect data with two ways; the first way is to observe only the actual levels of each of the alternatives by ignoring the socio demographic characteristics and the alternative way is to investigate the attribute levels by asking the decision makers what they believe these levels are. Thus on the first case we have authentic data and on the second case we have perceptual data (Hensher et al., 2005).

It is found that authentic data on real attributes produces 'cleaner' data, which are more preferable for modelling purposes. On the other hand, perceptual data produces data with outliers which pose problems for analysts.

Revealed preference (RP) data are data that are collected on choices made in an actual market. Therefore, it can be said that data represent events that have been observed to have actually occurred. There are many options on how analysts can collect revealed preference data. First, they can choose to observe a market and note the alternatives as chosen and non-chosen. An alternative way is to record the choices made within the market. In every case it should be taken into consideration how data must be collected on the attributes level and the socio demographic characteristics of the decision makers and often this is achieved by distributing questionnaires to the decision makers (Hensher et al., 2005).

One advantage of revealed preference data is that can be collected on a representative sample of the population, and therefore in theory can replicate the actual market shares for all the goods and services within that market. This 'replication' is in effect of a replication of the market 'equilibrium'. Another advantage is that revealed preference data incorporate real

constraints that decision makers face, and these constraints limit the choices of individuals. A further advantage is that these data provide analysts with data that are reliable and valid.

However, one of the disadvantages of revealed preference data is that analysts are limited on collecting data on existing alternatives only within the market being researched. This means that if new market entrants appear or new innovations are introduced in the market, there would be a need to collect further data in order to produce new models. Another down side of revealed preference data is that analysts fail to obtain information on the alternatives that were not chosen by decision makers, either if they collect the data directly from the market or from respondents directly. A further problem with revealed preference data is that a proportion of the markets exhibit significant levels of attribute correlations and this poses problems for the model estimation. Finally there is the disadvantage that collection of revealed preference data can be costly, both in terms of money and time. Due to the fact the collection of such data can be costly there are possibilities that analysts will be tempted to miss out some stages of the data collection and this will not produce accurate model specification (Louviere et al., 2000).

In order to estimate a statistical model the analyst requires data and in the case that the analyst wishes to estimate a statistical model of choice, there is a need for choice data. One method for collecting choice data is the distribution of questionnaires. The writing of questionnaires for the collection of choice data are an in-depth process that adds to the already complexities of more traditional questionnaire construction. However, the more time the analyst spends for preparing the questionnaire less problems are likely to occur, that can be rectified at early stages of the questionnaire construction. Therefore, the analysts must spend as much time as possible to test their survey instruments before commencing any field experiments. All studies that require collection of Revealed preference data also require problem refinement in the case that the analyst is not clear of the problem that has to be researched. After refining the problem, the analyst must proceed to the research design and therefore has to decide how the research project will proceed in terms of how the information will be gathered in order to answer the problem formulated at the first stage of the research project. The two questions that the analyst must answer are what type of data should be collected and what is the best way to collect this data. At this stage is very important that the research design is consistent with the problem definition. In other words, the research process should conform to the problem definition and not vice versa. Another important aspect is that the survey delivery method must be appropriate to the questions that are being asked to

decision makers. Furthermore, the questions being asked must correspond to the type of data that are necessary for the analysis. The research design phase is an iterative process and the analyst must weight considerations such as costs and time that are available to the study versus each delivery mechanism's ability to ask questions in an appropriate manner to answering the research problem. Thus the analyst might be required to review the definition of the problem in the light of any budgetary or other constraints.

In addition the analyst must consider very carefully how the questions are formulated in the light that they must be appropriate and addressed to the an intended population. Another important issue is whether the respondents will understand the questions, because this might lead to confusion, even in the case that the respondent and the analyst use different terms for the same concept. A further problem is the biased or leading questions, where often they are associated with political push polling and the results are known before the questions are even asked. When the analyst believes that the draft questionnaire is ready, they a code book should be developed, which describes how the data will be entered in the computer for analysis. Then the final stage before the data is collected, is to pilot the questionnaire. In this stage the analyst must sample from the interest population and then identify any potential problems that might occur at the data collection stage. It would be also helpful to ask decision makers their feedback on how this questionnaire would be improved (Hensher et al., 2005).

5.2.2 Questionnaires for choice data

A choice set represents the basic mechanism of conveying information to decision makers about the alternatives, attributes and attribute levels that exist in the hypothetical scenarios of the research project. In order to do so, the analyst has to attach the relevant attribute labels to the design after the coding structure has taken place. Each row of the experimental design is called treatment combination and it consists of attribute levels that are related directly to a set of attributes, which are related to a set of alternatives. In the case that the analyst changes the attribute levels observed between the rows then the underlying experimental design forces each treatment combination to act as a separate and independent hypothetical scenario- or choice set. For each treatment combination there is a separate choice set and the analyst can rearrange each treatment combination into a more workable choice set so that it provides information to the decision makers on the attribute levels of the alternatives but also to allow the decision maker to select one of the alternatives.

Once the analyst has generated the choice sets, then the next stage is to construct the survey. However, the analyst must consider how the survey will be constructed. Every choice that decision makers make as human being is within a decision context. The analyst decide the sample population but also to define the context in which decision makers are to assess each choice set in order to make a meaningful decision. This takes the form of a descriptive story, which explains to the respondents the context in which to consider their choice of alternative within the choice set. This procedure has to be followed even in the case that Revealed preference data is collected.

Another aspect that the analyst must consider is the independence of the choice sets. In order to overcome the problem of non-independence, the analyst can express to the decision maker that each scenario is to be treated as a spate hypothetical situation and should not be considered in conjunction with any other choice sets.

Furthermore, the no–choice alternative can occur in the distribution process. In this case the decision makers will be offered the opportunity not to choose one of the alternatives in certain questions or even delay the answer for the present. This is offered due to the fact that if the decision makers were forced to make a choice, then they trade off the attribute levels of the alternatives and thus obtain information on the relationships that exist between the varying attribute levels and choice (Louviere et al., 2000).

5.2.3 Sampling for choice data: the theory

The analyst in the stage must define the sampling frame for the study, and this sampling frame represents the universal but finite set of decision makers to whom the analyst may administer the data collection instrument (i.e. questionnaire). After obtaining the lists of decision makers consistent with the defined population, the sampling strategy must be determined. Some possible strategies that the analyst can follow is the simple random samples, stratified random samples, and a choice- based sample (Hensher et al., 2005).

5.2.3.1 Simple Random Samples

For this method, the minimum acceptable sample size, n, is determined by the desired level of accuracy of the estimated probabilities, p hat, where it is the true choice proportion of the relevant sample while α is the level of allowable deviation as a percentage between p hat and

p and β is the confidence level of estimations such that Pr (p hat – p)≤ $ap \geq \beta$ for a given n, where β= 1-α .The minimum sample size is defined as

$$n \geq \frac{q}{p\alpha^2}\left[\boldsymbol{\Phi^{-1}}\left(\mathbf{1}-\frac{\alpha}{2}\right)\right]^2 \qquad \textbf{Equation 5.2-9}$$

where q is defined as 1- p and $\Phi^{-1}(1-\frac{\alpha}{2})$ is the inverse cumulative distribution function of a standard normal (i.e. N~ (0,1) taken at $(1-\frac{\alpha}{2})$.

The analyst must decide the level of accuracy, α, specified as a percentage that the sample proportions drawn are allowed to deviate from the true population proportions.

The next step is to obtain an estimate of the inverse cumulative normal distribution function, $\Phi^{-1}(1-\frac{\alpha}{2})$. Basic statistics tells us that the cumulative normal distribution function of a normal distribution is the probability that a standard normal variable will take a value less than or equal to z (i.e. P(Z≤z)) where z is some established numerical value of Z. However, we are not interested in the inverse normal distribution but rather to its square, and theory shows that the square of a standard normal variable is distributes as a Chi- square with one degree of freedom, Z^2 (Louviere et al., 2000).

5.3 Methodology

In this study we employ a logit regression model to examine the adoption of e-banking and Internet banking in Greece. Logit model uses a binary or dichotomous variable as dependent variable. The logistic function F for each customer *i*, which is a function of any random variable, z, is given by

$$F(z_i) = e^{z_i}/1+e^{z_i} = 1/1+e^{-z_i} \qquad \textbf{Equation 5.3-1}$$

where e is the exponential under the logit approach. The model is called logit because the function F is the cumulative logistic distribution. The logistic model estimated has the form

$$P_i = 1/1+e^{-(\beta_1+\beta_2 X_2+\ldots\beta_k X_{kk}+u_i)} \qquad \textbf{Equation 5.3-2}$$

where P_i is the probability that the dependent variable is equal to 1, β_1 is the slope, x is the independent variables, k the number of independent variables in the equation and u_i is the disturbance term . When the dependent variable is equal to zero then the probability is given

by $1- P_i = 1/1+e^{z_i}$ **Equation 5.3-3**

and therefore we get $P_i/1-P_i = 1+e^{z_i}/1+e^{-z_i} = e^{z_i}$ **Equation 5.3-4**

The ratio $P_i/1-P_i$ is the odds ratio of an event will occur and if we take the natural logarithm we obtain the following formula

$$L_i = \ln(P_i/1-P_i) = z_i = \beta_1 + \beta_2 X_2 + ... + \beta_k X_k$$ **Equation 5.3-5**

That is the L, the log of the odds ratio, is not only linear in X, but also linear in the parameters. L is called the logit and hence equation (5.3-5) is the logit model. In equation 1, as z_i tends to infinity, e^{-z_i} tends to zero and $1/(1+e^{-z_i})$ tends to 1; as z_i tends to minus infinity, , e^{-z_i} tends to infinity and $1/(1+e^{-z_i})$ tends to 0. In equation 5, as P goes from 0 to 1, the logit L goes from -∞ to +∞. That is, although the probabilities lie between 0 and 1, the logits are not so bounded. Another issue is that although L is linear in X, the probabilities are not linear. In equation 5.3-5 we have included only one variable X , but we can add as many independent variables as may be required for a specific model. If the L is positive, it means that when the value of the regressors increases, the odds that the regressand equals 1 increase. In the opposite case where L is negative, the odds that the regressand equals 1 decrease as the value of X increase. The interpretation of the logit model given in equation 5.3-5 is as follows: β_2 the slope measures the change in L for a unit change in X, while the intercept β_1 is the value of the log odds in favour of our dependent variable in case the independent variable is equal to 0.

5.3.1 E-banking adoption model

The decision to use e-banking services is hypothesised to be a function of demographic characteristics (Kolodinsky et al., 2004; Laforet and Li, 2005; Mavri and Ioannou, 2006; Gan et al., 2006) and information related to familiarity with IT technology and internet (Sohail and Shanmugham, 2002; Mavri and Ioannou, 2006; Corrocher, 2006; Kim et al., 2006). For instance, Gan et al. (2006) and Mavri and Ioannou (2006) report that younger customers are more likely to adopt e-banking services ($H_{5.3\text{-}1}$: Young customers are more likely to adopt electronic banking).

In addition, Lawson and Todd (2003), Akinci et al. (2004) and Laforet and Li (2005) find that male customers are more likely to adopt e-banking services compared to females ($H_{5.3-2}$: Male customers are more likely to adopt e-banking). Furthermore, Lawson and Todd (2003) report that married customers are more likely to adopt e-banking services ($H_{5.3-3}$: Married customers are more likely to adopt e-banking).

Moreover, Polatoglu and Ekin (2001), Gurau (2002) and Gan et al. (2006) find that university education is positively related to the adoption of e-banking ($H_{5.3-4}$: Higher education has a positive impact on the adoption of e-banking). Also, Kolodinsky et al.(2004) and Lassar et al. (2004) report that customers with higher incomes are more likely to adopt e-banking services ($H_{5.3-5}$: Higher income customers are more likely to adopt e-banking).

Further, Chang (2005) reports that outright homeowners are less likely to adopt e-banking services, as they are involved in less complex banking transactions ($H_{5.3-6}$: Homeownership has a negative impact on the adoption of e-banking). Moreover, Lawson and Todd (2003) report that self-employed customers are more likely to adopt e-banking; ($H_{5.3-7}$: Public employees are more likely to adopt e-banking and $H_{5.3-8}$: Self-employed customers are more likely to adopt e-banking).

As far as the familiarity and ownership of personal computers and internet connections is concerned, Sohail and Shanmugham (2003) report that internet and computer ownership are positively related to the adoption of e-banking services ($H_{5.3-9}$: Internet connection has a positive impact on the adoption of electronic banking and $H_{5.3-10}$: PC ownership has a positive impact on the adoption of e-banking).

We extend the standard logit model (used in previous studies) to empirically test the perceptions of customers regarding their branch banking experiences, using three further variables; the branch dissatisfaction, the access to banks' web pages and high branch fees. Sciglimpaglia and Ely (2006) and Chang (2005) find that customers who are satisfied by the electronic services offered by their banks and customers who are exposed to banks' information on the internet are more likely to adopt e-banking services. Hence, our extended model tests (i) if Greek customers are dissatisfied with personal bankers' customer services and, therefore, decide to use e-banking services instead, (ii) if access to banks' web pages will have a positive impact on the adoption of e-banking (the tested hypotheses are $H_{5.3-11}$: Access to banks' web pages has a positive impact on the adoption of e-banking and $H_{5.3-12}$:

Branch dissatisfaction has a positive impact on the adoption of e-banking). Moreover, we test whether the high costs for branch banking transactions encourage Greek customers to adopt e-banking ($H_{5.3\text{-}13}$: High branch fees have a positive impact on the adoption of e-banking).

We expect that all three hypotheses stated above ($H_{5.3\text{-}11}$, $H_{5.3\text{-}12}$ and $H_{5.3\text{-}13}$) have a positive impact on the probability of e-banking adoption (as suggested by theory).

Following Gan et al. (2006) our proposed logit model for Greece takes the following form:

Ebuser = f (*Young*, *Male*, *Married*, *University education*, *High income*, *Public employee*, *Self-employed*, *Homeowner*, *PC owner*, *internet connection*, *branch dissatisfaction*, *access to banks' web pages*, *high branch fees*, ε) **Equation 5.3-6**

The discrete dependent variable, *Ebuser*, measures whether the respondent is an e-banking or non e-banking user[16].

5.3.2 Internet banking adoption model

In order to examine the adoption of Internet Banking we need to estimate the probability of each customer using Internet Banking services. This can be achieved by employing the logit model. This model[17] estimates for each customer the logarithm of the probability of using Internet Banking services to the probability of not using Internet Banking services. The logit can be calculated by the following equation: $\boldsymbol{logit\ p_i = log\left[{p_i}/{(1-p_1)}\right] = \beta_0 + \beta_1 * Young_i + \beta_2 * Old_i + \beta_3 * Male_i + \beta_4 * Married_i + \beta_5 * Uniedu_i + \beta_6 * Middleinc_i + \beta_7 * Highinc_i + \beta_8 * PublicEmp_i + \beta_9 * Selfemp_i + \beta_{10} * Homeowner_i + \beta_{11} * PcOwner_i + \beta_{12} * Internetcon_i + \beta_{13} * Branchdiss_i + \beta_{14} * Accessbankswebpages_i + \beta_{15} * Highbranchfees_i + \beta_{16} ATMusers_i}$ **Equation 5.3-7**

Or it can be transformed to:

$$p_i = \frac{exp(\beta_0 + \beta_1 * Young_i + \ldots\ldots + \beta_{16} * ATMusers_i)}{1 + exp(\beta_0 + \beta_1 * Young_i + \ldots\ldots + \beta_{16} * ATMusers_i)}$$ **Equation 5.3-8**

We examine the adoption of Internet banking in Greece, where the dependent variable is Internet banking adoption, which is discrete as it takes the value 0 when a customer is a non-Internet banking user and 1 if the customer is an Internet banking user. P is the probability of adopting Internet Banking and i is the number of customers. We also consider independent

[16] More detailed information about our variables is available in Appendix p. 160.
[17] More detailed information about our variables is available in Appendix p.160 (see also Gan et al., 2006).

variables that affect this adoption, such as demographic characteristics, technology familiarity, branch dissatisfaction, high branch fees and previous experience with ATMs. We follow recent academic papers to formulate our model that will test the adoption of Internet banking. Various papers find that the decision to adopt Internet banking depends on customers' demographic characteristics (Laforet and Li, 2005; Mavri and Ioannou, 2006; Gan et al., 2006; etc), computer and Internet familiarity (Corrocher, 2005; Kim et al., 2006; Lera-Lopez et al., 2010) and past experience with other e-banking technologies (Kolodinsky et al., 2004).Since previous experience with Internet has a positive effect on the adoption of Internet Banking, we add the access to banks' web pages and the ATM users, in order to test whether customers that access banks' web pages and conduct transactions over ATMs are more likely to adopt Internet Banking. We further add branch dissatisfaction and the high branch fees[18] variables, as we are able to test whether customers not receiving satisfactory services in bank branches or/and pay high branch fees are more likely to adopt Internet Banking services.

Therefore, we can empirically test whether the characteristics of customers have any impact on the adoption of Internet banking (following the literature) as well as the following hypotheses:

$H_{5.4\text{-}1}$: Branch dissatisfaction has a positive impact on the adoption of Internet banking services.

$H_{5.4\text{-}2}$: Access to banks' web pages has a positive impact on the adoption of Internet banking services.

$H_{5.4\text{-}3}$: High branch fees have a positive impact on the adoption of Internet banking services.

$H_{5.4\text{-}4}$: ATM users are more likely to adopt Internet banking services.

5.3.3 Data Description

In this study, we extend the work published by Mavri and Ioannou (2006) who analyse 2002 Greek data about the internet banking adoption for Athens and Thessaloniki; our recent survey has responses from customers of all top Greek banks. Our data was collected in 2008 after the distribution of 300 questionnaires in Thessaloniki (Northern Greece). Thessaloniki was chosen mainly due to convenience and the limited time of this study. Bryman and Bell

[18] In Greece, Internet Banking services cost less than branch and ATM services (Giordani *et al.*, 2009).

(2003) explain that a convenience sample is one that is simply available to the researcher by virtue of its accessibility. The city of Thessaloniki is the second largest city in Greece, and the capital of the Greek region of Macedonia. According to the 2001 census, the entire Thessaloniki area had a population of 1,057,825 residents.

Recent reports by Eurostat (2009) show that only 38% of Greek households have internet access with a 33% broadband (DSL) connections and 5% connections via modems. It is also reported that 53% of Greek individuals aged between 16 and 74 years old have never used the internet and only 5% of the individuals who use the internet perform online banking transactions in Greece. Furthermore, Thessaloniki had the largest increase in the internet penetration for the year 2008 compared to other regions in Greece (see Observatory for the Greek IS, 2010).

The method of 'random sampling' was applied to this study as explained in 5.2.3.1 (Mavri and Ioannou, 2006). The population of this research is individuals over the age of 18 years old, who perform banking transactions, either within bank branches or electronically. Respondents were selected randomly, after the distribution of questionnaires, outside banking institutions and other places of interest in Thessaloniki. The purpose of the questionnaire was to gather recent figures on the demographic characteristics of bank customers and get information on whether they are currently e-banking users or not. Moreover, we are interested in respondents' previous experience with the Internet and other electronic banking technologies, as we expect them to have a positive relationship with the adoption of e-banking. According to Mavri and Ioannou (2006), the number of observations required to estimate the probability that an individual is willing to use Greek online banking was estimated to be 178. For our study, we use equation (5.3-7) to calculate the minimum number of observations required. Following Mavri and Ioannou (2006), we estimate the probability that an individual will use e-banking services, so as the sample could be considered to be representative of the region. According to the Observatory for the Greek IS (2010), the penetration in Thessaloniki for the year 2008 was estimated at 19% compared to the overall internet penetration of Greece.

$$Z = \frac{e}{\sqrt{p(1-p)/n}} \Leftrightarrow n = \frac{Z^2[p(1-p)]}{e^2} \Leftrightarrow n = \frac{(1.96)^2[0.19(0.81)]}{0.05^2} = 197 \qquad \textbf{Equation 5.3-9}$$

where p is the percentage of internet penetration in Thessaloniki, equal to 19%. With a 95% confidence interval, we have a 5% tolerable error included in equation (5.3-9) with Z= 1.96.

Hence, we find that the number of observations required to estimate the probability of e-banking adoption for Thessaloniki is 197 responses.

In this study, a total of 217 usable questionnaires were collected, which turns to a 72 per cent respond rate. Out of the 217 respondents 93.5 % of the customers are e-banking users and branch banking users and they use either the telephone, ATMs, mobile or internet banking to perform their banking transactions, while the remaining 6.5% of the customers choose to perform their bank transactions only to bank branches.

Table 5.3-1 Descriptive Statistics for Greek banking customers (2009)

Variables		**No of respondents**	**Percentage**
Age	**18-40**	136	62.67%
	41-60	63	29.03%
	61 and over	18	8.29%
	Total	217	100.00%
Gender	**Male**	99	45.62%
	Female	118	54.38%
	Total	217	100.00%
Marital Status	**Single**	60	27.65%
	Married/Living with partner	140	64.52%
	Divorced/ widowed/ separated	17	7.83%
	Total	217	100.00%
Educational Level	**Primary school**	7	3.23%
	High school	61	28.11%
	occupational course	57	26.27%
	Undergraduate Degree	73	33.64%
	Postgraduate Degree	17	7.83%
	Doctorate or higher	2	0.92%
	Total	217	100.00%
Monthly Income	**0-€300**	24	11.06%
	€301-€900	82	37.79%
	€901-€1500	84	38.71%
	€1500 and over	27	12.44%
	Total	217	100.00%
			Table 5.31 cont.

Variables		No of respondents	Percentage
Employment Status	**Public Employee**	29	13.36%
	Private Employee	114	52.53%
	Self- Employed	30	13.82%
	Student	13	5.99%
	Retired	19	8.76%
	Home making	7	3.23%
	Serve army	1	0.46%
	Unemployed	4	1.84%
	Total	217	100.00%
Home Ownership	**Home owner**	164	75.58%
	Tenant	53	24.42%
	Total	217	100.00%
PC Ownership	**Yes**	164	75.58%
	No	53	24.42%
	Total	217	100.00%
Internet Connection	**Yes**	133	61.29%
	No	84	38.71%
	Total	217	100.00%
Satisfaction with branch banking employees	**Very Satisfied**	25	11.52%
	Satisfied	175	80.65%
	Not satisfied	17	7.83%
	Total	217	100.00%
Access to banks' web pages	**Never**	171	78.80%
	Once a week	13	5.99%
	Twice a week	5	2.30%
	More than 3 times per week	8	3.69%
	Once/ Twice per month	20	9.22%
	Total	217	100.00%
Average amount spent on branch fees per month	**€ 1 or less**	106	48.85%
	€2- €5	86	39.63%
	€ 6- € 10	8	3.69%
	€ 11- € 20	5	2.30%
	€ 21 and over	12	5.53%
	Total	217	100.00%
	Branch Banking users	172	98.85%
	Telephone Banking	56	32.18%
	ATM	203	93.10%
	Internet Banking	35	15.52%
	Mobile banking	23	11.49%

Table 5.3-1 presents the profile of the respondents (e-banking and non e-banking users) to this study. Note that there would be an equal distribution of questionnaires to men and women, however it seems that women were more willing to participate in this research; this result is in line with Gan et al. (2006) for New Zealand. The majority of our respondents are banking customers between 18 and 40 years old, female and married, with undergraduate degrees and they earn between € 301 and € 1500 per month. Furthermore, they are private employees, homeowners, PC owners with internet connection. As far as the branch banking is concerned, the majority of our respondents are satisfied with branch employees, while most of them never access banks' official web pages and pay at least € 1 or less for their branch transactions (per month). Regarding the Greek e-banking users, ATMs as well as telephone banking are more popular choices to them with 32.18% of the total respondents.

The low figures for internet banking can be explained by the fact that the Broadband (DSL) penetration is low in Greece (Eurostat, 2009). Delgado et al. (2007) explain that '*the differences across countries in internet banking penetration appear to be largely explained by the differences in the availability of access to the internet*'. Among the countries with the lowest rate of internet penetration in Europe are Spain, France and Portugal, followed by Italy, Germany and Belgium. On the other hand, Scandinavian countries have the highest internet penetration rates. Delgado et al. (2007) report that in spite of the low internet penetration reported for Spain and Portugal, the adoption of Internet banking was at higher levels when compared with France, Germany and Italy. They explain that this situation is not typical, as it exhibits a certain level of utilisation of the internet banking channel, above what would be expected when considering the level of the internet penetration in these countries.

5.3.4 Empirical Results

5.3.4.1 E-banking adoption results

Table 5.3-2 reports the results from our logit model, which shows the increase/decrease of e-banking adoption probability with reference to our hypotheses (our dependent variable refers to the *Ebuser*). First, the chi–squared test, for the log-likelihood ratio (also known as LR, similar to the F-test), shows a good fit to our data (i.e. we get a good measure of fit for the proposed logit e-banking model).

The Young variable is significant at 10% level and is positively related with the adoption of e-banking. That is because older customers in Greece are not familiar with technology and they are risk averse; therefore they prefer a personal branch banking relationship. This is in

line with Gan et al. (2006) for New Zealand who find that senior customers are less likely to adopt e-banking as they prefer more personal (traditional) banking services. Hence, we accept hypothesis $H_{5.3\text{-}1}$ that young customers are more likely to adopt e-banking in Greece. Furthermore, the male variable is significant at 10% level of significance, but negatively related to the adoption of e-banking. Note that, our conclusion is not in line with Lawson and Todd (2003) for New Zealand, Akinci et al. (2004) for Turkey and Laforet and Li (2005) for China; they all report that male customers are more familiar with computer technologies, and therefore, they are more likely to adopt e-banking services. So, we reject hypothesis $H_{5.3\text{-}2}$ and conclude that Greek men are less likely to perform banking transactions electronically.

In addition, university education is significant and positively related with the probability of adopting e-banking at 10% level of significance, and as a result we can accept hypothesis $H_{5.3\text{-}4}$. Hence, more educated people in Greece tend to be open to new technologies and they require less training to use these new technologies (see also Kim et al., 2006). Similarly, Polatoglu and Ekin (2001) for Turkey, Lawson and Todd (2003), Gan et al. (2006) for New Zealand and Gurau (2002) for Romania find that customers with higher education degrees are more likely to adopt e-banking due to their higher income status. Therefore, we conclude that Greek individuals with higher education levels are more likely to adopt e-banking services related to the less educated individuals. Further, we find that high income is also significant (at 10% level of significance) and has a positive impact on the decision of Greek customers to adopt e-banking; hence we accept $H_{5.3\text{-}5}$. In particular, Greek customers with higher income have higher value of time than customers with lower levels of income. In other words, Greek customers with high income can create more benefits for themselves by adopting e-banking (see Kim et al., 2004; Huang, 2005. This is not in line with Gan et al. (2006); they argue that high income customers are less likely to perform e-banking transactions as they may prefer to have a traditional contact with staff (especially when they perform complex transactions). On the other hand, the homeowner variable is significant but it is negatively related (lower probability) with the adoption of e-banking; thus we accept hypothesis $H_{5.3\text{-}6}$. This might be explained by the fact that outright homeowners are less likely to have complex banking activities than those who are in monthly rental schemes. Therefore, there is no need to deal with mortgages and monthly payments and the probability of adopting e-banking services will be less (Chang, 2005). Hence, homeownership is a significant factor. According to Chang (2005) (p.21, proposition 1.6) '*Outright owners of residential properties are less likely to have complex banking than those are in key money or monthly rental schemes as*

they do not have to deal with mortgages or monthly payments and therefore, would have less incentive to adopt e-banking'.

All the remaining variables seem to have no impact on the probability of e-banking adoption. In particular, married people are expected to be relatively conservative and therefore are less likely to engage to e-banking activities in Greece (Chang, 2005). On the other hand, Lawson and Todd (2003) find that married customers are more likely to adopt e-banking, while Kim et al. (2005) report that the marital status has no significant impact on the decision to adopt e-banking services.

Table 5.3-2 Determinants of E-banking adoption (2009)

Modelling EBUSER by Logit				
The estimation sample is 1 - 217				
	Coefficient	**Std.Error**	**t-value**	**t-prob**
Constant	29.751200	0.3517	84.600	0.000***
MALE	-1.501020	0.8087	-1.860	0.065*
MARRIED	0.817373	0.7804	1.050	0.296
UNIEDU	2.007540	1.1530	1.740	0.083*
HIGHINC	1.367160	0.8022	1.700	0.090*
PUBLICEMP	-0.657713	1.0000	-0.657	0.512
HOMEOWNER	-28.866800	0.3517	-82.100	0.000***
PCOWNER	-0.230204	0.8851	-0.260	0.795
INTERNETCON	0.921591	0.9371	0.983	0.327
ACCESSBANKSWEBPAGE	0.841209	1.5580	0.540	0.590
YOUNG	1.511990	0.8267	1.830	0.069*
SELFEMPL	-1.226000	0.8660	-1.420	0.158
BRANCHDISS	0.841627	1.3100	0.642	0.521
HIGHBRANCHFEES	-0.602229	1.5350	-0.392	0.695
log-likelihood	-35.9420249		**no. of states**	2
no. of observations	217		**no. of parameters**	14
baseline log-lik	-51.91011		**Test: Chi^2(13)**	31.936 [0.0025]***
AIC	99.8840498		**AIC/n**	0.460295161
mean (EBUSER)	0.935484		**var(EBUSER)**	0.0603538

	Count	**Frequency**	**Probability**	**loglik**	
State 0	14	0.06452	0.06452	-24.00	
State 1	203	0.93548	0.93548	-11.94	
Total	217	1.00000	1.00000	-35.94	

Notes: * (***) indicates a significance at 5% (1%) level
State 0: Non-ebanking users; State 1: e-banking users

Moreover, in our study, the employment status does not seem to have an effect on the decision to adopt e-banking services in Greece. Note that, Lawson and Todd (2003) find that self- employed customers are more likely to adopt e-banking services, as these customers are highly involved in various banking technologies and aware of different financial options that are available to them. In addition, the access to banks' web pages variable is not significant in influencing Greek customers to adopt e-banking (this is due to a low penetration of internet in Greece). Chang (2005) reports that the more exposed customers are to banks' information on their websites, the more likely is that they adopt e-banking services. Furthermore, the PC ownership and the internet connection do not have any impact on the decision of customers to adopt Greek e-banking. However, there are a few studies report that both have a positive impact on the e-banking adoption (see Guriting and Ndubisi, 2006; Hernandez and Mazzon, 2006). For instance, Sohail and Shanmugham (2003) find that customers in Malaysia with computer and internet experience are more likely to adopt e-banking. Finally, the branch dissatisfaction and the high branch fees do not have any impact on customer's probability of adopting e-banking services in Greece. This is not in line with Sciglimpaglia and Ely (2006) who find that banking relationships have an important impact on the adoption of e-banking. We conclude that Greek customers, who use e-banking services, also choose to perform banking transactions in bank branches if they need to consult a personal banker.

Table 5.3-3 reports the derivatives of our discrete independent variables, which are useful for the interpretation of our e-banking logit results. More specifically, we find that male customers are 0.00286 % less likely to adopt electronic banking than female customers in Greece, while we find that younger customers are 0.00289% more likely to adopt E-banking compared to older customers. Further, we report that customers with University education are 0.00383% more likely to adopt Electronic banking than customers without University degrees. Moreover, customers with higher income are 0.00261% more likely to adopt Electronic banking than customers with lower income. In addition, Greek customers who are homeowners are 0.055% less likely to adopt Electronic banking than customers who are renting their properties. Overall, we can observe that there is a very small influence of the personal characteristics of customers on their decision to adopt e-banking services. This could be due to the limited sample size.

Table 5.3-3 Derivatives of E-banking logit model

	State 1
Constant	0.0005677
MALE	-0.0000286*
MARRIED	0.0000156
UNIEDU	0.0000383*
HIGHINC	0.0000261*
PUBLICEMP	-0.0000126
HOMEOWNER	-0.0005508***
PCOWNER	-0.0000044
INTERNETCON	0.0000176
ACCESSBANKSWEBPAGE	0.0000161
YOUNG	0.0000289*
SELFEMPL	-0.0000234
BRANCHDISS	0.0000161
HIGHBRANCHFEES	-0.0000115

Note: *** Significant at 1% level and * Significant at 10% level.

5.3.4.2 Internet banking adoption results

Table 5.3-4 presents the results from our Logit Model for the Internet banking adoption. The chi-squared test, which is the Log Likelihood ratio, tests the overall significance of our regressors. Since the chi-squared value is high, therefore we reject the null hypothesis of non-significance and accept that at least one of our regressors is significant in explaining the adoption of Internet banking[19]. The Old variable is significant at 1% level of significance and negatively related with the adoption of Internet banking. This can be explained by the fact that older customers are not familiar with technology, they are risk averse and they prefer personal branch banking (Gan et al., 2006). In addition, the access to banks' web pages variable is significant and positive at 1% level of significance, where the more frequent visits to banks' web pages, the higher is the probability that customers will adopt Internet banking. Corrocher (2006) reports that customers with higher levels of Internet use are more likely to adopt Internet banking. Therefore we accept hypothesis $H_{5.4\text{-}2}$. The ATM users variable is also significant at 1% level of significance and positively related with the adoption of Internet banking; hence we accept $H_{5.4\text{-}4}$. Recent papers report that customers with prior experience of other e-banking technologies are more likely to adopt Internet banking (Kolodinsky et al., 2004; Kim et al., 2006; Polasik and Wisniewski, 2009). Additionally, university education is

[19] We have also performed exclusion tests, and we find that the Male, Homeowners and Pc Owners variables are not significantly different from zero. Therefore, these variables can be excluded from our original regression. We have also run another logit regression without the above variables, and our results are identical to our initial (reported) results.

significant and positively related with the probability of adopting Internet banking at 10% level of significance. Kim et al. (2006) and Lera-Lopez et al. (2010) find that individuals with higher levels of education are more familiar with Internet technologies and they do not require training. At 10% level of significance we find that high income is also significant and has a positive impact (higher probability) on the decision of customers to adopt Internet banking. Kim et al. (2006) and Huang (2005) find that customers with higher levels of income have a high value of time and therefore by performing banking transactions electronically they can save time.

Table 5.3-4 Logit Results for Internet Banking adoption

	Modelling Internet banking user by Logit			
	Coefficient	**Std.Error**	**t-value**	**p-value**
Constant	-31.765	0.810	-39.200	0.000
Young	0.316	0.583	0.541	0.589
Old	-26.161	0.000	0.000	0.000***
Male	0.201	0.535	0.376	0.708
Married	-0.306	0.556	-0.550	0.583
Uniedu	1.019	0.595	1.710	0.088*
Middleinc	1.393	1.305	1.070	0.287
Highinc	2.215	1.262	1.760	0.081*
Publicemp	-0.679	0.741	-0.917	0.360
Selfemp	-0.771	0.807	-0.955	0.341
Homeonwer	0.100	0.612	0.163	0.871
Pc owner	-0.353	1.119	-0.316	0.753
Intconnect	0.547	0.862	0.635	0.526
Branchdiss	-1.293	1.032	-1.250	0.212
Accessbanksweb	2.727	0.576	4.730	0.000***
High branch fees	0.797	0.772	1.030	0.303
Atm users	26.541	0.809	32.800	0.000***
log likelihood	-55.240	**no of states**		2.000
no of observ.	217.000	**no of parameters**		17.000
baseline log lik.	-95.870	**Test Chi^2 (16)**		81.263 (0.000)
AIC	144.479	**AIC/n**		0.666
mean Ibuser	0.161	**VAR(IBUSER)**		0.135
	Count	**Frequency**	**Probability**	**loglik**
State 0	182.000	0.83871	0.83871	-23.56
State 1	35.000	0.16129	0.16129	-31.68
Total	217.000	1	1	-55.24

Note: *** Significant at 1% level,** Significant at 5% level, * Significant at 10% level.

Table 5.3-5 reports the derivatives of our discrete independent variables, which are useful for the interpretation of our logit results. More specifically, we find that Old customers are 5.29% less likely to adopt Internet banking than young customers in Greece. Further, we report that customers with University education are 0.21% more likely to adopt Internet banking than customers without University degrees. Moreover, customers with higher income are 0.45% more likely to adopt Internet banking than customers with lower income. In addition, Greek customers who access frequently banks' web pages are 0.55% more likely to adopt Internet banking than customers who do not access banks' web pages at all. Further, we report that ATM users are 5.36% more likely to adopt Internet banking than non ATM users in Greece. Similarly to the e-banking adoption derivatives, we observe a very small influence of the personal characteristics of banking users on their decision to adopt Internet banking. As it was explained before, this could be attributed to the limited sample size.

Table 5.3-5 Derivatives of the Internet banking logit model

	State 1
Constant	-0.0641
YOUNG	0.0006
OLD	-0.0529***
MALE	0.0004
MARRIED	-0.0006
UNIEDU	0.0021*
MIDDLEINC	0.003
HIGHINC	0.0045*
PUBLICEMP	-0.0014
SELFEMPL	-0.0016
HOMEOWNER	0.0002
PCOWNER	-0.0007
INTERNETCON	0.0011
BRANCHDISS	-0.0026
ACCESSBANKSWEBPAGE	0.0055***
HIGHBRANCHFEES	0.0016
ATMusers	0.0536***

Note: *** Significant at 1% level,** Significant at 5% level, * Significant at 10% level.

5.4 Conclusion

This study provides an understanding of the characteristics of banking customers and the factors which affect the adoption of e-banking and Internet banking services in Greece. We extend previous works by Gan et al. (2006) and Mavri and Ioannou (2006) and we follow the rank approach (Davies, 1979) and logit method to examine the impact of individual customers' characteristics, on their decision to adopt e-banking services in Greece. Apart from demographic characteristics, we also consider factors such as access to banks' web pages, branch dissatisfaction and high branch fees (these factors have not included in a logit model before).

The empirical findings of this research confirm a positive relationship between the young age variable and the adoption of e-banking services; however, we report that important factors such as the access to bank web pages, branch dissatisfaction and high branch fees have no impact on the adoption of e-banking in Greece. Our results partially support previous studies for several countries (Kim et al., 2006; Sohail and Shanmugham, 2003; Mavri and Ioannou, 2006; and Polatoglu and Ekin, 2001).

As far as Internet banking in concerned, we find that branch dissatisfaction and high branch fees have no impact to the IB adoption in Greece, therefore Greek customers prefer to go to branches and are willing to pay high fees for their transactions.[20] This is due to the fact that customers are aware of the potential electronic risk associated with e-banking services and they may prefer to have face to face contact with personal bankers when they conduct their banking transactions (Kolodinsky et al., 2004 and Pikkarainen et al., 2004). However, we find that ATM users are more likely to adopt Internet Banking services in Greece; this is in line with Kolodinsky et al. (2004), Kim et al.(2006) and Polasik and Wisniewski (2009).

Furthermore, we prove that access to banks' web pages help to increase Internet banking adoption and profitability of banks, but Greek customers do not trust Internet banking services due to a low quality of banking services in Greece. Hence, if more customers are willing to adopt Internet banking, we further expect costs of Internet banking to be low and therefore bank performance in Greece will be improved. In other words, if the quality of Internet banking services is high in Greece, consumers' surplus and demand of these services will increase, which indicates an increase in bank's profits.

[20] Giordani et al. (2009) find that in Greece, banks' branch fees are much higher than the Internet banking fees.

Banker et al. (1998) identify that the continuing adoption of internet technology is a crucial strategic decision for firms to make, since technology improves the operational processes conducted within firms. Moreover, it enhances competitiveness by giving the adopting firms competitive advantage and higher levels of operating efficiency are achieved. The provision of e-banking in Greece is still in its infancy, probably due to the fact that the internet penetration in Greece is very low, and customers are more confident in performing their banking transactions in physical bank branches. Banks can exploit the provision of banking services electronically, aiming clearly at the advertisement of these products to customers that are not yet familiar with these services as they offer to banks significant cuts in costs, reduction in staff and physical branches. Banking institutions should also maximise customers' satisfaction, by reducing the banking fees to the minimum. Banks can simplify various transactions that can be processed through telephone or internet banking, and therefore fewer teller employees would be required. Similarly, cards and loans payments could be processed through electronic kiosks that are located in bank branches. Hence, the number of employees and physical branches can be reduced. In addition, banks can reduce significantly their operational costs, by exploiting economies of scale. By reducing their costs, banks should pass this reduction as a reduction in the fees imposed, while they could also offer lower interest rates on loans and mortgages, and higher interest rates in savings/ deposits accounts. Note that the e-banking fees and commissions for transactions in Greece are less than branch fees, while internet banking fees are less than the ATM and branch fees (for more details see Giordani et al., 2009). Therefore, it is concluded that Greek customers prefer most the traditional banking because they worry about possible high electronic risk that comes with the foray into e-banking and this in line with Cunningham et al. (2005). Hence, Greek banks can attract their customers to electronic services if they design their marketing offers or value propositions according to the needs of these groups.

Our results provide recommendations to the Greek bank managers and help customers in improving relationships with new technologies. The findings of this study are limited to a population (Thessaloniki) which represents the current situation in Greece. Following the most recent studies, we empirically test several hypotheses related to a number of significant adoption factors. While this research has reported some interesting results from an extended logit model, further research is possible. We should employ a technology acceptance model (TAM), to test the effect of perceived ease-of use, perceived usefulness and technology self-efficacy of customers on the probability of e-banking adoption. We should also examine

other hypotheses using recent data from other European countries and compare the results with those from Greece.

Chapter 6

Internet banking adoption by banks and their Performance

6.1 Introduction

The aim of this study is to examine banks' profitability in Greece in relation to their Internet banking services and customers' adoption. It is a matter of vital importance for bank customers and managers to get full information about the economic benefits of Internet banking adoption. We test whether high branch fees have any impact on the probability of Internet banking adoption as well as whether click and mortar banks in Greece exhibit any technology-based scale and technology-based experience effects. These effects are considered to be additive to any general scale and experience effects that occur at Greek banks, which use the existing technology (i.e. Branch banking, ATMs, telephone banking).

More specifically, we extend the findings of DeYoung (2005) and Jenkins (2007) by addressing a test of their hypotheses using recent data from Greece. In particular, we test if bank performance is improved when Internet technology is considered using two different methodologies. The research is primarily motivated by the lack of similar studies (and the use of the above two methodologies) to explain empirically the economic performance of Greek banks over the period 2001-2005. To this end, the bank performance investigation of Greek commercial banks is conducted using econometric modelling of annual financial ratios (following DeYoung, 2005). Section 6.2 presents the theory, Section 6.3 describes the data, while Section 6.4 describes the methodology. Section 6.5 presents the results and Section 6.6. is the conclusion to these studies.

6.2 Theory

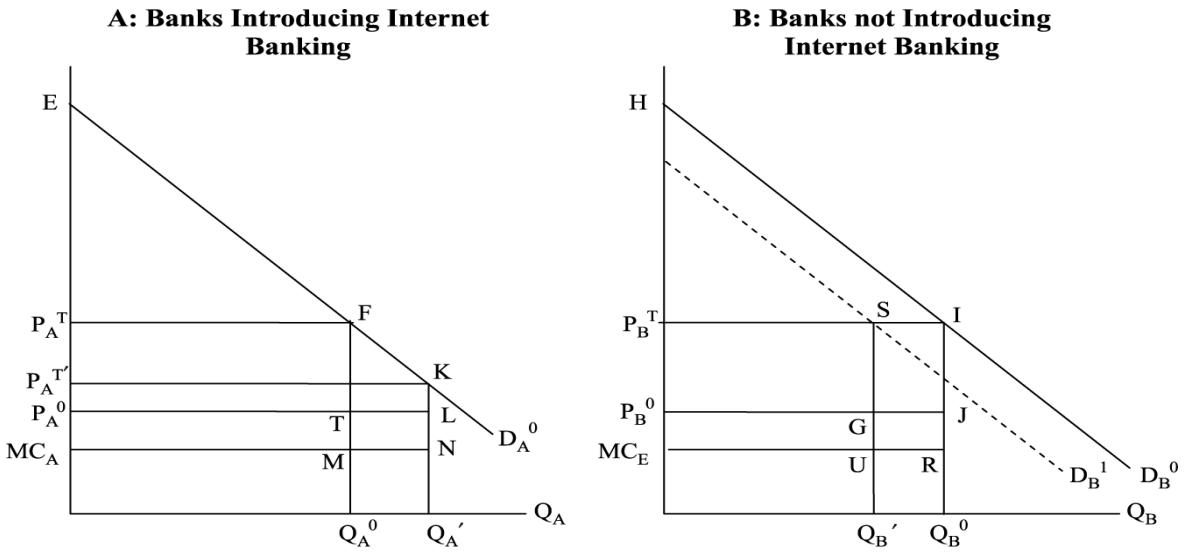
Clark (1997) explains that pricing Internet serves several purposes, such as recovering the costs and attracting customers. Customers would be able to select between a number of services, and those who wish to use more resources will have to pay accordingly. It is common that Internet providers charge a flat subscription fee, based on the capacity of the

access link. The advantages of this practice is that subscribers know what they have to pay, their satisfaction is increased and there are no administrative costs of tracking, allocating and billing for usage. Keeton (2001), reports that customers prefer to have access to both traditional and electronic banking services, and as a result banks need to maintain both these channels. However, the costs of maintaining these channels will be passed to the customers as a form of banking fees for performing various transactions. Furthermore, DeYoung and Rice (2004) find that the provision of Internet banking services has allowed banks to reduce their costs and increase customers' satisfaction. Consequently, customers will be more willing to pay for services that offer them convenience.

Furthermore, innovation[21] and the development of new banking products have become the key strategic focus for the most successful banks (see Rogers, 1995 and Doyle, 1998). E-banking is an innovative product that banking institutions offer all over the world with superior benefits for the customers. However, there is a process through which customers pass from initially gaining knowledge of an innovative product, to the confirmation of adoption of this particular product. Rogers (1995) identified the innovation-decision process, and argues that there is a relative speed at which an innovation is adopted by individuals, and this is called the rate of adoption (for more information see Rogers, 1995). It is measured as the number of individuals who adopt a new product in a specific period. According to Faria et al. (2002) the various theoretical contributions of technology of diffusion have been classified into epidemic, rank, stock, order and evolutionary models (Karshenas and Stoneman, 1995). In epidemic models the explanation of technology diffusion depends on the spread of information about the existence of a new technology (Mansfield et al., 1977). In rank models the decision to adopt an innovation or not depends on the different characteristics of potential adopters (Davies, 1979), while in stock models this decision depends on the number of actual users (Reinganum, 1981). In order models, the adoption depends on the order of adoption with early adopters having greater benefits than later adopters (Fudenberg and Tirole, 1985) and finally in the evolutionary models the decision to adopt a new technology comes after the competition of two or more technologies (Colombo and Mosconi, 1995).The adoption of Internet banking relies on the different characteristics of customers adopting this technology, therefore we follow the rank approach

[21] An innovation is 'an idea, practice, or object that is perceived as new by an individual or other unit of adoption' (Rogers, 1995).

Figure 6.2-1 The market for banking services



Source: Jenkins (2007)

According to Jenkins (2007), the market for banking services can be divided into two parts; the first is the demand by consumers for Internet banking services of type A banks, who intend to offer Internet banking soon, while the second part is type B banks, which are banks that do not have the intention of offering Internet banking. It is assumed that the services being offered by Type A and Type B banks are substitutes. In the initial situation the prices that customers pay for services are identical in both types of banks and it is at P_A^T andP_B^T. These prices are made up from costs incurred by banks P_A^O and P_B^O, and costs incurred by customers. In the above figure, the prices net of the coping costs incurred by customers are shown as P_A^O andP_B^O. The coping costs for type A banks is given by $C_A^O = P_A^T - P_A^O$ and for type B banks is given by $C_B^O = P_B^T - P_B^O$. Initially, the effect of Internet banking services is to provide convenience to customers that decide to adopt these services. Hence, it is shown on the type A figure that there is a reduction in the coping costs from $(P_A^T - P_A^O)\ to\ (P_A^{T'} - P_A^O)$. This reduction in the costs of the banking services offered by type A banks will cause an increase in the quantity demanded for these services by type A banks. Therefore, there will be a decrease in the quantity demanded for services offered by type B banks, as they are substitutes to services offered by Type A banks. This is illustrated by the leftward shift of the demand curve in the Type B banks figure from$D_B^O\ to\ D_B^1$. In the case that the marginal cost ,MC_A, of supplying services offered by Type A banks is less than the price charged for the

service P_A^O, then the Type A banks' profit will be increased by the area MNLT. Similarly, if the marginal costs for producing Type B products MC_B, is less than the price charged by Type B banks, then they will suffer a loss in profits by the area UGJR.

In addition, from the customers' perspective, the availability of Internet banking in Type A banks increases consumers' surplus, as there is improvement in the quality of the services provided. In the figure this is depicted in the area P_A^T EF to $P_A^{T'}$ EK. Likewise, it can be shown that if Internet banking increases service quality by offering new products at full price, that is less than the maximum fee that customers are willing to pay, then there will be an upward increase in the demand for Type A products by more than the increase in the full price of the services. Consequently, this will lead customers to move from type B banks to type A banks. The loss of customers and falling profits for type B banks, will give them an incentive to follow type A banks and introduce Internet banking services.

Various academic papers have researched the performance of multichannel and traditional banking institutions. These papers test for general scale and experience effects for newly chartered banks and for technology- based scale and experience effects, specific to banks that offer Internet banking services (DeYoung, 2005 and Delgado et al., 2007). The term scale economies refer to the ability of banks to reduce their average costs, as their output increases. In addition, Ghemawat (1985) defines the term experience economies as the rate at which units costs are reduced, as banks accumulate experience by using technology, such as the Internet. According to DeYoung (2005), general scale effects occur when traditional banks exhibit better financial performance as their size increases. General experience effects occur when traditional banks accumulate experience and they improve their financial performance, by taking into account risk control, risk management and investment diversification (DeYoung, 2005 and Delgado et al., 2007). Similarly, technology-based scale effects occur when the financial performance of multichannel banks increase as their size increase. Likewise, technology-based experience effects imply better financial performance for multichannel banks that grow in age and accumulate experience, as they employ the Internet as part of their business and understand the capabilities of this technology (Delgado et al., 2007). Moreover, the performance of multichannel and traditional banks will improve only in the case that significant general scale and experience effects exist in meaningful magnitudes as both these types of banks increase in size and age. Nevertheless, in the case that technology-based scale and experience effects exist, then multichannel banks will exhibit a

quicker improvement in their performance compared to traditional banks (Delgado et al., 2007). In this study, we follow DeYoung (2005), Hernando and Nieto (2007) and Delgado et al. (2007) who choose key financial performance ratios, that measure profitability (ROE, ROAA, net interest margin), capitalisation (equity over total assets), leverage (equity over liabilities), operational performance (non interest expenses over assets) and business activity (net loans over total assets).

6.3 Data Description

For the examination of the performance of click and mortar and traditional banks we employ annual audited public financial data for Greek banks that have been collected from the BankScope database for the years between 2001 and 2005. DeYoung (2005) uses quarterly data for US banks between 1997 and 2001, while Delgado et al. (2007) employ annual data for the years 1994-2002 for EU primarily Internet and traditional banks. Our sample, consists of 10 Greek banking institutions, where 3 banks (Agricultural Bank of Greece, Attica Bank and Geniki Bank) offered only traditional banking services for the period 2001-2005, while the remaining 7(Alpha Bank, Aspis Bank, Emporiki Bank, National Bank of Greece, EFG Eurobank, Marfin Egnatia Bank, and Piraeus Bank) offered both traditional and Internet banking services between 2001 and 2005. We particularly choose the period 2001-2005 as by 2001 most of the top Greek banks were already offering Internet banking services, while by the end of 2005, all the banks in our sample were offering Internet banking. ROAA measures the efficacy with which bank uses existing assets to generate profits, while ROE provides an alternative measure of the efficacy with which a bank uses shareholders' equity and which indicates the efficacy with which management manages the resources invested by shareholders (Beccalli, 2007).

Table 6.3-1 compares the banks in the traditional and click and mortar subsamples, across 7 financial performance ratios. In columns (1) and (2), we display the mean performance levels, and it is indicated that click and mortar banks were significantly different from traditional banks (in terms of their financial performance at the beginning of our sample period 2001). On average, click and mortar banks were more profitable than traditional banks, in terms of ROAA and ROE, which is in line with DeYoung et al. (2007); however, we report less overhead expenses (this is not in line with DeYoung et al., 2007). In addition, click and mortar banks invested less proportion of their assets for loans, and a greater

proportion of their assets for shareholders' equity; these findings are in contrast with DeYoung et al. (2007). Moreover, Greek click and mortar banks have a higher leverage ratio (Equities/Liabilities) compared to traditional banks, which implies that these banks are more risky as they have more liabilities and less equity; this result is not in line with Delgado et al. (2007). According to DeYoung et al. (2007), the Difference in Means tests, displayed in final column of Table 6.3-1, are uncontrolled tests that control for the fact that banks are observed multiple times in each panel data set.[22] The difference of means tests show that the net interest margin, the Non Interest Expenses/Assets and the ROAA mean click and mortar banks ratios are different compared to traditional banks. On the other hand, we report that, for the remaining performance ratios, there is not sufficient evidence to confirm that there is a significant difference between the mean performance ratio for banks offering Internet banking services and banks offering traditional services only.

Table 6.3-1 Subsample Means and Difference of Means Test (2001-2005)

	Descriptive Statistics		
	(1) Traditional Banks	**(2) Click and Mortar Banks**	**(2)-(1) T-Test**
Net interest margin	3.758	3.035	- **[23]
Non interest expenses/Assets	4.535	3.369	- **
ROAA	0.016	0.819	+ **
ROAE	2.072	9.555	Non significant
Equities/liabilities	6.925	8.946	Non significant
Net loans/assets	64.397	57.099	Non significant
Equity/assets	6.267	7.820	Non significant

[22] As explained in DeYoung (2005), the differences of means tests are generated from random effect regressions that pool the annual data from the two groups of banks that are being compared (i.e. Group 1are traditional banks and Group 2 are click and mortar banks). These regressions are specified as $X_{it} = \alpha + bD_{it} + u_i + e_{it}$, where X_{it} is the performance variable being tested, D_{it} is a dummy variable equal to 1 for banks in Group 2, u_i is a random disturbance term specific to each bank and constant across time and e_{it} is a random disturbance term with mean zero. The statistical difference of b from zero provides the statistical significance test for the difference of means.

[23] ** Significant at 5% level

6.4 Methodology

6.4.1 Technology-Based Scale and Technology-Based Experience effects

We follow DeYoung (2005) and Delgado et al. (2007), in order to measure the performance of multichannel and traditional banks. We formulate the following equation to test the general scale and experience effects, while we also allow the existence of both technology-based scale effects ($INTERNET * LnASSETS$) and technology-based experience effects ($INTERNET * LnAGE$).

Pooled Performance

$$\boldsymbol{Performance_{i,t} = \alpha + \beta * INTERNET_I + \delta * LAGE_{i,t} + \lambda * LASSETS_{i,t} + \gamma * INTERNET_i * LAGE_{i,t} + \eta * INTERNET_i * LASSETS_{i,t} + \epsilon_{i,t}}$$ **Equation 6.4-1**

where performance can be any of the seven ratios that summarise the financial performance of banks in our sample (net interest margin, noninterest expenses over assets, return on assets, return on equity, equities over liabilities, net loans over total assets, and equity over total assets. Subscripts i and t are banks' indices and time in years respectively. Internet is a dummy variable which takes the value of 1 for click and mortar banks and 0 for traditional bank and the coefficient β indicates the financial performance gap between multichannel and traditional banks at the means of the data. DeYoung (2005) explains that Age and Assets are control variables and their natural logarithms are taken into account to control for accumulated production experience effects on banks' performance (LAge) and effects of operating scale (LAssets) on bank performance respectively . The coefficient γ shows the importance of technology-based experience effects and similarly η indicates the importance of technology-based scale effects, while $\epsilon_{i,t}$ is the error term. We estimate the equation by employing OLS (Ordinary Least Squares) and GLS (Generalised Least Squares) with random effects models. As explained by Delgado et al. (2007) when we apply the random effects method a bank specific random error term is included ($v_{i,t}$), apart from the usual normal error term ($u_{i,t}$), in order to account for unexplained variation(unobservable heterogeneity) in the dependent variable that is specific to bank i for the sample period t. Therefore :

$$\boldsymbol{\epsilon_{i,t} = v_{i,t} + u_{i,t}}$$ **Equation 6.4-2**

Observations coming from populations with greater variability are given less weight than those coming from populations with smaller variability. Unfortunately, the OLS method does not follow this strategy, but the GLS method takes such information into account and is therefore capable of producing estimators that are best linear and unbiased (BLUE) (Gujarati 2004). DeYoung (2005), adds that a fixed effects approach is not feasible in our case, as the phenomena that are being tested here are themselves fixed effects, and the variation necessary to estimate our coefficients β, γ, and η in the equation would disappear in a fixed effect approach. DeYoung (2005) adds that it might be difficult to separate empirically the technology-based scale and experience effects as a result of the colinearity between LAge and LAssets; hence he suggests that two equations should be run in parallel in order to test for these effects separately. In this way, the effects are tested in isolation and there is no restriction for the click and mortar banks to follow the same performance size and time paths as the traditional banks in our sample. The two equations that have been run separately are the following:

Equation (6.4-3): Technology-based scale effects

$$Performance_{i,t} = \alpha + \beta * INTERNET_I + \lambda * LASSETS_{i,t} + \eta * INTERNET_i * LASSETS_{i,t} + \epsilon_{i,t}$$

Equation 6.4-3

Equation (6.4-4): Technology-based experience effects

$$Performance_{i,t} = \alpha + \beta * INTERNET_I + \delta * LAGE_{i,t} + \gamma * INTERNET_i * LAGE_{i,t} + \epsilon_{i,t}$$

Equation 6.4-4

6.4.2 Effect of Internet banking on the change of performance

We test how the Internet affects the financial performance of Greek banks following the methodology proposed by DeYoung et al. (2007). In particular, we hypothesise that the change in the performance measures for a sample of years is affected by: (1) the Internet banking delivery channel, (2) the performance in the first year of the sample, (3) the lagged change in performance, (4) the log of assets and (5) equities. For the purpose of this research, we employ key performance measures from both the income statement and the balance sheet of the above Greek banking institutions. These performance measures include the net interest revenue over average assets ratio, the net interest margin ratio, the non interest expenses over average assets ratio, the return on average assets (ROAA) and the return on average equity (ROAE). From the balance-sheets, we consider the assets, net loans over total assets and the

equities over total assets performance measures. Therefore, we run eight separate regressions for each performance measure by using the equation 5.5-1 stated below (see also DeYoung et al. 2007).

Equation 6.4-5

$$\Delta Performance_i\ (2001-2003) = \alpha + \beta * INTERNET_i + \gamma * Performance_i(2001) + \delta * \Delta Performance_i(2000-2001) + \zeta * LAssets_i + \theta * Equity_i + \varepsilon_i$$

where the subscript i is a cross-sectional index of Greek banks. The dependent variable $\Delta Performance_i\ (2001-2003)$ measures the change in a range of performance measures for bank i between the end of year 2001 and the end of year 2003. $Internet_i$ is a dummy variable that is equal to one if the bank i offered Internet banking services at the end of year 2001 and zero otherwise. In order to control for regression to the mean and for performance trends, we include the beginning of period measure of the dependent variable ($Performance_i(2001)$) and the one period lagged dependent variable ($\Delta Performance_i(2000-2001)$) respectively. Furthermore, we add the log of assets to control for possible scale effects and the equity performance measure (calculated as the equity over total assets for bank i in order to control for risk. We also include the error term ε_i , where we assume that it is distributed normally and independently with a mean of zero.

6.5 Empirical Results

6.5.1 Technology-Based Scale and Technology-Based Experience effects

Pooled and Random Effects

According to our results (Table 6.5-1), the coefficient of Internet β has a negative sign in the case of the net interest margin and the non interest expenses over assets ratios; this reflects lower profitability and lower overhead expenses for the click and mortar banks, respectively. On the contrary, Greek click and mortar banks are more profitable in terms of the ROAA and ROAE ratios. The coefficient λ is negative and significant for the non interest expenses over

assets. This shows that traditional banks access mainly cost related scale economies and, that the cost economies are larger in absolute terms when scale and learning are considered jointly. ROAE is positive and significant, with a coefficient λ of 14.609; this results in an increase in the profitability (in terms of ROAE) as total assets increases. The equities over total assets ratio has a negative coefficient, and explains the difficulty of traditional banks to add assets to their balance sheets, where they would have been treated as expenses, as their size grows. The coefficient for Lage, δ, is negative and significant for the non interest expenses over assets. This results in a decrease in the overhead expenses as traditional banks grow in age. However, the coefficient δ for ROAA and ROAE is positive and significant, showing an increase in the profitability of traditional banks as these banks grow in age. Further, significant evidence of technology- based scale effects exist for click and mortar banks. The coefficients η of the net interest margin and the non interest expenses over assets are always positive and significant. A 50% increase in assets results in a 0.11% points increase in net interest margin as well as a 0.068 % points decrease in noninterest expenses over assets; therefore, there is an increase in the profitability and a decrease in the overhead expenses for click and mortar banks. Looking at the results from the GLS method (Table 6.5-2), a 50% increase in assets results in a 0.05% points decrease in noninterest expenses over assets. Further, experience has a negative impact on the profitability of the click and mortar banks (in terms of ROAA and ROAE) when the OLS method is used. We also find that Greek click and mortar banks have higher overhead costs as they grow in age. This could be explained by the fact that Greek banks have invested significantly in new technologies in order to keep up with the current demand of banking services (Gaganis et al. 2009). From the GLS results, only the ROE is found to have a negative relationship with the experience effect of click and mortar banks. Therefore, we report that there is a decrease in the profitability as click and mortar banks gain experience.

The regression analysis of scale and experience effects in isolation. According to Table 6.5-3, click and mortar banks exhibit a reduction in their operating expenses. The coefficient λ is negative and significant for the non interest expenses over assets. This means that traditional banks access scale economies, as the operating expenses decrease. Further, click and mortar banks exhibit an increase in the non interest expenses over assets and the ROAE. This leads to an increase in the overhead expenses and the profitability. The coefficient for Lage, δ, is positive and significant for the ROAE. This results in higher profitability as traditional banks

grow in age. The results also show that click and mortar banks have lower operating costs as they grow in age, as well as lower profitability in terms of the ROE ratio.

Table 6.5-1 Pooled Ordinary Least Squares Results

Estimation method: Pooled Least squares								
Number of Final observations: 50								
Variable		Net Interest Margin	Non Interest Expenses /Assets	ROAA	ROAE	Equities/ Liabilities	Net Loans/ Total Assets	Equity/ Assets
Internet (β)		-13.347	-27.627	25.272	500.184	22.609	-92.304	4.065
		(7.363) *	(9.545)***	(10.926)**	160.796)**	(101.781)	(190.128)	(48.167)
Lage(δ)		-5.609	-10.872	12.443	241.838	6.186	-32.544	6.336
		(3.944)	(5.107)**	(5.846)**	(86.040)**	(54.462)	(101.736)	(25.774)
Lassets(λ)		-0.135	-2.119	0.062	14.609	-4.568	-1.694	-4.090
		(0.306)	(0.396)***	(0.454)	(6.678)**	(4.227)	(7.897)	(2.001)**
Lage*Internet(γ)		-5.090	10.847	-12.358	-242.270	-3.881	26.534	-6.503
		(3.944)	(5.112)**	(5.852)**	(86.124)**	(54.515)	(101.835)	(25.799)
Lassets* Internet(η)		0.763	1.735	-0.367	-11.678	-2.793	8.625	2.587
		(0.332)**	(0.431)***	(0.493)	(7.259)	(4.595)	(8.583)	(2.174)
R^2		0.53	0.64	0.32	0.31	0.32	0.16	0.18

Note: *** Significant at 1% level,** Significant at 5% level, * Significant at 10% level. Standard Errors in Parentheses.

Table 6.5-2 Pooled Generalised least squares

Regression analysis of scale and experience effects								
Estimation method Generalised least squares with random effects								
Number of Final observations: 50								
Variable		Net Int Margin	Non Interest Expenses /Assets	ROA	ROAE	Equities/ Liabilities	Net Loans/ Total Assets	Equity/ Assets
Internet(β)		-0.841	1.494	5.783	450.211	8.009	325.074	-13.820
		(11.807)	(13.350)	(16.738)	208.907)**	(135.706)	(286.519)	(70.805)
Lage(δ)		1.236	4.080	1.736	216.063	-8.182	217.864	-2.776
		(6.424)	(7.247)	(9.120)	(112.190)*	(73.299)	(159.729)	(38.124)
Lassets(λ)		0.006	-1.690	-0.248	13.620	-4.936	1.704	-4.319
		(0.557)	(0.620)***	(0.797)	(8.941)	(60.075)	(15.673)	(3.094)
Lage*Internet(γ)		-1.892	-4.182	-1.289	-215.934	12.961	-231.795	2.470
		(6.431)	(7.255)	(9.131)	(112.303)*	(73.379)	(159.957)	(38.164)
Lassets* Internet(η)		0.862	1.405	-0.593	-11.318	-6.764	23.532	2.894
		(0.588)	(0.657)**	(0.841)	(9.637)	(6.480)	(16.237)	(3.318)
R^2		0.36	0.29	0.28	0.20	0.39	0.40	0.10

Note: *** Significant at 1% level,** Significant at 5% level, * Significant at 10% level. Standard Errors in Parentheses

Table 6.5-3 Effects in Isolation

Regresssion Analysis of scale and experience effects														
Estimation method: Generalised least squares with random effects in isolation														
Number of Final observations: 50														
Scale Effects							Experience Effects							
Variable	Net Int Margin	Non Interest Expenses /Assets	ROAA	ROAE	Equities/ Liabilities	Net Loans/ Total Assets	Equity/ Assets	Net Int Margin	Non Interest Expenses /Assets	ROAA	ROAE	Equities/ Liabilities	Net Loans/ Total Assets	Equity/ Assets
Number of Final observations: 50														
Internet(β)	-3.438	-5.495	2.911	52.688	20.305	-67.325	-8.292	0.994	35.604	14.804	406.419	-6.195	138.486	-17.657
	(2.315)	(2.704)**	(3.102)	(43.462)	(19.951)	(50.853)	(10.336)	(13.887)	(18.398)*	(15.171)	(232.887)*	(155.132)	(290.289)	(73.667)
Lassets(λ)	0.532	-1.497	-0.220	14.357	-4.825	4.841	-4.211							
	(0.590)	(0.688)**	(0.790)	(10.947)	(5.010)	(13.0.38)	(2.560)							
Lassets* Internet(η)	0.668	1.199	-0.504	-12.419	-4.127	14.4756	2.672							
	(0.617)	(0.720)	(0.826)	(11.562)	(5.306)	(13.552)	(2.719)							
R^2	0.345	0.235	0.193	0.07	0.3	0.3	0.123							
Lage(δ)								0.881	19.444	7.416	216.009	-6.858	79.125	-11.185
								(7.458)	(9.875)	(8.148)	(125.087)*	(83.325)	(155.902)	(39.566)
Lage*Internet(γ)								-0.929	-19.815	-7.543	-214.230	4.057	-78.258	9.892
								(7.465)	(9.890)**	(8.155)	(125.191)*	(83.393)	(156.046)	(39.600)
R^2								0.094	0.14	0.125	0.104	0.023	0.027	0.024

Note: *** Significant at 1% level,** Significant at 5% level, * Significant at 10% level. Standard Errors in Parentheses.

6.5.2 Effect of Internet banking on the change in performance of Greek banks

Table 6.5-4 compares brick-and- mortar and click-and-mortar banking institutions across 8 different financial performance measures. Columns [1] and [2] show the mean performance levels for brick-and-mortar and click-and-mortar institutions respectively, at the beginning of our sample in 2001. On average, click-and-mortar banks were more profitable that brick-and mortar banks in terms of the ROAA and ROAE. In addition, click and mortar banks had larger assets, invested more in loans and had more equities than brick-and-mortar banks. Columns [3] and [4] show the change in performance during our sample 2001-2003. On average, click-and-mortar Greek banks became more profitable in terms of ROAE and increased their assets, compared to brick-and-mortar Greek banks. These results are consistent with the performance results for 2001. However, all other results are not consistent with the 2001 performance indicators. We have also performed the Wu-Hausman endogeneity tests and we report that in all our models the OLS estimator of the same equation yields consistent estimates. Therefore, our models are free of endogeneity.

The OLS regression results (from equation 6.4-5) are presented in Table 6.5-5. In addition, we report the estimated percentage change in the financial performance of Greek banking institutions after the adoption of Internet banking. It is calculated by dividing the estimated β coefficient with the mean financial performance measure at the end of the year 2001 (DeYoung et al. 2007). We find that the net interest revenue, the net interest margin and the non interest expenses are slightly affected by the Internet banking adoption. More specifically, we show that the net interest revenue over average assets ratio is decreased with the adoption of the Internet delivery channel. This implies that there is a reduction in the revenues attributable to loans after the deduction of funding costs. This is not in line with DeYoung et al. (2007) for US; they show that the interest revenues were unaffected by the adoption of Internet banking. In addition, we find that the net interest margin ratio is also decreased with the adoption of Internet banking. This indicates the reduction in the profits made by Greek banks from the interest gained from loans and mortgages after the deduction of the interest paid to lenders. However, DeYoung et al. (2007) report a small increase in the net interest margin for US banks for the period between 1999 and 2001. Moreover, our results show that the non interest expenses over average assets ratio is negative and significant at the 10% level of significance. This indicates a relatively small decrease in the overhead expenses for Greek banks switching to the click-and-mortar model. This finding is in line with Hernando and Nieto (2007) for Spain; however it is not in line with DeYoung et

al. (2007) for US, who report that there is no evidence of a reduction in the operational expenses of US banks adopting the Internet as a banking delivery channel.

Table 6.5-4 Percentage changes in income and balance sheet items

	Performance 2001		**∆Performance (2001-2003)**	
	[1]Internet=0	**[2]Internet=1**	**[3]Internet=0**	**[4]Internet=1**
Net Interest revenue/average assets	2.765	2.563	0.92	0.21
Net Interest Margin	3.04	2.819	1.042	0.187
Non Interest Expenses/average assets	4.345	3.433	1.07	-0.237
ROAA	-0.138	1.101	-0.188	-0.307
ROAE	0.135	9.941429	0.9	1.441
Assets	5549.375	19077.34	559.15	1851.671
Net Loans/total assets	44.675	44.877	19.465	11.2
Equities/Total assets	8.518	11.564	-0.325	-4.436
Figures reported are in mil Euros				

In this study, there is no evidence that ROAA and ROAE increased with the adoption of Greek Internet banking; a contradicting result to DeYoung et al. (2007) for US and Hernando and Nieto (2007) for Spain. They both find that the profits of banks adopting the Internet as a delivery channel increased in terms of the ROA and ROE. Additionally, we find no impact on the assets of click-and-mortar banks in Greece; nonetheless, DeYoung et al. (2007) show that click-and-mortar US banks experienced an increase in their assets 5% to 8% faster than brick-and-mortar institutions. We further report that net loans over total assets were unaffected by the Internet banking adoption in Greece; this finding is in line with DeYoung et al. (2007) for US. Finally, we show that the equity over total assets ratio is unaffected by the adoption of

Internet banking. Note, however, that DeYoung et al. (2007) find that the Internet banking adoption in the US caused a small reduction in the equity over total assets ratio. This implies that click-and-mortar banks hold less capital than brick-and-mortar banks. They further explain that '*perhaps banks felt that increased revenue from deposit service charges was contributing to permanent and stable increases in profits and/or that the small observed shifts in asset composition were reducing their risk profiles*'(DeYoung et al. 2007, p.1057).

Table 6.5-5 Effect of Internet on Performance

Variables	OLS Results
Net Interest revenue/average assets	-0.340% ** [24] [-2.79]
Net Interest Margin	-0.339% ** [-2.8]
Non Interest Expenses/average assets	-0.259% *[25] [-2.37]
ROAA	0.126% [0.428]
ROAE	0.160% [0.709]
Assets	0.084% [0.523]
Net Loans/total assets	0.041% [0.215]
Equities/Total assets	-0.024% [-0.153]

6.6 Conclusion

In this study we examine the economic performance of Greek click and mortar banks; In particular, we test whether click and mortar banks in Greece exhibit any technology-based scale and technology- based experience effects. Previous papers find that banking institutions, that offer Internet banking services, can be profitable by reducing their average costs, or by enhancing the products already being offered, and fees will be charged

[24] Significant at the 5% level of significance
[25] Significant at the 10% level of significance

Note: t-statistics in [ ]

appropriately (Sullivan, 2000). In addition, there is previous evidence that customers are willing to pay higher fees for transactions that offer convenience and hence, banks are able to generate additional profits (Jenkins, 2007).

Empirical results show that Greek click and mortar banks have higher profits in terms of Net interest margin, ROAA and ROAE. However, this is not in line with Delgado et al. (2007), as they find that click and mortar banks exhibit lower profitability compared to traditional banks. Further, we report that when scale and technology effects are considered, these banks exhibit lower profitability. This could be explained by the fact that few customers adopt Internet banking services in Greece. This is not in line with the theory of Jenkins (2007) for the economic performance of banks adopting Internet banking services. He argues that banks' profits can increase if the marginal costs are less than the fees charged for these services, and as customers' convenience and surplus is increased, more customers will be willing to adopt Internet banking services. In addition, we report that the operational expenses of Greek click and mortar banks are decreased, and this is in line with Berger (2003) and Delgado et al. (2007). However, when we consider technology- based scale and experience effects, the operational expenses for click and mortar banks are increased. This could be attributed to the fact that Greek banks have invested heavily in technology, in order to meet the needs of Greek customers (Gaganis et al., 2009). However, this is not in line with DeYoung (2005), as he finds that operational expenses of US Internet banks are decreased, when technology-based scale and experience effects are considered.

Moreover, we examine how the Internet affects the financial performance of Greek commercial banks (brick-and-mortar and click-and-mortar banks) over the period 2001-2003. Using several OLS regressions, we examine the degree to which Internet has contributed to an improvement in the profitability of the Greek banking industry. Empirical results suggest that the adoption of Internet had no effect on the profitability of banks in terms of the ROAA and the ROAE ratios. Further, we show that there is a reduction in the net interest margin ratio, implying a decrease in the profits gained from the interest on loans after the deduction of the interest paid to lenders. In addition, we find that there is a decrease in the net interest revenue over average assets. Moreover, we suggest that there is a reduction in the operational expenses for the banks adopting Internet banking. We further report that assets, net loans over total assets and equities over total assets are unaffected by the Internet banking adoption.
Overall, our study concludes that adding the Internet delivery channel to an existing network of physical Greek bank branches resulted in no significant impact on the profitability. This is

partially in line with Carlson et al. (2001) for the US, while it is not in line with DeYoung et al. (2007) for the US and Hernando and Nieto (2007) for Spanish banks. Although previous evidence shows that more profitable banks are quicker to adopt Internet banking, this is not the case here due to the different conditions at Greek banks (small/large/new/old) offering Internet banking compared to other banks (US and European). However, Greek Internet banking will eventually become a very important factor affecting financial performance if the speed of adoption along with the IT investments will depend on the growth in the use of Internet banking, see Carlson et al. (2001). Finally, for technology (Internet) to have a positive impact on the financial performance of a Greek bank, it is necessary for bank managers to take into consideration the concept of "appropriate use" of Internet (Beccalli, 2007). Bank managers also need to consider the efficiency of Internet banking performance, in order to make better financial decisions and create more profits (Wu and Wu, 2010). Further research is needed to measure Internet banking efficiency of all major European banks using parametric and non-parametric methods.

Chapter 7

E-banking Efficiency, Profitability and Performance

7.1 Introduction

The determinants of bank efficiency and profitability have attracted the interest of academic research, in addition to bank management, financial markets and bank supervisors. The purpose of this study is to extend earlier works by Holden and El-Bannany (2004), Pasiouras (2007), Kosmidou (2008) and Kondo (2008) on the determinants of bank efficiency and profitability. In particular, we examine to what extent the efficiency and profits of Greek commercial banks over the period 2004-2009 are influenced by factors such as the number of ATMs and IT investments. The Greek banking system has undergone major reforms since the 1990s (i.e. market liberalisation, mergers-acquisitions, the introduction of the Euro currency, deregulation of interest rates etc). We study the above period as it includes (i) the post-EMU period of Greece and (ii) the 2004 Athens Olympic Games period (where significant growth in the economy was observed as a result of heavy investments in construction and communication technologies)[26].

Following the two step approach, where Technical Efficiency (TE) scores are obtained from the VRS input-oriented non-parametric DEA method, scores are linked to a series of bank efficiency determinants; this can be modelled with a Tobit regression model. Furthermore, we investigate whether the number of ATMs and IT expenses contribute to increasing the profitability of Greek banks in terms of ROAA, ROAE, net fees and commissions, and net interest income.

This study is organised as follows: Section 7.2 describes the theory and methodology and Section 7.3 the data employed. In Section 7.4 the empirical findings are presented and interpreted, while the final section 7.5 provides a summary of our study and conclusions.

[26] During the period 2004-2009 there was a significant post-Olympic dynamic growth in Greece (see Floros 2010), while after 2009 the Greek Banking system was influenced by the international economic crisis (see National Bank of Greece 2009).

7.2 Theory and Methodology

There are several approaches that can be followed to examine the efficiency of banks, such as Stochastic Frontier Analysis (SFA), Thick Frontier Approach (TFA), Distribution Free Approach (DFA), Free Disposal Hull (FDH) and DEA. The theoretical foundations for the frontier estimations were laid by Debreu (1951), Koopmans (1951) and Farrell (1957). Farrell (1957) proposed that the efficiency of a firm consists of two components: TE and allocative efficiency. TE reflects the ability of a firm to achieve maximum output from a given set of inputs, and allocative efficiency reflects the ability of a firm to use inputs in optimal proportions, considering their respective prices. Coelli (1996) explains that when these two measures are combined they provide a measure for total economic efficiency. For this present study we use the DEA non-parametric method in order to estimate the efficiency of Greek commercial banks. DEA, which was firstly introduced by Charnes et al. (1978), uses principles of linear programming to examine how decision making units (DMUs) operate relative to other DMUs in the sample. Cooper et al. (2000) explain that DEA was given this name because of the way it 'envelops' observations, in order to identify the frontier that is used to assess observations representing the performances of all DMUs. Efficiency can be defined as the ratio of an output to an input. The DMUs that are on the frontier are assigned a score of one, while the ones that are inside of the frontier curve are assigned efficiency scores between zero and one (Ketlar and Ketlar 2008). However, the efficiency estimation becomes complex, when we have to consider multiple inputs and outputs (Ho and Wu, 2009). The main advantage of the DEA method is that it can overcome this problem by constructing an efficiency frontier from weighted outputs and weighted inputs. Furthermore, Halkos and Salamouris (2004) add that there is no need to determine the functional form or the statistical distribution of the scores, as we need to do with parametric methods (such as the SFA). In addition, the DEA method can allow for zero output values as well as zero input values, it is less data demanding and can handle small sample sizes (Damar, 2006 and Sufian, 2006). Nevertheless, the deficiency of the DEA method is that it very sensitive to outliers and assumes that data are free of measurement errors (Pasiouras, 2007). DEA can be applied by assuming either CRS or VRS. Charnes et al. (1978) introduced the DEA method that had input orientation and assumed CRS. In this case, it is assumed that there is data on K inputs and M outputs on each of N DMUs. For the ith DMU these are represented by the vectors x_i and y_i, respectively. The data of all N DMUs are represented by a K x N input matrix, X, and

a M x N output matrix, Y. We calculate the input oriented measure of a particular DMU, under the assumption of CRS as:

$$\begin{aligned} &\text{Min}_{\theta,\lambda}\ \theta, \\ &\text{s.t.} \quad -y_i + Y\lambda \geq 0, \\ &\theta x_i - X\lambda \geq 0, \end{aligned} \qquad \textbf{Equation 7.2-1}$$

where θ is a scalar efficiency score and λ is a Nx1 vector of constants. It will satisfy the $\theta \leq 1$, with the value 1 indicating a point on the frontier and consequently a technically efficient DMU (Farrell 1957), while $\theta < 1$ indicates that the DMU is inefficient and therefore needs a 1- θ reduction in the inputs employed to reach the frontier. The above linear programming model can be solved N times, once for every DMU and obtain a value of θ for each DMU.

Coelli (1996) explains that the CRS assumption is appropriate only where all DMUs operate at an optimal scale. The reasons that a DMU is not operating at an optimal scale might be attributed to imperfect competition, constraints on finance, etc. The use of the CRS model, in the case that not all DMUs operate at an optimal scale, will result in TE scores that are confounded by SE scores. Banker et al. (1984) introduced the extension of the CRS model to account for VRS, which permits the calculation of TE scores, which are free of any SE effects. Under the VRS assumption, the overall TE (OTE) is decomposed into a product of two components. The first component is TE under the VRS assumption or pure TE, and it relates to the ability of managers to utilise firms' given resources. The second component is SE and refers to the exploitation of scale economies by operating at a point where the production frontier exhibits CRS (Pasiouras, 2007). The CRS model is then modified to account for VRS by adding the convexity constraint N1'λ=1 to equation (7.2-1) to provide:

$$\begin{aligned} &\text{Min}_{\theta,\lambda}\ \theta, \\ &\text{s.t.} \quad -y_i + Y\lambda \geq 0, \\ &\theta x_i - X\lambda \geq 0, \\ &N1'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \qquad \textbf{Equation 7.2-2}$$

where N1 is a N x 1 vector of ones. Pasiouras (2007) adds that the TE scores obtained under the VRS method are higher than or equal to the scores obtained under the CRS model, and SE scores can be obtained by dividing the overall TE by the pure TE.

7.2.1 Determinants of Bank efficiency

In order to investigate further the determinants of bank efficiency for the Greek commercial banks we follow the so called Two-step approach, as suggested by Coelli et al. (1998). The first step is to calculate the efficiency scores from the DEA input-oriented and assuming VRS method and the second step is to estimate a Tobit regression model. The Tobit model (or censored normal regression model) is a model that describes the relationship between a non-negative dependent variable that it is observed in a selected sample and is not representative of the sample, and an independent variable. In this case we don't apply Ordinary Least Squares (OLS) regressions because the Xs are correlated with the disturbance term and therefore, they will provide inconsistent estimates of β. The general Tobit model is as follows:

$$y_i^* = X_i\beta + \varepsilon_i \qquad \textbf{Equation 7.2-3}$$

where $\varepsilon_i \sim N(0, \sigma^2)$. y^* is a latent variable that is observed for values greater than τ and censored otherwise. The observed y is defined by the following measurement equation

$$y_i = \begin{cases} y^* \_ if \_ y^* > \tau \\ \tau_y \_ if \_ y^* \le \tau \end{cases} \qquad \textbf{Equation 7.2-4}$$

In the typical Tobit model, it is assumed that τ=0. That means that data are censored at 0. Therefore, we have:

$$y_i = \begin{cases} y^* \_ if \_ y^* > 0 \\ 0 \_ if \_ y^* \le 0 \end{cases} \qquad \textbf{Equation 7.2-5}$$

We follow Pasiouras (2007) and Kosmidou (2008) to formulate the proposed Tobit regression model that examines the determinants of bank efficiency, as follows:

$$\theta_{it} = \beta_1 \log BSize_{it} + \beta_2 Risk_{it} + \beta_3 \log ATMs_{it} + \beta_4 \log ITExp_{it} + \beta_5 \Pi_{it} + \varepsilon_{it} \quad \textbf{Equation 7.2-6}$$

where i refers to bank i and t is the year. θ_i is the dependent variable and is the TE of bank i. The independent variables are LBSize, Risk, LATMs, LITexp and profitability measures, such as ROAA or ROAE. BSize is the total assets of bank i and it should be positive and significant, as large banks are considered to be more efficient. Risk is the equity capital of bank i divided by its total assets; This variable is expected to have a positive relationship with efficiency, as a lower equity to total assets ratio leads to lower efficiency levels, because lower equity ratios imply a higher risk-taking propensity, which might result in higher borrowing costs (Casu and Molyneux, 2003). ATMs is the number of ATMs that bank i holds. In the case that ATMs is an important determinant of bank profitability, this will be positive and significant. Floros and Giordani (2008) report that Greek banks with a large number of ATMs are more efficient than smaller banks. ITExp is the expenses in IT that bank i has invested over the period 2004-2009. This is also expected to have a positive impact on the efficiency of Greek banks. Π_{it} is the profitability of bank i at year t, measured by ROAA, ROAE, net fees and commissions and net interest income. ROAA is the profits of bank i in year t measured as after tax returns on assets. ROAE measures a firms' efficiency in generating profits from investments in share holders' equity. Net fees and commissions are profits generated from fees collected for the various services that banks offers to their customers and net interest income is the amount of money the bank receives from interest on assets (loans, mortgages, etc.), minus the amount of money that the banks has to pay for interest in their liabilities (deposits) Therefore we estimate four regressions considering the different profitability measures.

7.2.2 Determinants of Bank Profitability

We follow Holden and El-Bannany (2004), Beccalli (2007) and Kondo (2008) to formulate our model that assesses the effect of various determinants on the profitability of Greek banks.

We estimate the parameters of the following model by using a balanced panel data regression with fixed effects[27], as our dataset is not considered as being drawn from a random sample.

$$\Pi_{it} = \beta_0 + \beta_1 \log BSize_{it} + \beta_2 Risk_{it} + \beta_3 \log ATMs_{it} + \beta_4 \log ITExp_{it} + u_{it} \qquad \textbf{Equation 7.2-7}$$

where i refers to bank i. Π is the dependent variable and is the profitability of bank i expressed in terms of ROAA, ROAE, net interest income and net fees and commissions. We consider net fees and commissions which represent the direct sources of profits from ATMs including fees collected by ATMs (Kondo 2008). We also consider the net interest income as banks are able to invest the fees from ATMs and succeed in making high profits (Kondo 2008). The independent variables are LBSize, Risk, LATMs and LITexp. BSize should be positive and significant for larger banks as they might explore economies of scale that reduces the costs of collecting and processing information (Boyd and Runkle 1993). Risk is a measure of capital strength. Risk and bank performance have often a negative relationship when there is high risk of loss or liquidation. However, banks with higher equity to total assets ratio will have lower need of external funding and therefore will have a positive relationship with banks' performance (Pasiouras and Kosmidou, 2007). In the case that ATMs is an important determinant of bank profitability, this will be positive and significant. We expect ITExp to have a positive impact on Greek banks' profitability. Therefore, we estimate Equation 7.2-7 using four different dependent variables; ROAA, ROAE, net fees and commissions and net interest income.

7.3 Data

Our sample consists of 11 Greek commercial banks with financial statements that are available from the BankScope database, for the period 2004-2009. These banks were selected in terms of their total assets. The banks in our sample are the following: Agricultural Bank of Greece, Alpha Bank, Attica Bank, Eurobank, Emporiki Bank, Geniki Bank, Marfin Bank, Millennium Bank, National Bank of Greece, Piraeus Bank and Post Bank. Additional information on the number of employees, number of ATMs and number of branches was collected from the Hellenic Bank Association. In total, our panel dataset consists of 66 observations.

[27] We have performed a Hausman test, in order to compare the fixed effects estimates to the random effects estimates, and we find that the estimates are equal in both methods, so it is safe to apply the fixed effects model.

Berger and Humphrey (1997) identify two approaches for the proper selection of inputs and outputs; the production approach and the intermediation approach. In the production approach it is assumed that banks produce loans and deposit accounts, by using labour and capital as inputs, and outputs are measured by the type of accounts. In the intermediation approach, banks are viewed as financial intermediaries, who collect funds and use labour and capital to transform these funds into loans and other assets. They also point out that the production approach might be more appropriate for evaluating the efficiency of branches of financial institutions and the intermediation approach for evaluating the entire financial institution. Casu and Molyneux (2003) add that 'the intermediation approach might be superior for evaluating the importance of frontier efficiency to the profitability of financial institutions, since the minimisation of total costs, not just production costs, is needed to maximise profits'. Therefore, following various studies (Mester, 1996; Berger and Humphrey, 1997; Casu and Molyneux, 2003; Beccalli, 2007; Pasiouras, 2007) we adopt the intermediation approach and we employ three inputs and two outputs. Our inputs are the number of employees, the number of branches and the total deposits, while our outputs are total loans and total securities.

7.4 Results

Table 7.4-1 represents the descriptive statistics for the variables employed in our Tobit and Pooled Fixed Effects estimations. The mean DEA scores for TE with VRS are reported in Table 7.4-2. It is clear that the mean TE of Greek commercial banks was quite high in 2004 and then it gradually fell, until 2007. After 2007, an increase in the efficiency scores is indicated until 2009, where TE reached the highest observed value of 0.977. This indicates that Greek banks could have improved their TE by reducing their inputs by 0.023.

Table 7.4-1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROAA	66	0.371	1.054	-2.340	1.970
ROAE	66	3.447	20.590	-66.670	33.110
LBsize	66	4.229	0.500	3.282	5.055
RISK	66	0.552	2.788	-0.019	17.023
LAtms	66	2.576	0.415	1.716	3.182
Lfees	66	1.959	0.586	0.255	2.888
Lninc	66	2.646	0.505	1.774	3.596
LITexp	66	2.207	0.430	1.521	2.989
Eff	66	0.941	0.115	0.557	1.000

Table 7.4-2 DEA Results with Intermediation approach

	Mean TE VRS
2004	0.963
2005	0.930
2006	0.925
2007	0.916
2008	0.957
2009	0.977
(Overall 2004-2009; N=66)	

The empirical results for the Tobit regression are reported in Table 7.4-3. We examine the effect of various bank related variables on banks' TE. We estimate four regressions that allow us to consider different profitability measures such as ROAA, ROAE, LFees and Lninc. ROAA is statistically significant and negatively related to efficiency in Model 1. This result is consistent with Casu and Girardone (2004) for Italy and Attaulah and Le (2006) for India; nevertheless, Christopoulos et al. (2002) for Greece, Casu and Molyneux (2003) for EU and

Isik and Hasan (2002) for Turkey, report a significant and positive relationship between ROA and efficiency. This result indicates that banks with higher profits in Greece are less efficient than banks with lower profits. Similarly, we report a negative and significant relationship between ROAE and efficiency in Model 2, while Isik and Hasan (2002) and Casu and Molyneux (2003) report a positive relationship between ROE and efficiency, indicating that more profitable banks are more efficient.

LATMs is found to be statistically significant and negatively related to efficiency in Models 1, 2 and 4. This might be attributed to the fact that there are significant investments in ATMs in Greece, while at the same time there is expansion of the branch network. This is in line with Pastor and Serrano (2006), who report high cost inefficiencies in Greece and Spain, due to the high investments in ATMs. On the other hand, Pasiouras (2007) reports that there is no significant relationship between ATMs and efficiency, as high investments in the branch network lead ATMs to be considered as supplements to branches.

RISK has a negative and statistically significant impact on efficiency, which is consistent with Hauner (2005) for EU banks; hence, well-capitalised banks are less efficient than other Greek commercial banks with a lower equity to total assets ratio. This is not in line with Kwan and Eisenbis (1997) for US, Isik and Hasan (2003) for Turkey, Casu and Girardone (2004) for Italy, Rao (2005) for United Arab Emirates, Havrylchyk (2005) for Poland and Pasiouras (2007) for Greece, who report a positive and significant impact of the equity over total assets ratio on efficiency. Although Hauner (2005) and Delis and Papanikolaou (2009) for EU banks report a positive and statistically significant relationship between Banks' size and efficiency, we find no evidence of a significant relationship for Greek commercial banks.

We further report that LITexp has no significant impact on Greek banks' TE; this is consistent with Beccalli (2007), who finds little relationship between IT investments and efficiency.

Table 7.4-3 Tobit censored regression results (Dependent Variable Eff, N=66)

Model 1	Coefficient	Z-Statistic	P Value	Model 2	Coefficient	Z-Statistic	P Value
Intercept	1.027***	5.920	0.000	**Intercept**	1.074***	6.370	0.000
ROAA	-0.027**	-2.310	0.021	**ROAE**	-0.002***	-3.280	0.001
LBSize	0.072	1.030	0.303	**LBSize**	0.055	-2.010	0.411
LAtms	-0.178*	-1.850	0.064	**LAtms**	-0.188**	-2.010	0.044
LITexp	0.036	0.360	0.720	**LITexp**	0.058	0.610	0.541
RISK	-0.006*	-1.950	0.051	**RISK**	-0.005*	-1.680	0.093
Chi^2	16.13	**P value**	0.07	**Chi^2**	22.01	**P value**	0.0005
Model 3	**Coefficient**	**Z-Statistic**	**P Value**	**Model 4**	**Coefficient**	**Z-Statistic**	**P Value**
Intercept	1.020***	5.460	0.000	**Intercept**	0.968***	5.200	0.000
Lfees	-0.061	-0.980	0.329	**Lninc**	-0.188	-1.410	0.158
LBSize	0.034	0.470	0.636	**LBSize**	0.149	1.360	0.175
LAtms	-0.145	-1.380	0.167	**LAtms**	-0.179*	-1.920	0.055
LITexp	0.124	1.130	0.258	**LITexp**	0.137	1.260	0.207
RISK	-0.008**	-2.420	0.015	**RISK**	-0.008**	-2.240	0.025
Chi^2	11.52	**P value**	0.042	**Chi^2**	13.05	**P value**	0.023

NOTES:*** „** and * Significant at the 1, 5 and 10% levels respectively

Tables 7.4-4 A-D report the regression results for the Fixed Effects Model for our panel dataset. We estimate four models for Equation 7.2-7, considering the determinants of various forms of profitability measures (ROAA, ROAE, LFees and Lninc).

We report that LBsize has a positive and highly significant (at 1% level of significance) relationship with Greek commercial banks' profitability, in terms of net interest income, which is in line with Kondo (2008) for Chinese banks. This confirms the fact that banks with higher assets are more profitable, compared to banks with lower assets. However, Holden and El-Bannany (2004) report a negative impact of BSize on ROA for UK banks. While we find no significant relationship between LBSize and ROAA, ROAE, and LFees, Pasiouras and Kosmidou (2007), Kosmidou (2008) and Kondo (2008) report a positive and significant, at 5% level of significance, relationship with ROA and a highly significant and positive relationship between BSize and Fees and commissions. In addition, Ali et al. (2011) find a

positive impact of banks' size to the profitability of commercial banks in Pakistan, measured by ROA, while they report a negative relationship between banks' size and ROE.

RISK has a significant and positive relationship with Greek banks' profitability, in terms of ROAA and Lninc at 5% level of significance and with ROAE, at 1% level of significance. These findings are consistent with previous studies by Rhoades and Rutz (1982) for US, Naceur and Goeaid (2001) for Tunisia, Abreu and Mendes (2001) for EU banks, Holden and El-Bannany (2004) for UK, and Pasiouras and Kosmidou (2007). However, Kondo (2008) reports a negative relationship between banks' size and ROA and net interest income and a positive relationship between banks' size and net fees and commissions. This confirms that well-capitalised banks are more profitable than other banks with lower levels of equity over total assets ratios.

We report a positive and significant relationship between LATMS and LFees at 1% level of significance, but a negative and highly significant (at 1%) relationship with Lninc. This is in line with Kondo (2008), for LFees, but is not in line when the Lninc is considered. Likewise, Holden and El-Bannany (2004) report a positive and significant relationship at 5% level of significance, of ATMs on ROA. Therefore, banks with a higher number of ATMs are more profitable in terms of the net fees and commissions, but less profitable when the net interest income is considered. Ou (2009) suggest that investments in ATMs are associated with positive cost efficiency.

LITexp has a positive and highly significant relationship with LFees and Lninc. Higher investments in IT have a positive impact on Greek commercial banks' profitability. This result in not in line with Beccalli (2007), who finds little relationship between IT expenses and bank profitability or improved bank profitability, and indicates the existence of a profitability paradox. However, it is consistent with Koetter and Noth (2011), who report that IT efficient banks are more profitable, more competitive and less risky.

Table 7.4-4 Regression Results for MODEL 7.2-7

A. DEPENDENT VARIABLE ROAA

Variable	Coefficient	T-statistic	P value
Intercept	1.115	0.249	0.804
LBSize	0.720	0.499	0.620
RISK	0.055*	1.838	0.072
Latms	-0.559	-0.970	0.336
LITexp	-1.078	-1.259	0.214
Adjusted R^2 0.570			
*Prob (F statistic) 0.000****			

NOTES:*** and * Significant at 1 and 10 % levels, respectively

B. DEPENDENT VARIABLE ROAE

Variable	Coefficient	T-statistic	P value
Intercept	49.079	0.970	0.337
LBSize	-0.103	-0.005	0.996
RISK	1.380*	1.680	0.099
Latms	-17.837	-0.903	0.371
LITexp	-0.002	-0.000096	1.000
Adjusted R^2 0.497			
*Prob (F statistic) 0.000****			

NOTES:*** and * Significant at 1% and 10 % levels, respectively.

C. DEPENDENT VARIABLE LFees

Variable	Coefficient	T-statistic	P value
Intercept	-1.234**	-2.350	0.023
LBSize	-0.069	-0.390	0.698
RISK	0.005	1.384	0.172
Latms	0.806***	2.825	0.007
LITexp	0.637***	2.757	0.008
Adjusted R^2 0.968			
*Prob (F statistic) 0.000****			

NOTES:*** and ** Significant at the 1% and 5 % level, respectively.

D. DEPENDENT VARIABLE Lninc

Variable	Coefficient	T-statistic	P value
Intercept	0.284	1.513	0.137
LBSize	0.602***	11.956	0.000
RISK	0.002**	2.083	0.042
Latms	-0.354***	-3.977	0.000
LITexp	0.330***	3.947	0.000
Adjusted R^2 0.992			
*Prob (F statistic) 0.000****			

NOTES:*** and ** Significant at the 1% and 5 % level, respectively.

7.5 Conclusions

This study investigates the determinants of efficiency and profitability for 11 Greek commercial banks over the period 2004-2009. More specifically, we extend models by Holden and El-Bannany (2004), Beccalli (2007), Pasiouras (2007) and Kondo (2008), to examine the effect of ATMs and IT investments on the Greek banking industry. We employ the non-parametric DEA method, assuming VRS and follow the intermediation approach for the selection of our inputs and outputs, in order to calculate the TE scores. We follow the two

step approach and regress the TE scores on a number of bank specific variables, so as to examine the determinants of banks' efficiency. In addition, we run Panel Regressions with Fixed Effects, in order to identify the determinants of banks' profitability.

Overall, we find that Greek commercial banks' average TE scores vary between 0.916 for 2007 and 0.977 for 2009, implying that banks could have improved their TE by decreasing their inputs by 0.084 and 0.023 respectively. Tobit regressions on banking variables reveal that profitability (ROAA and ROAE), LAtms and RISK, have a negative effect on Greek banks' efficiency, while we report that LBSize and LITexp have no impact on TE of Greek banks.

Panel regressions with fixed effects identify that LBSize, RISK, and LITexp have a positive and significant impact on Greek bank profitability. Furthermore, LAtms have a positive relationship with LFees, but a negative relationship with Lninc. This might be explained by the fact that Greek banks have invested heavily in the expansion of the ATM network as well as their branch network, but ATMs are considered as being supplements for branches; therefore, they do not play a significant role into generating profits.

Future research should consider parametric methods (i.e. SFA) for the estimation of recent TE scores for EU countries, with a different combination of inputs/outputs. Our results provide important insights to policy makers, bank managers and practitioners, on the determinants of bank efficiency and profitability, which would help them in taking important decisions and improve the efficiency and profitability of Greek Banks.

Chapter 8

E-banking and Competition

8.1 Introduction

The globalisation and liberalisation of financial markets have raised interest in the topic of competition in the banking industry. Competition in the banking industry affects the wealth of consumers and companies and has an impact on the performance and financial condition of the banks. A healthy rivalry among banks can serve as a driving force in improving the quality, the price, the availability of products offered to customers, and at the same time promote financial innovation by introducing more modern banking skills and technology (Yildirim and Philippatos, 2007). Hence, this initiated mergers among banks and other financial institutions, which caused significant changes in the structure of the banking system (Aktan and Masood, 2010). The purpose of this study is to extend previous studies of Hondroyiannis et al. (1999) and Aktan and Masood (2010); in particular, we examine the competitive structures of the Greek banking system over the period 2004-2009. We employ the non-structural Panzar-Rosse model (Hondroyiannis et al, 1999; Bikker and Haaf, 2002; Claessens and Laeven, 2003; Al-Muharrami, 2009; Greenberg and Simbanegavi, 2009; Aktan and Masood, 2010; Delis, 2010; Masood and Aktan, 2010; Rezitis, 2010; Hamza, 2011; Liu et al., 2011; Mwega, 2011; Olivero et al., 2011; Mlambo and Ncube, 2011), which provides a measure of the market structure, the H-statistic, as the sum of the elasticities of the total revenue of the bank with respect to its input prices.

This study is organised as follows: Section 8.2 presents the theory and the methodology that we follow, while 8.3 describes the data employed. Section 8.4 discusses the results and 8.5 provides the summary and conclusions of this study.

8.2 Theory and Methodology

Baumol et al. (1982) developed the theory of contestable markets, which states that oligopolies and monopolies behave like perfectly competitive firms, due to the existence of short-term entrants. The three main features of a perfectly contestable market are: 1) no entry

or exit barriers, 2) no sunk costs[28] and 3) no access to the same level of technology as the incumbent firms and the new entrants. There are four types of market structure according to the degree of competition that exists between the firms within the industry. When perfect competition exists, there are many small firms that compete and have no influence on the price. In the case of monopoly market structure, there is only one firm in the industry and these firms have large shares of the market. Moreover, in the case of monopolistic competition, there are many firms within the industry and freedom of entry into the industry, but each firm produces a differentiated product and therefore has some control over the price. Further, in the case of oligopoly, there are a few firms within the market and there is restricted entrance of new firms (Sloman and Wride, 2009).

Rosse and Panzar (1977) and Panzar and Rosse (1987) built on the theory of Baumol et al. (1982) and formulated models for competitive markets under oligopoly, monopoly and perfect competitive conditions. They developed a test in order to discriminate for these market structures based on properties of a reduced-form revenue equation at bank level. Panzar and Rosse (1987) introduced the test H statistic, which serves as a measure of competitive behaviours of banks. This test is derived from a general banking model, which determines the equilibrium output and the equilibrium number of banks, by maximising the profits at bank and industry levels (Bikker and Bos, 2008). Hence, bank i maximises its profits, when marginal revenue is equal to marginal cost:

$$R'_i(Yi, n, Z_i) - C'_i(Y_i, w_i, T_i) = 0 \qquad \textbf{Equation 8.2-1}$$

where R_i are the revenues, C_i the costs, Y_i the output, w_i is a vector of m factor input prices, and Z_i and T_i refer to vectors of exogenous variables that shift the bank's revenues and cost functions. In addition, the subscript i refers to the ith bank, while n is the number of banks in our sample and the prime denotes the first derivative with respect to output. At the market level, the equilibrium condition holds and therefore 8.2-1 becomes as follows:

$$R^*(Y^*, n^*, Z^*) - C^*(Y^*, w^*, T^*) = 0 \qquad \textbf{Equation 8.2-2}$$

The variables that are marked with the asterisk (*) represent the equilibrium values. Bikker and Bos (2008) add that the market power is measured by the extent to which a change in the factor input prices ($dw_{k,i}$) for k= 1,2,..., m is reflected in the equilibrium revenues (dR_i^*), that are earned by bank i (Claessens and Laeven, 2003).

[28] Sunk costs are the costs that have already been incurred and cannot be recovered (Sloman and Wride, 2009).

Panzar and Rosse (1985) showed that the sum of elasticities of the reduced form revenue function with reduced prices is a measure of competitive conditions.

$$H = \sum_{k=1}^{m} \frac{\partial R_i^*}{\partial w_{k,i}} \frac{w_{k,i}}{R_i^*}$$

Equation 8.2-3

Panzar and Rosse (1987) first investigate monopoly, which includes the case of price-taking competitive banks, given the fact that the prices they face are exogenous[29]. Under monopoly, the Panzar-Rosse model proves that an increase in input prices will increase the marginal costs, and therefore the equilibrium output will be reduced and subsequently there will be a reduction in the revenues. Therefore, the H statistic will be zero or negative. Monopolistic and perfect competition depends on models that introduce interdependence into banks' structural revenue equations via the hypothesis that, in equilibrium free entry and exit will result to zero profits; hence, the H statistic can be proved to be less or equal to one. Positive values for the H statistic indicate that the data are consistent with monopolistic competition and a value of one indicates that the market is operating under perfect competition. In the monopolistic competition the banks' products are considered to be perfect substitutes of one another, and under the perfect competition conditions, an increase in input prices will increase both the marginal and average costs, without possibly changing the optimal output of any banking institution. When a banking institution decides to exit the market, then the demand for the products will be increased for the remaining institutions within the market and this will lead to an increase in prices and subsequently to an increase in banks' revenues, which would be equivalent to the increase in costs. In the case that the market is operating under perfect collusion oligopoly or a perfect cartel, then the H statistic will be a non positive number. Vesala (1995) shows that the H statistic is an increasing function of the demand elasticity; in other words, the less the market power is imposed on banks, the higher the H statistic will become (Bikker and Bos, 2008).

The main advantage of the Panzar-Rosse model is that it employs bank-level data and allows for bank-specific differences in the production function. In addition, the model can be employed to study the differences between types of banks (i.e. large versus small banks, foreign versus domestic banks, etc.), see Claessens and Laeven (2003).

[29] That is, as long as their equilibrium values are unaffected by changes in the other exogenous variables in the model.

Table 8.2-1 Descriptive Statistics of variables for the period 2004- 2009

	LNREV	LNPL	LNPK	LNPF	LNRISK	LNASS	LNBR	LNATMS	LNROAA
Mean	6.087977	-4.37416	-4.65351	-3.54021	-2.62332	9.736945	-2.97356	-2.90788	4.608934
Median	6.359920	-4.35357	-4.70102	-3.57342	-2.70928	9.943957	-2.5756	-2.4119	4.610357
Maximum	8.281243	-3.64798	-3.41922	-2.41735	2.834568	11.63863	-1.84471	-1.4835	4.624679
Minimum	4.084294	-5.43699	-5.77726	-4.38402	-4.27658	7.557577	-5.98785	-4.71385	4.581492
Std. Dev.	1.170881	0.412953	0.372267	0.426468	1.029873	1.161099	0.971421	0.948670	0.010601
Skewness	0.019263	-0.26309	0.380114	0.457841	4.438920	-0.23827	-1.5347	-0.39808	-1.06355
Kurtosis	1.767171	2.567790	4.680127	2.868175	24.25758	1.799740	5.362039	1.888658	3.483555
Jarque-Bera	4.120329	1.255760	9.210422	2.317928	1437.315	4.516722	40.62626	5.061774	12.88716
Probability	0.127433	0.533722	0.010000	0.313811	0.000000	0.104522	0.000000	0.079588	0.001591
Sum	395.7185	-284.32	-302.478	-230.114	-170.516	632.9015	-193.282	-189.012	299.5807
Sum Sq. Dev.	87.74155	10.91394	8.869282	11.64002	67.88083	86.28160	60.39410	57.59838	0.007192
Observations	65	65	65	65	65	65	65	65	65
Cross sections	11	11	11	11	11	11	11	11	11

We follow Shaffer (1985), Hondroyiannis et al. (1999) and Aktan and Masood (2010) to formulate our model, for assessing the competitive conditions in the Greek banking system. The model has the following form:

$$\ln REV = \beta_0 + \beta_1 \ln PL + \beta_2 \ln PK + \beta_3 \ln PF + \beta_4 RISK + \beta_5 \ln Assets + \beta_6 \ln BR + \beta_7 \ln ATMs + \varepsilon$$ **Equation 8.2-4**

Where Rev, total revenue of each bank

PL, personnel expenses to employees (unit price of labour);

PK, other operating expenses over total assets (unit price of capital);

PF, ratio of total interest expenses over total deposits (unit price of funds);

Risk, ratio of equities over total assets;

Assets, bank total assets;

BR, number of branches of each bank over the total number of branches of the whole Greek banking system

ATMs, number of ATMs of each bank over the total number of ATMS of the whole Greek banking system

Ln, is the natural logarithm.

The dependent variable in equation 8.2-4 is banks' revenues and PL, PK, and PF are the input prices. We cannot observe directly the capital expenditures and hence we adopt the proposed proxy for the capital price by Aktan and Masood (2010), being the administration and other expenses over the total assets. We also consider further the ratio of equity over assets as being a proxy for banks' Risk measurement; we expect this to be positively related with the revenues. In addition, following Hondroyiannis et al. (1999), we include the Assets variable in our model to account for possible scale economies and the branches variable, as it is considered to be a proxy for banks' size. However, we extend the above model by including ATMs, which is considered to be a proxy for the investments in IT and generally electronic banking technologies. We would expect ATMs to have a positive effect on banks' revenues, as their use offers convenience and reduction in the costs incurred by both customers and banks.

Following Panzar and Rosse (1987), Hondroyiannis et al. (1999) and Aktan and Masood (2010), we further employ equation 8.2-5 to assess the equilibrium condition for the Greek banking system over the period 2004 and 2009. This test is justified on the grounds that

competitive markets will have to equalise risk-adjusted rate of returns across banks such that, in equilibrium the rates of return are not correlated with the input prices (Hondroyiannis et al., 1999).

$$\ln ROAA = \beta_0 + \beta_1 \ln PL + \beta_2 \ln PK + \beta_3 \ln PF + \beta_4 RISK + \beta_5 \ln Assets + \beta_6 \ln BR + \beta_7 \ln ATMs + \varepsilon$$ **Equation 8.2-5**

Where, ROAA is the Return on Average Assets. The LnROAA is calculated as Ln(ROAA+100), in order to adjust for the negative values of ROAA (Liu et al., 2011).

8.3 Data

The data for this study were obtained from the BankScope database for 11 commercial banks over the period 2004 and 2009. Other information was obtained from the Hellenic Bank Association and individual banks' websites. The banks in our sample are the Agricultural Bank of Greece, Alpha Bank, Attica Bank, Eurobank, Emporiki Bank, Geniki Bank, Marfin Bank, Millennium Bank, National Bank of Greece, Piraeus Bank and Post Bank and were selected in terms of their total assets.

Table 8.3-1 Competitive Conditions tests results

Period: 2004-2009	
Dependent variable LnREV	
Coefficients	**Greece**
lnP_L	0.286 (0.030)***
lnP_K	0.274 (0.038)***
lnP_F	0.032 (0.443)
lnRisk	0.023 (0.135)
lnass	1.143 (0.056)***
lnBR	0.040(0.052)
lnATMs	0.104 (0.088)
R^2=0.99	
PR H-Stat=0.59	
Monopoly H=0	Reject
Perfect Competition	Reject
Monopolistic Competition	0<H<1 Fail to Reject

Note *** Signifcant at 1%, Robust Standard Errors in ()

Table 8.3-2 Equilibrium Test Results for the Greek Banking System

Competitive Conditions tests results		
Dependent variable LnROAA		
Coefficients	**Greece**	
$\ln P_L$	-0.09	(0.003)*
$\ln P_K$	0.002	(0.006)
$\ln P_F$	0.006	(0.003)
lnRisk	0.002	(0.000) ***
lnass	0.006	(0.001)
lnBR	-0.0005	(0.002)
lnATMs	-0.003	(0.002)
R^2=0.69		
E stat= -0.0082	(0.003)	
Equilibrium E=0	Fail to Reject	

Note *** (*)Signifcant at 1%(10%), Robust Standard Errors in ()

8.4 Results

Table 8.2-1 presents the descriptive statistics for the variables under consideration in our models. The competitive conditions and the equilibrium test for the pooled panel data set were estimated by employing the fixed effect GLS econometric method and the robust standard errors. The results are presented in tables 8.3-1 and 8.3-2. We examine the competitive conditions by following equation 8.2-4. We report that the price of labour, the price of capital and the assets have a positive and highly significant effect on the revenues of Greek banks. This indicates that more employees, investments in banks' capital and other assets, will lead to an increase in banks' revenues, a result which is in line with Aktan and Masood (2010), who report a positive effect of the price of labour; this is also supported by Al-Muharrami (2009), who finds a positive impact of the assets on revenues. However, Hamza (2011) finds a negative impact of the price of labour and capital to the revenues earned by Tunisian banks. Our model has an almost perfect fit, with 99% of the variation in revenues, being explained by model 8.2-4. We perform Wald tests in order to calculate the Panzar-Rosse (1987) H statistic, which is a sum of the input elasticities. Hence, $\beta_2 + \beta_3 + \beta_4$ is tested under the hypothesis that is equal to one and to zero. We reject both hypotheses and therefore, we can conclude that the Greek banking system is operating under monopolistic competition. This is in line with the majority of studies and in particular with Hondroyiannis et al. (1999) for Greece and with other recent studies by Aktan and Masood (2010) for

Turkey, Delis (2010) for central European and Eastern banking systems, Mlambo and Ncube (2011) for South Africa, Olivero et al. (2011) for Latin America and Asia and Hamza (2011) for Tunisian banks. Nevertheless, we find no relationship between the banks' size and investments in ATMs with revenues.

We assess the equilibrium conditions, by considering the ROAA as dependent variable. Our model yields an R-squared value of 0.69, which indicates that 70% of the variation in ROAA is explained by the proposed model and the rest 30% is affected by other variables which are not specified. In the model, we report a negative and significant relationship between the ROAA and the price of labour. This indicates that an increase in the price of labour will have a negative effect on the profitability in terms of ROAA; this is in line with studies by Al-Muharrami (2009) and Hamza (2011). We also find a positive and highly significant relationship between ROAA and the risk. This confirms that well capitalised banks are more profitable and is consistent with Aktan and Masood (2010) but opposite to findings by Al-Muharrami (2009). We perform Wald tests in order to test whether the Greek banking system was in equilibrium condition between 2004 and 2009. We obtain a value of -0.0082 for the E Statistic and we accept the null hypothesis of E=0. The value of E statistic is the sum of the elasticities in equation 8.2-5. Hence E stat is $\beta_2 + \beta_3 + \beta_4 = -0.0082$. Similarly, for equation 8.2-4 we find no significant relationship between banks' network of branches and ATMs with their profitability.

8.5 Conclusions

In this study we employ the Panzar-Rosse model to assess the competitive and equilibrium conditions in the Greek banking system over the period 2004-2009. We study the particular period as, apart from the adoption of the single currency and the de-regulations and liberalisation in the exchange rates, there was significant post-Olympics growth in Greece (particularly in the banking industry, where significant technology investments took place). However, at the end of our sample period (i.e. year 2009), the Greek banking system experienced challenges due to the global financial crisis and Greek banks have decided to consolidate and join forces with other banks, through mergers and acquisitions. Hence, banks through healthy competition can improve the quality of their products, the prices and the availability of these products and therefore maximise customers' satisfaction. This will lead to an increase in banks' revenues and profits.

We extend previous studies by Hondroyiannis et al. (1999), Aktan and Masood (2010), Rezitis (2010) and Al-Muharrami (2009) by considering a further proxy of investments in IT, namely the ATMs. We estimate our models by applying the Generalised Least Square method with fixed effects and robust standard errors. Our results are in line with recent studies and indicate that during the period 2004- 2009 the Greek banking system has been operating under monopolistic competition conditions. This implies that there is a free entry and exit within the Greek banking system, but due to the slight differentiation of the products offered by banks, there is still control over the prices imposed. Moreover, we report that the Greek banking system has been operating under equilibrium conditions over the period 2004 to 2009. This means that the rates of return are not correlated with the input prices (PL, PK and PF).

Future research should consider the examination of the competitive conditions using other modern econometric methods, such as the Generalised Methods of Moments dynamic panel estimator. Moreover, the recent wave of mergers and acquisitions in Greece and the increased presence of foreign banks will have an impact on the competitive structure of the Greek banking system. Therefore, there will be an impact of changes in the banking competition on the monetary policy followed in Greece and we may consider examining this effect in the near future. Further, we should consider examining the competitive conditions of European countries by employing recent data.

Chapter 9

Conclusions and Future Research

9.1 Summary and Conclusions

This study examines the adoption of e-banking services in Greece and the impact of banks' IT investments on their performance and profitability, using recent econometric models. To the best of our knowledge, this is the first PhD thesis on the adoption of e-banking and performance of Greek banks.

The objectives of this thesis are threefold: (i) to examine the impact of branch fees, access to banks' web pages and branch dissatisfaction on the adoption of e-banking and Internet banking, (ii) to study the effect of the IT and ATM investments on the efficiency and profitability of Greek banks and (iii) to assess the competitive and equilibrium conditions in Greece, by considering the investments in IT and ATMs. We employ recent econometric models and methods to explain several hypotheses. In general, we concentrate on the following five research questions:

(i) *Internet Banking Fees and Branch Banking Fees*: When we compare the fees imposed by Greek banking institutions, we find that Internet Banking fees are lower than branch banking fees and ATM fees.

(ii) *Impact of branch fees, access to banks' web pages and other demographics*: The empirical findings of this research confirm a positive relationship between the young age variable, the university education and the high income with the adoption of e-banking and internet services; however, we report that important factors such as the access to bank web pages, branch dissatisfaction and high branch fees have no impact on the adoption of e-banking in Greece.

(iii) *Technology based scale and experience effects*: Empirical results show that Greek click and mortar banks have higher profits in terms of Net interest margin, ROAA and ROAE. Further, we report that when scale and technology effects are considered, these banks exhibit lower profitability. This could be explained by the fact that few customers adopt Internet banking services in Greece. In addition, we report that the operational expenses of Greek click and mortar banks are decreased. However, when we

consider technology- based scale and experience effects, the operational expenses for click and mortar banks are decreased.

(iv) *Assessment of the change in the performance of Greek banks before and after the adoption of Electronic banking services*: Empirical results suggest that the adoption of Internet had no effect on the profitability of banks in terms of the ROAA and the ROAE ratios. Further, we show that there is a reduction in the net interest margin ratio, implying a decrease in the profits gained from the interest on loans after the deduction of the interest paid to lenders. In addition, we find that there is a decrease in the net interest revenue over average assets. Moreover, we suggest that there is a reduction in the operational expenses for the banks adopting Internet banking. We further report that assets, net loans over total assets and equities over total assets are unaffected by the Internet banking adoption.

(v) *Effect of IT and ATM Investments on the Performance and Profitability of Greek banks*: Panel regressions with fixed effects identify that LBSize, RISK, and LITexp have a positive and significant impact on Greek bank profitability. Furthermore, LAtms have a positive relationship with LFees, but a negative relationship with Lninc. This might be explained by the fact that Greek banks have invested heavily in the expansion of the ATM network as well as their branch network, but ATMs are considered as being supplements for branches; therefore, they do not play a significant role into generating profits.

(vi) *Assessment of the competitive and equilibrium conditions in Greece:* Our results indicate that during the period 2004- 2009 the Greek banking system has been operating under monopolistic competition conditions. This implies that there is a free entry and exit within the Greek banking system, but due to the slight differentiation of the products offered by banks, there is still control over the prices imposed. Moreover, we report that the Greek banking system has been operating under equilibrium conditions over the period 2004 to 2009.

There is a direct link between the above research topics. Firstly, we describe the Internet banking services that Greek banks provide and we also examine the fees that these banks charge to customers for using banking services. We report that Internet banking fees are lower compared to branch banking and ATM fees. Next, we examine the impact of the high branch fees on the e-banking and Internet banking adoption, where we report that there is no

effect. Furthermore, from the banks' side, we investigate the performance of Greek banks that are offering e-banking services. Since there are more customers that adopt e-banking services, this will have a positive impact on the performance of Greek banks. Indeed, we confirm that 'click and mortar' banks are overall more profitable compared to traditional banks. Moreover, we extend the analysis of the performance of Greek banks by examining the efficiency of the Greek banking institutions that offer electronic services. We show that IT expenses and investments in ATMs have a positive impact on banks' profitability. Finally, we further expand the analysis of the performance of Greek banking institutions by assessing the competitive and equilibrium conditions that exist in Greece. We report that Greek banks are under equilibrium and they operate under monopolistic competition conditions.

9.2 Policy implications and Recommendations

The provision of e-banking in Greece is still in its infancy, probably due to the fact that the internet penetration in Greece is very low, and customers are more confident in performing their banking transactions in physical bank branches. Banks can exploit the provision of banking services electronically, aiming clearly at the advertisement of these products to customers that are not yet familiar with these services as they offer to banks significant cuts in costs, reduction in staff and physical branches. Banking institutions should also maximise customers' satisfaction, by reducing the banking fees to the minimum. Banks may simplify various transactions that can be processed through telephone or internet banking, and therefore less teller employees would be required. Similarly, cards and loans payments could be processed through electronic kiosks that are located in bank branches. Hence, the number of employees and physical branches can be reduced. In addition, banks can reduce significantly their operational costs, by exploiting economies of scale. By reducing their costs, banks should pass this reduction as a reduction in the fees imposed, while they could also offer lower interest rates on loans and mortgages, and higher interest rates in savings/ deposits accounts. Overall, there are economic benefits for both Greek customers and Greek banks, when banks adopt the Internet technology. Note that the e-banking fees and commissions for transactions in Greece are less than branch fees, while internet banking fees are less than the ATM and branch fees (for more details see Giordani et al., 2009). Therefore, it is concluded that Greek customers prefer most the traditional banking because they worry about possible high electronic risk that comes with the foray into e-banking and this in line with Cunningham et al. (2005). Hence, Greek banks can attract their customers to electronic

services if they design their marketing offers or value propositions according to the needs of these groups. Therefore, they can link the simple access on routine transactions with the more personalised services on higher yielding products (Arnaboldi and Claeys, 2010).

Finally, for technology (Internet) to have a positive impact on the financial performance of a Greek bank, it is necessary for bank managers to take into consideration the concept of "appropriate use" of Internet (Beccalli 2007). Bank managers also need to consider the efficiency of Internet banking performance, in order to make better financial decisions and create more profits (Wu and Wu 2010).

Our results provide important insights to policy makers, bank managers and practitioners, on the determinants of bank efficiency and profitability, which would help them in taking important decisions and improve the efficiency and profitability of Greek Banks.

9.3 Future Research

The primary extension of this study is data; we should consider recent data from other European countries to test the following possible models:

1) A technology acceptance model (TAM), which tests the effect of perceived ease-of use, perceived usefulness and technology self-efficacy of customers on the probability of e-banking adoption. We should also examine other hypotheses on the adoption of E-banking/ Internet banking, using countries and compare the results with those from Greece.

2) We could employ parametric econometric models such as SFA, for the estimation of inefficiency scores for EU countries, with a different combination of inputs/outputs.

3) The Generalised Methods of Moments (GMM) dynamic panel estimators could be taken into consideration for the assessment of competitive and equilibrium conditions in Greece and compare them with results from EU countries.

4) The impact of Internet banking on the reduction of sunk costs of European banks using Baumol et al (1982) contestability theory. It is thought that Internet banking can influence the way banks enter the market and the way consumers access banking services.

Appendix

Questionnaire

My name is Georgia Giordani and I am a PhD student of the Economics Department at the University of Portsmouth. I am currently undertaking a study of investigating the adoption of e-banking services by Greek bank customers as well as the services that Greek banks are offering. As a part of this research, I am required to collect data about the Greek bank customers' point of view related to the e-banking services provided in Greece and the acceptance of these services. All responses will be treated confidentially and will be used only for the purpose of this research. Please do not hesitate to contact me at my email address if you would like further information. Your contribution to this research is highly appreciated.

Email: Georgia.Giordani@port.ac.uk

Director of Studies: Dr. Christos Floros, Email: Christos.Floros@port.ac.uk

Section 1)

1) Please indicate your demographical information

i. ***Please indicate your age***

18-40 ☐

41-60 ☐

61 and more ☐

ii. ***Please indicate your gender***

Male ☐

Female ☐

iii. ***Please indicate your marital status***

Single ☐

Married/ Living with partner ☐

Divorced/ widowed/separated ☐

iv. ***Please indicate the level of your education***

Primary School ☐

High School ☐

Occupational Course (I.E.K.) ☐

Undergraduate Degree ☐

Postgraduate Degree ☐

Doctorate or higher ☐

v. ***Please indicate your monthly income***

€0-€300	☐
€301 -€900	☐
€901-€1500	☐
€1501 or more	☐

vi. ***Please indicate your occupation/position***

_____

vii. ***Please indicate the status of employment***

Private Employee	☐
Public Employee	☐
Self-Employed	☐
Student	☐
Retired	☐
Soldier	☐
Homemaker	☐
Unemployed	☐

viii. ***Please indicate how many hours you work per week***

0 hours	☐
1- 10 hours	☐
11 – 23 hours	☐
24 – 48hours	☐
49 hours and more	☐

ix. ***Type of housing***

Home Owner	☐
Rented Accommodation	☐

x. ***Please indicate your area of residence***

North Greece	☐
South Greece	☐
East Greece	☐
West Greece	☐

Section 2) Use of Internet and banking Services

2) Are you an owner of a Personal Computer?

i. Yes ☐

ii. No (Please go to Q.6) ☐

3) Please indicate whether you have an internet connection

i. Yes ☐

ii. No ☐

iii.

4) Please indicate the type of your internet connection

i. Dial up ☐

ii. ADSL/Broadband ☐

5) Please indicate the cost of your internet connection

i. €10 or less ☐

ii. €11 – €20 ☐

iii. €21 – €30 ☐

iv. €31 – €40 ☐

v. €41 or more ☐

6) Please indicate the place where you have internet access

i. Home ☐

ii. Work ☐

iii. Internet Café ☐

iv. School / University ☐

7) How many hours do you spend on internet each week?

i. 0 hours ☐

ii. 1 – 4 hours ☐

iii. 5 – 10 hours ☐

iv. 11 – 20 hours ☐

v. <21 – 30 hours ☐

vi. > 31 hours ☐

8) I use Internet mostly for … *(Please indicate your frequency of use)*

		Never	**Up to 3 times p/w**	**More than 3 times p/w**
i.	Education – e.g. information for learning and /or research	☐	☐	☐
ii.	Browsing for information gathering about products and services- (e.g. get travel info and compare prices of different products/goods)	☐	☐	☐
iii.	Communication – e.g. e-mail, videoconferencing, social networking chat	☐	☐	☐
iv.	Entertainment – e.g. surfing for fun, games, gambling, downloading music or watch web video/radio/TV etc.	☐	☐	☐
v.	News – e.g. events, political news, sports, weather forecast, etc.	☐	☐	☐

vi. Online Shopping (i.e. online grocery shopping, online tickets shopping, e-auctions, etc. ☐ ☐ ☐

vii. Internet banking/Finance ☐ ☐ ☐

viii. Other (please indicate)… _____ ☐ ☐ ☐

9) Please indicate the duration of your traditional transactions with banks

i. 1 year or less ☐

ii. 2 – 3 years ☐

iii. 4 – 6 years ☐

iv. 7 – 9 years ☐

v. 10 years and more ☐

10) How satisfied are you with face – to face contact with bank staff in conducting your personal banking?

i. Very Satisfied ☐

ii. Satisfied ☐

iii. Not satisfied ☐

11) Please indicate how often you use the following services

		Never	Rarely	Often	Very Often
i.	Branch Banking	☐	☐	☐	☐
ii.	Telephone Banking	☐	☐	☐	☐
iii.	ATM Banking	☐	☐	☐	☐
iv.	Internet banking	☐	☐	☐	☐
v.	Mobile Banking	☐	☐	☐	☐

12) Please indicate the frequency of visit to banks' homepages

i. Never ☐

ii. Once a week ☐

iii. Twice a week ☐

iv. More than 3 times per week ☐

v. Once/twice per month ☐

Part 3) Internet banking Perceptions and usage behaviour

13) How long have you been using Internet banking?

i. 0 – 11 months ☐
ii. 1 – 3 years ☐
iii. 4 – 6 years ☐
iv. More than 7 years ☐
v. I have never used and I do not intend to use in the future
vi. **Please go to question 26**I have never used but I intend to use in the future
vii. **Please go to question 26**I have tried but quit using WHY (?) ☐

14) What was your main banking method prior to Internet banking?

i. Branch Banking ☐
ii. ATM Banking ☐
iii. Telephone Banking ☐
iv. Mobile Banking ☐

15) Please indicate which bank(s)' Internet banking services you are using

_____

_____

16) I use Internet banking for my…(You can tick more than one statement)

i. Personal Banking Purposes ☐
ii. Commercial Banking Purposes ☐
iii. Investment Banking Purposes ☐

17) I usually use Internet banking from…(Please tick only one)

i. Home ☐
ii. Office ☐
iii. Internet Café ☐
iv. School/University ☐

18) Which of the following services you use and how frequent is your use of these services?

		Never	Up to 3 times p/w	More than 3 times p/w
i.	Information enquiries (e.g. balance of accounts)	☐	☐	☐
ii.	Funds transfers	☐	☐	☐
iii.	Payments of loan instalments	☐	☐	☐
iv.	Payments of Credit cards	☐	☐	☐
v.	Payments of public utility bills	☐	☐	☐
vi.	Payments of mobile bills	☐	☐	☐
vii.	Payments of any other bills(Please indicate)	☐	☐	☐
viii.	Mutual funds buy/sell	☐	☐	☐
ix.	Stocks buy/sell	☐	☐	☐
x.	Foreign Exchange buy/sell	☐	☐	☐
xi.	Application for loans	☐	☐	☐
xii.	Application for mortgages	☐	☐	☐
xiii.	Application of chequebook	☐	☐	☐
xiv.	E-contact with bank	☐	☐	☐

19) Do you receive any e-offers when accessing your account through Internet banking?

i.	Lower Rates on Loans	☐
ii.	High Rates on Saving Accounts	☐
iii.	Overdraft	☐
iv.	Cheaper fees for traditional banking transactions	☐
v.	I do not receive any e-offers through my online banking	☐

20) Please indicate the initial reasons for Internet banking adoption

i.	Ease of Use	☐
ii.	Security of customer information	☐
iii.	Convenience- i.e. 24/7	☐
iv.	No need to visit a branch or find an ATM	☐
v.	Visual verification of banking transactions	☐
vi.	Time Saving	☐
vii.	Lower fees than branch fees	☐
viii.	Recommendation by other	☐
ix.	Advertising	☐

21) How satisfied are you with Internet banking in conducting your personal banking?

i.	Very Satisfied	☐
ii.	Satisfied	☐
iii.	Not satisfied	☐

22) Please indicate the problems that you have experienced about Internet banking usage so far

i.	Slow transaction and/ or download speed	☐
ii.	Responsiveness- i.e. slow feedback about transactions	☐

iii. Access problems to banks' website ☐

iv. Delay in transactions ☐

v. Difficulty of accessing to customers service ☐

vi. Difficulty experience in the log in process ☐

23) What are the most important criteria for you to select Internet banking of the bank you have (would be) working with?

		Extremely Important	**Important**	**Not important**	**Not Important at all**
i.	Recommendation by other	☐	☐	☐	☐
ii.	Personal knowledge and loyalty: Previous experiences with the bank and satisfaction with other services	☐	☐	☐	☐
iii.	Bank's banking expertise/competence	☐	☐	☐	☐
iv.	Privacy/Confidentiality provided by bank	☐	☐	☐	☐
v.	Security measures taken by the bank	☐	☐	☐	☐
vi.	Bank's expertise in technological advancements: availability, variety and range of other technological services	☐	☐	☐	☐
vii.	Range of Internet banking services	☐	☐	☐	☐
viii.	Low Fees	☐	☐	☐	☐
ix.	Advertising	☐	☐	☐	☐

24) What are the reasons for not adopting Internet banking?

i. Security reasons ☐

ii. Errors appearing in the screen ☐

iii. It is complicated ☐

iv. Not an owner of a PC ☐

v. Lack of internet connection ☐

vi. Lack of face – to face contact with bankers ☐

25) Please indicate whether you use any secure technology for accessing Internet banking

i. E-token ☐
ii. Tan list ☐
iii. I don't use secure log in ☐

Part 4) Branch/Internet banking Fees

26) Please indicate the average amount of fees you pay on branch transactions per month

i. €1 or less ☐
ii. €2 – €5 ☐
iii. €6 – €10 ☐
iv. €11 –€ 20 ☐
v. €21 or more ☐

27) Please indicate the branch services you use and there is a fee charged for these services

i. Funds transfers ☐
ii. Payments of loan instalments ☐
iii. Payments of Credit cards ☐
iv. Payments of public utility bills ☐
v. Payments of mobile bills ☐
vi. Payments of any other bills ☐
vii. Mutual funds buy/sell ☐
viii. Stocks buy/sell ☐
ix. Foreign Exchange buy/sell ☐
x. Chequebook order ☐

28) Please indicate the average amount of fees you pay for the Internet banking services per month

i. €1 or less ☐
ii. €2 – €5 ☐
iii. €6 – €10 ☐
iv. €11 –€ 20 ☐
v. €21 or more ☐

29) Please indicate the Internet banking services you use and there is a fee charged for these services

i. Funds transfers ☐
ii. Payments of loan instalments ☐
iii. Payments of Credit cards ☐
iv. Payments of public utility bills ☐
v. Payments of mobile bills ☐
vi. Payments of any other bills ☐
vii. Mutual funds buy/sell ☐
viii. Stocks buy/sell ☐
ix. Foreign Exchange buy/sell ☐
x. Chequebook order ☐
xi. E-token /Tan list order ☐

30) Is it a good or a bad idea for customers to open Internet banking accounts?

i. Good Idea ☐
ii. Bad Idea ☐
iii. Good idea for some reasons and bad idea for other reasons ☐

31) In general is it good for a customer to use Internet banking in Greece for…

i. Fund Transfers ☐
ii. Payments of public utility bills ☐
iii. View the balance of the account ☐
iv. Payments of credit cards ☐
v. Applications for loans ☐

32) Please indicate whether you wish to add anything to this research

_____

_____

33) Please indicate your email address if you wish to be informed with the results of this research

Thank you for completing this questionnaire! All the answers will be treated with confidentiality and they will be used only for the purpose of this research.

Explanation of variables in the logit models

e-banking User = 1 if the respondent is an e-banking user; 0 otherwise

Internet banking User = 1 if the respondent is an Internet banking user; 0 otherwise

Young = 18- 40 years old; 0 otherwise

Old = 60 years or more; 0 otherwise

Male = 1 if the respondent is male; 0 if the respondent is female

Married = 1 if the respondent is married; 0 if the respondent is single/divorced or widowed.

University Education (UniEdu) = 1 if the respondent holds a university degree; 0 otherwise

Middle income (Middleinc) = 1 if the respondent's monthly income is €300-900[30]; 0 otherwise

High income (Highinc) = 1 if the respondent's monthly income is € 900 or higher; 0 otherwise

Public employee (Publicemp) = 1 if the respondent is a public employee; 0 otherwise

Self employed (Selfemp) = 1 if the respondent is self-employed; 0 otherwise

Homeowner = 1 if the respondent is a homeowner; 0 if the respondent is a tenant

Pc owner= 1 if the respondent is a pc owner; 0 otherwise

Internet connection (Intconnect) = 1 if the respondent has an Internet connection; 0 otherwise

Branch dissatisfaction (Branchdiss) = 1 if respondent is dissatisfied with branch services; 0 otherwise

Access to banks' web pages (Accessbanksweb) = 1 if the respondent access banks' web pages for information; 0 otherwise

High branch fees= 1 if the respondent pays more than € 11 for branch banking transactions; 0 otherwise

ATM users =1 if the respondent is an ATM user; 0 otherwise

ε = error term

[30] Since the minimum monthly salary for a full time position is €600, then we consider €300 - 900€ as a middle range income.

Correlation Matrices

1) E-banking adoption

	EBUSER	MALE	MARRIED	UNIEDU
EBUSER	1.0000	-0.060743	0.0038053	0.18734
MALE	-0.060743	1.0000	0.051839	0.15029
MARRIED	0.0038053	0.051839	1.0000	-0.054319
UNIEDU	0.18734	0.15029	-0.054319	1.0000
HIGHINC	0.078670	0.27418	0.22269	0.24926
PUBLICEMP	-0.0071132	0.048117	-0.023942	0.15635
HOMEOWNER	-0.15302	0.065770	0.14962	0.0068165
PCOWNER	0.16018	0.10238	0.085726	0.30685
INTERNETCON	0.17929	0.11168	0.11789	0.31063
ACCESSBANKSWEBPAGE	0.090311	0.24932	-0.044657	0.37641
YOUNG	0.18221	0.045991	-0.15379	0.11088
SELFEMPL	-0.11220	0.14243	-0.013800	0.0075945
BRANCHDISS	0.0067557	0.11171	-0.10951	0.027507
HIGHBRANCHFEES	0.0067557	-0.026022	-0.037607	0.096913

	HIGHINC	PUBLICEMP	HOMEOWNER	PCOWNER
EBUSER	0.078670	-0.0071132	-0.15302	0.16018
MALE	0.27418	0.048117	0.065770	0.10238
MARRIED	0.22269	-0.023942	0.14962	0.085726
UNIEDU	0.24926	0.15635	0.0068165	0.30685
HIGHINC	1.0000	0.22483	0.14579	0.13732
PUBLICEMP	0.22483	1.0000	0.073173	0.093575
HOMEOWNER	0.14579	0.073173	1.0000	-0.054098
PCOWNER	0.13732	0.093575	-0.054098	1.0000
INTERNETCON	0.15313	0.0025684	-0.044401	0.69109
ACCESSBANKSWEBPAGE	0.30856	0.028250	0.043002	0.26475
YOUNG	-0.17933	-0.084956	-0.23562	0.14139

SELFEMPL	0.15469	-0.15731	0.17199	0.068465
BRANCHDISS	-0.021182	-0.064105	-0.027253	-0.077391
HIGHBRANCHFEES	0.047423	-0.064105	0.091025	0.083316

	INTERNETCON	ACCESSBANKSWEBPAGE	YOUNG	SELFEMPL
EBUSER	0.17929	0.090311	0.18221	-0.11220
MALE	0.11168	0.24932	0.045991	0.14243
MARRIED	0.11789	-0.044657	-0.15379	-0.013800
UNIEDU	0.31063	0.37641	0.11088	0.0075945
HIGHINC	0.15313	0.30856	-0.17933	0.15469
PUBLICEMP	0.0025684	0.028250	-0.084956	-0.15731
HOMEOWNER	-0.044401	0.043002	-0.23562	0.17199
PCOWNER	0.69109	0.26475	0.14139	0.068465
INTERNETCON	1.0000	0.29219	0.12978	0.095455
ACCESSBANKSWEBPAGE	0.29219	1.0000	0.12517	0.053591
YOUNG	0.12978	0.12517	1.0000	-0.10088
SELFEMPL	0.095455	0.053591	-0.10088	1.0000
BRANCHDISS	-0.15872	0.058590	0.014996	0.032285
HIGHBRANCHFEES	0.088302	0.10055	0.014996	0.18134

	BRANCHDISS	HIGHBRANCHFEES
EBUSER	0.0067557	0.0067557
MALE	0.11171	-0.026022
MARRIED	-0.10951	-0.037607
UNIEDU	0.027507	0.096913
HIGHINC	-0.021182	0.047423
PUBLICEMP	-0.064105	-0.064105
HOMEOWNER	-0.027253	0.091025
PCOWNER	-0.077391	0.083316
INTERNETCON	-0.15872	0.088302
ACCESSBANKSWEBPAGE	0.058590	0.10055
YOUNG	0.014996	0.014996

SELFEMPL	0.032285	0.18134
BRANCHDISS	1.0000	-0.021176
HIGHBRANCHFEES	-0.021176	1.0000

2) Internet banking adoption

	IBUSER	OLD	MALE	MARRIED	UNIEDU
IBUSER	1.0000	-0.12373	0.17690	0.0067780	0.33369
OLD	-0.12373	1.0000	-0.010605	-0.014650	-0.17068
MALE	0.17690	-0.010605	1.0000	0.051839	0.15029
MARRIED	0.0067780	-0.014650	0.051839	1.0000	-0.054319
UNIEDU	0.33369	-0.17068	0.15029	-0.054319	1.0000
HIGHINC	0.28214	-0.14498	0.27418	0.22269	0.24926
SELFEMPL	0.0058549	-0.11301	0.14243	-0.013800	0.0075945
HOMEOWNER	0.025087	0.16439	0.065770	0.14962	0.0068165
PCOWNER	0.18748	-0.33734	0.10238	0.085726	0.30685
INTERNETCON	0.24201	-0.28592	0.11168	0.11789	0.31063
BRANCHDISS	-0.034595	-0.016633	0.11171	-0.10951	0.027507
HIGHBRANCHFEES	0.10529	-0.082257	-0.026022	-0.037607	0.096913
ATMusers	0.11516	-0.35657	-0.060743	0.0038053	0.18734

	HIGHINC	SELFEMPL	HOMEOWNER	PCOWNER	INTERNETCON
IBUSER	0.28214	0.0058549	0.025087	0.18748	0.24201
OLD	-0.14498	-0.11301	0.16439	-0.33734	-0.28592
MALE	0.27418	0.14243	0.065770	0.10238	0.11168
MARRIED	0.22269	-0.013800	0.14962	0.085726	0.11789
UNIEDU	0.24926	0.0075945	0.0068165	0.30685	0.31063
HIGHINC	1.0000	0.15469	0.14579	0.13732	0.15313
SELFEMPL	0.15469	1.0000	0.17199	0.068465	0.095455
HOMEOWNER	0.14579	0.17199	1.0000	-0.054098	-0.044401
PCOWNER	0.13732	0.068465	-0.054098	1.0000	0.69109
INTERNETCON	0.15313	0.095455	-0.044401	0.69109	1.0000

BRANCHDISS	-0.021182	0.032285	-0.027253	-0.077391	-0.15872
HIGHBRANCHFEES	0.047423	0.18134	0.091025	0.083316	0.088302
ATMusers	0.078670	-0.11220	-0.15302	0.16018	0.17929

	BRANCHDISS	HIGHBRANCHFEES	ATMusers
IBUSER	-0.034595	0.10529	0.11516
OLD	-0.016633	-0.082257	-0.35657
MALE	0.11171	-0.026022	-0.060743
MARRIED	-0.10951	-0.037607	0.0038053
UNIEDU	0.027507	0.096913	0.18734
HIGHINC	-0.021182	0.047423	0.078670
SELFEMPL	0.032285	0.18134	-0.11220
HOMEOWNER	-0.027253	0.091025	-0.15302
PCOWNER	-0.077391	0.083316	0.16018
INTERNETCON	-0.15872	0.088302	0.17929
BRANCHDISS	1.0000	-0.021176	0.0067557
HIGHBRANCHFEES	-0.021176	1.0000	0.0067557
ATMusers	0.0067557	0.0067557	1.0000

Correlation Matrix for Tobit censored regressions

	idcode	year	ROE	LBsize	RISK	LAtms	Lfees	Lninc	ROAsq	ROEsq	eff
idcode	1.0000										
year	0.0000	1.0000									
ROE	0.0262	-0.2652	1.0000								
LBsize	-0.0629	0.3015	0.4686	1.0000							
RISK	0.0392	-0.1469	0.5006	0.2072	1.0000						
LAtms	-0.2230	0.2133	0.3602	0.8782	0.0689	1.0000					
Lfees	-0.2252	0.1465	0.4795	0.8737	0.2518	0.8026	1.0000				
Lninc	-0.0956	0.2000	0.4740	0.9789	0.1999	0.8776	0.8673	1.0000			
ROAsq	0.0733	-0.2024	0.2873	0.2531	0.1912	0.3247	0.2920	0.3055	1.0000		
ROEsq	-0.1079	-0.2340	0.2274	0.2012	-0.0299	0.3471	0.2461	0.2703	0.8890	1.0000	
eff	0.3712	0.0704	-0.0338	-0.0169	0.1974	-0.1581	-0.0493	-0.0663	0.0608	-0.1317	
LITexp	-0.0075	0.2012	0.4430	0.9580	0.1509	0.8767	0.8717	0.9650	0.3042	0.2781	
ROA	0.1762	-0.1991	0.9204	0.5060	0.6134	0.3522	0.5120	0.4955	0.3413	0.1421	

Correlation Matrix for Efficiency and Competition

	LTAssets	LNIR	LPL	LPK	LPF
LTAssets	1.0000	0.97963	-0.39235	-0.56672	0.31243
LNIR	0.97963	1.0000	-0.25978	-0.46540	0.28515
LPL	-0.39235	-0.25978	1.0000	0.65129	-0.34174
LPK	-0.56672	-0.46540	0.65129	1.0000	-0.021062
LPF	0.31243	0.28515	-0.34174	-0.021062	1.0000
LBR	0.76036	0.75619	-0.21879	-0.39073	0.084769
LATMS	0.84131	0.87810	0.016170	-0.21980	0.088402
LROAA	-0.30501	-0.32446	0.25184	0.22924	-0.10119

	LBR	LATMS	LROAA
LTAssets	0.76036	0.84131	-0.30501
LNIR	0.75619	0.87810	-0.32446
LPL	-0.21879	0.016170	0.25184
LPK	-0.39073	-0.21980	0.22924
LPF	0.084769	0.088402	-0.10119
LBR	1.0000	0.80801	-0.22290
LATMS	0.80801	1.0000	-0.24514
LROAA	-0.22290	-0.24514	1.0000

Bibliography

Abreu, M., & Mendes, V. (2001). Commercial bank interest margins and profitability: evidence from some EU countries. Paper presented at the Pan-European Conference Jointly organised by IEFS-UK and University of Macedonia Economic and Social Sciences, Thessaloniki, Greece.

Akinci, S., Aksoy, S., & Atilgan, E. (2004). Adoption of Internet banking among sophisticated consumer segments in an advanced developing country. International Journal of Bank Marketing, 22(3), 212-232.

Aktan, B., & Masood, O. (2010). The state of competition of the Turkish banking industry: An application of the Panzar-Rosse model. Journal of Business Economics and Management, 11(1), 131-145.

Ali, K., Akhtar, M. F., & Ahmed, H. Z. (2011). Bank-Specific and Macroeconomic Indicators of Profitability - Empirical Evidence from the Commercial Banks of Pakistan. International Journal of Business and Social Science, 2(6), 235-242.

Allen, F., McAndrews, J., & Strahan, P. (2001). E-finance: an introduction, Working paper No 01-36. Philadelphia: Wharton University.

Allen, L., & Rai, A. (1996). Operational efficiency in banking: an international comparison. Journal of Banking & Finance, 20, 655-672.

Al-Muharrami, S. (2007). The causes of productivity change in GCC banking industry. International Journal of Productivity and Performance Management, 56(8), 731-743.

Al-Muharrami, S. (2009). The competition and market structure in the Saudi Arabia banking. Journal of Economic Studies, 36(5), 446-460.

Al-Muharrami, S., Matthews, K., & Khabari, Y. (2006). Market structure and competitive conditions in the Arab GCC banking system. Journal of Banking & Finance, 30(12), 3487-3501.

Alpha Bank. (2011). History. Retrieved June 10, 2011, from http://www.alpha.gr/page/default.asp?la=2&id=8

Al-Somali, S. A., Gholami, R., & Clegg, B. (2009). An investigation into the acceptance of online banking in Saudi Arabia. Technovation, 29(130-141).

Amin, H. (2007). Internet banking adoption among young intellectuals. Journal of Internet banking and Commerce, 12(3), 1-13.

Anania, L., & Solomon, R. J. (1997). Flat- THe minimalist price. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics (3rd. ed.). Massachusetts The MIT Press.

Asimakopoulos, I. G., Brissimis, S. N., & Delis, M. D. (2008). The efficiency of the Greek Banking System and its determinants. Athens: Bank of Greece.

Ataullah, A., & Le, H. (2006). Economic reforms and bank efficiency in developing countries: the case of the Indian banking industry. Applied Financial Economics, 16(9), 653 - 663.

ATE, Bank. (2011). Profile. Retrieved June 10, 2011, from http://www.atebank.gr/English/Bank/ATEbank+info/Profile.htm

Athanasoglou, P., Brissimis, S., & Delis, M. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. Journal of International Financial Markets, Institutions and Money, 18(2), 121-136.

Attica, Bank. (2011). History/Profile. Retrieved June 10, 2011, from http://www.atticabank.gr/index.asp?a_id=1297

Bailey, J. P. (1997). The Economics of Internet Interconnection Agreements. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics (3rd. ed.). Massachusetts: The MIT Press.

Bakos, J. Y. (1998). The emerging role of emerging marketplaces on the Internet. Communications of the ACM, 41(8), 35-42.

Balto, D. (2000). The problem of Interchange fees: Costs without benefits? E.C.L.R.(4), 215-224.

Banker, A. N., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. Management Science, 30, 1078-1092.

Banks, E. (2001). E-finance: the electronic revolution. Chichester: Wiley.

Bankscope, B.-V.-D.-. (2011). Greek Banking data. Retrieved May 13, 2011, from https://bankscope2.bvdep.com/version-2011715/Home.serv?product=scope2006

Bartolini, E., & Baussola, M. (2001). The determinants of technology adoption in Italian manufacturing industries. Review of Industrial Organisation, 19, 305-328.

Bauer, C., & Colgan, J. (2001). Planning for electronic commerce strategy: an explanatory study from the financial services sector. Logistics Information Management 1(2), 24-32.

Baumol, W. J., Panzar, J. C., & Willig, R. D. (1982). Contestable markets and the Theory of Industry Structure. New York: Harcourt Brace Jovanovich.

Beccalli, E. (2007). Does IT investment improve bank performance? Evidence from Europe. Journal of Banking & Finance, 31(7), 2205-2230.

Beck, T., Demirguc-Kunt, A., & Martinez Peria, M. S. (2007). Reaching out: Access to and use of banking services across countries. Journal of Financial Economics, 85(1), 234-266.

Bergendahl, G., & Lindblom, T. (2007). Pricing of payments services:a comparative analysis of paper-based banking and electronic banking. The Service Industrial Journal, 27(6), 687-707.

Berger, A. (2003). The Economic Effects of Technological progress: Evidence from the Banking Industry. Journal of Money, Credit and Banking, 35(2), 141-176.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: international survey and directions for future research. European Journal of Operational Research, 98, 175-212.

Bikker, J. A., & Bos, J. W. B. (2008). Bank Performance A theoritical and empirical framework for the analysis of profitability,competition and efficiency. Oxon: Routledge.

Bikker, J. A., & Haaf, K. (2002). Competition, concentration and their relationship: An empirical analysis of the banking industry. Journal of Banking & Finance, 26(11), 2191-2214.

Bikker, J. A., Spierdijk, L., & Finniez, P. (2007). Misspecification of the Panzar-Rosse Model: Assessing Competition in the Banking Industry: De Nederlandsche Bank.

Birch, D., & Young, M. A. (1997). Financial services and the Internet-what does cyberspace mean for the financial services industry? Internet Research, 7(2), 120-128.

Bos, J., & Schmiedel, H. (2007). Is there a single frontier in a single European banking market? Journal of Banking & Finance, 31(7), 2081-2102.

Boyd, J. H., & Runkle, D. E. (1993). Size and performance of banking firms: Testing the prediction of theory. Journal of Monetary Economics, 31(1), 47-67.

Bryman, A. (2008). Social Research Methods (3rd ed.). New York: Oxford University Press.

Bryman, A., & Bell, E. (2003). Business Research Methods. New York: Oxford University Press.

Cai, Y., Yang, Y., & Cude, B. (2008). Inconsistencies in US consumers' attitudes toward and use of electronic banking: An empirical investigation. Journal of Financial Services Marketing, 13(2), 150-163.

Carlson, J., Furst, K., Lang, W. W., & Nolle, D. E. (2001). Internet Banking: Market Developments and Regulatory Issues. Paper presented at the Society of Government Economists Conference 2000, Washington, DC.

Casaló, L. V., Flavián, C., & Guinalíu, M. (2008). The role of satisfaction and website usability in developing customer loyalty and positive word-of-mouth in the e-banking services. International Journal of Bank Marketing, 26(6), 399-417.

Casu, B., & Girardone, C. (2004). Financial conglomeration: efficiency, productivity and strategic drive. Applied Financial Economics, 14(10), 687 - 696.

Casu, B., & Molyneux, P. (2003). A comparative study of efficiency in European banking. Applied Economics, 35(17), 1865-1876.

Chang, Y. T. (2005). Dynamics of Internet Banking adoption. Norwich: University of East Anglia.

Charnes, A., Cooper, W. W., & Rhoades, E. (1978). Measuring the efficiency of decision making units. European Journal of Operational Research, 2, 429-444.

Chatzoglou, P. D., Diamantidis, A. D., Vraimaki, E., Polychrou, E., & Chatzitheodorou, K. (2010). Banking productivity: an overview of the Greek banking system. Managerial Finance, 36(12), 1007-1027.

Cheng, T. C. E., Lam, D. Y. C., & Yeung, A. C. L. (2006). Adoption of Internet banking: An empirical study in Hong Kong. Decision Support Systems, 42(1558-1572).

Christopoulos, D. K., Lolos, S. E. G., & Tsionas, E. G. (2002). Efficiency of the Greek banking system in view of the EMU: a heteroskedastic stochastic frontier approach. Journal of Policy Modeling, 24(9), 813-829.

Ciciretti, R., Hasan, I., & Zazzara, C. (2008). Do Internet Activities Add Value? Evidence from the Traditional Banks. Journal of Financial Services Research, 35(1), 81-98.

Claessens, S., Gilaessner, T., & Klingebiel, D. (2003). Electronic Finance: Reshaping the Financial Landscape around the world. Hyderabad: ICFAI University Press.

Claessens, S., & Laeven, L. (2003). What drives Bank competition?Some international evidence. Journal of Money, Credit and Banking, 36(3), 563-583.

Clark, D. D. (1997). Internet Cost Allocation and Pricing. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics (pp. 215-252). Massachusetts: The MIT Press.

Clarke, R., Davies, S., & Waterson, M. (1984). The Profitability-Concentration Relation: Market Power or Efficiency? The Journal of Industrial Economics, 32(4), 435-450.

Clemons, E. K., & Hitt, L. M. (2000). The internet and the future of financial services: transparency, differential pricing and disintermediation. Philadelphia: Wharton University.

Coelli, T. (1996). A guide to DEAP version 2.1: a data envelopment analysis (computer) program. CEPA Working Paper, 1996/08.

Cohbam, A. (1999). The Financing and Technology Decisions of SMEs: Finance as a Determinant of Investment. Oxford: University of Oxford.

Colombo, M., & Mosconi, R. (1995). Complementary and cumulative learning effecs in the early diffusion of multiple technologies. The Journal of Industrial Economics, 43(1), 13-48.

Cooper, W. W., Seiford, L. M., & Tone, K. (2000). Data envelopment analysis. A Comprehensive Text with Models, Applications, References and DEA-Solver Software. USA: Kluwer Academic Publishers.

Corrocher, N. (2006). Internet adoption in Italian banks: An empirical investigation. Research Policy, 35(4), 533-544.

Cranich, G., Nguyen, D.-T., & Nguyen, A. (2007). Australian banks' approaches to privacy in an online world. International Journal of Electronic Finance, 1(4), 389-405.

Cunningham, L. F., Gerlach, J., & Harper, M. D. (2005). Perceived risk and e-banking services: An analysis from the perspective of the consumer. Journal of Financial Services Marketing, 10(2), 165-178.

Currency, E. D. (2011). Maastricht Criteria. Retrieved September 20, 2011, from http://www.euro-dollar-currency.com/maastricht_criteria.htm

Damar, H. E. (2006). The effects of shared ATM networks on the efficiency of Turkish banks. Applied Economics, 38(6), 683-697.

Dandapani, K. (2008). Growth of e-financial services: Introduction to the special issue. Managerial Finance, 34(6), 361-364.

Daniel, E., & Storey, C. (1997). On-line banking: strategic and management challenges. Long Range Planning, 30(6), 890-898.

Davies, S. (1979). Diffusion innovation and market structure. In D. Sahal (Ed.), Research, Development and Technological Innovation. Massachusetts: Lexington.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly, 13(3), 319-340.

De Bandt, O., & Davis, E. P. (2000). Competition, contestability and market structure in European banking sectors on the eve of EMU. Journal of Banking & Finance, 24(6), 1045-1066.

Debreu, G. (1951). The Coefficient of Resource Utilisation. Econometrica, 19, 273-292.

Delgado, J., Hernando, I., & Nieto, M. J. (2007). Do European Primarily Internet banks show scale and experience efficiencies? European Financial Management, 13(4), 643-671.

Delgado, J., & Nieto, M. J. (2004). Internet banking in Spain:some stylized facts. Monetary Integration, Market and Regulation. (4), 187-209.

Delis, M. D. (2010). Competitive conditions in the Central and Eastern European banking systems. Omega, 38(5), 268-274.

Delis, M. D., & Papanikolaou, N. I. (2009). Determinants of bank efficiency: evidence from a semi-parametric methodology. Managerial Finance, 35(3), 260-275.

Delis, M. D., Staikouras, K. C., & Varlagas, P. T. (2008). On the Measurement of Market Power in the Banking Industry. Journal of Business Finance & Accounting, 35(7-8), 1023-1047.

Dewey. (1910). How We Think. New York: Health

DeYoung, R. (2001). The financial performance of pure play Internet banks. Economic Perspectives, 60-75.

DeYoung, R. (2005). The performance of Internet-based Business Models: Evidence from the Banking industry. Journal of Business, 78(3), 893-947.

DeYoung, R., Lang, W. W., & Nolle, D. L. (2007). How the Internet affects output and performance at community banks. Journal of Banking and Finance, 31, 1033-1060.

DeYoung, R., & Rice, T. (2004). How do banks make money? The fallacies of fee income. Economic Perspectives, 34-51.

Doyle, P. (1998). Marketing Management and Strategy. Hempstead: Prentice Hall Europe.

Drake, L., Hall, M., & Simper, R. (2006). The impact of macroeconomic and regulatory factors on bank efficiency: A non-parametric analysis of Hong Kong's banking system. Journal of Banking & Finance, 30(5), 1443-1466.

ECB. (1999). The effects of technology in the EU banking systems. Frankfurt am Main.

ECB. (2011). European Central Bank. Retrieved September 20, 2011, from http://europa.eu/about-eu/institutions-bodies/ecb/index_en.htm

Elberse, A., Barwise, P., & Hammond, K. (2002). The impact of the Internet on horizontal and vertixal competition: market efficiency and value chain reconfiguration. The Economics of Internet and E-Commerce, 11, 1-27.

Emporiki, B. (2011). Milestones in the history of Emporiki Bank. Retrieved June 10, 2011, from http://www.combank.gr/cbgen/gr/emporiki_group/group_story.jsp?docpath=/gr/Investor/static/landmarks&section=landmarks

Espitia Escuer, M., Polo Redondo, Y., & Salas Fumas, V. (1991). Market structure and the adoption of innovation: the case of the Spanish banking sector. Economics of Innovation and New Technology, 1(4), 295-307.

Eurobank, E. (2011). A European banking group that actively supports the economy. Retrieved June 05, 2011, from http://www.eurobank.gr/online/HOME/genericnew.aspx?code=trapeza&mid=851&lang=en

Eurobank, (2011). History. Retrieved June 11, 2011, from http://www.eurobank.gr/online/home/generic.aspx?id=5&mid=851&lang=en

Eurobank, (2011). Press Releases. Retrieved June 10, 2011, from http://www.eurobank.gr/online/home/news.aspx?mid=707&lang=en&Code=PRESS

Eurostat. (2009). Computers and the Internet in households and enterprises. Retrieved September 2, 2011, from http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/main_tables

Eurostat. (2010). Europe's Digital Competitiveness Report.ICT Country Profiles. Brussels.

Eurostat. (2010). Internet access and use in 2010. Brussels.

Eurostat. (2010). Internet usage in 2010 – Households and Individuals. Brussels.

Evanoff, D., & Fortier, D. (1988). Reevaluation of the structure-conduct-performance paradigm in banking. Journal of Financial Services Research, 1(3), 277-294.

Faria, A., Fenn, P., & Bruce, A. (2002). Determinants of adoption of flexible production technologies: Evidence from portuguese manufacturing industry. Economics of Innovation and New Technology, 11(6), 569-580.

Farrell, M. J. (1957). The Measurement of Productive Efficiency. Journal of the Royal Statistical Society, A CXX(Part 3), 253-290.

Flash-Eurobarometer. (2008). Information society as seen by EU citizens. Brussels.

Flavián, C., Guinalíu, M., & Torres, E. (2006). How bricks-and-mortar attributes affect online banking adoption. International Journal of Bank Marketing, 24(6), 406-423.

Floros, C. (2010). The impact of the Athens Olympic Games on the Athens Stock Exchange. Journal of Economic Studies, 37(6), 647-657.

Floros, C., & Giordani, G. (2008). ATM and Bank Efficiency: the case of Greece. Banks and Bank Systems, 3(4), 55-64.

Fu, X., & Heffernan, S. (2009). The effects of reform on China's bank structure and performance. Journal of Banking & Finance, 33(1), 39-52.

Fudenberg, D., & Tirole, J. (1985). Pre-emption and rent equalisation in the adoption of new technology. Review of Economics Studies, 52, 383-401.

Furst, K., Lang, W. W., & Nolle, D. E. (2000). Internet Banking: Developments and Prospects.

Gaganis, C., Liadaki, A., Doumpos, M., & Zopounidis, C. (2009). Estimating and analyzing the efficiency and productivity of bank branches Evidence from Greece. Managerial Finance, 35(2), 202-218.

Gan, C., Clemes, M., Limsombunchai, V., & Weng, A. (2006). A logit analysis of electronic banking in New Zealand. International Journal of Bank Marketing, 24(6), 360-383.

Gao, P., & Owolabi, O. (2008). Consumer adoption of internet banking in Nigeria International Journal of Electronic Finance 2(3), 284-299.

Geniki, Bank. (2011). Geniki Bank. Retrieved June 10, 2011, from http://www.geniki.gr/Default.aspx?tabid=103&language=en-US

Geniki, Bank. (2011). Geniki Bank Annual Report 2010. Retrieved June 10, 2011, from http://www.geniki.gr/LinkClick.aspx?fileticket=-l2TY1kkKpc%3d&tabid=116&language=en-US

Gerrard, P., & Cunningham, J. B. (2003). The difusion of Internet Banking among Singapore consumers. International Journal of Bank Marketing, 21(2), 16-28.

Geyskens, I., Gielens, K., & Dekimpe, M. G. (2000). Establishing the Internet channel: short-term pain but long-term gain?, Working paper e-business Research center.

Ghemawat, P. (1985). Building Strategy on the experience curve. Harvard Business Review, 143-149.

Giordani, G., Floros, C., & Judge, G. (2009). Internet Banking services and fees: The case of Greece. International Journal of Electronic Finance, 3(2), 177-198.

Gischer, H., & Stiele, M. (2008). Competition Tests with a Non-Structural Model: the Panzar–Rosse Method Applied to Germany's Savings Banks. German Economic Review, 10(1), 50-70.

Goel, R. K., & Rich, D. P. (1997). On the adoption of new technologies. Applied Economics, 29, 513-518.

Goldberg, L. G., & Rai, A. (1996). The structure-performance relationship for European banking. Journal of Banking & Finance, 20(4), 745-771.

Gong, J., & Srinagesh, P. (1997). The Economics of Layered Networks. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics. Massachusetts: The MIT Press.

Gounaris, S., & Koritos, C. (2008). Investigating the drivers of internet banking adoption decision: A comparison of three alternative frameworks. International Journal of Bank Marketing, 26(5), 282-304.

Greenberg, J. B., & Simbanegavi, W. (2009). Testing for Competition in the South African Banking Sector. Cape Town: University of Cape Town.

Gupta, V. (2002). Risks of E-banking in India. Hyderabad: UCFAI University Press.

Gurau, C. (2002). E-banking in transition economies: The case of Romania. Journal of Financial Services Marketing, 6(4), 362-378.

Guriting, P., & Ndubisi, N. O. (2006). Borneo online banking: evaluating customer perceptions and behavioural intention. Management Research News, 29(1/2), 6-15.

Halkos, G. E., & Salamouris, D. S. (2004). Efficiency measurement of the Greek commercial banks with the use of financial ratios: a data envelopment analysis approach. Management Accounting Research, 15(2), 201-224.

Hallgren, M. M., & McAdams, A. K. (1997). The economic efficiencyt of Internet Public goods (3rd. ed.). Massachusetts: Massachusetts Institute of Technology.

Hamza, R. A. (2011). Validation Panzar-Rosse Model in determining the structural characteristics of Tunisian banking industry. Journal of Economics and International Finance, 3(5), 259-268.

Hannan, T. H. (2007). ATM surcharge bans and bank market structure: The case of Iowa and its neighbors. Journal of Banking & Finance, 31(4), 1061-1082.

Hasan, I., Zazzara, C., & Ciciretti, R. (2005). Internet, Innovation and Performance of Banks: Italian Experience: Unpublished manuscript.

Hauner, D. (2005). Explaining efficiency differences among large German and Austrian banks. Applied Economics, 37(9), 969 - 980.

Havrylchyk, O. (2006). Efficiency of the Polish banking industry: Foreign versus domestic banks. Journal of Banking & Finance, 30(7), 1975-1996.

HBA. (2009). Hellenic Bank Association. Retrieved May 13, 2011, from http://www.hba.gr

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). Applied Choice Analysis: A Primer: Cambridge University Press.

Hernandez, J. M. C., & Mazzon, J. A. (2007). Adoption of internet banking: proposition and implementation of an integrated methodology approach. International Journal of Bank Marketing, 25(2), 72-88.

Hernando, I., & Nieto, M. J. (2007). Is the Internet delivery channel changing banks' performance? The case of Spanish banks. Journal of Banking & Finance, 31(4), 1083-1099.

Hitt, L. M., & Brynjolfsson, E. (1996). Productivity, business profitability, and consumer surplus: Three different measures of information technology value. MIS Quarterly, 20(2), 121-142.

Ho, B., & Wu, D. (2009). Online banking performance evaluation using data envelopment analysis and principal component analysis. Computers & Operations Research, 36(6), 1835-1842.

Ho, S. J., & Mallick, S. K. (2009). The impact of information technology on the banking industry. Journal of the Operational Research Society, 61(2), 211-221.

Holden, K., & El-Bannany, M. (2004). Investment in information technology systems and other determinants of bank profitability in the UK. Applied Financial Economics, 14(5), 361 - 365.

Hondroyiannis, G., Lolos, S., & Papapetrou, E. (1999). Assessing competitive conditions in the Greek banking system. Journal of International Financial Markets, Institutions and Money, 9(4), 377-391.

Hondroyiannis, G., & Papapetrou, E. (1996). International banking activity in Greece: The recent experience. Journal of Economics and Business, 48(3), 207-215.

Howcroft, B., & Beckett, A. (1996). Branch networks and the retailing of high credence products. International Journal of Bank Marketing, 14(4), 3-11.

Howcroft, B., Hamilton, R., & Hewer, P. (2002). Consumer attitude and the usage and adoption of home-based banking in the United Kingdom. International Journal of Bank Marketing, 20(3), 111-121.

Huang, H. (2005). Essays in Electronic Money and Banking: The University of Texas at Austin.

Hwang, H.-G., Chen, R.-F., & Lee, J.-M. (2007). Measuring customer satisfaction with internet banking: an exploratory study

International Journal of Electronic Finance 1(3), 321-335.

Ibbotson, P., & Moran, L. (2003). E-banking and the SME/bank relationship in Northern Ireland. International Journal of Bank Marketing, 23(3), 94-103.

Isik, I., & Hassan, M. K. (2002). Technical, scale and allocative efficiencies of Turkish banking industry. Journal of Banking & Finance, 26(4), 719-766.

Jenkins, H. (2007). Adopting internet banking services in a small island state: assurance of bank service quality. Managing Service quality, 17(5), 523-537.

Joshi, V. C. (2004). E-finance Log in to the future. London: Sage.

Kalakota, R., & F.Frei. (1998). Frontiers of On-Line Financial Services. In M. J. Cronin (Ed.), Banking and Finance on the Internet (pp. 19-74). Canada: John Wiley& Sons.

Kaleem, A., & Ahmad, S. (2008). Bankers' Perceptions of Electronic Banking in Pakistan. Journal of Internet Banking and Commerce, 13(1), 1-16.

Karatzas, T. (2003). The Greek Banking System: Bank of Greece.

Kardaras, D., & Papathanassiou, E. (2001). Electronic Commerce opportunities for improving corporate customer support in banking in Greece. International Journal of Bank Marketing, 19(7), 292-298.

Karshenas, M., & Stoneman, P. (1995). Technological diffusion. In P. Stoneman (Ed.), Handbook of the Economics of Innovation and Technological Change. London: Blackwell.

Keeton, W. R. (2001). The transformation of banking and its impact on consumers and small businesses. Economic Review Federal Reserve Bank of Kansas, 25–53.

Ketlar, K. W., & Ketlar, S., L. (2008, May 13-17, 2008). Performance and Profitability of Indian Banks in the Post Liberalization Period. Paper presented at the World Congress on National Accounts and Economic Performance Measures for Nations, Washington, DC.

Kiang, M. Y., Raghu, T. S., & Shang, K. H.-M. (2000). Marketing on the internet-who can benefit from an online marketing approach? Decision Support Systems, 27(4), 383-393.

Kim, B. M., Widdows, R., & Yilmazer, T. (2005). The Determinants of Consumers' Adoption of Internet Banking. Purdue: Unpublished paper.

Koetter, M., & Noth, F. (2011). The Efficient Use of IT and Bank Competitiveness. University of Frankfurt.

Kollmeyer, B. (2011). Greece's Alpha Bank, Eurobank agree to merge. Retrieved September 05, 2011, from http://www.marketwatch.com/story/greeces-alpha-bank-eurobank-agree-to-merge-2011-08-29

Kolodinsky, J. M., Hogarth, J. M., & Hilgert, M. A. (2004). The adoption of electronic banking technologies by US consumers. International Journal of Bank Marketing, 22(4), 238-259.

Kondabagil, J. (2007). Risk Management in Electronic Banking. Singapore: John Wiley and Sons.

Kondo, K. (2010). Do ATMs influence bankprofitability in Japan? Applied Economics Letters, 17(3), 297-303.

Koopmans, T. C. (1951). An analysis of Production as an Efficient Combination of Activities. In T. C. Koopmans (Ed.), Activity Analysis of Production and Allocation. New York: Wiley.

Koskosas, I. V. (2011). Risk Management in On-Line Banking. Intelligent Information Management, 03(04), 112-118.

Kosmidou, K. (2008). The determinants of banks' profits in Greece during the period of EU financial integration. Managerial Finance, 34(3), 146-159.

Kosmidou, K., & Zopounidis, C. (2008). Measurement of Bank performance in Greece. South-Eastern Europe Journal of Economics, 1, 79-95.

Kuisma, T., Laukkanen, T., & Hiltunen, M. (2007). Mapping the reasons for resistance to Internet banking: A means-end approach. International Journal of Information Management, 27(2), 75-85.

Kumar, S., & Gulati, R. (2008). Evaluation of technical efficiency and ranking of public sector banks in India: An analysis from cross-sectional perspective. International Journal of Productivity and Performance Management, 57(7), 540-568.

Kumar, S., & Gulati, R. (2010). Measuring efficiency, effectiveness and performance of Indian public sector banks. International Journal of Productivity and Performance Management, 59(1), 51-74.

Kwan, S., & Eisenbeis, R. A. (1997). Bank risk, capitalization, and operating efficiency. Journal of Financial Services Research, 12(2/3), 117-131.

Laforet, S., & Li, X. (2005). Consumers' attitudes towards online and mobile banking. International Journal of Bank Marketing, 23(5), 362-380.

Lassar, W. M., Manolis, C., & Lassar, S. S. (2005). The relationship between consumer innovativeness, personal characteristics, and online banking adoption. International Journal of Bank Marketing, 23(2), 176-199.

Laukkanen, T. (2007). Internet vs mobile banking: comparing customer value perceptions. Business Process Management Journal, 13(6), 788 - 797.

Lawson, R., & Todd, S. (2003). Consumer preferences for payment method: a segmentation analysis. International Journal of Bank Marketing, 21(2), 72-79.

Lee, M. C. (2009). Factors influencing the adoption of Internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. Electronic Commerce Research and Applications, 1-12.

Li, Z., & Zhong, Y. (2005). The adoption of virtual bankingin China: An empirical Study. Chinese Business Review, 4(6), 75-78.

Liu, H., Molyneux, P., & Nguyen, L. H. (2011). Competition and risk in South East Asian commercial banking. Applied Economics, 44(28), 3627-3644.

Louviere, J., Swait, D., & Hensher, D. (2000). Stated choice methods: analysis and applications. Cambridge: Cambridge University Press.

Lustsik, O., & Sorg, M. (2003). e-Banking developments in Estonia. In P. Mantravadi (Ed.), E-finance Vol.1. Hyderabad: ICFAI University Press.

Lymperopoulos, C., & Chaniotakis, I. E. (2004). Branch employees' perceptions towards implications of e-banking in Greece. International Journal of Retail & Distribution Management, 32(6), 302-311.

Lynch, J. G. J., & Ariely, D. (2000). Wine online: search costs affect competition on price, quality and distribution. Marketing science, 19(1), 83-103.

M'Chirgui, Z. (2005). The economics of the smart card industry: towards coopetitive strategies. Economics of Innovation and New Technology, 14(6), 455-477.

Mackie-Mason, J. K., Murphy, L., & Murphy, J. (1997). Persponsive pricing in the internet. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics. Massachusetts: Massashussets Institute of Technology.

Maenpaa, K., Kale, S., Kuusela, H., & Mesiranta, N. (2008). Consumer perceptions of Internet banking in Finland: The moderating role of familiarity. Journal of Retailing and Consumer Services, 15(4), 266-276.

Malhotra, P., & Singh, B. (2007). Determinants of Internet banking adoption by banks in India. Internet Research, 17(3), 323-339.

Mansfield, E. (1963). Size of firm, market structure, and innovation. Journal of Political Economy, 71, 556-576.

Mansfield, E., Rapport, J., Romeo, A., Wagner, S., & Beardsley, G. (1977). Social and private rates of return from industrial innovations. Quarterly Journal of Economics, 91, 221-240.

Marfin, E. B. (2011). Annual Report 2010. Retrieved June 09, 2011, from http://www.marfinbank.gr/EN/InvestorsUpdate/AnnualReports/Documents/MPB/MarfinPopularBankAnnualReport2010EN.pdf

Marfin, E. B. (2011). E-banking. Retrieved June 10, 2011, from http://www.marfinbank.gr/EN/MarfinDirect/eBanking/eBanking/Pages/Home.aspx

Masood, O., & Aktan, B. (2010). Market structure and competitive conditions of banking industry in KSA: The Panzar-Rosse approach. Actual Problems of Economics, 1(103), 263-276.

Masood, O., & Sergi, B. S. (2011). China's Banking System, Market Structure, and Competitive conditions. Frontiers of Economics in China, 6(1), 22-35.

Maudos, J., & Solís, L. (2011). Deregulation, liberalization and consolidation of the Mexican banking system: Effects on competition. Journal of International Money and Finance, 30(2), 337-353.

Mavri, M., & Ioannou, G. (2006). Consumers' perspectives on online banking services. International Journal of Consumer Studies, 30(6), 552-560.

McAndrews, J. J. (2003). Automated Teller Machine Network Pricing – A Review of the Literature. Review of Network Economics:, 2(2), 1-10.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behaviour. In P. Zarembka (Ed.), Frontiers in Econometrics (pp. 105-142): Academic Press.

McKnight, L. W., & Bailey, J. P. (1997). An introduction to Internet Economics. In L. W. McKnight & J. P. Bailey (Eds.), Internet Economics (3rd. ed.). Massachusetts: Massashussets Institute of Technology.

Mensi, S. (2010). Measurement of Competitiveness Degree in Tunisian Deposit banks: an application of the Panzar-Rosse Model. Panoeconomicus, 2, 189-207.

Mester, L. J. (1996). A study of bank efficiency taking into account risk-preferences. Journal of Banking & Finance, 20, 1025-1045.

Meyer, T. (2010). Online banking and research: The state of play in 2010. Frankfurt am Main.

Millennium, Bank. (2011). History. Retrieved June 08, 2011, from http://www.millenniumbank.gr/MillenniumVB/MillenniumEN/LeftMenu1_EN/TheBank_EN/History_EN/

Mlambo, K., & Ncube, M. (2011). Competition and Efficiency in the Banking Sector in South Africa. African Development Review, 23(1), 4-15.

Molyneux, P. (1993). Structure and performance in European banking. Unpublished PhD Thesis, University of Wales, Bangor.

Molyneux, P., & Teppett, J. (1993). Structure-conduct-performance in EFTA banking markets. Bank-en-Financiewezen, 3(133-137).

Molyneux, P., Thornton, J., & Michael Llyod-Williams, D. (1996). Competition and market contestability in Japanese commercial banking. Journal of Economics and Business, 48(1), 33-45.

Mwega, F. (2011). The Competitiveness and Efficiency of the Financial Services Sector in Africa: A Case Study of Kenya. African Development Review, 23(1), 44-59.

Naceur, S. B., & Goaied, M. (2001). The determinants of the Tunisian deposit banks' performance. Applied Financial Economics, 11(3), 317 - 319.

Nath, R., Schrick, P., & Parzinger, M. (2001). Bankers' Perspectives on Internet Banking. e-Service Journal, 21-36.

National, B. (2011). Investor Relations. Retrieved May 15, 2011, from http://www.nbg.gr/wps/portal/!ut/p/c1/04_SB8K8xLLM9MSSzPy8xBz9CP0os3jXIFNnSzcPIwMLgxADAyMfL5dgz5AQQwsLM6B8JJK8u6mLK1A-0NDP3MjPwMDSiIBuP4_83FT9gtyIcgD06JGc/dl2/d1/L2dJQSEvUUt3QS9ZQnB3LzZfRVI1QzlGSDIwR09MRDAyTEU4RU1CTDEwTDE!/?WCM_GLOBAL_CONTEXT=/wps/wcm/connect/nbg-en/NBG+Site/Group/Investor%20Relations

Noulas, A. G. (1997). Productivity growth in the Hellenic banking industry: state versus private banks. Applied Financial Economics, 7(3), 223 - 228.

Observatory-for-the-Greek-IS. (2008). Study for measuring the indicators of the i2010 initiatives for the year 2008. Athens.

Observatory-for-the-Greek-IS. (2010). Identity of Internet Users in Greece. Athens.

Olivero, M. P., Li, Y., & Jeon, B. N. (2011). Competition in banking and the lending channel: Evidence from bank-level data in Asia and Latin America. Journal of Banking & Finance, 35(3), 560-571.

Ou, C.-S., Hung, S.-Y., Yen, D. C., & Liu, F.-C. (2009). Impact of ATM intensity on cost efficiency: An empirical evaluation in Taiwan. Information & Management, 46(8), 442-447.

Panda, S. (2004). How safe is online banking? In K. N. Rao & Y. Pahuja (Eds.), IT in banks: Emerging Trends. Panjagutta: ICFAI University Press.

Panzar, J. C., & Rosse, J. N. (1987). Testing for "Monopoly" Equilibrium. The Journal of Industrial Economics, 35(4), 443-456.

Pasiouras, F. (2007). Estimating the technical and scale efficiency of Greek commercial banks: The impact of credit risk, off-balance sheet activities, and international operations. Research in International Business and Finance, 22(3), 301-318.

Pasiouras, F., & Kosmidou, K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. Research in International Business and Finance, 21(2), 222-237.

Pasiouras, F., Sifodaskalakis, E., & Zopounidis, C. (2007). Estimating and Analysing the Cost Efficiency of Greek Cooperative Banks: An application of Two-Stage Data Envelopment Analysis: University of Bath Working Paper.

Pasiouras, F., Tanna, S., & Gaganis, C. (2011). What Drives Acquisitions in the EU Banking Industry? The Role of Bank Regulation and Supervision Framework, Bank Specific and Market Specific Factors. Financial markets institutions and instruments, forthcoming, 29-77.

Pasiouras, F., & Zopounidis, C. (2008). Consolidation in the Greek banking industry: which banks are acquired? Managerial Finance, 34, 198-213.

Pastor, J. M., & Serrano, L. (2006). The Effect of Specialisation on Banks' Efficiency: An International Comparison. International Review of Applied Economics, 20(1), 125 - 149.

Pikkarainen, T., Pikkarainen, K., Karjaluoto, H., & Pahnila, S. (2004). Consumer acceptance of online banking: an extension of the technology acceptance model. Internet Research, 14(3), 224-235.

Piraeus, Bank. (2011). Annual Reports. Retrieved June 02, 2011, from http://www.piraeusbank.gr/ecPage.asp?id=240059&lang=2&nt=102&sid=&fid=240188

Piraeus, Bank. (2011). Corporate Profile. Retrieved June 02, 2011, from http://www.piraeusbank.gr/ecPage.asp?id=293365&lang=2&nt=96&sid=&fid=234891

Polasik, M., & Wisniewski, T. P. (2009). Empirical analysis of internet banking adoption in Poland. International Journal of Bank Marketing, 27(1), 32-52.

Polatoglu, V. N., & Ekin, S. (2001). An empirical investigation of the Turkish consumers' acceptance of Internet Banking services. International Journal of Bank Marketing, 19(4), 156-165.

Pontikakis, D., Lin, Y., & Demirbas, D. (2006). History matters in Greece: The adoption of Internet-enabled computers by small and medium sized enterprises. Information Economics and Policy, 18(3), 332-358.

Prendergast, G., & Marr, N. (1994). Towards a branchless banking society? International Journal of Retail & Distribution Management, 22(2), 18-26.

Ramanathan, R. (2007). Performance of banks in countries of the Gulf Cooperation Council. International Journal of Productivity and Performance Management, 56(2), 137-154.

Rao, A. (2005). Cost frontier efficiency and risk-return analysis in an emerging market. International Review of Financial Analysis, 14, 283-303.

Reinganum, J. F. (1981). The timing of innovation: research, development and innovation. In R. Schmalensee & R. D. Willig (Eds.), Handbook of Industrial Organization (pp. 850-908). Amsterdam: North Holland.

Rezitis, A. (2010). Evaluating the state of competition of the Greek banking industry. Journal of International Financial Markets, Institutions and Money, 20, 68-90.

Rhoades, S. A., & Rutz, R. D. (1982). Marker power and firm risk: a test of the 'Quiet Life' hypothesis. Journal of Monetary Economics, 9, 73-85.

Rigopoulos, G., & Askounis, D. (2007). A TAM framework to evaluate users' perception towards online electronic payments. Journal of Internet banking and Commerce, 12(3), 1-6.

Robson, C. (2002). Real World Research: A Resource for Social Scientists and Practitioner-Researchers. Oxford: Blackwell.

Rogers, E. M. (2003). Diffusion of Innovations. New York: Free Press.

Rosse, J. N., & Panzar, J. C. (1977). Chamberlin vs Robinson: an empirical test for monopoly rents: Bell Laboratories.

Sadowski, B. M., Maitland, C., & van Dongen, J. (2002). Strategic use of the Internet by small- and medium companies: an exploratory study. Information Economics and Policy, 14, 75-93.

Sayar, C., & Wolfe, S. (2007). Internet banking market performance: Turkey versus the UK. International Journal of Bank Marketing, 25(3), 122-141.

Scheller, H. K. (2004). The European Central Bank. History, Role and Functions. Frankfurt: ECB.

Sciglimpaglia, D., & Ely, D. (2002). Internet Banking: A Customer-Centric Perspective. Paper presented at the 35th International Conference on System Sciences, Hawaii.

Shaffer, S. (1985). Competition, economies of scale, and diversity of firm sizes. Applied Economics, 17, 467-476.

Siam, A. Z. (2006). Role of the Electronic Banking Services on the Profits of Jordanian Banks. American Journal of Applied Sciences, 3(9), 1999-2004.

Siriopoulos, C., & Tziogkidis, P. (2010). How do Greek banking institutions react after significant events?—A DEA approach. Omega, 38(5), 294-308.

Sivaram, Y. G. (2004). Efficient Payment Systems: Issues and Concerns. In K. N. Rao & Y. Pahuja (Eds.), IT in Banks: Emerging Markets. Panjagutta: ICFAI University Press.

Sloman, J., & Wride, A. (2009). Economics (7th ed.). Essex: Pearson Educational Limited.

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

Smith, A. D. (2006). Exploring security and comfort issues associated with online banking. International Journal of Electronic Finance, 1(1), 18-48.

Sohail, M. S., & Shanmugham, B. (2003). E-banking and customers preferences in Malaysia: An empirical investigation. Information Sciences, 150, 207-217.

Staikouras, C., Mamatzakis, E., & Koutsomanoli-Filippaki, A. (2008). An empirical investigation of operating performance in the new European banking landscape. Global Finance Journal, 19(1), 32-45.

Subramani, N., Murugesan, M., Anbalagan, D., & Ganesan, V. (2008). E-banking and E-Commerce: Emerging issues in India. India: Abhijeet publications.

Sufian, F. (2007). Trends in the efficiency of Singapore's commercial banking groups: A non-stochastic frontier DEA window analysis approach. International Journal of Productivity and Performance Management, 56(2), 99-136.

Sullivan, R. J. (2000). How has the adoption of Internet Banking affected performance and risk in banks? A look at the Internet Banking in the Tenth Federal Reserve District. Financial Industry perspectives, 1-16.

TBank. (2011). TBank Development. Retrieved June 10, 2011, from http://www.tbank.com.gr/tbank/index.php?option=com_content&view=article&id=63&Itemid=125

TBank. (2011). TBank History Retrieved June 14, 2011, from http://www.tbank.com.gr/tbank/index.php?option=com_content&view=article&id=196&Itemid=34

Thornton, J., & White, L. (2001). Customer orientations and usage of financial distribution channels. Journal of Services Marketing, 15(3), 168 - 185.

Tsionas, E. G., Lolos, S. E. G., & Christopoulos, D. K. (2003). The performance of the Greek banking system in view of the EMU: results from a non-parametric approach. Economic Modelling, 20(3), 571-592.

Vesala, J. (1995). Testing for competition in banking: behavioral evidence from Finland. Helsinki: Bank of Finland.

Wagenvoort, R., & Schure, P. (1999). The Recursive Thick Frontier Approach to Estimating Efficiency. Luxembourg: European Investment Bank.

Wan, W. W. N., Luk, C.-L., & Chow, C. W. C. (2005). Customers' adoption of banking channels in Hong Kong. International Journal of Bank Marketing, 23(3), 255-272.

Wu, D., & Wu, D. D. (2010). Performance evaluation and risk analysis of online banking service. Kybernetes 39(5), 723-734.

Yildirim, H. S., & Philippatos, G. C. (2007). Restructuring, consolidation and competition in Latin American banking markets. Journal of Banking & Finance, 31(3), 629-639.

Yiu, C., Grant, K., & Edgar, D. (2007). Factors affecting the adoption of Internet Banking in Hong Kong—implications for the banking sector. International Journal of Information Management, 27(5), 336-351.

Yuan, Y. (2006). The state of competition of the Chinese banking industry. Journal of Asian Economics, 17(3), 519-534.

Zeithaml, V. A., & Bitner, M. J. (2003). Services Marketing: Integrating Customer Focus across the Firm (3rd ed.). Boston, MA: McGraw-Hill Irwin.