THE JOURNAL OF THE KOREAN ECONOMY, Vol. 7, No. 2 (Fall 2006), 231-252

E-Finance Development in Korea*

Choong Yong Ahn ** · Doo Yong Yang***

E-finance in Korea has evolved since the late 1980s, when developments in information and telecommunication technology started to be applied to the financial industry. Since the 1990s, e-finance has led a paradigm shift in the financial industry as financial transactions in computer-based tools began increasing. There are several factors that contributed to e-finance development. This paper shows that the decision for the introduction of Internet banking depends on the profit level for the bank rather than the asset size and/or operation costs. Intuitively, large banks are early takers in providing Internet banking due to a huge amount of initial investment costs to establish an Internet banking network. At the same time, cost inefficient banks are inclined to consider the introduction of Internet banking earlier to reduce inefficiency caused by replacing cost-inefficient infrastructure. However, Korea shows an interesting case such that the asset size and operation costs were irrelevant to the establishment of Internet banking networks. On the other hand, profitability was relevant to the introduction of Internet banking. This implies that relatively profitable banks at the onset of the crisis were able to jump into e-finance earlier than non-profitable banks. Furthermore, this paper shows that the adoption of Internet banking has a positive effect on bank profit.

JEL Classification: G21, L86, C33
Keywords: e-finance development in Korea, internet banking, financial industry

---

* Received July 5, 2006. Accepted November 5, 2006.
This paper is part of a project funded by a grant from the Ford Foundation, administered by the Social Science Research Council, and managed by Catherine L. Mann, Senior Fellow, Institute for International Economics, Washington DC.

** Department of Economics, ChoongAng U31 Tw( )ai 0 Twecerminy Seoul, Korea, Tel: 82-2-820-5490, E-mail: cyahn@c

*** Correspondence for author, Research Fellow, Korea Institute for International Economic Policy, 300-4 Yomgok-dong, Seocho-gu, Seoul 137-747, Korea, Tel: 82-2-3460-1124, Fax: 82-2-3460-1212, E-mail: yangdy@kiep.go.kr

1. INTRODUCTION

As an element of e-commerce, e-finance has its own unique characteristics. On one hand, the Internet offers convenience, price transparency, broader access to information and lower costs; on the other hand, financial services are data intensive and do not generally need physical delivery of products. The combination of these two factors seems to give unique advantages that make it particularly suitable for finance. The aim of e-finance is to automate and modernize financial services through the application of information and communication technology and infrastructure. E-finance grew rapidly in Korea in the late 1990s, developing in three general phases. First, financial institutions automated their businesses through the establishment of an on-line system within their own branch offices. This process was completed in the late 1980s. Second, a network of financial institutions, through which most domestic financial institutions are integrated, was established since the early 1990s and is now in the final stages of completion. The latest development is general e-money and e-banking, which is in its early stages to date.

Among other fast growing e-finance countries, Korea has shown rapid development of e-finance in e-banking and e-brokerage in particular.[1)] This paper will examine the current development of e-financing in Korea and identify what factors make it develop faster than other countries, thus providing lessons from the Korean experience.

2. BRIEF HISTORY OF E-FINANCE DEVELOPMENT IN KOREA

E-finance in Korea has evolved since the late 1980s, when developments in information and telecommunication technology started to be applied to the financial industry. Since the 1990s, e-finance has led a paradigm shift in the financial industry as financial transactions in computer-based tools began

[1)] For cross countries' e-finance comparison, see OECD, 2001; Claessens *et al*., 2000; 2001.

increasing. In 1987, the Kookmin bank first introduced the firm banking system through the PC network, introducing individual home banking in 1991. According to the Bank of Korea, the use of PC banking increased in the second half of the 1990s. The cases of home banking, which recorded 15.7 million in 1995, jumped to 460 million in 1999. The cases of firm banking also increased from 147 million in 1995 to 1.268 billion cases in 1999.

Internet-based banking services in Korea were introduced in 1999. Before that, information on new financial products and banks was advertised through the Internet, but the utilization of Internet by commercial banks was limited. There are two reasons for the late introduction of Internet banking services in Korea. First, an Internet hacking incident in 1996 delayed the early startup of e-banking due to security issues. In September 1996, a graduate student of a prestigious university stole customer IDs from a home banking system and misused them for personal gain. This event raised concerns about security problems in establishing an e-banking network. Second, the financial sector, especially commercial banks had no room for development of e-banking because the 1997 economic crisis brought them into serious financial restructuring processes after the onset of the crisis.

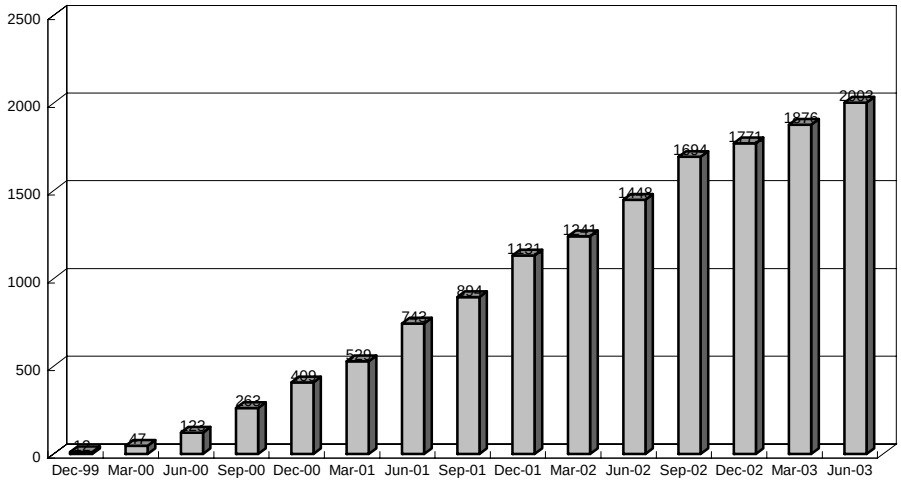
The general sentiments for Internet banking have changed in 1999. Followed by the Shinhan Bank, which was a relatively newly established bank and survivor from the financial crisis in 1997, several banks introduced Internet banking in the second half of 1999. Active Internet banking service such as fund transfers in 1999 was possible because of the establishment of "Banktown" of Korea Telecommunication Commercial Solution, which provides Internet solutions for various banking services between Internet users and commercial banks.[2)]

As of the first half of 2003, most commercial banks in Korea provided various Internet banking services to both individuals and firms, including 18 domestic commercial banks, two foreign subsidiary banks (Citibank and

[2)] Most commercial banks and non-banking financial institutions still use Banktown for money transfers instead of their own system.

Figure 1 Internet Banking Users in Korea

(Unit: 10,000 people)



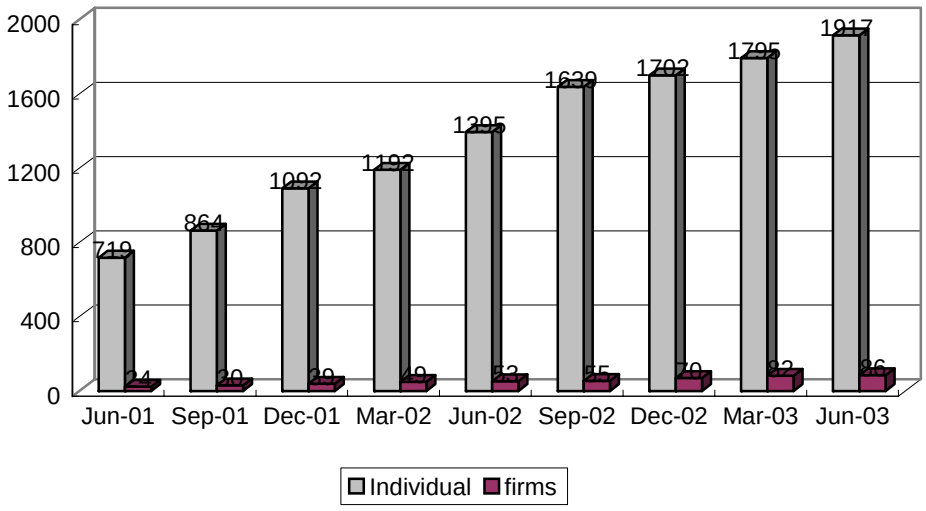
Source: Bank of Korea.

HSBC) and the postal service. Most banks lowered their fees for bank wire transfers when clients used this service through banking homepages, thus attracting many subscribers. The number of Internet banking users dramatically increased from only 120,000 in 1999 to over 20 million in the first half of 2003 according to the Bank of Korea. Among the registered Internet banking users, most of them are individuals, accounting for 99% of the total. The number of individuals using Internet banking services increased by 37% year on year, while the number of firms using these services rose 62.3% during the same time period. Banks have customized their Internet banking services for corporate accounts. In 2001, approximately 390,000 firms were using Internet banking services and in 2003, the number of companies jumped to 860,000.

Along with the increase in the registered number of users, various Internet banking services provided through the Internet have also experienced increased usage. Relatively simple transactions such as balance inquiries and fund transfers were provided through Internet banking right after the

Figure 2 Internet Banking Users by Type

(Unit: 10,000 people)

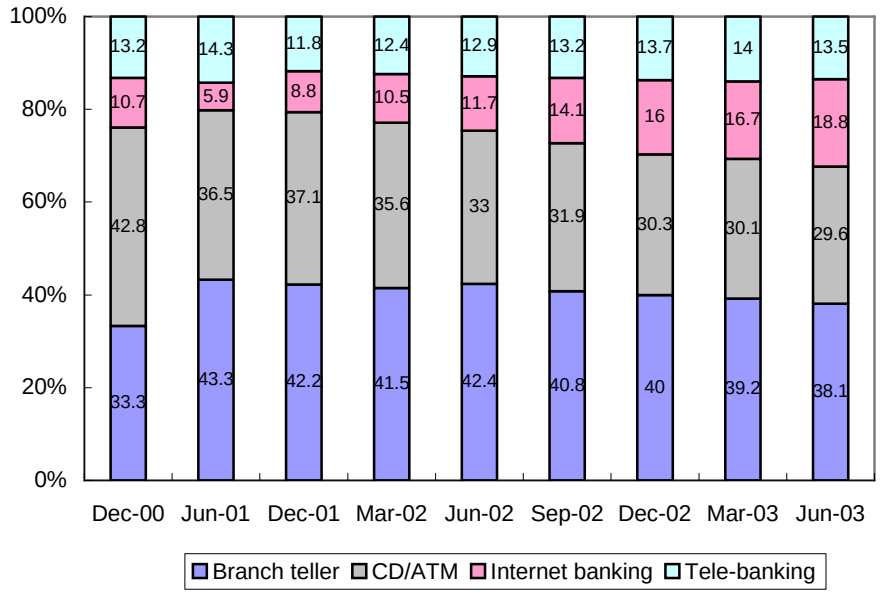


Source: Bank of Korea.

introduction of Internet banking services, but recently increases in various transactions including aggregate account service and asset management have also been seen. Among these Internet transactions, balance inquiries still dominate Internet banking services, accounting for the largest portion transactions in 2002 (85.6% of the total). Transfer of funds also accounts for 14.3% of total Internet banking services, while loan applications only accounted for 0.1% of the total Internet banking services.

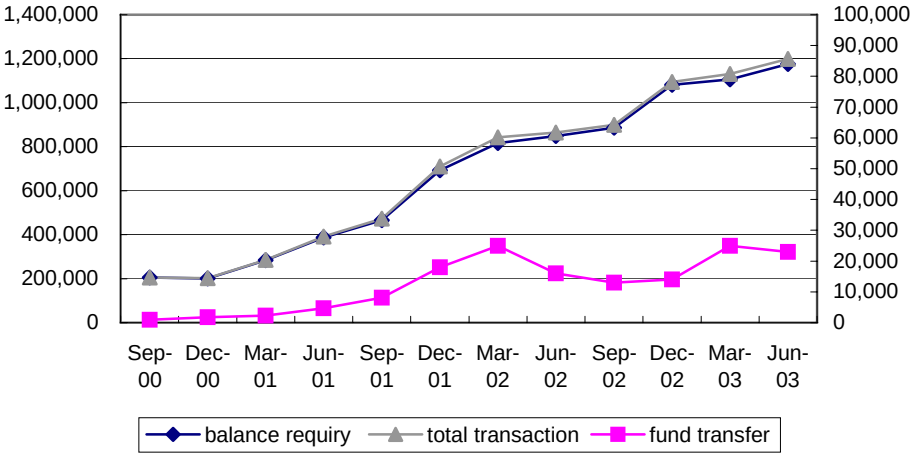
Internet banking services in 2002 accounted for 18.8% of total services for domestic banks, increasing from 11.7% in 2001 (figure 3). The number of Internet banking transactions has seen a significant increase in the past year (figure 4). However, there is a significant demographical difference between urban and rural areas. The weight of Internet banking services in total services at city banks was an average 26.5%, which is comparable with services by tellers. On the other hand, Internet banking services for regional banks recorded an average of 15%. This reflects the gap between Seoul and regional areas in term of the Internet infrastructure.

Figure 3 Banking Services Transactions



Source: Bank of Korea (2003).

Figure 4 Mobile Banking Transactions



Source: Bank of Korea (2003).

Table 1 Internet Banking Users by Age and Sex

(Unit: %)

	Age					Sex	
	20s	30s	40s	50s	Over 60s	Male	Female
2001	38.2	37.9	16.4	4.9	2.7	57.6	42.4
2002	31.6	38.9	19.4	6.6	3.6	54.7	45.3

Source: Korea National Statistical Office.

Active Internet banking users are from a relatively young generation, with 70% of total Internet banking users in their 20s and 30s (table 1). Male Internet banking users account for 54% of total Internet banking users, while female Internet banking users account for 45%.

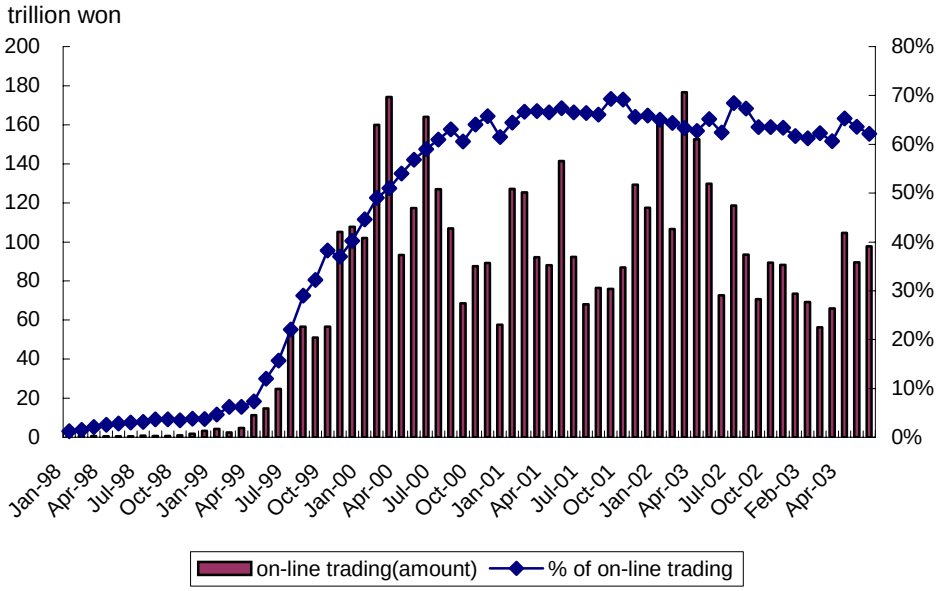
Despite the rapid development of Internet banking, mobile banking services have grown gradually since 2000. Although just 1.4 million mobile banking users were reported in 2002, the number of total mobile banking transactions has increased around six times from 200,000 in December 2000 to 1.2 million in June 2003. Most domestic banks provide mobile banking services as of today, with the exception of two foreign branch banks. The scope of mobile banking service differs for each bank, but most of them offer relatively simple banking transactions such as balance inquiries and account fund transfers. Large banks in general extended to various services including mobile account aggregation and loan inquiries. However, 98% of mobile banking transactions accounted for balance inquiries for individual clients in 2002, and the rest of them were account transfers. For loan services, only inquiries for loan redemption and loan interest payments were applicable through mobile banking. There are several factors in facilitating the mobile banking industry in Korea. First, a single standard mobile phone system was introduced in the form of CDMA and is interoperable among telecommunication businesses. Second, unlike the United States and Europe, the relationships between telecommunication companies, cellular phone manufacturers and content providers were so close that more convenient services could be provided to individual customers

from a coalition between these players. Lastly, government intervention in the telecommunication industry was so strong that a more competitive market has been developed to prevent monopolistic competition.

E-brokerage has been increasing since 1999. In August 1998, Daeshin Securities Co. first introduced a web-based brokerage system, and most securities companies provide e-brokerage trading in a flat form to their customers. Internet-only brokerage companies have also opened, including E*trade, E*mirae-asset and Kium.com. On-line trading through the Internet accounted for over 90% of e-brokerage transactions, with the rest being undertaken through wireless PDA, ARS and mobile phones.

The weight of e-trading, which recorded only 3.7% out of the total amount traded in 1998, increased to 62% as of the end of 2002. As a result, Korea's on-line trading market has become a world leader. Three important revisions of the securities law contributed to the rapid development of on-line trading in Korean stock markets. First, the restrictions on brokerage fees lifted in 1997: brokerage fees for stock trading were set at 0.5% of trading volume prior to 1997, but after liberalization, competition between securities companies brought brokerage fees down to 0.025-0.1% for on-line stock trading. Second, security companies were able to execute client orders not only through forms signed by each individual but also via telephone, FAX, and computer by revising the Securities Transaction Law in April 1997. This made non face-to-face transactions between stockbrokers and their clients possible. Third, the minimum capital requirement for the establishment of security companies was lowered from 10 billion won to 3 billion won in May 1999. Therefore, it was easier to establish security companies and competition among them increased. All of these changes to Security Transaction Laws reduced competitive advantages for existing securities companies with branch networks and large capital accumulation. Lastly, Korean stock markets have a higher volume of individual investors than institutional investors. More than 70% of Korean Stock Exchange (KSE) transactions are made by individual investors and 94% of e-brokerage trading was conducted by individual investors in 2002.

Figure 5 On-line Trading of Stocks



E-insurance has also been developed since 1997 but not as quickly as other financial services. This is mainly due to the characteristics of insurance contracts in general. First of all, insurance contracts are long-term contracts, therefore after these contracts are formed, insurance companies and clients have little need for frequent transactions. Second, due to the complexity of insurance contracts, the clients prefer face-to-face contracts through insurance agencies and brokers to non face-to-face transactions via the Internet. Reflecting these factors, only 0.5% of total insurance contracts were made through e-insurance in 2002.

3. BACKGROUND FOR DEVELOPMENT OF E-FINANCE IN KOREA

3.1. Well-Equipped Internet Infrastructure

The rapid development of e-finance in Korea was possible mainly due to the great diffusion of information and telecommunication technology since the late 1990s. As of December 2002, the number of Internet users had reached 26 million, and almost 60% of the total population over the age of six had Internet access. Moreover, the number of subscribers to high speed Internet services such as ADSL (introduced in 1998) surpassed 10 million. The Internet adoption rate among housewives, people over the age 40, manufacturing sector employees and women showed a slight increase. According to the survey by the Korea Network Information Center (KRNIC) in 2002, 91.4% of people between the age of 6 and 19 use the Internet, and 89.8% of people in their 20s had Internet access. The younger generation had the highest rate of Internet adoption, with 95.3% of all students using the Internet and 81% of all professional and management level workers using the Internet at work.[3)]

The remarkable growth in Internet use is attributable to active investment in IT infrastructure from the government and business sector, as well as the dynamic characteristics of Korean society. Since the 1980s, the government enthusiastically invested in information and communications technologies and related infrastructure, and Internet service providers have tried hard to sharpen their competitiveness in various sectors. In addition, the cultural characteristic of people enjoying gatherings and communicating with each other has resulted in the proliferation of Internet bulletin boards and cyber communities. This improved telecommunication and information environment has not only made on-line connection possible among financial institutions, but also has connected financial institutions with individuals.

[3)] Details on Internet infrastructure in Korea refer to White paper Internet 2003.

3.2. Financial Crisis and Changes in Banking Industries

Ironically, the financial crisis in 1997 contributed to the expansion of e-finance in Korea. As mentioned earlier, commercial banks had no room for adopting e-finance after the onset of the crisis because of the requirements of establishing e-finance. Korea's financial restructuring started with the closure or suspension of non-viable financial institutions. Authorities closed or suspended the operation of a number of non-viable financial institutions, substantially decreasing the number of institutions from 2,101 at the end of 1997 to 1,522 at the end of 2001. Of the 27 commercial banks, 14 'unsound' banks that did not satisfy the BIS ratio requirement of eight percent at the end of 1997 were classified into three categories. Five small banks were 'disapproved' and seven banks were 'conditionally approved.' The five 'disapproved' banks were liquidated through purchases and acquisitions in July 1998. The seven 'conditionally approved' viable banks took corrective actions imposed by the FSC. Two large banks (Korea First Bank and Seoul Bank) that were insolvent were nationalized and sold to foreign investors. After bank restructuring was in place, the FSC dictated similar restructuring for non-bank financial institutions. The first targets were the merchant banks, which accounted for a large concentration of credit risk, for the troubled *chaebols* and their affiliates. Out of 30 merchant banks at the end of 1997, only three remained by the end of 2001. The others were closed, merged with commercial banks or nationalized and consolidated. The targets of the next step were the smaller institutions such as smaller depository institutions, mutual savings and financial companies, and credit unions. Insurance companies, especially life insurance companies, revealed severe financial stress since a large portion of their assets were invested in commercial lending. In 1998, 18 troubled life insurance companies out of 33 were requested to submit rehabilitation plans. At the end of 2001, seven of those 18 companies were closed and five were merged. Disposal of non-performing loans and recapitalization was also an important part of the financial sector restructuring. As of the end of 2002, a total of 156 trillion won of public funds, or 28% of the

Table 2 Consolidation of Non-viable Financial Institutions

	No. of Inst. in 1997	1998			2000			2001			No. of Inst. in 2001
		Exit	Merger	New	Exit	Merger	New	Exit	Merger	New	
Banks	33	5	3	-	-	1	-	-	2	-	20
Merchant banks	30	16	-	-	1	-	1	4	3	-	3
Securities co.	36	6	-	1	-	1	12	-	-	3	46
Investment trust co.	31	6	-	-	-	-	3	-	-	3	30
Life insurance	31	4	-	-	1	5	-	2	-	-	19
Non-life insurance	14	-	1	-	-	-	-	-	-	1	14
Mutual savings & finance co.	231	22	2	4	28	13	2	23	1	-	122
Credit unions	1,666	69	14	9	83	42	-	48	1	-	1.268
Total	2,072	128	20	14	113	62	18	77	7	7	1,522

Source: Ministry of Finance and Economy (2002).

Table 3 Injection of Public Funds

(Unit: trillion won)

	Recapitali-zation	Contribution	Deposit payment	Asset purchase	NPLs purchase	Total
Banks	33.9	13.6	-	14	24.5	86.0
Non-banks	26.3	2.3	26.1	0.9	11.9	68.0
Foreign financial institutions	-	-	-	-	2.3	2.3
Total	60.2	16.4	26.1	14.9	37.8	156.3

Source: Ministry of Finance and Economy.

2001 GDP, had been injected towards financial restructuring; more than half of this amount was injected into banks (table 3).

In the course of financial restructuring, commercial banks looked for new financial products and niche markets in order to increase their profitability and efficiency. In 1999, some commercial banks equipped with new capital found an opportunity in Internet banking services. This was partly inevitable so that commercial banks should change their main customers from corporations to individuals. Before the crisis, most banks were concentrated on wholesale banking since corporate financing was convenient, stable and profitable to a lack of large corporate bankruptcy. However, large bankruptcies and non-performing loans after the crisis prompted commercial banks to move away from the corporation sector to the retail banking area. It was also consistent for them to do so in diversifying their asset and liability risks.

These major changes in the banking sector after the crisis resulted in major commercial banks actively participating in Internet banking. As there were few differences in franchise value between commercial banks before the crisis, each commercial bank competed to show off their products for the retail banking sector. Internet banking services were a good medium for this purpose.

3.3. Government Initiatives for Facilitating E-Transactions

Korea began building e-government in 1998 to increase its national competitiveness. The government enacted the “Act on the Promotion of Digitalization of Administrative Work to Actualize Electronic Government” (or the e-Government Act) to build an e-government using Korea’s ultra-high-speed information and communications infrastructure, which is one of the top infrastructures in the world. The government also created the Special Committee on e-Government as an advisory presidential committee to select and implement 11 core tasks. Korea’s e-government project, first of all aims to build a safe and reliable infrastructure for information and

communications. Upon that foundation, the ultimate objective is to build a government with high productivity and transparency (G2G; Government-to-Government) by building an Internet-based e-government portal that offers the best services to citizens (G2C; Government-to-Citizens) and the best environment for businesses (G2B; Government-to-Business). Specifically, in order to reform public service delivery (G2C and G2B), the government has been pushing for a unified service system for key civil applications (G4C; Government for Citizens), integrating the information systems of the four major social insurance programs, and building a comprehensive electronic government procurement system (G2B). For administration within the government (G2G), information systems have been built for core government functions sensitive to efficiency and productivity, which then became the basis for building unified information systems for the fields of public finance, human resources and education. Furthermore, the effort to build an information infrastructure included projects on electronic approval and circulation of documents, electronic certification and permits, and planning innovations in the pan-governmental computing environment. In addition, active work is being done on informatizing the business of individual departments, such as patents, tariffs, taxes, financial settlements and conscription administration. Among the 11 e-government initiatives, several projects are directly and indirectly related to the facilitation of e-finance.

The first project is the civil application service (G4C). This project aims to provide information on procedures for civil applications and on-line application service for major civil applications through a single window (portal). In addition, by having ministries share information related to key civil applications, the project eliminated the inconvenience to individuals of having to personally deliver documents to government administrative agencies. Second, the Home Tax Service (HTS) through the Internet allows taxpayers to file tax returns, receive e-bills, and process notices, and payment from home or the office via the Internet without having to visit the tax office or a financial institution. Third, a comprehensive national electronic

procurement (G2B) system was constructed. All national procurement procedures can now be processed online, and a supplier may now participate in all public agency bids by registering only once at the G2B portal site. Fourth, the information systems of the four major social insurance programs were linked. Information resources for the four social insurance programs – national pension, national medical insurance, unemployment insurance and workmen's compensation insurance – were integrated to allow a petitioner to subscribe to or cancel a policy by visiting a Web site or a branch office of any one of these four insurance programs.

Even though the major goal for the establishment of e-government is to provide the most effective public-centered system to meet the needs of individuals and private businesses and produce high quality prompt government services, all of these initiatives for e-government contributed to the development of e-finance in Korea by providing more accredited on-line transactions through government for the private sector.

3.4. Security Issues for E-Finance

For secure e-finance transactions, the Korean government has made the use of certificate of authentication as part of its policy for countering financial fraud by encouraging more people to use authentication codes. For this purpose, the Digital Signature Act was enacted in 2002 to establish and enforce a public certification infrastructure. An accredited e-signature is confirmed of its authenticity by a licensed certification authority. In 2002, the first certification authority – Korean Information Certification Authority (KICA) – was established, and currently there are six accredited agencies.

In the Internet banking sector, a certificate authentication is widely used to verify transactions. As of September 2002, only certificates from licensed certification authorities (LCA) were valid for Internet banking transactions. Certificates from LCA became mandatory in January 2003 for all brokerage firms when the security trading is made through an electric network. The establishment of the e-government in November 2002 also helped the spread

of certification authentication among Internet users because e-government services cannot be accessed without an authentication code.

4. EVALUATION OF E-FINANCE DEVELOPMENT IN KOREA

To evaluate e-finance in Korea, we estimate how much greatly the introduction of e-finance affected the banking industry based on individual bank-level data.[4] The firm-level data used in this analysis comes from the National Information and Credit Evaluation, Inc (NICE), including information on balance sheets, income and cash flows and related bank data coded by NICE. To cover both the pre-crisis and post-crisis periods, an eight-year (1995 to 2002) panel data set of indicators was constructed. Only listed banks were covered in this analysis, as bank data before 2000 does not encompass unlisted banks.

First, to analyze the factors that contribute to the introduction of Internet banking, we utilize the multivariate logit model.

$$y_{it}^{*} = x_{it}' \beta + u_{it}, \tag{1}$$

$$y_{it} = \begin{cases} 1 \ \textit{if a bank provides Internet bank to individual clients} \\ 0 \ \textit{if not} \end{cases}$$

where x_{it} is a vector of independent variables, including asset size, operating cost and profit before corporate tax, or Return on Asset (ROA). Since all the independent variables show unit-root in level, we take logarithm difference form rather than level data.[5] Furthermore, in order to identify

[4] Kim and Park (2002) analyze the structural changes on banking sector due to adoption of Internet banking since 2000 based on bank-level data.

[5] We do not report the unit root test result for individual variables, but we can provide the test

the effects of the crisis and the development of high speed internet environment on the Internet banking, we include the crisis dummy and ADSL dummy in the regression. It is assumed that the error term *u* is logistically distributed with a mean of zero and a constant variance across time such that

$$\Pr(y_i = 1 \mid x_{i,}\beta) = \frac{e^{x_i'\beta}}{1+e^{x_i'\beta}}.$$

We pool the data without considering time-series characteristics. Therefore, the regression is cross-sectional analysis. The regression results of the logit estimation of equation (1) are reported in table 4. The sign of estimated coefficients are reasonably well fitted. The coefficient of asset size, operation cost and profit are all positive values. However, the coefficients of log difference asset and cost are statistically insignificant. The estimation of equation (1) shows that the decision for the introduction of Internet banking depends on the profitability for the bank rather than the asset size and/or operation costs.[6] Intuitively, large banks are early takers in providing Internet banking due to a huge amount of initial investment costs to establish an Internet banking network. At the same time, cost inefficient banks are inclined to consider the introduction of Internet banking earlier to reduce inefficiency caused by replacing cost-inefficient infrastructure. However, Korea shows an interesting case such that the asset size and operation costs were irrelevant to the establishment of Internet banking networks. On the other hand, profitability was relevant to the introduction of Internet banking. This may implies that relatively profitable banks at the onset of the crisis were able to jump into e-finance earlier than non-profitable banks in order to differentiate the bank's operation line. In addition, Internet banking was not characterized by heavy investment from

Table 4 Logit Estimation Result of Equation (1)

results if requested. Return on Asset (ROA) also shows non-stationarity, but we use level difference.

[6] The estimated coefficients of profit and ROA are positive value and statistically significant.

	(1)	(2)	(3)	(4)
Constant	–1.02** (0.31)	–1.05** (0.33)	–1.62** (0.50)	–0.78** (0.34)
Asset Size	6.06 (3.78)	5.60 (3.73)	8.27 (7.42)	4.77 (3.75)
Operation Cost	0.33 (0.42)	0.42 (0.42)	0.24 (0.40)	1.26 (0.81)
Profit	0.05* (0.02)	–	0.02* (0.01)	0.06** (0.03)
ROA	–	0.23* (0.12)	–	–
Crisis	–	–	1.01* (0.64)	–
ADSL	–	–	–	–1.97 (1.31)
R-squared	0.08	0.08	0.11	0.10

Notes: All variable are transferred to logarithm difference form. Parentheses are standard errors. * and ** indicate statistical significant at 10% level and 5% level respectively .

banks due to the existence of the common Banktown network, which can reduce the individual banks' initial investment cost. In addition, we estimate the effect of the financial crisis and the introduction of high speed internet infrastructure on the introduction of Internet banking in Korea in equation (1). According to the estimation, the crisis has affected the introduction of Internet banking, but the introduction of the ADSL did not contribute to the development of Internet banking.

To analyze the effects of the introduction of Internet Banking on profit, we estimate the panel structure of the data set as follows

$$y_{it} = c_{it} + \beta_i' x_{it} + \varepsilon_{it}, \qquad (2)$$

Table 5 Panel Estimation (Fixed Effects) of Equation (2)

Dependent variable / Independent variable	Profit		ROA	
Asset size	−8.49 (8.15)	−2.15 (6.80)	4.46 (3.01)	5.71* (3.30)
Cost	–4.11** (1.64)	–4.28** (1.65)	–1.21 (0.35)	–1.27** (0.34)
Internet	5.44** (2.15)	5.18** (2.27)	0.78 (0.27)	0.54* (0.27)
R-squared	0.16	0.15	0.19	0.21

Note: All variable are transferred to logarithm difference form. Parentheses are standard errors. * and ** indicate statistical significant at 5% level and 10% level respectively .

for *i* cross-section unit and period *t.* It is assumed that the constant coefficient *c* is different for each pool member, that is, $c_{it} = c_i$ and $E(c_i \varepsilon_{it}) = 0.$ Therefore, this is the fixed effects panel estimation. We believe that the fixed effects model is a reasonable approach since the differences between individual banks are well represented in the model specification. Dependent variable *y* is log difference of profit for each bank, and independent variables *x* consist of log difference of asset, log difference of cost and dummy variable *I* for Internet-banking.

The estimation results are reported in table 5. The estimation of equation (2) shows that the adoption of Internet banking has a positive effect on bank profit by indicating that the coefficient of dummy variable of Internet banking has a positive value and is statistically significant. For developed countries cases, previous research concludes that the introduction of Internet-banking does not affect the bank's profitability since the initial investment on Internet-banking is too huge to generate profits in an early stage (Frust, Lang, and Nolle, 2002). Thus, it is quite unusual that introduction of Internet Banking has influenced the bank's profitability in Korea. However, this result should be carefully interpreted since it is not clear whether introduction of Internet banking contributed to higher profitability for commercial banks.

On the contrary, it seems that only banks that are relatively profitable introduce Internet banking in advance.

5. CONCLUSION

Korea has witnessed rapid development in e-finance in the last five years. There are several factors that contributed to e-finance development. Korea possesses the basic requisite conditions to foster thriving e-finance, including an advanced IT infrastructure, several government e-commerce initiatives and financial restructuring resulting from the financial crisis. In fact, all of these factors have eliminated possible impediments to the development of e-finance in developing countries.[7] An adequate level of infrastructure is extremely important for the adoption of e-finance by market participants. Fortunately, Korea has developed a high-speed Internet network for the last five years, and due to the rapid diffusion of IT technology, secure e-transactions have been possible for market participants. In addition, e-finance development in Korea was the result of cooperative efforts between the private and public sectors. The government has been a key player in e-transactions. In addition, for transaction security, the government has introduced the use of certificate authentication as part of its policy for countering financial fraud, encouraging more people to using this authentication code. More importantly, competition in the financial sector is an important factor for e-finance development. Since the crisis resulted in financial restructuring in Korea, previous monopolistic competition has been broken. As a result, competition between commercial banks has increased, inducing commercial banks to look for new financial products and niche markets in order to increase their profitability and efficiency.

Despite recent developments, e-finance in Korea has many opportunities to advance. E-transactions or e-payments make up the main business of

[7] Impediments to development of e-finance in developing countries discuss in Sato and Hawkins (2001) and Hadidi (2003).

Internet-banking, and e-brokerage for individuals has dominated e-securities business. As yet, there is no Internet-only banking in Korea, but the financial industry has already adopted e-finance as its main business. The commercial banks have focused more on private banking and asset management rather than traditional banking business such as money transferrals and inquiries. Securities companies have moved away from traditional brokerage business to underwriting and fund business due to the lower commission on brokerage. Judging from this, e-finance in Korea should contribute more to building efficient and effective resource allocation in the future.

REFERENCES

Bank of Korea, *Recent Survey for Internet Banking Service in Korea*, press release (in Korean), 2000.

_____, *Recent Survey for Internet Banking Service in Korea*, press release (in Korean), 2001.

_____, *Recent Survey for Internet Banking Service in Korea*, press release (in Korean), 2003.

Claessens, Stijin, Thomas Glaessner, and Daniela Kingebiel, "Electric Finance: Reshaping the Financial Landscape Around the World," Financial Sector Discussion Paper No. 4, World Bank, 2000.

_____, "E-finance in Emerging Markets: Is Leapfrogging Possible?," Financial Sector Discussion Paper No. 7, World Bank, 2001.

Frust, Karen, William Lang, and Daniel Nolle, "Internet Banking: Development and Prospects," Center for Information Policy Research, Harvard University, 2002.

Hadidi, Rassule, "The Status of E-finance in Developing Countries,"

UNCTAD 2002 Report, 2003.

Kim, Hyun Ook and Changkyun Park, “Research on Structural Changes for Financial Industry from Diffusion of Internet Banking in Korea,” Korea Development Institute, Policy papers 2002-3 (in Korean), 2002.

OECD, Electronic Finance: Economics and Institutional Factors, DAFFE/AS/WD, 27, 2001.

Sato, Setsuya and John Hawkins, “Electronic Finance: An Overview of the Issues,” BIS Papers No. 7, Electronic Finance: a New perspective and Challenges, 2001.

White Paper Internet Korea, National Computerization Agency and Ministry of Information and Communication, 2003.