Banking Structure and Governance:

Changes in Regulation and Technology

by

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To my family

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Declaration

An earlier version of Chapter 2 of this thesis was presented at the VIth Spring Meeting of Young Economists (SMYE) – Copenhagen 2001, the 28th European Association for Research in Industrial Economics (EARIE) – Dublin 2001, and the 5th European Network on Industrial Policy (EUNIP) – Vienna 2001. An earlier version of Chapter 3 appeared as a working paper in the Warwick Economic Research Paper Series (No. 664); it was also presented at the 29th European Association for Research in Industrial Economics (EARIE) – Madrid (2002), the 6th European Network on Industrial Policy (EUNIP) – Turku (2002), the 1st International Conference on E-Banking and Global Marketplace (ICeBG) – Mons (2003), and the International Industrial Organization Conference (IIOC) – Chicago (2004), and the Royal Economic Society Annual Conference (RES) – Coventry (2003); it also appeared in their working paper series (No. 41). A version of Chapter 4 was presented at the International Industrial Organization Conference (IIOC) – Boston (2003), and the Econometric Society Far Eastern Meeting – Seoul (2004); it also appeared in their working paper series (No. 734).

Summary

This thesis is concerned with the banking structure and its governance when the industrial policy and the banking technology change over time. The first part of the thesis briefly reviews the East Asian banking structure and its changes during the industrialisation. In chapter 2, we investigate the impact of industrial policy on banking behaviour and on the overall banking structure. We argue that the transition from a price-cap regulation (*interest rate control*) to a rate-of-return regulation (*ROA and/or BIS ratio*) induces a more concentrated banking structure as banking behaviour shifts from revenue maximising to profit maximising. Empirical evidence from Japan and Korea supports the argument.

In chapter 3, we examine the behaviour of banks and customers when a new banking technology is introduced. The determinants of consumer adoption of internet banking are identified using survey data from Korea. Empirical issues of banking technology concerning customer inertia, risk aversion and pre-emption are assessed. Duration analysis finds no evidence of first mover advantage in internet banking, whilst the largest bank in commercial banking is dominant in internet banking.

In chapter 4, we introduce 'collective relationship banking' as a new concept of banking to link the real and the banking sector structures. We analyse the choice between collective relationship banking and independent banking in addition to the switching between the two banking relationships using a case study. Changes in the corporate ownership structure appear to influence the banking relationship as well as its switching. Chapter 5 contains policy discussions, and some concluding remarks.

Chapter 1

Introduction

1.1 A Brief Review of the East Asian Banking

The East Asian banking structure during the last decade has undergone a noticeable change moving towards a substantial consolidation. Japanese and Korean banks in particular, have made a critical shift in their banking regulation and policy, by relaxing many of the previously regulated areas in the banking business such as control over interest rates on loans and deposits, branching restrictions, and cross-financial sector. It was commonly believed that these regulations are necessary for those emerging market countries so that their industrial sectors (*non-financial*) can benefit from relatively stable financial markets and achieve more favourable overall economic growth.

However, these regulations may become unsustainable when states try to meet international regulatory standards in order to enter world economic and/or trade organisations. For example, Japan and Korea [1] underwent significant structural changes under external pressure from other member countries of the G7 (*Group of*

[1] Throughout the thesis, Korea refers to South Korea, i.e. Republic of Korea (ROK).

Seven) and the OECD (*Organisation for Economic Co-operation and Development*) which promoted the ideology of a free market economy. Deregulation in banking, whether a response to external pressure or a purely domestic response, seems to coincide with the financial crises in Japan and Korea. Hence, research on financial crises has often focused on regulatory changes, which may potentially protect countries from such financial crises in the future. However, the flaw in such research is arguably in the generalisation of financial crises since each financial crisis appears to have arisen for different reasons. For example, the 1995 Mexican crisis was largely due to its unsustainable currency peg whilst, the Korean crisis[2] was mainly caused by the speculative debt financing behaviour in the corporate sector. Therefore, it is essential to investigate the evolution of the banking structure in each country instead of analysing banking and financial crises as a single global phenomenon. Much research has attempted to explain how a financial and/or banking crises can come about and how they can be avoided by changing and/or raising regulatory standards.[3] However, most of this approach overlooked the importance of industrial policy in East Asia to its banking sector development.

Japan and Korea led the economic growth in East Asia and provided examples for neighbouring Asian countries. Moreover, the two countries do have similarities in their industrial structure as well as financial sector structure. In contrast to the existing research on banking crises, this thesis analyses the role of

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[2] Referring to the Korean financial crisis in the wave of Asian financial crisis in 1997.
[3] The Bank for International Settlements (BIS) has set a guideline of higher level of sound asset ratio, so called Asset Adequacy Ratio or also known as BIS ratio.

Japanese and Korean banks in the industrialisation process and the economic developments. As Castley (1997) and Cho (1994) have pointed out, the banking system in Japan and Korea has operated as the financing arm of the industrialisation policy and thanks to the stability of the financial sector, Korea and Japan enjoyed unprecedented economic success in the post war period.[4] They also emphasised the close relationship between Korea and Japan throughout the industrialisation. However, Castley (1997) and Cho (1994) do not investigate empirically how Government industrial policy had an influence over the banking activities via various types of regulation[5] in order to maintain the financial stability and to promote economic growth.

The traditional literature of banking summarises the characteristics of banking activity as follows. A first function of banking activity is *intermediation* between depositors and borrowers that reduces transaction costs by diversifying risks (Gurley and Shaw, 1960). Second, banks provide financial *transformation* of short-term deposits into long-term loans.[6] Finally, banks also provide *delegated monitoring* more efficiently with scale economies in monitoring and expertise in investment appraisal (Diamond, 1984). However, in East Asia, banks perform a further function, namely *implementation of industrial policy*.

Irrespective of whether Japan and Korea have met international guidelines and standards in banking and finance, one must note that the East Asian economy

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[4] Japan after the World War II (WWII) and Korea after the Korean War.
[5] For example, interest rate control, branching restrictions, cross-financial sector entry regulation, etc.
[6] Diamond and Dybvig (1983) explains the liquidity crunchy when early withdrawal of short-term deposits faces a long-term outstanding loans.

developed quickly due to their idiosyncratic structure of conglomerates tied together with the banking sector. In these countries, the conglomerates, so-called Keiretsus in Japan and Chaebols in Korea, are the results of Government-led industrial policies, where the banking sector has operated as a financing arm throughout the industrialisation process.[7] For instance, the Japanese Keiretsu system allows its own group bank (*Keiretsu bank*) within the Keiretsu network to secure its finance. On the other hand, the Korean Chaebols establish a long-term banking relationship with a particular bank in the absence of the Japanese style group owned banks. These Keiretsu banks and long-term relationship banks in Korea offer preferential rates against their policy loans to the respective Keiretsu and Chaebol customers.

It is therefore essential to investigate changes in banking structure and regulation in relation to real sector developments driven by industrial policy. The next section reviews changes in banking structure and introduces recent developments in regulation and technology in Japan and Korea with respect to their industrial policy.

1.2 Overview of Changes in Banking Structure

In light of a series of recent banking and financial crises globally, there has been a proliferation of research on financial crises and banking regulation. However, as previously mentioned, whilst existing research focuses on how to regulate the

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[7] Keiretsus and Chaebols are a network of subsidiary companies with a large holding company at the centre of the network tied by cross-ownership. Large conglomerates in Japan and Korea are used interchangeably for Keiretsu and Chaebols in some literature.

financial sector with exogenous measures, there have been few studies of why such regulatory measures were not initially implemented in some countries in the context of banking evolution and structure.

Therefore, this thesis makes a departure from the common practice of linking financial crises and banking regulation. Instead, it aims to bridge the gap between banking structure and several other factors beyond regulation. There are several reasons why one should care about the banking structure. Firstly, financial and banking crises are themselves costly. Secondly, since one of the attributes of banking activities is intermediation, these crises have spill-over effects on the real sector as well as on a macro level economy. Finally, regulation is costly both *ex ante* and *ex post*. One should therefore thoroughly investigate the past and current banking structure before identifying the future structure that regulation tries to achieve. Hence, the main purpose of the thesis is concerned with identifying determinants of banking structure in East Asia. In particular, the factors influencing changes in banking structure beyond conventional regulatory consideration.

It is necessary to look at the evolution of the banking structure in East Asia in order to identify where the banking structure originated from and where it stands at present before going on to think about where it should be in the future. In the aftermath of the recent financial crises in Asia, there were debates over structural changes in the financial sector and/or in the real sector (*non-financial*) but these proceeded as two separate discussions.[8] Although the importance of restructuring of

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[8] The Financial Supervisory Service was established in Korea after the financial crises in 1997 to supervise the restructuring of the financial sector and its regulation.

both the financial and non-financial sectors was often addressed during this period, no one attempted to link these two sectors for restructuring, in particular in evolutionary perspectives. Although the banking structure in East Asia adopted a more concentrated structure following the recent crisis, the banking concentration in the region has followed a non-monotonic path over time. When investigating the non-monotonic evolution of banking concentration, it should be noted that there has always been Governmental interest in 'industrial policy' behind the evolution of banking structure by allowing certain interest rate regulation, together with the guidance on policy loans for strategic industries.[9] In addition, some of the East Asian banks were initially created as special banks to finance certain industries or business aspects and were later transformed to commercial banks.

Secondly, proposals of banking regulation have considered regulation as the only way to return an ailing banking system to normal. However, it was not only the East Asian banking, but also the global banking sector including those in Europe and the US, that have experienced periods of 'regulation and deregulation'. Balance between regulation and deregulation in different areas of banking seems to be more desirable than trying to come up with a comprehensive regulation package. Moreover, banking regulation and/or deregulation needs to take into account different types of regulation and deregulation.

Thirdly, another important factor affecting the modern banking system is the evolution of banking technology. The banking system has benefited from a series of

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[9] We will discuss 'strategic industries' together with 'industrial policy' more carefully in chapter 2.

technological advances such as telephones, mobile phones and computers. These new technologies offered new channels of communication in banking namely automated teller machines (ATMs), phone banking, mobile banking and internet banking. Given the tech-savvy culture in Asia, the banking system and structure have progressed to the new generation of 'internet banking (IB)' rather quickly compared to the rest of the world. In addition, one should note that this new way of banking has been readily adopted by both banks and customers in Korea.[10] Although this new way of banking has received a lot of public attention, there has been little research conducted into why the banking industry is adopting new technologies and why the customer adoption of a new banking technology is faster in certain countries. The notion of consumer adoption of a new technology also allows us to study banking structure, as we look at the customer side adoption as well as bank side adoption. Investigating the intermediation between banks and customers via a new technology, the internet, leads us to another important issue of banking, namely relationship banking as our next consideration and final one in the thesis.

The final consideration of the thesis is concerned with the banking relationship between the real sector and the financial sector. It is a well-known fact that banks and their customers engage in a long-term relationship and existing research has tried to explain why we observe relationship banking. However, what we observe as the banking relationship in East Asia is not always a one-on-one relationship given the peculiar structure of Keiretsus and Chaebols. For example,

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[10] The Bank of Korea (BOK) press release (27 Jan. 2005) on 'Domestic Use of Internet Banking Services as of 31 Dec. 2004' indicates 24.3 million registered internet banking users in Korea.

some companies that belong to a single Keiretsu or Chaebol network, sometimes establish banking relationship with an identical bank collectively (*Collective Relationship Banking*) whilst others in the network choose to deal with other banks independently (*Independent Banking*). Moreover, in some cases, these banking relationships change over time from 'Collective Relationship Banking (*CRB*)' to 'Independent Banking (*INDB*)' or *vice versa*. Therefore, one should not consider relationship banking as just a one-dimensional relationship as it appears to be affected by the changes in the real sector structure via cross-ownership between holding companies and their subsidiaries through either collective relationship banking or independent banking.

1.3 Overview of the Thesis

The main purpose of this thesis is to challenge the existing research on banking structure and regulation and to suggest some new angles to investigate the banking structure and its evolution. The thesis tries to broaden the scope of study in banking structure and regulation by introducing other relevant issues such as industrial policy, banking technology, and relationship banking with the real sector.

The main body of the thesis starts in Chapter 2 with a review of the history of East Asian banking which provides detailed accounts of facts and events for banking in Japan and Korea. In doing so, it becomes obvious that it is necessary to link the industrial policy in these two countries with the development of the banking system as they appear to evolve together. More importantly the industrial policy in both

countries had control over the banking system in order to accelerate economic growth. Both Japan and Korea experienced successful economic growth after the World War II and the Korean War as these countries were brought back from complete destruction to emerge as industrialised countries. One could argue that the key to this success was a centrally-led and well-thought out industrial policy. However, the review of their banking histories shows that the industrial policy could not have materialised without the appropriate banking system and its regulation.

There have been several types of regulation in the East Asian banking for the purpose of industrial policy set by the Government but the most notable ones were: 1/ regulation on interest rates (*price-cap regulation*) to keep loan rates under control at a reasonably low and affordable level for industrial sector, and 2/ a relaxed policy towards non-performing loans if the loans were engaged in the strategic industries according to the overall industrial policy. However, these regulations have been gradually relaxed due to external pressure or simply because the banking industry has become mature enough to make its own strategic decisions on rates and provisions instead of abiding the rules set in favour of industrial development.

In order to investigate the impact of these changes in regulation and/or deregulation and the banking behaviour towards non-performing loans and their provisions, this thesis develops a simple banking competition model that shares some key features with the spatial competition model developed by Chiappori et al. (1995): for example we assume monopolistic competition in banking and a uniform distribution of customers across the market. The model developed in chapter 2 departs from their model by taking non-performing loans and their loss provisions

into consideration. This simple model is developed to investigate how changes in regulation in reference to non-performing loans (NPLs) affect the banking structure and to explain how policy behind the loss provision of NPLs and regulation on interest rates influence banks' behaviour and therefore, the banking structure.

For the consideration of NPLs, the objective function of a bank includes a direct loss of interest on NPLs and an indirect loss from loan loss provisions. The equilibrium number of banks in the market has a negative relationship with the size of NPLs. Large NPLs reduce the size of profits given the direct and indirect loss functions and create fewer incentives for a new bank to enter the market. In addition, more mergers or exits are encouraged for banks to cover their provisions on NPLs. Therefore, the market structure becomes more concentrated with larger NPLs. Similarly, market concentration increases with the degree of loss provisions on NPLs. In other words, stricter regulation on loan provisions creates a more concentrated market. However, it is difficult to pin down whether a general tightening of regulation on NPLs would eventually reduce the overall size of NPLs as banks become reluctant to offer loans to risky projects.

In order to investigate the impact of industrial policy, banking behaviour is divided into two types: 1/ whereby banks simply act as a financing arm for the economic development under a price-cap regulation (*deposit/loan rate control*) and hence they are revenue maximising under the guided interest margins, and 2/ banks are profit maximising under a rate-of-return regulation (*ROA and/or BIS ratio guideline*). One must note that the East Asian banking sector has made a transition from a price-cap regulation to a rate-of-return regulation. The relative dominance of

the two types of banking behaviour, revenue maximising versus profit maximising, is influenced by industrial policy via preferential rates on strategic policy loans and their loss provisions. Shifting the weight from revenue maximising behaviour under a price-cap regulation to profit maximising behaviour under rate-of-return regulation shows reduction in the equilibrium number of banks.

An empirical analysis of Japanese and Korean banking is conducted to investigate market structure with respect to banking behaviour and deregulation. The econometric model is based on Bain's (1951) SCP (*Structure-Conduct-Performance*) paradigm and a set of variables for *Structure* (concentration), *Conduct* (branching and pricing) and *Performance* (profitability) were chosen. Three dummy variables were used to capture the effect of various types of deregulation. The empirical results not only reaffirm what the simple banking competition model has suggested, but also explains further important aspects of banking in East Asia such as the evolution of banking during the economic boom, competition in branching network, and differences in banking structure between nationwide banks and regional banks.

So far in our analysis, our main focus has been on the behaviour of banks although behaviour of banks and customers are mutually affected in any circumstances given the role of banks as intermediaries. As Waterson (2003) points out the importance of consumer behaviour in competition policy, in chapter 3, the focus is shifted towards consumers (*banks' customers*) in the event of an introduction of a new technology (*internet banking*). The chapter examines the relationship between banks and customers. It is natural for financial intermediaries including banks to improve their production (*process*) technology by focusing on their

distribution network. In this context, banking technology has come a long way from over-the-counter tellers (OTC) to internet banking (IB). However, research on banking technology has been relatively neglected and research on internet banking appears almost non-existent. Most common reasons for concentrated market structures in technology intensive industries (Farrell and Saloner, 1986; Sutton, 1998) are network effects and standardisation and the banking sector seems to follow the same route with adoption of modern technology.

As we shift our focus from the perspective of banks to the perspective of customers, an online customer survey was conducted for the residents in Korea. The determinants of consumer adoption of internet banking are characterised using the survey data in both static and dynamic framework based on duration analysis of the panel data.[11]

The empirical results show that sex, age, marital status, and degree of exposure to internet banking as well as the characteristics of the banks they deal with influence adoption of internet banking. Some of the findings show that middle age males are more likely to adopt internet banking ahead of tech-savvy teens and twenties. Banking activities become more complex as people get older and it creates more need for internet banking to middle age males. This has an even more crucial implication in a dynamic framework as Koreans tend to imitate the norm set by their family leaders namely middle age fathers and hence motivates a faster diffusion of internet banking.

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[11] Duration analysis and survival analysis are often used interchangeably in the literature.

Additionally, this thesis assesses empirical issues of banking technology concerning customer inertia, risk aversion and pre-emption in order to explain why the adoption of internet banking by Koreans has been noticeably faster than by anyone else. One important point to make in this context is that there has been a nationwide technology policy set by the Government, which explicitly encouraged the general public to adopt e-culture in a network society, which outweighed customer inertia and risk aversion. The Korean Government has undertaken large-scale investments to wire the entire country into a single high-speed cable network to provide an ultimate e-society.[12] In the wake of e-culture and e-society promotion, a consortium of banks together with the Korea Telecom (KT)[13] has made collective efforts to develop internet banking software and has been providing its technological service to all banks and financial institutions in Korea. As concerns over internet-associated risks increase, some banks have decided to further develop their own internet banking software but it is important that the initiative was taken centrally and collectively at the beginning.

Finally, in order to test the structural change in banking with the introduction of internet banking, we have included first mover and market leader (the largest bank) dummy variables in the duration model. However, the results show no evidence of first mover advantage (*order effects*) in internet banking whilst the

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[12] Korea shows the highest penetration ratio of broadband connection (23% as of June 2003 according to an OECD report on 13-Jan-2004: DSTI/ICCP/TIP(2003)6/FINAL). A consultation document by Ofcom (Office of Communications, UK) points out the Korean case of high broadband take-up rate is due to the high level of population density and public financing of roll-out.

[13] The Korea Telecom is the incumbent provider of fixed line telecommunications which used to be fully owned by the Government.

largest bank (*rank effects*) in commercial banking remains dominant in internet banking. When internet banking was first introduced in Korea, we expected to see some churning effects with the new concept of banking as internet banking provides extra transparency of information and allow consumers to search and switch between banks. However, the empirical results do not support our expectation and instead reinforces the position of large banks. This is a very important finding that provides policy makers with a valuable piece of information as internet banking technology may encourage further consolidation of the banking industry.

In chapter 4, the focus was moved on to the relationship between the real sector (*non-financial*) and the banking sector structures to try to identify the economic principles underlying their banking relationship. The shift of focus towards real sector and investigating its structural changes in terms of cross-ownership opens up a new way of analysing relationship banking. There has been a plethora of literature focused on the structure of conglomerates (*Keiretsu/Chaebol*) in East Asia to explain the fast economic growth and/or recent crisis in the region. However, no research has been conducted to investigate the link between the structural changes in the real sector and the banking sector although relationship banking by definition suggests the necessary link between the two sectors. Hence, the contribution of this chapter is to bridge the gap between these two sectors and to investigate how relationship banking develops over time with respect to what is happening in the real sector. Traditionally, the strong vertical relationship between core companies and their subsidiaries in the real sector was believed to be a driving force for the economic success in the region. However, the degree of vertical relationship varies

depending upon macroeconomic fluctuations and subsequently affects their banking relationship.

One important concept that is introduced in this chapter is 'collective relationship banking (*CRB*)' since firms within a same network of conglomerates (*Keiretsu/Chaebol*) often establish banking relationship with an identical bank collectively. On the other hand, 'independent banking (*INDB*)' forms another sub-concept of relationship banking established independently of conglomerates (*Keiretsu/Chaebol*)' relationship bank.

Empirical evidence from the panel data constructed for the top 10 chaebols and their subsidiaries in Korea indicates that collective relationship banking is more likely when the holding company has a smaller stake in the subsidiary. The main implication of this result is that the banking relationship is strongly driven by signalling and sharing of private information. Banks should screen and monitor private information about their borrower's projects before and after the loan approval and vertical ownership structure in the real sector provides a mechanism for signalling and sharing of the private information. Clearly, the higher stake held by a holding company means that its subsidiary has better business prospects. This high ownership stake sends out a positive signal as public information and provides its subsidiaries with an opportunity to shop around for loans irrespective of whether the bank is already dealing with its holding company or not. By contrast, a low ownership stake only creates some doubts as to subsidiaries' business prospects as well as to strategic importance within the chaebol. Therefore, collective banking becomes favourable for both the borrowing subsidiary and the lending bank as the

bank has an information advantage having both the holding company and the subsidiary as borrowers together when the holding company can also provide indirect monitoring of its subsidiary on behalf of the bank. Koreans have paid much attention to corporate governance and restructuring following the recent financial crises. Korean chaebols have undergone many mergers and acquisitions (M&As) and divestitures and it is argued that this restructuring in the real sector has a significant impact on banking relationship in Korea. Further opportunities of investigation on collective relationship banking should not be overlooked.

The second part of the chapter 4 examines the situations where the banking relationship has been switched from collective relationship banking to independent banking or *vice versa*. The data do not have enough cases of switching to construct a proper econometric model, but the case study provides interesting and valuable information. Most switching cases tend to appear when: 1/ the subsidiary firms experience deterioration in their profits; 2/ there is a plan for major expansion and a large capital is required, and 3/ there are significant ownership changes such as foreign partner's involvement or departure. It is difficult to generalise the above outcomes from the case study, but it provides an interesting piece of information. This concludes the investigation of banking structure and the main analysis of the thesis.

As described above, these three chapters present an investigation of how and why banking structure changes over time within the East Asian context: 1/when regulation and deregulation in certain areas of banking are implemented; 2/ when a new banking technology is introduced, and 3/ when the real sector (*borrowers*)

experiences structural changes. Although the investigation is limited to the East Asian banking and focuses on the Korean experience, it provides valuable insight regarding banking structure and these results can be applied to other countries under certain conditions. The last chapter analyses some policy implications and presents the main conclusion of the thesis and suggests some possible extensions to the work.

Chapter 2

East Asian Banking Restructuring: Regulation and Industrial Policy

2.1 Introduction

Throughout the last decade, the East Asian banking industry has adopted a significantly more concentrated market structure. The number of banks in the region was substantially reduced via mergers and exits in the late 1990s as shown in Table 2.1. Japan has authorised only one new regional bank since 1976 whilst there were 5 large-scale mergers between nationwide banks and one revocation of the license in the 1990s. On the other hand, the banking structure in Korea took a slightly different path. Korea authorised 9 new nationwide banks and 3 transformations from specialty banks throughout the industrialisation in the 1980s and early 1990s. However, Korea took a drastic turn with 9 mergers between nationwide banks and 4 mergers between regional banks. This wave of mergers and exits has halved the number of nationwide banks in Japan and Korea from its peak, and the market share of the larger banks has grown. One can say that the Japanese and Korean banks made a radical move

towards consolidation to deal with their respective economic and financial crises since the consolidation seems to coincide with the post-crises period as shown in Figures 2.3 and 2.4. Traditionally, one of the main roles of these East Asian banks was a means of supporting the real sector in the process of pursuing economic development.[14] However, when the East Asian financial crises in 1997 triggered the restructuring process of many industrial sectors in the region, the banking sector appeared to be an industry where restructuring was most urgently and seriously required. The 1997 financial crisis in Asia renewed recognition of the significance of the banking industry and its importance to the overall economy.

Previous literature (Cerasi et al., 2002; Chiappori et al., 1995; Dewatripont and Maskin, 1995; Dewatripont and Tirole, 1993) on bank structure has primarily focused on the impact of exogenous change in regulation and the subsequent change in competition environment without any consideration of industrial policy. The industrial policy in East Asia, which dominated banking sector regulation, had the objective of encouraging industrial development in the region. Therefore, the competition environment in the East Asian banking should not be investigated independently of its industrial policy.

Banking regulation in Japan and Korea has included entry barriers, branching restrictions, and deposit rate ceilings. East Asian banking regulation was designed to facilitate the development of strategic industries as shown in Table 2.2. Japan and Korea have aimed to promote certain industries, which they believed to be

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[14] Kim (1999) claims one of the reasons for recent financial crisis in Korea is basic functions of the financial industry being neglected such as credit screening, which led to higher non performing loans.

strategically beneficial for the national economy. The target industries have varied from primary and light industries (food and textiles) in the 1950s and 1960s, to high-tech knowledge intensive industries in the 1990s. The deposit rate regulation, for instance, allowed banks to have access to cheap funding so that they could provide loans at lower rates to these strategic industries. With cheap funding via banks and with the help of government subsidies, the strategic industries could grow fast, generating supernormal profits and remained as high quality customers to banks. This kind of growth pattern continued in East Asia until they faced the recent economic crises.

Not only have Japan and Korea led the economic growth in East Asia, but also other East Asian countries have replicated many of the development patterns set by Japan and Korea.[15] Moreover, the two countries have similarities in their industrial structure due to their strong trade networks.[16] Since the modern banking system in Korea was established during the Japanese occupation, it seems natural that Korea followed the Japanese type of banking establishments. However, there is some evidence of divergence as well as convergence in terms of recent restructuring of the banking sector, especially with respect to adopting concentrated market structure as in Figures 2.3 to 2.6. For instance, the Korean banking structure has consolidated more immediately and drastically after the 1997 Asian financial crisis.

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[15] World Bank data categorise Japan, Korea, China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore and Thailand as East Asia. However, Japan and Korea dominated the regional economy and its growth representing 78-90% of East Asian GNP (constant market price 1995, in US dollars) over the period 1960-1997. Their contribution to the regional growth has been more than 80%, which fell down to 50-60% in the 1990s.

[16] Castley (1997) showed Japanese influence on Korea's industrialisation in detail.

On the other hand, the Japanese banking structure has reacted to the economic crisis in the early 1990s[17] with some delays and the major banking consolidation took place only after 2000 with almost a decade delay. The difference in the restructuring is more notable when we compare the two countries in terms of regional banking as Japan does not appear to have implemented any measures for their regional banks.

The main emphasis of this chapter is to identify the determinants of banking structure in East Asia using empirical data from Japan and Korea. The recent consolidation in East Asian banking will be assessed with respect to industrial policy and regulation. This chapter also investigates the role of Japanese and Korean banks in their respective industrialisation processes and how the changes in regulation affected the evolution of the market structure based on the structure-performance relationship.

The main method of analysis lies in the application of industrial organisation theory to banking. Most traditional methods used in industrial economics are designed to analyse non-financial firms, such as manufacturing firms that produce physical goods. Some economists attempt to identify factors affecting market structure by differentiating advertising or technology intensive industries from the rest.[18] However, little research has been undertaken on the service industries until recently. It is important to note that the banking industry has some special attributes

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[17] Kanaya and Woo (2000) discusses the Japanese banking crisis in the 1990s, in particular the collapse of the asset bubble in the early 1990s.

[18] Cowling (1972) discusses optimal advertising policies for a variety of market structures with empirical evidence. Sutton (1991, 1998) uses escalation mechanism in explaining the market structure of advertising and technology intensive industries.

due to its nature of service industry and hence an industry-specific approach is inevitable.

First, the role of East Asian banks in industrialisation is investigated by comparing the evolution of the banking system with the country's macroeconomic position. The uniqueness of this approach lies in the sense of inter-industry comparison between financial and non-financial industries using an industrial organisational framework. It is important to note that financial and non-financial industries have different attributes and therefore, it is interesting to investigate how they have evolved together.

Second, a theoretical model of banking competition by Chiappori et al. (1995) is extended using Salop's circular (1979) model. We construct two objective functions of banks: a revenue maximising bank under regulation and a profit maximising bank under deregulation. We show the relative dominance of the two objective functions is influenced by industrial policy, thus by regulation and explain the banking structure in terms of the equilibrium number of banks in the market depending on the relative dominance of the two objective functions.

This chapter analyses the impact of transition from a price-cap regulation (*deposit/loan rate control*) to a rate-of-return regulation (*ROA and/or BIS ratio guideline*) on banking industry structure. A simple theoretical model of banking competition suggests that the relative dominance of the two objective functions is influenced by industrial policy via preferential rates and relaxing price-cap regulation reduces the equilibrium number of banks. The result is supported by empirical

evidence from Japan and Korea, which have both undergone a substantial consolidation.

Finally, we investigate empirically the consequences of the regulation and deregulation on entry, branching and deposit rates. The different types of regulation and deregulation are defined and separately analysed from a country specific perspective. The relationship between concentration (*Structure*) and the degree of competition (*Conduct*) in Japan and Korea is examined. The effects of deregulation on the structure of the banking industry and the profitability (*Performance*) of banks are tested. The evolution of banking industry in the two countries is compared and we show evidence of divergence in the restructuring process of the banking sector between Japan and Korea.

The analysis is applied to a unique data set of the entire commercial banking sector in Japan and Korea, which covers both pre- and post- banking crisis periods. This chapter draws attention to the role of banking sector in the East Asian industrialisation and the evolution of the banking structure based on the structure-performance relationship.

2.2 Review of East Asian Banking History

In the post war period, East Asian Governments actively promoted heavy and chemical industries and some academics like Cho (1994) and Castley (1997) argued that the financial sector was lagging behind the fast-developing real sector. Moreover, the pattern of fast growth in the real sector and the lagging financial sector

was common in all East Asian countries. In particular, the similarities between Japan and Korea were significant due to their strong trade networks.

It is fair to say that the Korean industrialisation process followed that of Japan with a time lag of almost a decade. This overlapping transfer of industrial structures from Japan to Korea was explained by the Japanese relocation process, which started in the late 1960s. In Table 2.2, we notice Korea established a general pattern of catching up with the Japanese industrial policy a decade after.

Ishii (1997) claimed the reason for the high growth rate in East Asia was its high rate of savings. Even in the 1980s the rate of savings of the household economy in Japan was around 17%, which was twice as much as those in the advanced Western countries. It is true that the high rate of savings in East Asia is one of the common factors for its fast growth. However, the role of banks in the process of allocating the funds into appropriate industries and enterprises should not be overlooked. As Ishii (1997) pointed out for Japan, the main part of the funds for industrialisation in East Asia was not procured directly from the capital market but supplied indirectly through various kinds of banks, and the respective central banks provided these banks with funds if necessary.

Cho (1994) explains that the East Asian Governments were heavily involved in the direction of savings fund to achieve development goals in the real sector. Industrialisation in East Asia has not only meant a transformation of an agrarian economy into an industrial economy, but it also means a more focused industrial development in strategic industries such as heavy industries. Thus, the financial sector has never developed independently of the real sector in East Asia. More

importantly, the industrial policy dominated financial sector developments leaving the banking sector subordinate to the real sector.

2.2.1 Brief History of Banking in Japan[19]

It is worth looking at the formation of modern banking system in Japan as it set a prototype for the region. The Meiji Restoration in 1868 provided a ground for the modern banking system in Japan. A structural framework including operating principles and regulatory issues started to form and continued to develop from 1868 up to the mid-1990s. The development phases of Japanese banking reflect three distinctive periods, the period from the Restoration through World War II (*WWII*) and the Allied occupation, the high growth era of the 1950s to the 1970s, and the quarter-century since the oil shock of 1973.

1868-WWII

A modern banking system was built by adopting a variety of Western models on top of a legacy of indigenous financial practices between the Meiji Restoration in 1868 and World War I (*WWI*). The main institutional feature of the banking evolution in Japan was characterised under the Bank Act 1890, which took effect in 1893. National banks began to change to ordinary banks in substantial numbers from the end of 1896, when the charters started to expire and by 1899 no national banks remained. This amalgamated three classes of banking institutions: 1/ national; 2/

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[19] Hugh (1999) well documented the Japanese banking system in historical perspectives in Banking in Japan edited by Tsutsui (1999).

private, and 3/ quasi-bank, into one. Interestingly enough, the new bank law did not set any minimum bank size in favour of free competition. As a result, unit banking[20] was predominant in Japan until WWI.

With the development of Zaibatsu,[21] the Mitsubishi and Sumitomo Zaibatsu transformed their finance department into banks in 1895. This made the monetary crises more severe because these banks were susceptible to failure during recessions. The Big Five banks: 1/ Mitsui; 2/ First; 3/Mitsubishi; 4/ Sumitomo, and 5/ Yasuda, dominated the sector until WWI.

Special banks started to emerge during this period as well, such as the Tokohama Special Bank, which was established in 1880 to finance foreign trade. Within the 5-year period between 1897 and 1902, the Government founded the Hypothec Bank of Japan (*Nippon Kangyo Ginko*),[22] 46 affiliated prefectural Agricultural and Industrial Banks, the Hokkaido Colonial Bank (*Hokkaido Takushoku Ginko*)[23] and the Industrial Bank of Japan (*Nippon Kogyo Ginko*). Most of these banks were designed to finance the transition from an agrarian economy to an industrial economy.

During the 1920s and 1930s, Japanese banking underwent considerable adjustment in terms of the relationship between private institutions and state regulators. The trigger to this legislative reform was the Banking Crisis in 1927 caused by the post WWI recession. With the intensification of official regulation,

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[20] Unit banking as opposed to branch banking.
[21] Former enterprise type of Keiretsu.
[22] Japanese names in italic font inside parenthesis.
[23] Note that Hokkaido Takushoky Ginko became insolvent in Nov. 1997.

concentration in commercial banking increased.[24] However, interactions between public and private sectors were dynamic and complex and the bureaucracy therefore could not simply dictate policy to the banks. Zaibatsu banks continued to be the leading institutions in the system while a new financial institution, Wartime Finance Corporation (WFC), was created in 1942 for the sole purpose of financing military production during the WWII.

WWII-1973

There were some institutional changes in the banking sector after the WWII as post-war reorganisation of the financial system was carried out by dissolving wartime institutions and establishing private long-term credit institutions and financial institutions for small-and medium-sized firms and agriculture. Development of government institutions began alongside the reform of capital markets. During high growth era between 1952 and 1973, Japanese banking established the uniqueness of the system. The predominant pattern of banking activities was over-lending and over-borrowing in indirect financing in order to facilitate the investment-led growth. It is worth noting that this type of over-lending and over-borrowing created typical Keiretsu firms in Japan with high debt-to-equity ratios. The investment-led growth eventually led Japan to the asset bubble in the late 1980s before it collapsed in the early 1990s.

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[24] Higher concentration following stricter regulation during this period is the opposite of what is happening in Europe and East Asia lately. Recent deregulation in competition measures has made banking structure more concentrated.

Post 1973

During the 1970s, the oil shocks had a negative effect on the banking sector. Japan tried to reform the banking industry once again to cope with the difficulties in the real sector and the driving force of the reform was from market liberalisation with various deregulation measures as shown in Table 2.3. The main focus of liberalisation was on lifting interest rate regulation starting with short-term rates. Branching restriction and cross-financial sector entry restriction started to relax later. In the 1980s, banks were allowed to diversify their financial products and services. Enactment of the Financial System Reform Act of 1993 enabled banks and securities firms to enter each other's fields.

One of the most significant liberalisation measures in recent Japanese banking history was the "Big-Bang programme"[25] initiated in 1996 by the then Prime Minister Hashimoto. Various reforms were scheduled to be implemented based upon the three guiding principles of 'freedom', 'fairness', and 'globalisation', so that the Tokyo financial market could attain an equal status as New York and London by 2001.[26] Restructuring has accelerated following the Asian crisis in 1997.[27] The bank-on-bank holding companies created a new environment for financial institutions as they can form alliances. In April 2000, four banks: 1/ Tokyo-Mitsubishi; 2/ Mitsubishi Trust; 3/ Nippon Trust, and 4/ Tokyo Trust, announced a plan for a holding company, the Mitsubishi Tokyo Financial Group. Mergers

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[25] The "Big-Bang programme" was a general financial reform package to enhance the efficiency of Japanese banks, which can be summarised into two main objectives: 1/ reducing bad debts, and 2/ relaxing foreign exchange regulation.

[26] See Japanese Banks 2000 (2000), Japanese Bankers Association.

[27] Note that the restructuring after the collapse of the asset bubble in the early 1990s was very slow.

between banks were frequent throughout the late 1990s while the industry is expecting entry of new types of banks.[28]

2.2.2 Brief History of Banking in Korea[29]

The Korean banking system seems to replicate the Japanese system as the introduction of a modern banking system into Korea dates back to the beginning of Japanese domination over the country.

1878 – WWII

In 1878, the First National Bank (a Japanese bank) opened in Pusan and this was followed by Korean banks' openings. However, most Korean banks only existed for a short period of time due to insufficient capital and a lack of experience. In 1909, the Old Bank of Korea was founded and was renamed the Bank of Chosun in 1910. During the early 1900s, numerous banks were established including Chosun Industrial Bank, Chosun Commercial Bank (later renamed the Commercial Bank of Korea), Cho Hung Bank, Korea First Bank (1929) and Hanil Bank (1932). In 1959, Bank of Seoul was established and became nationwide in 1962. Since the Government had owned commercial banks until government-owned stocks were sold in the late 1950s, these banks exercised very little autonomy.

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[28] In May 2001, Sony Corp. filed a formal application for an online bank in cooperation with Sakura Bank and JP Morgan. Sony Bank (www.sonybank.net) opened for business on 11 June 2001. This type of internet banks can be also found in the UK, e.g. Eggs, Smile, and FirstDirect.
[29] See annual publications by the Bank of Korea, 'Financial system in Korea'.

WWII – 1982

The establishment of the new banking system followed the liberation from Japan in 1945 and the inauguration of the Republic of Korea in 1948. At that time, the Korean banking system was reorganised for the purpose of financing the 5-year Economic Development Plan more efficiently.[30] The Bank of Korea Act was amended in 1962 and various specialised banks were introduced to facilitate financial support for underdeveloped or strategically important industries such as Small and Medium Industry Bank, Citizens National Bank, Korea Exchange Bank, The Korea Housing Bank.

Post 1982

The General Banking Act was revised in 1982 and commercial banks started to be privatised. These included Hanil Bank, Korea First Bank, Bank of Seoul and Trust, Chohung Bank. One of the main revisions was the shift from direct credit controls through credit ceilings on individual banks to indirect controls through management of bank reserves. In 1984, the preferential rates on policy loans by commercial banks were abolished and band system in loan rates was introduced, in which banks are allowed to charge different rates. The ceilings on various rates (inter-bank call rates and issuing rates of unsecured corporate bonds) were also lifted.

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[30] Note that the 5-year Economic Development Plan determined the industrial policies with the strategic industries presented in Table 2.2.

As a measure to provide a more competitive environment in banking, Shinhan Bank and KorAm Bank opened in 1982 and 1983 respectively. It is important to note that Shinhan Bank was the first banking establishment financed by private capital only. In the 1980s, to encourage the domestic banks to improve their banking practices and managerial skills, numerous foreign bank branches were allowed to open. In 1988, interest rates were extensively deregulated to increase banking competition in the process of financial liberalisation. Entry barriers were further lowered in 1989, adding 3 new commercial banks: Dongwha Bank; Dongnam Bank, and Daedong Bank. Also, Korea Exchange Bank changed its status from a specialised bank to a nationwide commercial bank. Between 1991 and 1997, a four-stage plan for interest rates deregulation was completed (see Table 2.4). The main focus of liberalisation was on lifting interest rate regulation starting with short-term rates while branching restriction and cross-financial sector entry restriction has not been fully relaxed.

Further deregulation is in the process of being implemented in the aftermath of the Asian financial crisis of 1997. As one of the most significant changes of banking regulation in Korea, the restriction on foreign ownership of domestic commercial banks has been lifted and now there is virtually no restriction on foreign ownership. As a result, there have been a couple major mergers and acquisitions by foreign banks[31] and we expect to see several more of the kind to happen in the future.

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[31] New Bridge Capital (US) acquired 51% stake of Korea First Bank (KFB) in Jan. 2000 and Standard Chartered Bank (Hong Kong) announced an agreement to purchase 100% stake of KFB New Bridge Holding Ltd. In Jan. 2005.

Also, mergers between domestic banks were encouraged to increase competitiveness. Quite a number of mergers of this kind took place since the Asian financial crisis in 1997 and such merger waves are expected to continue.

In this context, one could consider the restructuring in the Korean banking system as an immediate result of the Asian financial crisis. If we were to associate the banking restructuring directly with the financial crisis, it is worth noting that the restructuring takes only a narrow definition by focusing on the post-crisis structural changes in response to the stricter banking supervision. However, this thesis adopts a much broader definition of banking restructuring in the evolutionary perspectives. This can cover a wider spectrum of bank entry, transformation, exit (revocation) or mergers and acquisitions (M&As) when the regulatory environment changes over time in either direction, a relaxation or a tightening up.

Nonetheless, we acknowledge the significance of the recent crisis and that this very substantial crisis had a major impact on both the banking and the industrial sectors in Korea. Although the thesis have not chosen to look at this crisis in depth since the major interest of the thesis is in studying the long term evolution of the structure of the two sectors, it is worth discussing what actually happened during the particular period of financial crisis as it radically affected the situation in many areas of the Korean economy.

As Kim and Lee (2002) and Lee et al. (2002) pointed out, the epicentre of the crisis in Korea was in financial troubles of the corporate sector which were deeply rooted in the high leverage ratio. On average, the leverage ratio of the Korean firms has fluctuated around 70% throughout the 1980s and the 1990s prior to the crisis.

One should also note that during the above period, the Korean firms traditionally relied on debt-financing[32] as opposed to equity-financing since the equity market was relatively under-developed in Korea and a large number of firms feared losing their management control with equity-financing.

Another important observation to make in the context is that the increasing level of foreign leverage (Lee et al. 2000) in addition to the high overall leverage as it significantly and negatively affected their debt repayments when the currency was under attack during the crisis. All in all, the unsustainable debt management left Korean corporations together with their respective banks in a very vulnerable position.

As a result, many of the Korean firms including large Chaebols experienced insolvency and the voices calling for corporate as well as financial restructuring heightened in response to bankruptcy. Hence, one could argue that the changes within the Korean banking structure are being propelled by the recent financial crisis as government officials try to implement appropriate measures to protect the Korean banks from similar crises. For example, to improve the banking standards, Financial Supervisory Service (FSS hereafter)[33] enforced the new accounting standards in accordance with internationally accepted standards.[34] Changes in the management

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[32] The history of the Korean banking sector earlier in the section explains the background for this in detail.

[33] The FSS was established on 1 Jan. 1999 by combining former supervisory bodies: the Banking Supervisory Authority (BSA hereafter), the Securities Supervisory Board, the Insurance Supervisory Board, and the Non-bank Supervisory Authority. The FSS inherited the role of the BSA.

[34] Kim (1999) discusses prudential regulation in detail in his BIS policy paper. Many of the changes in regulation are related to disclosure requirements on bank financial statements. One example is the forward-looking criteria for asset classification in Korea introduced in 1999 that incorporate the "Basel Core Principles for Effective Banking Supervision".

structure, in particular with the presence of foreign management,[35] will definitely affect the structure of the Korean banking industry. However, since changes of this kind are still on-going, the chapter does not analyse the effect in greater detail.

2.2.3 Industrial Policy and Banking Structure under Threat

With the increasing importance of East Asian economy in the global context, Japan and Korea have experienced significant pressure from outside on market liberalisation in the both real and financial sectors. Japan faced the pressure earlier than Korea as the Japanese presence in the global organisation predated that of Korea. Requests for eliminating tariff and non-tariff trade barriers were one of the most common pressures in the real sector, whereas the liberalisation of interest rates and mobility of capital were often required by global institutions such as IMF, World bank and OECD. For instance, the OECD entry condition for Korea included capital market liberalisation.[36]

Therefore, the East Asian Governments started to lose their tight control over industrial policy and banking operation. Large enterprises increased their activities overseas both in production and financing in the wake of globalisation and domestic economies in East Asia were left behind. Cowling and Tomlinson (2000) explain a

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[35] Korea First Bank managed by New Bridge Capital and subsequently by Standard Chartered Bank as mentioned earlier in the section.

[36] Korea had to comply with the minimum requirements set by 'OECD Codes of Liberalisation of Capital Movements and Current Invisible Operations'

case of strategic failure about a hollowing out of Japanese industry caused by the relocation of Keiretsus and other multinationals.[37]

When the Japanese bubble burst in 1990 and the banking crisis followed a year after, mergers between banks were recommended. However, the Keiretsus were the main hurdle to both large-scale mergers and massive corporate restructuring as city banks in Japan were at the core of respective Keiretsus. These large business groups, Keiretsus, had cross-shareholdings with the group banks, which has worked in favour of industrial policy during the fast growing period. However, when the real sector started to deteriorate, the Keiretsu holdings in the city banks proved to be a substantial obstacle.[38]

The Korean case is somewhat different, as there is no large group bank publicly known, tied via cross-shareholdings. However, the strong long-term relationship between certain banks and Chaebols, which are the Korean version of Keiretsus, turned out to be a problem after the recent crisis. Despite the absence of group banks, the loan portfolio of Korean banks was concentrated on a small number of Chaebols.[39]

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[37] 'Hollowing out' as a result of outward FDI (foreign direct investment) when the domestic cost base increases.
[38] Tsutsui (1999) explains the obstacles faced by Keiretsus and the group banks in detail.
[39] It appears to be bilateral oligopoly suggested by Waterson (1984) using Galbraith (1954) examples in American Capitalism.

2.3 Background Literature

There has been much research to explain the causes of Korea's economic growth and many attribute Korea's growth to the strong industrial policy adopted by the Government. In order to finance this industrial policy, the Korean banking system was reorganised.[40] Cho (1994) explains that the reason the Korean banking system was under tight government control was to aid strategic investments to finance development plans. East Asian Governments promoted a group of strategic industries as listed in Table 2.2 and regulation was designed to direct the money flow to such target industries.[41]

On the other hand, macroeconomists often discuss the optimal mix of government policies to explain economic growth in a country. In particular, the recent crisis in Asia brought more attention to the role of monetary policy in an economy.[42] However, the economic success in East Asia may have more to do with the credibility of hands-on development policy in the private sector alongside monetary policy. The liquidity for the development was provided and the fund flows were carefully directed to the strategic industries. The signal of Government's

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[40] The importance of the banks' role in financing this industrial policy is well documented in 'Financial System in Korea (1998)' published by The Bank of Korea.
[41] Castley (1997) explains the industrialisation process in East Asia as a form of ladder where each rung has to be scaled before moving on to the next. His illustration of the ladder is simplified as 1/ Pre-industry with primary products, 2/ Labour-intensive industries, 3/ Capital-intensive industries, and 4/ Knowledge or technology-intensive industries.
[42] Agenor et al (1999) laid out excellent models for monetary policy and macroeconomic aspects of financial sector in order to explain the recent Asian financial crisis.

intention was clear and credible to the private sector via announced development plans without any policy inconsistency.[43]

Given the special attributes of banking industry, the theory of financial intermediation indicates measuring the both quantity output and quality of banks is not as straightforward as for non-financial firms. In addition to the intangible nature of banking output, it is difficult to account for quality in banking service.[44] Heffernan (1996), Klein (1971) and Clark (1988) discussed the relevant concepts of bank output and input.[45] Despite the importance of commercial banking as a major financial intermediary, there has been little consensus as to what constitutes a workable and productive theory of the banking firm. Klein (1971) claims that neo-classical microeconomic analysis is rarely used to explain bank behaviour, primarily because there is so little agreement concerning even the most fundamental concepts. In the face of conceptual difficulties in drawing the analogy between a bank and the typical firm of neo-classical analysis.

Among various competition models in banking, Gehrig (1996) and Matutes and Vives (1996; 2000) included monopolistic competition with horizontal and vertical product differentiation, where the equivalent quality parameter is the degree of branching. However, the weakness of the monopolistic competition approach is the lack of empirical evidence, given the imperfect nature of the industry. There are information gaps among borrowers and lenders and imperfect information lies at the

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[43] Castley (1997) lists suggested causes for East Asian economic success including consistent macroeconomic policies, high rates of investment, command economy through government intervention, total commitment of regime to economic growth.
[44] See Gordon (1990) for hedonic price adjustment.
[45] They define loans and deposits as output and input respectively.

centre of banking sector dynamics. Freixas and Rochet (1997) explain that intermediaries in the brokerage market, including banking, can affect their trading probabilities by establishing an information and communication network. As communication possibilities across potential traders are imperfect, Freixas and Rochet (1997) claim that, several firms, not one, will offer similar or identical intermediary services. Gehrig (1996) shows that the structure of financial markets is usually fairly concentrated with a few large firms and monopolistic competition market conditions will not be present.

On the other hand, Klein (1971) assumed that banks maximise profits in the course of the intermediation activity and thus, the microeconomic analysis of banks has been influenced by industrial organisation theory. This led to the development of banking competition models and to empirical studies based on methods developed for industrial economics. Klein (1971) and Monti (1972) considered a bank as a firm maximising its net present value of assets and established a landmark model of banking.

Among other competition models in banking, Repullo (1995) and Chiappori et al. (1995) applied horizontal differentiation to banking. In these models, the main difference between banks and non-financial firms is that banks compete in two markets instead of one, i.e. deposits and loans markets. However, they assume that under perfectly competitive interbank market conditions complete independence of the two activities of the bank can be obtained. The predictions of these models are that banking industries should be fragmented, and market shares should be symmetrically distributed. On the other hand, Gehrig (1996) and Matutes and Vives

(1996; 2000), introduce network externalities to explain how asymmetric configurations in market share could arise in banking. This asymmetric information paradigm has emerged as a mainstream approach for recent banking analyses.

The traditional approach to early empirical studies of banking was based on the structure-conduct-performance (SCP) paradigm.[46] Bain (1951) supposed a one-way linear relationship of causality, which runs from *structure* (the level of concentration) to *conduct* (the degree of collusion or competition), and then to *performance* (profitability). Therefore the structure of an industry is important to the understanding of its performance. However, the application of SCP paradigm has been subject to considerable criticism as it neglected feedback. Cowling (1976) suggests the structure-performance relationship be a recursive system of feedback with substantial lags. Berger (1995) also questioned the results obtained following the SCP paradigm. Despite the criticism, the SCP paradigm provided the foundation for the study of market structure.

In general, the banking industry is highly concentrated. Kolari and Zardkoohi (1987) and Clark (1988) explained the concentration in banking industry with economies of scale and scope. Economies of scale in banking and financial intermediation allow banks to exercise market power or to pre-empt potential rivals' entry. Although banking systems tend to be quite concentrated, in some developed countries, the United States shows a fragmented structure.[47] However, this

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[46] Baltensperger (1972), Gilbert (1984) and Hannan (1991) used the SCP paradigm.

[47] See Macey (2001) and Calomiris (1997).

fragmentation exists primarily as a result of regulation on inter-state branching designed to deal with their concern about financial power.

Game theory provides another useful approach for analysing banking competition. When banks are to maximise their profits under SCP paradigm, the market structure can be investigated under a two stage game theoretic model. Banks can play two different games, competing in prices or quantities. As an example of price competition, banks enter the market with sunk costs. The exogenous sunk cost such as capital requirement to open a bank is a fixed set-up cost as it is fixed by an entry regulation and only varies in the presence of change in regulation. The endogenous sunk cost of branching is a variable set-up cost, which is considered to be a parameter for an escalation mechanism in vertical product differentiation in banking.[48] A similar application to internet bank networks is feasible.

Chiappori et al. (1995) derived the equilibrium number of banks under various regulatory conditions and suggested the equilibrium number of banks under regulation is larger than that under free market condition but none of them is socially optimal. Cerasi et al. (2002) also looked at the impact of deregulation on concentration and branch networks in European banking. Since deregulation reduces profits for a given branching network, fewer firms find it profitable to enter the industry and therefore the degree of concentration rises. On the other hand when the banks collude, they establish a smaller network compared with competition as opening new branches damages rivals by stealing their clients. By coordination, they

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[48] Sutton (1991, 1998) laid out a model of sunk cost and market structure and discusses extensively on escalation mechanism and the market structure.

will avoid this damage. However, her empirical analysis shows the weakness in explaining the feedback process of structure-performance relation.

2.4 Simple Model for Non-Performing Loans (NPLs)

As per bank-specific attributes, banks are considered to produce loan products by taking deposits as funding sources. Deposits might appear as one of the products that banks offer but the role of deposits in banking operation lies in the cost function. Since the interest rates are determined not entirely by market competition,[49] it is worth being cautious in using interest rates as a proxy for price variable in banking. The model consists of banks (*creditors*) and customers (*borrowers*). Money market activities or government intervention in the banking is allowed.

In the absence of industry-specific assumptions, microeconomic theory assumes banks maximise their profits subject to constraints. However, Asian banks showed evidence of maximising lending during the regulated period as their interest margins were protected by the deposit rate ceilings and the minimum lending rate guaranteed for strategic industries.[50] Asian banks started to focus more on profit maximisation as their objectives following market deregulation. This recent

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[49] Monetary policy can affect the benchmark inter-bank rates and therefore can shift the overall level of deposit and loan rates.

[50] The Banking Supervisory Authority (BSA) in Korea claims the financial crisis was rooted in this peculiar objective of banks, i.e. revenue maximising rather profit maximising. Thus, one of the most significant changes in the banking supervision in Korea was to guide banks to focus more on profits via published performance measure of return on asset (ROA), return on equity (ROE) and Bank for International Settlement (BIS) ratio instead of publishing deposit per employee and deposit per branch. This new guideline has only been effective from 1998 following the recent financial crisis.

transformation in the Asian bank objectives is in part due to the increasing number of non-performing loans following the economic crisis. The banks realised revenue maximising does not protect them from losses due to non-performing loans (*NPLs*).

Considering lending as equivalent to revenues of non-financial firms, our model is built to incorporate both revenue maximisation and profit maximisation. A parameter θ is used for the weight on revenue maximisation, which varies with the degree of regulation. Banks are assumed to make an optimal choice between revenue maximisation and profit maximisation by changing θ for a given regulatory environment. Equilibrium numbers of banks are derived under various market conditions and show how regulation affects market structure.

The usual assumptions for Salop's model adopted in Chiappori et al. (1995) are applied as they assume banks are engaged in spatial competition providing differentiated products. This notion of monopolistic competition is often challenged as some people argue that banks offer homogeneous products, i.e. non-differentiated loans/deposits. However, even if there is no physical differentiation in banking products, we argue that there is product differentiation in terms of location, perceived quality differences in terms of after service and fringe benefits.

Although Chiappori's model is suitable in explaining banking competition and its market structure, it does not capture the fundamental issues of banking operation regarding NPLs and their loss provision nor the regulatory impacts on the banking. Hence, we depart from their model in the following respects: 1/ asymmetric information between the lender and the borrower i.e. lenders do not have full information about the quality of the project they are financing; therefore 2/ loss

provision associated to NPLs is taken into consideration, and finally 3/ banks are considered not to be always profit maximising.[51]

A continuum of customers, both borrowers and depositors, is assumed to be uniformly located around a unit circle with a unit density in an economy. There are N banks located on the circle and each installation has a fixed cost of C. Banks are assumed to be identical and can freely enter or exit. For simplicity, each customer on the circle has one unit of cash that must be deposited in a bank. The typical bank will pay an interest rate t. The depositors are supposed to incur a transportation cost α per unit length. In other words, a depositor has to incur extra costs of travelling to a bank further away from its vicinity.[52]

Each bank can now make loans to customers using the collected funds. The lending rate is r and β is the unit transportation cost for loans. Inequality is allowed in the respective price elasticities of loans and deposits, i.e. the transportation costs of α and β are not necessarily the same. The transportation costs of α and β include the costs of gathering relevant information in searching appropriated banking services. A fraction λ of the total population is supposed to borrow and these borrowers are uniformly distributed around the unit circle. A crucial assumption here is that borrowers are also depositors as banking is usually established in a bundled form of loans and deposits. The size of each loan is L and the surplus generated by the loan is supposed to be large enough to justify borrowing at the prevailing rate.

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[51] Imperfect information and non-performing loans are very important issues in banking and they naturally provide another crucial topic to investigate in banking in chapter 4.

[52] There are many other conventional ways to interpret the transportation cost and this chapter adopts most of them e.g. information cost, search cost, cost of inconvenience, and etc.

The prevailing technology is assumed linear. The money market rate ρ is exogenously set by monetary authorities.[53]

Aggregate net demand of the banking sector on the money market is equal to $\lambda L - 1$ considering a unit circle of deposits. If aggregate net demand on the money market is zero, the total volume of loans made by banks is equal to the total volume of deposits, $V = \lambda L = 1$

It is important to note that each bank has a proportion ϕ of the total loans in NPLs, on which the banks have to build provisions. Using the provision rate δ on NPLs, the loss function related to NPLs becomes $(\delta + r)\phi$ of loans.

The objective function of profit maximisation was derived based on the Klein-Monti (Klein, 1971; Monti, 1972) type of approach.[54] However, given the deposit rate regulation and due to the industrial policy which was common knowledge for the public, banks behaved as revenue maximising firms subject to minimum requirement on the rate of return. As a majority of economic growth came from the strategic industries, banks were bound to provide more credits to them and this led banks to become revenue maximisers rather than profit maximisers. In my model, a convex combination of the two, a weighted average of revenue maximisation and profit maximisation, is used for the objective function while maintaining interest rates (price) as a strategic variable for competition.

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[53] The parameter ρ is considered to be a weighted average of non-banking rates which include any exogenously set rates such as the money market rate, the rate on government bonds and etc.
[54] Klein and Monti consider a monopolistic bank, a purely competitive model.

Banks enter the market when profits cover their fixed costs of entry. A typical customer will search between bank i and i^0 and then the marginal depositor condition (x distance away from the bank) for the bank is:

$$\alpha x - t_i = \alpha\left(\frac{1}{n} - x\right) - t^0 \tag{2.1}$$

Hence, the supply of deposits for the bank is:

$$2x = \frac{1}{n} + \frac{t_i - t^0}{\alpha} \tag{2.2}$$

Therefore, as the market becomes more fragmented with a larger number of banks (n), the supply of deposits per banks becomes smaller under competition. On the other hand, the higher deposit rates (t_i) offered, the bank can attract more depositors. However, the supply of deposits would decline as the transportation cost increases.

Equivalently, the marginal borrower condition (y distance away from the bank) for the bank is:

$$\beta y + r_i L = \beta\left(\frac{1}{n} - y\right) + r^0 L \tag{2.3}$$

Hence, the total volume of demand for loans for the bank is:

$$2y \cdot V = \left(\frac{1}{n} - \frac{r_i - r^0}{\beta} \cdot L \right) \cdot V \tag{2.4}$$

The interpretation for the equilibrium condition for the loans is much the same as in the deposit market condition. As the market becomes more fragmented with a larger number of banks (n), the demand of loans per banks becomes smaller under competition. On the other hand, the higher loan rates (r_i) offered, the bank attracts less number of borrowers. However, as in the deposit market case, the demand for loans would decline as the transportation cost increases.

2.4.1 Profit Maximising Free Competition

NPLs enter the loss function and thus affect the profit function in the model. Assume a proportion ϕ of the total loans are NPLs, on which the banks have to build provisions of $(\delta + r)\phi$ proportion on loans at a provision rate δ.[55] Then, the profit function of bank i becomes

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[55] Assume $0 < \delta < 1$, $0 < \phi < 1$ as neither provisions nor NPLs can be larger than the total volume of loans.

$$\pi_i = (r_i - \rho)\left(\frac{V}{n} - \frac{r_i - r^0}{\beta}VL\right) + (\rho - t_i)\left(\frac{1}{n} + \frac{t_i - t^0}{\alpha}\right) - C - (\delta + r_i.)\phi\left(\frac{V}{n} - \frac{r_i - r^0}{\beta}VL\right) \tag{2.5}$$

Differentiating the profit function with respect to t_i and r_i and applying a symmetry by substituting to $t_i = t^0$ and $r_i = r^0$ into the first-order conditions leads to the following symmetric equilibrium condition:

Proposition 1. At the symmetric equilibrium, unregulated short-term rates with consideration of NPLs are given by

$$t_n^s = \rho - \frac{\alpha}{n} \quad and \quad r_n^s = \frac{\rho}{1-\phi} + \frac{\phi}{1-\phi}\delta + \frac{1}{n}\frac{\beta}{L} \tag{2.6}$$

Under the free-entry condition $(\pi = 0)$*, the number of banks in the market* n_n *and the long-run equilibrium values for t and r are:*

$$n_n = \sqrt{\frac{\alpha + \beta(1-\phi)V/L}{C}} \tag{2.7}$$

$$t_n^L = \rho - \alpha\sqrt{\frac{C}{\alpha + \beta(1-\phi)V/L}} \tag{2.8}$$

$$r_n^L = \frac{\rho}{1-\phi} + \frac{\phi}{1-\phi}\delta + \frac{\beta}{L}\sqrt{\frac{C}{\alpha + \beta(1-\phi)V/L}} \tag{2.9}$$

The notation is as follows. A subscript m (market) indicates free competition values without NPL consideration, whereas *n* refers to free competition with NPL consideration. A subscript *w* (weighted) indicates mixed competition with NPL consideration. A superscript *S* was used for short-term values obtained for a given number of *n* banks. A superscript *L* refers to long-term values in the case that the number of banks is endogenous.

First, the NPL ratio does not affect the deposit rates, but affects the loan rates positively. The provision rate is also positively related to the loan rates. Higher loan rates can be interpreted as the banks' reaction towards risky assets to offset the potential loss in non-accrual interest payments and the loan provisions.

Second, the deposit and loan rates are positively related to the money market rates. The mark-down and mark-up are not simple any more. The margin is also positively related to the NPL ratio. It is important to note that any change in ρ due to some monetary policy will be passed on to rates offered by banks, but the magnitude of impact on the loan rates is larger as NPL ratio increases. Even if banks do not participate in the money market ($V = \lambda L = 1$), ρ still remains as a dominant factor for the equilibrium rates offered by banks.

Finally, the endogenous number of banks in the long-run is positively related to the short-term profits, thus negatively related to NPL ratio.

A market where the Government imposes a deposit rate ceiling is considered as most East Asian countries used to have some sort of regulation on deposit rates to promote their industrial policy. Let us consider a revenue maximising bank with initial capital of A.

2.4.2 Revenue Maximising Competition under Regulation

Banks in Asia tried to maximise revenue only under regulation prior to the recent restructuring and the objective function of revenue becomes:

$$R_i = A + (1+r_i)\left(\frac{V}{n} - \frac{r_i - r^0}{\beta}VL\right) - C - (\delta + r_i)\phi\left(\frac{V}{n} - \frac{r_i - r^0}{\beta}VL\right) \qquad (2.10)$$

Differentiating the revenue function with respect to r_i and applying a symmetry by substituting to $r_i = r^0$ into the first-order conditions leads to the following symmetric equilibrium condition:

Proposition 2. At the symmetric equilibrium for revenue maximising banks, unregulated short-term loan rates with consideration of NPLs are given by

$$r_r^s = \frac{\delta\phi - 1}{1-\phi} + \frac{1}{n}\frac{\beta}{L} \qquad (2.11)$$

Again, the loan rates are positively related to the NPL ratio and the provision rate. We were able to derive the loan rate for revenue maximising banks but the number of banks for a given market size was indeterminate. The market can support infinitely many banks when the banks are revenue maximising. There are some

examples of unnecessarily high number of banks in the market, particularly in developing countries.

2.4.3 Mixed Competition

Now we introduce the parameter θ into the objective function as a weight for revenue maximisation so that we can incorporate both revenue and profit maximisation under regulation, using the weight θ for revenue maximisation and the residual weight $1-\theta$ for profit maximisation.

We assume that banks are more likely to revenue maximise under a price-cap regulation whereby interest rates on loans and deposits are predetermined by the regulator (*deposit/loan rate control*) and hence, these interest rates are no longer their strategic variables. By contrast, under a rate-of-return regulation, banks are more likely to profit maximise in order to meet the guideline for return on asset (*ROA*) and/or capital adequacy ratio (*BIS ratio*).

$$\pi_i^w = \theta * R_i + (1-\theta) * \pi_i, \quad where \quad 0 < \theta < 1 \tag{2.12}$$

Differentiating the new profit function with respect to t_i and r_i and applying a symmetry by substituting to $t_i = t^0$ and $r_i = r^0$ into the first-order conditions leads to the following symmetric equilibrium condition:

Proposition 3. At the symmetric equilibrium, short-term rates are given by

$$t_w^s = \rho - \frac{\alpha}{n} \quad and \quad r_w^s = \frac{\rho}{1-\phi} + \frac{\delta\phi - (1+\rho)\theta}{1-\phi} + \frac{1}{n}\frac{\beta}{L}. \tag{2.13}$$

Deposit rates are same as previous cases but the loan rates are now negatively related to θ. This can be interpreted as banks offering lower loan rates to increase the revenue via a larger volume of loans.

Under the free-entry condition $(\pi = 0)$, *the number of banks in the market* n_w *and the long-run equilibrium values for t and r are:*[56]

$$n_w = \sqrt{\frac{\alpha(1-\theta) + \beta(1-\phi)V/L}{C - \theta(A+C)}} \tag{2.14}$$

$$t_w^L = \rho - \alpha\sqrt{\frac{C - \theta(A+C)}{\alpha(1-\theta) + \beta(1-\phi)V/L}} \tag{2.15}$$

$$r_w^L = \frac{\rho}{1-\phi} + \frac{\delta\phi - (1+\rho)\theta}{1-\phi} + \frac{\beta}{L}\sqrt{\frac{C - \theta(A+C)}{\alpha(1-\theta) + \beta(1-\phi)V/L}} \tag{2.16}$$

$$where \quad 0 < \theta < \frac{C}{A+C} \leq 1 \quad (condition \ for \ non-negative \ capital)$$

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[56] Recall the subscript m represents usual monopolistic competition outcome without considering NPL factor whereas the subscript n is for the outcome with NPL consideration and the subscript w is mixed competition of revenue and profit maximisation.

First, the initial capital A is positively related to the number of banks as it provides a lower bound in the profit function and this increases incentives for new banks to enter the market.

Second, the effect of θ parameter is not independent of the size of capital A. If A is large enough, then θ is positively related to the number of banks. Therefore, for a reasonably capitalised market for banks, the number of banks increases with the regulation, while deposit and loan rate spread becomes smaller.

Finally, the NPL ratio affects the number of banks negatively whereas the provision rate has no impact on the number of banks. However, the loan rate rises with the NPL and provisions.

2.4.4 Comparison

$$
\begin{aligned}
& n_m > n_n \\
& n_w = n_n, \qquad if \;\; \theta = 0 \\
& n_w > n_n, \qquad if \;\; 0 < \theta < \frac{C}{A+C} \leq 1
\end{aligned}
\tag{2.17}
$$

As shown in the previous section, the equilibrium number of banks in the market is smaller if we take NPLs into consideration ($n_m > n_n$). On the other hand, when banks behave more like a profit maximiser i.e. focusing more on their performance measures such as ROA and BIS ratios, the market equilibrium would support a smaller number of banks as shown in the equations 2.17.

In summary, as banks focus more on revenue maximisation, the equilibrium number of banks tends to be unnecessarily large compared to the profit maximising case. A higher capital base, A, decreases the upper bound for θ implying the sound capital base encourages banks to profit maximise more than to revenue maximise. Figures 2.16 illustrates the simulation results for the upper bound of θ when the paid-in-capital size, A, is increased from 0.01 to 0.1 *ceteris paribus*. Figure 2.17 summarises the inverse relationship between the paid-in-capital size (A) and the relative weight assigned to revenue maximisation (θ). Thus, the probability of profit-maximisation increases for banks with larger paid-in-capital. When θ is equal to zero, the results are identical to the case of unregulated competition.

The figures suggest that the equilibrium number of banks increases with the parameter θ but there is a upper bound for θ as n grows exponentially after a certain point, which may not be feasible. Higher paid-in-capital (A) sets this upper bound at a lower level as well as the level of equilibrium number of banks. In an extreme case, where banks have no paid-in-capital, i.e. A=0, the upper bound is equal to 1. On the other hand, if banks have extremely large amount of paid-in-capital ($A \rightarrow \infty$), the upper bound converges to zero asymptotically. Thus, a better-capitalised banking sector tends to have a smaller number of banks, i.e. more concentrated. This could explain the reason why stricter BIS ratio induced more mergers or exits and therefore created a more concentrated banking environment in East Asia.[57]

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[57] The current guideline for BIS ratio is 8% minimum set by Basel Accord 1988. Most G7 countries show 9-10% BIS ratio. Redrafting of the BIS Capital Accord was announced in Jan.2001. A revised framework for the New Basel Capital Accord (Basel II) was published in June 2004, which suggests stricter regulation on risky assets (http://www.bis.org/publ/bcbs107.htm).

2.5 Empirical Analyses of the Banking Structure in Japan and Korea

In this section, we attempt to prove the results of the theoretical model with empirical data using an econometric specification based on structure-performance relationship. In a concentrated industry, there exist economies of scale and thus higher profits are expected under a concentrated market structure. The rationale behind this prediction is that in a concentrated industry, firms behave as oligopolists, earning high profits. However, the SCP paradigm is not always justified if we take into account the strategic behaviour of firms. For instance, there are barriers to entry where banks can act together collusively against new entries. One other point, which is missed out in the SCP paradigm is the feedback that the higher the profits, the greater the number of firms that enter the industry and thus lower the level of concentration. This feedback is exemplified within the regulatory framework. Tougher competition leads to lower profits and thus many firms are driven out of the industry and hence raises concentration.

There have been studies on the impact of deregulation on the structure of the banking industry, but most of them focused on EEC banking industries and there are no studies on East Asian banking. Given the peculiarity of industrial policy and the role of banks in East Asia, it is worth trying to estimate the impact of deregulation on concentration and the structure of banking industry in Japan and Korea. The process of deregulation since 1979 in Japan and since 1988 in Korea provides the natural

framework to assess this impact, especially when the process accelerated following the Asian financial crisis in 1997.

2.5.1 The Data

In order to test the predictions of SCP paradigm with modification for feedback, a set of variables for *Structure* (concentration), *Conduct* (branching and pricing) and *Performance* (profitability) were chosen and the relevant indices computed with respect to the strategic variable, deposits.[58] The number of branches per bank measured the size of the branch network. Finally, three dummy variables were used to capture the effect of different types of deregulation: 1/ deregulation of deposit interest rates; 2/ deregulation of branching restriction, and 3/deregulation of cross-financial sector entry.

The time-series data in aggregate for both Japan and Korea were constructed using 22 nationwide banks and 64 regional banks in Japan (86 banks) and 18 nationwide banks and 10 regional banks in Korea (28 banks). Hence the panel of all 114 commercial banks in the two countries over the 28 year period from 1976 to 2003 were used in the calculation of the time-series data for the analyses. However, one should note that this data set has only time-series features as we lost panel attributes when calculating the market structure variables in aggregate. When a bank changes its name after restructuring, it was recorded as a new entry in the data set.

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[58] We assume the strategic objective of a bank is to compete for deposits in the market. Hence, we use deposits as the strategic variable.

Changes in the number of commercial banks in Japan and Korea are shown in Table 2.1 with a substantial number of mergers.

These two countries are chosen for several reasons: 1/ the times series data are not readily available for the entire set of commercial banks in other countries in the region; 2/ the available data are more reliable compared to those of other countries' banks; 3/ the banking sector in Japan and Korea have undergone a substantial consolidation; 4/ both countries have implemented progressive deregulation in the banking sector, and finally 5/ the industry restructuring in Japan and Korea are often replicated in other newly industrialised countries (NIEs) and the restructuring of the banking sector is no exception.

For both countries, the data for all commercial banks were aggregated into time-series instead of panel. The Japanese data were collected from the Bank of Japan (BOJ hereafter) and Japanese Bankers Association (Zenginkyo hereafter) publications and the Korean data came from the Bank of Korea (BOK), Financial Supervisory Services (FSS) and Maekyung-Annual Corporation reports.

We have followed the classification of deposit institutions set by the respective central banks. The econometric model is tested on commercial banks (i.e. nationwide city banks and regional banks), as foreign bank branches and specialised banks do not participate in the majority of competitive activities given the prevailing regulation. Moreover, city and regional banks represent nearly 50% of the deposit market and they are the ones that compete in the more realistic sense.

2.5.2 Description of Variables

We classified variables into three groups following the SCP paradigm. The level of concentration, market size and branch concentration were included in *Structure* as shown in the dependent variable section in Table 2.5. Deposit and loan rates are taken as a proxy for price and the average branching as a proxy for quantity.[59] These price and quantity proxy variables were included in *Conduct*. Return on deposits was included in *Performance*. The conduct and performance measures are shown as independent variables in Table 2.5. Variables included in the 3 groups are discussed in further details hereunder.

There are various ways to measure concentration (CNC_t). However, we have chosen to use a logit transformation of C_{5t} (n-firm concentration ratio of top 5 banks in year t) to avoid the problem of an upper limit of $C_{5t}=1$ and to maintain an identical distribution of residuals at all values of market size.[60] We calculate C_{5t} for an n-firm concentration ratio of top 5 banks[61] by aggregating market shares of top five banks in the deposit market for year t.[62] Sutton (1991) has been using the logit transformation for some time, which was subsequently adopted by others like Cerasi and Daltung (2000). For those who are not familiar with this type of transformation, the conventional Hirschman Herfindal Indices (HHI_t) were also used for comparison,

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[59] Banks expand their branch networks to gain market share in both deposits and loans.

[60] Here, the deposit market size follows the same definition as used for the variable MKS_t, i.e. all the local currency deposits in current, savings and time deposit accounts at city and regional banks.

[61] $C_{5t} = \sum_{i=1}^{5} s_{it}$ where s_{it} = market share of bank i in year t

[62] For multi-market conglomerate mergers and market shares, see Mueller (1985).

although we do not expect to find much difference in results as shown in Figure 2.3 and 2.4.

$$CNC_t = \ln\left(\frac{C_{5t}}{1-C_{5t}}\right) \tag{2.18}$$

The deposit market size (MKS_t) was computed in index form in order to deflate for changes in prices and currency devaluation. The total deposit size includes local currency deposits in current, savings and time deposit accounts at city and regional banks, i.e. ordinary banks.[63]

$$MKS_t = \ln\left(\frac{Total\ Deposit\ Size_t}{GNP_t}\right) \tag{2.19}$$

The size of the branch network is also calculated in index form for the whole market taking the number of branches per bank.

$$AVB_t = \ln\left(\frac{Total\ number\ of\ branches_t}{Number\ of\ banks_t}\right) \tag{2.20}$$

Branch concentration ($BCNC_t$) is computed in index form as well taking a logarithmic ratio of the number of branches operated by top five banks over total number of branches (BC_{5t}). [64]

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[63] The deposit size data were taken from 'Bank Management Statistics' published by FSS for Korea and 'Analysis of Financial Statement of All Banks' published by Zenginkyo for Japan.

[64] $BC_{5t} = \sum_{i=1}^{5} b_{it}$ where $b_{it} = \dfrac{\text{No. of branches operated by bank } i \text{ in year } t}{\text{Total No. of bank branches in the market in year } t}$

$$BCNC_t = \ln\left(\frac{BC_{5t}}{1-BC_{5t}}\right) \tag{2.21}$$

Interest rates on deposits (IRD_t)[65] and loans (IRL_t)[66] were directly taken without transformation as IRD_t and IRL_t are already normalised with respect to the size of deposits by taking the weighted average of market interest rates.[67] For the performance measure, Return on deposits (ROD_t) was computed as a ratio of net profits over total deposits.[68] It is important to note that the performance measure cannot be simply the interest margin. Return on deposits (ROD_t) is a measure of banks' soundness as non-accrual interests and provisions for non-performing loans were taken into account. Therefore, return on deposits (ROD_t) should definitely be distinguished from interest margins.

In addition to 3 groups of variables, 3 deregulation dummy variables used in the analysis: D_{1t} for deregulation on deposit interest rates, D_{2t} for deregulation of branching restriction, and D_{3t} for deregulation on cross-financial sector entry.

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[65] For Korea, indicative interest rate on time deposits for more than 1 year and less than 2 years (but effective for 1 year or more before Dec. 5, 1988) published by BOK is used, where the rate is an average weighted by amount from 1996. For Japan, the rate is an average weighted by amount for total deposits published by Zenginkyo.

[66] For Korea, indicative interest rate on loans of general funds up to 1 year for general enterprises at the end of period, where the rate is an average weighted by loan of banking funds from 1996. For Japan, the rate is an average weighted by amount for total loans published by Zenginkyo.

[67] IRD_t and IRL_t are taken from 'Money and Banking' published by BOK for Korea (http://ecos.bok.or.kr/) and 'Analysis of Financial Statement of All Banks' published by Zenginkyo for Japan.

[68] No logarithmic transformation is taken, as the distribution of residuals is normal with the simple ratio form.

Banking licenses in East Asia were initially given out for banking operations only exclusively. However, the deregulation of cross-financial sector entry allowed banks to enter other financial business areas such as securities trading and insurance sales.

These dummy variables take a progressive form based on the gradual deregulation processes, between 0 and 1, with 0 being complete regulation versus 1 being complete deregulation. As deregulation on interest rates in Japan and Korea was carried out in a progressive way as shown in Table 2.3 and 2.4, the relative magnitude of deregulation impact was determined according to local authorities statements, which imply the first stage of deregulation has more weight than the rest. For instance, D_{1t} =1 means complete deregulation on interest rates in 1995 for Korea, whereas D_{1t}=0.5 represents deregulation is only half way through the process as described in Table 2.5. Figure 2.13 illustrates the progressive deregulation on deposit interest rates whilst Figures 2.14 shows a one-off deregulation of branch restriction in Japan in contrast to the full restriction on branching in Korea. For the deregulation of cross-financial sector entry, Figure 2.15 illustrates a one off deregulation in Korea and a two-stage deregulation in Japan.

Finally, in order to investigate the impact of size distribution of market concentration and compare the results from nationwide banking with those from regional banking, the Hirschman Herfindal Indices (HHI_t) were calculated and scaled by 100 for:[69] 1/ all commercial banks (HHI_t); 2/ nationwide banks ($HHIN_t$), and 3/

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[69] All three HHI_t, $HHIN_t$, and $HHIR_t$ are obtained by e.g. $HHI_t = \frac{\sum_{i=1}^{n} s_{it}^2}{100}$

regional banks ($HHIR_t$). One could argue that the HHI_t is more effective measures for market concentration as it intrinsically gives weight to both number of firms in the market and their market share distribution.

2.5.3 The Econometric Model

An econometric model is tested in a SCP paradigm framework using two-stage least squares (TSLS) of a system of simultaneous equations:

$$CNC_t = \alpha_0 + \alpha_1 MKS_t + \alpha_2 IRD_{t-1} + \alpha_3 IRL_{t-1} + \alpha_4 AVB_t + \alpha_5 ROD_{t-1} + \alpha_6 CNC_{t-1} + \sum_{k=1}^{3} \delta_{kt} D_{kt} + \varepsilon_{1t} \quad (2.22)$$

$$BCNC_t = \beta_0 + \beta_1 MKS_t + \beta_2 IRD_{t-1} + \beta_3 IRL_{t-1} + \beta_4 AVB_t + \beta_5 ROD_{t-1} + \beta_6 BCNC_{t-1} + \sum_{k=1}^{3} \varphi_{kt} D_{kt} + \varepsilon_{2t} \quad (2.23)$$

$$AVB_t = \gamma_0 + \gamma_1 MKS_t + \gamma_2 BCNC_t + \gamma_3 ROD_{t-1} + \gamma_4 AVB_{t-2} + \sum_{k=1}^{3} \lambda_{kt} D_{kt} + \varepsilon_{3t} \quad (2.24)$$

, where k=1,2,3 for three deregulation dummy variables.[70]

Equations 2.22 and 2.23 use one of the most general forms of specification. They are designed to detect the effects of deposit market size (MKS_t), lagged interest rates on

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[70] All three equations are identified as they pass both order and rank conditions. Deregulation on branching restriction (D_{2t}) is excluded for Korea, as the restriction has not yet been relaxed in Korea.

deposits and loans (IRD_{t-1} and IRL_{t-1}), average branch network size (AVB_t), lagged return on deposit (ROD_{t-1}), lagged concentration (CNC_{t-1} in eqn. 2.22; $BCNC_{t-1}$ in eqn. 2.23), and three types of deregulation (D_{1t} , D_{2t}, and D_{3t}) on the banking concentration (CNC_t in eqn. 2.22; $BCNC_t$ in eqn. 2.23).

On the other hand, equation 2.24 takes a form that is simplified by dropping lagged interest rate variables as banks do not consider the level of market interest rates as strategic reasons to expand their branch network size. Equation 2.24 explains the effects of deposit market size (MKS_t), branch concentration ($BCNC_t$), lagged return on deposit (ROD_{t-1}), lagged average branch network size (AVB_{t-1}), and three types of deregulation (D_{1t} , D_{2t}, and D_{3t}) on average branch network size (AVB_t). One should note that we use two-stage least squares (TSLS) given the endogeneity between AVB_t, CNC_t, and $BCNC_t$.

This is a dynamic model, which corrects the weakness of the traditional SCP paradigm assumption of a one-way flow of causality.[71] In order to incorporate a feedback feature, interest rates on deposits and loans were taken in lagged forms of one year (IRD_{t-1} and IRL_{t-1}). Effective business plans of most East Asian banks are made on an annual basis reflecting the performance of the previous year. Hence, return on deposit (ROD_t) also takes a lagged form (ROD_{t-1}) together with the overall feedback via the lagged dependent variables (CNC_{t-1} in eqn. 2.22; $BCNC_{t-1}$ in eqn.

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[71] Cowling (1976), Strickland & Weiss (1976) and Sutton (1991) pointed out this weakness of SCP paradigm and suggested various alternative methods. Cowling suggested a recursive model and Strickland and Weiss suggested a system of simultaneous equations while Sutton claims there is no single specification explains all industries.

2.23). These one-year lagged variables are verified by interviews with banks such as Korea Housing Bank (KHB), Korea First Bank (KFB), and Kookmin Bank (KB) as well as FSS in Korea and Zenginkyo in Japan.[72] All lagged dependent variables were taken to be with one-year lag except for the average branch network size (AVB_t) where we use two-year lags given the nature of data.[73]

Market size (MKS_t) was also assumed exogenous in the model as deposit size is not endogenously determined in relation to the market structure measured in concentration. Deregulation dummy variables were considered to be exogenous since the reason for deregulation in East Asia lies in the outside pressure from the international organisations such as G7, OECD, IMF and World Bank.

Concentration (CNC_t), branch concentration ($BCNC_t$) and average branch network (AVB_t) are the variables determined endogenously as well as contemporaneously based on the number of banks, the number of branches and the concentrations in the market.

So far we have examined whether the relationships between the variables in the model are contemporaneous or have lagged features in constructing the simultaneous equations and have shown exogeneity and endogeneity. This model enables the testing of the following propositions drawn from the literature within the SCP framework:

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[72] The interview with Zenginkyo took place during the visit to its office in Tokyo between 18-20 Dec. 2000 and the interviews with KHB, KFB, KB, and FSS took place in Seoul between 26-30 Dec. 2000.
[73] The Phillips-Perron test of unit roots were conducted for all the dependent variables on their lags and the number of lags were determined accordingly: one-year lag for CNC_t and $BCNC_t$ and two-year lag for AVB_t.

Structure (Concentration: CNC_t, Branch Concentration: $BCNC_t$)

1. The degree of concentration decreases as the market size increases with given set-up costs:[74]

   This proposition follows the theory put forward by Sutton's (1991) exogenous sunk cost model. He explains that a growing market size would attract more entrants and hence has a more fragmented market structure at equilibrium for a given level of sunk costs.

2. The degree of concentration in the industry is positively related to the degree of concentration in branching:

   This proposition is directly related to the literature by Cerasi et al. (2002) which showed a positive relationship between the market concentration and the branch networks in European banking. This also follows the school of thoughts (Kolari and Zardkoohi, 1987; Clark, 1988) that banking concentration is positively associated with economies of scale and scope.

3. The average branch network size is positively related to the degree of branch concentration:

   This proposition aims to test the feedback process between a *Conduct* variable (AVB_t) and a *Structure* variable ($BCNC_t$) within the SCP framework. The literature by Cerasi et al. (2002) provides a useful insight for the proposition.

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[74] Traditionally, the SCP paradigm with feedback predicts higher profit levels as the market size grows and therefore it attracts more entrants and a fragmented market structure is established as a result.

Conduct (Deposit and loan rates: IRD_{t-1} and IRL_{t-1}, Branch network: AVB_t)

1. The interest rate on deposits is negatively related to the degree of concentration:

   Sutton (1991) argues that the degree of price competition in the market affects the market concentration. For example, a monopoly bank can abuse its market power and offer only very low deposit rates to its customers. On the other hand, in a perfectly competitive market structure, banks offer more competitive deposit rates, i.e. higher rates. The basic framework is to test the feedback process between a *Conduct* variable (IRD_{t-1}) and a *Structure* variable (CNC_t) in the SCP paradigm.

2. The interest rate on loans is positively related to the degree of concentration:

   The argument of this proposition follows the same principle laid out in the above proposition 1 on the deposit rates but in the opposite direction as a monopoly bank now charges its highest possible interest rates for its loans.

3. The average branch network size is positively related to the degree of concentration:

   This proposition aims to test the feedback process between a *Conduct* variable (AVB_t) and a *Structure* variable (CNC_t) within the SCP framework. Cerasi et al. (2002) argue that considering branching as a strategic variable in banking competition, more concentrated market structure would have a larger average network size per bank as banks more aggressively open up new branches under more threats of competition.

Performance (Return on deposits: ROD_{t-1})

1. The return on deposits is positively related to the degree of concentration:

   This proposition aims to test the feedback process between a *Performance* variable (ROD_{t-1}) and a *Structure* variable (CNC_t) within the SCP pardigm. The argument of the proposition is straightforward since firms with more market power within a concentrated market structure can charge prices close to a monopoly price and therefore the profitability of these firms would be higher.

Deregulation (Different types of deregulation: D_{1t}, D_{2t}, and D_{3t})

1. Relaxed regulation leads to a higher degree of concentration:

   This proposition aims to test the impact of regulation on market structure put forward by Chiappori et al. (1995). Their model suggests that the equilibrium number of banks in the market is higher under deposit and loan rate regulation than under free-market competition.

2. Deregulation leads to higher degree of concentration in branching:

   This proposition also follows the same principle set out above by Chiappori et al. (1995) but the only difference is to look at branch concentration ($BCNC_t$) instead of market concentration (CNC_t).

3. Deregulation leads to banks with larger branch networks

   Considering the feedback process between *Structure* and *Conduct* in the SCP paradigm, this proposition aims to test the indirect impact of deregulation on a *Conduct* variable (AVB_t)

Traditional literature suggested that the degree of concentration would be negatively related to the size of the market to sunk costs ratio, assuming that the sunk costs are similar across the market. For example, Sutton (1991) explains, for a wide class of homogeneous goods models, including the Cournot and joint profit maximisation models, the industry converges to a fragmented structure, as the ratio of the size of the market to sunk costs becomes large. The larger the market size is, the more room there is for new entries, which leads the market to a more fragmented structure. However, Cerasi et al. (2002) showed some evidence of a negative relationship between concentration and market size in the banking industries in Europe. They suggest that set-up costs for the first branch are mainly due to entry regulation, i.e. the requirement a bank has to meet in order to become operative and the access costs to funds, given by the interbank market. In a single country case like in Japan or Korea, this assumption simplifies the empirical test allowing one to ignore the problem of finding a proxy for set-up costs.

The results from estimating the 3-equation system are reported in Table 2.6. For the first proposition in *Structure*, the relationship between the degree of concentration (CNC_t) and the market size (MKS_t) is positive in Japan but negative in Korea. The coefficient of the market size is statistically significant in Japan but not significant in Korea. We would not elaborate on the contradicting results between two countries as the coefficient of the market size in Korea is extremely small and statistically significant to make any meaningful comments on it. In addition, we find more convincing results which indicate positive relationships between banking concentration and market size in both Japan and Korea when we use Hirschman

Herfindal Indices (HHI_t) as shown in Table 2.7. These results reject the proposition set out earlier in the section that the degree of concentration decreases as the market size increases with given set-up costs. One could question the assumption of sunk costs in explaining the reason for the opposite signs. The proposition was initially based on the assumption of exogenous sunk costs, i.e. set-up costs but if we assume endogenous sunk costs as Sutton (1991) suggested, it is possible to observe escalation in concentration as market size increases (see Figure 2.3 and 2.4). Sutton's (1991) endogenous sunk costs model uses advertisement and R&D costs as an example and characterises these markets as markets with some network or learning effects where the sunk costs are not fixed but to increase with the intensity of competition and as result, the market tends to move towards a more concentrated structure which he denotes as escalation in concentration.

The result for the second proposition in *Structure* is also interesting since the sign on the estimated coefficient of market size (MKS_t) in branch concentration ($BCNC_t$) is positive in both Japan and Korea (the coefficients are 0.34 and 0.35 respectively) although neither is significant. The usual prediction is that when the market size increases, the branching network size also increases but the dominant banks expand their branch network even more to pre-empt new entries. Therefore the results are typical evidence for this type of pre-emptive and/or competitive branching activity and reiterates the results for the first proposition suggesting a certain degree of escalation in concentration if we assume the cost of branching as endogenous sunk costs.

Concerning size of average branch network, the data do support the third proposition in *Structure* showing a statistically significant positive relationship between the average branch network size (AVB_t) and the branch concentration ($BCNC_t$) in Japan. However, the coefficient of branch concentration ($BCNC_t$) in Korea rejects the proposition and insignificant. One general and important observation to make here is that the econometric results in Korea shown in Table 2.6 do not correspond so well with the propositions set out earlier largely because most coefficients are statistically insignificant. However, the results shown in Table 2.7 using Hirschman Herfindal Indices (HHI_t) look much more significant and in line with the propositions. This is perhaps an area that a future research should look into as to why the specification using Hirschman Herfindal Indices (HHI_t) work better than that with transformed N-firm concentration ratios (CNC_t or $BCNC_t$). It may need some alternative model specifications when using transformed N-firm concentration ratios (CNC_t or $BCNC_t$) in Korea.

The negative relationship between the average branch network size (AVB_t) and the market size (MKS_t) in Japan can be explained by the dominance of Keiretsu networks (the coefficient of –0.05 significant at 10% level) which does not need much branching to attract large size banking business as it is mostly secured with the Keiretsu. On the other hand there is a positive relationship between the average branch network size (AVB_t) and the market size (MKS_t) in Korea, although it is not significant (the coefficient is 0.03). This difference in the results suggests that the banking network between Keiretsus and Japanese banks is more effective than that between Chaebols and Korean banks. This is an important observation as it firstly

indicates that the banking structure should not be looked at independent of the real sector.[75] Secondly, it also helps us to understand why two countries show divergence in banking restructuring or if not divergence, in different stages of banking evolution.

For the first proposition in *Conduct* regarding the deposit interest rate (IRD_{t-1}), we had consistent results from Japan although it was significant only in explaining branch concentration ($BCNC_t$). The initial proposition predicted a more fragmented market structure with new entries would raise deposit rates under competition and squeeze interest margins for a given level of loan rate. The results do support this proposition and indicates that dominant banks can afford to pay relatively lower deposit rates in a concentrated market structure.

However, one could probably argue that the banking conduct in the region is not entirely up to the market concentration and the loose competition environment in East Asia where industrial policies and regulation dominated the banking. It is worth noting that banks' entry decision in East Asia has been less sensitive to the banking outlook given the industrial policy as shown in Table 2.2 but to banking regulation as listed in Table 2.3 and 2.4. Therefore, this result should not be looked at independently of changes in regulation, which aim for free competition. On the other hand, the results on deposit rate in Korea are not significant for market concentration (CNC_t) nor for branch concentration ($BCNC_t$).

The second proposition in *Conduct* deals with loan rates (IRL_{t-1}). Following the same logic as in the previous proposition, a positive relationship is predicted

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[75] Chapter 4 will investigate this relationship between the banking sector and the real sector using borrowers' ownership structure and the monitoring mechanism of private information.

between the interest rate on loans (IRL_{t-1}) and the degree of concentration (CNC_t) for a given level of deposit rate as dominant banks can charge higher loan rates. We find that the results for both Japan and Korean agree with the proposition and the positive relationship is significant at 5% level in explaining branch concentration ($BCNC_t$).

Once again, as free entry condition has not been common in Korea due to prevailing regulation and the determination of loan rates and deposit rates were predominantly regulated by the Korean Government in favour of its industrial policy, changes in interest margins do not necessarily seem to affect new entries and hence the market structure. This is a very important and useful observation to justify the simple theoretical model illustrated in the earlier section suggesting that it is not appropriate to consider interest rates on loans and deposits as only strategic variables in banking competition without taking regulation and NPL provisions into consideration.

It is clear that increasing margins allowed more market power to the incumbent banks in Japan to pre-empt new entries via branching. On the other hand, the proposition holds in the Korean case without much significance, which suggests that we need other explanatory variables over and above interest rates on loans and deposits.

Regarding the relationship between the average branch network size (AVB_t) and the concentration (CNC_t), the initial proposition of a positive relationship holds only for the Korean case explaining market concentration (CNC_t). The coefficients are negative in all other cases. This third proposition in *Conduct* is rooted in the idea that increasing network size in order to provide services to a bigger market may

create a concentrated market structure. However, the results in both Japan and Korea show more or less evidence of negative relationship (except for the market concentration in Korea). This may indicate a banking inefficiency in East Asia where branch network expansion does not increase market share.

Finally, the last proposition reveals a relationship between *Performance* and market structure. The Japanese data show no evidence of relationship between the concentration (CNC_t) and the return on deposit (ROD_{t-1}), whereas the Korean data show a negative relationship between branch concentration ($BCNC_t$) and return on deposit (ROD_{t-1}), which is significant at 10% level. This result in Korea rejects the initial proposition set out earlier in the section but suggests that banks tend to leave the market or merge together to restore some power in light of falling profitability. However, this corresponds to the proposition drawn from the simple theoretical model with NPLs, that indicates the larger the NPLs, i.e. less profitable or lower return on deposit, more concentrated the market is. However, there is a problem interpreting the case of high profitability attracting new entries, as a free entry condition has not been applicable in Japan and Korea given the strict regulation on licensing new banks and new branches as indicated in Table 2.3 and 2.4. These results are somewhat ambiguous and would need further in-depth investigation with alternative model specifications.

Before we move onto the next section of results, it is worth noting that interest margins and return on deposits are two different concepts as the latter does include the risk effects of loans offered by the banks whereas the former does not factor in the risk returns but simply represents the interest rate strategy, i.e. pricing

strategy. This is clear when we look at the figures 2.9 to 2.12. Figure 2.9 illustrates the historic movement of interest rates on deposits and loans in Japan which translates into interest margins (*solid line*) in Figure 2.10 whilst the dashed line in the figure represents return on deposits. Similarly, Figure 2.11 shows the historic movement of interest rates on deposits and loans in Korea whilst Figure 2.12 compares the Korean interest margins to its return on deposits. In Japan it seems difficult to conclude any relationship between interest margins and return on deposits in Japan. On the other hand, we observe stability of return on deposits in Korea (except for the 1997 financial crisis period) despite the fluctuation in the interest margins.

Concerning the deregulation we need to specify which type of deregulation among the three (D_{1t}, D_{2t} and D_{3t}) is considered in each case. The first proposition relies on deposit rate deregulation (D_{1t}), which is one of the most crucial types of deregulation in the SCP framework as it indicates a shift from price-cap regulation to rate-of-return regulation. With the deregulation on deposit rate (D_{1t}), banks are expected to compete more vigorously and thus created more concentrated market structure to obtain some market power. Similarly, branch concentration ($BCNC_t$) was expected to increase with deregulation in the process of mergers and exits. However, the results do not give any clear sign of direction in the relationship except for the case where we explain movements in average branch network size (AVB_t) in Japan. All three deregulation measures here show significant evidence for smaller branch network size. This seems to explain adjustments in banking activity from unnecessary branch expansion under regulation to more rationale and efficient

branch expansion. This type of irrational branch expansion was not unknown when banks have to take advantage of granted branching licenses under strict control over branch licensing.

Both the Japanese and the Korean data showed a negative relationship between deregulation on deposit rate (D_{1t}) and the concentration (CNC_t) although they are not significant. The negative relationship could be related to the inflexible deposit rates around zero in Japan and the moderate regulation in Korea. Thus, the deposit rate deregulation (D_{1t}) leaves little room for East Asian banks to strategically move rates and thus affect the market structure. The feedback process of SCP paradigm going through the deposit rates in East Asia is somewhat disconnected for the above reason.

The relationship between the deposit rate deregulation (D_{1t}) and the branch concentration ($BCNC_t$) was found to be positive in Japan whereas the Korean data show the opposite direction although the coefficients are not significant. The Korean case should be re-examined in the future since the negative relationship could be only temporary given the short history of deregulation.

It is interesting to notice that the relationship between the cross-sector entry deregulation (D_{3t}) and the concentration (CNC_t) in both Japan and Korea is positive, although not significant. One explanation can be that the cross-sector synergy effects lead banks to merge across the financial sector. The other explanation can be that the incumbent banks merge to act against the new entrants from neighbouring financial industries. The latter is an interesting result as it explains banks' entry deterrent activities when they face potential new entrants due to deregulation.

The relationship between the cross-sector entry deregulation (D_{3t}) and the average branch network size (AVB_t) was positive in Korea. The rationale behind this is similar to the second proposition concerning the Korean banks' entry deterrent activities. Banks seem to expand their size of branch network to deter new entrants.

However, the Japanese data indicated a negative relationship between the cross-sector entry deregulation (D_{3t}) and the average branch network size (AVB_t), which was also significant. These opposite results can be looked at in parallel with the phases of financial sector development. Korea as an example of a less developed banking industry enhances pre-emptive behaviour against potential new entries from other financial industries. On the other hand, as the Japanese banking industry is relatively more mature, a lifting of cross-sector entry restriction can create synergy effects among various financial firms rather without expanding their branch network size.

The average branch network size (AVB_t) in Japan show several significant results for some variables. First, the market size (MKS_t) is negatively associated with the branch network size (AVB_t) and the coefficient of –0.05 is significant at 10% level. This indicates that as market size increases, the banks tend to downsize their branching network in Japan (see Figure 2.8). On the other hand, branch concentration ($BCNC_t$) is positively related to the average branch network size (AVB_t) in Japan suggesting that dominant banks' branch network expansion increases the overall average branch network size. However, the results for the Korean average branch network size are showing the opposite signs. One could argue this is because Korean banks have not yet started downsizing branch network as shown in Figure 2.8.

It is also important to note that the impacts of all three deregulation dummy variables (D_{1t}, D_{2t}, and D_{3t}) on the average branch network size (AVB_t) in Japan are significantly negative which means that the Japanese banks' reaction towards banking liberalisation is to cut down their branch network size to reduce their costs and improve efficiency.

The lagged dependent variables are all positive and significant at 1% level as expected indicating the substantial path dependence in banking structure.

From a quick overview of Figure 2.5 and 2.6, we notice that the Japanese banking has undergone a major consolidation in nationwide banking throughout the last 3 decades with acceleration whilst the regional banks pursued a more fragmented market structure since 1990s. This is not so obvious in Figure 2.1. By contrast, we notice that the number of Japanese banks declined substantially in the nationwide banking whereas the regional banking actually had a new entrant during the sample period.

On the other hand, the Korean banks have experienced a similar concentration path in both the nationwide and the regional banking heading towards a more fragmented market structure until the early-mid 1990s and a more concentrated market structure since the late 1990s. One interesting observation to make here is that the banking consolidation is achieved across both nationwide and regional banking in Korea whilst the Japanese banking consolidation is solely due to the nationwide banking.

The results of the Hirschman Herfindal Index measures presented in Table 2.7 also suggest that there are differences in the market structure and the banking behaviour in the SCP paradigm between nationwide banks and regional banks.

One noticeable difference between the results from the concentration index estimation in Table 2.6 and the Hirschman Herfindal Index (HHI) estimations in Table 2.7 is that the market size variables (MKS_t) are more noticeably significant and all positive in Table 2.7 which uses HHI. This positive relationship between concentration and market size variables clearly supports Sutton's (1991) argument of escalation in concentration with endogenous sunk costs, which are associated with the expansion of branch network in banking.

We have noticed from Table 2.1 that Korea is in a different pace and stage of banking evolution, which indicates a large number of new entries as well as M&As in Korea in contrast to no new entry in Japan during the sample period. We can draw a similar conclusion from Figure 2.4 where Korean banking concentration moves from a highly concentrated market (HHI > 18) to an unconcentrated market (HHI < 10) and is moving back up to a moderately concentrated market (10 < HHI < 18). By contrast, the Japanese banking remains unconcentrated (HHI < 10) even after the significant consolidation in the nationwide banking.[76] This is mainly due to the fragmented regional banking in Japan.

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[76] The European Commission and the US Department of Justice classify market conditions according to HHI (unscaled): 1/ less than 1000 (i.e. 10 in scaled HHI in this chapter) as unconcentrated; 2/ between 1000 and 1800 as moderately concentrated, and 3/ over 1800 as highly concentrated.

Therefore it is crucial to note that the two countries adopted different strategies for their regional banks whereby Japan took more fragmented banking structure for its regional banks whilst Korea took a same policy of consolidation for both nationwide and regional banks as presented in Table 2.1, Figure 2.5 and 2.6. Perhaps the overall market size covered by regional banks differ since Japanese regional banks tend to be larger compared to Korean regional banks and they tend to have more geographical monopoly as Japan is formed as a group of islands. On the other hand, Korean regional banks operate in a relatively smaller scale and are less geographically differentiated from one another.

Another interesting result is that the Japanese nationwide banks show a significantly negative relationship between market concentration ($HHIN_t$) and deposit interest rates (IRD_{t-1}), whilst regional banks show positive relationship for the same pair ($HHIR_t$ and IRD_{t-1}).

On the other hand, the signs are reversed for the loan rates (IRL_{t-1}) whereby higher loan rates suggests more concentrated nationwide banking whilst lower loan rates are associated with more concentrated regional-banking in Japan, which is significant at 5% level. In other words, dominant Japanese nationwide banks seem to be able to stretch their interest margins under a more concentrated market structure as opposed to those in the regional banks cannot. Perhaps one explanation for the reversed sign for the Japanese regional banks is that they operate more or less as a regional monopoly and therefore even under fragmented market their interest margins can be stretched further within their respective geographical markets.

On the Korean banking side, the results look more significant in the regional banking, especially the return on deposit (ROD_t) effects are well captured and supports the proposition on performance whereby lower returns i.e. larger non-performing loans are associated with a more concentrated market structure.

2.5.4 Comparison between Japan and Korea

Although many economists showed similarities between Japan and Korea during the industrialisation period after World War II, very few people tried to explain differences between the two countries. This empirical analysis on the banking sector adds some value in this context. Despite the close interdependency with respect to trade and industrial structure, the banking sector has shown evidence that they were taking fundamentally different steps towards restructuring, although the overall path of restructuring looks similar at first sight.

Japan seemed to have taken a prolonged plan for restructuring compared to Korea where banking deregulation and restructuring has only just begun. Table 2.3 on Japanese banking liberalisation dates back to 1978 whereas Table 2.4 indicates the Korean banking liberalisation has only begun since 1991. One important point to make regarding interest rates is the Japanese banks cannot truly compete in interest rates as they are more or less bounded around zero currently. By contrast, Korea seemed to have moved faster towards restructuring within a short period. In this context, one could argue the divergence in their restructuring mainly due to the pace of restructuring and/or the respective stages in the restructuring time horizon where

two countries stand. In Figure 2.7, branch concentration ($BCNC_t$) in both countries follows a similar path of a U shape, i.e. a move towards branch fragmentation until late 1980s in Japan and until later 1990s in Korea followed by a series of consolidation. However, the Japanese banking seems to have taken a longer time horizon whilst Korean banking took a drastic adjustment over a short period.

On the other hand, average branch network size has taken a rather similar path until early 1990s and then diverged as the Japanese banking started downsizing their network size alongside the ongoing M&As (see Figure 2.8). It is an important point to make that the Korean banking has not downsized its branch network size although its general move towards concentration are revealed on the surface. This suggests that the drastic consolidation in Korea did not seem to have really triggered banking efficiency.

2.6 Conclusions

The role of East Asian banking in industrialisation was carefully discussed. To help understand the East Asian banking structure, the determinants of the industry concentration were analysed. Concentration depends on the market size for given set up costs as well as banks' conduct and their performance. This recursive process is affected by regulation to some degree. Some of the predictions suggested by the simple theoretical model are also tested on a time-series sample of Japanese and Korean commercial banking industry.

In East Asia, we conclude that concentration rises when deposit market size increases as a consequence of deregulation process in banking industry. Although we have not found a convincing pattern of events in East Asia supporting the prediction of the deregulation on interest rates, other types of deregulation such as relaxing branching restrictions and cross-financial sector entry restrictions have shown positive relationship with the banking concentration with an increasing pattern of concentration in the time path. This reaffirms that banking industry structure does not conform to standard convergence theory in concentration with a given sunk cost. The evolution of banking concentration has been non-monotonic in East Asia.

The econometric model also predicts average branch network size to increase as market size increases, whereas deregulation leads to an expansion of the average size of branch network. The data support that deregulation increases the average size of branch network. However, we did not find convincing evidence of a positive relation between average branch network size and degree of concentration in the industry in the presence of deregulation.

The relationship between the loan rates and the concentration was significantly positive in Korea. However, a more important result we found is that Japan and Korea are not going through an identical path in terms of banking restructuring. This overturns most academic claims about similarities between Korea and Japan in their economic development. They might just have started a diverging path in financial sector development. This divergence path needs further studies.

The impact of deregulation is measured in terms of deregulation on deposit rates, branching restriction, and cross-sector entry restriction. The data show that

deregulation of deposit rates has a direct impact on concentration and branch concentration. It is also important to note that the Korean banks are using unambiguous entry deterrent tactics when they face new entrants following the deregulation on cross-sector entry within the financial industry.

There are several limitations in this analysis. First of all, some of the conclusions are based on weak evidence due to the limited number of observations available. Another limitation is that the restructuring process has short history and long-term effects have to be further studied. However, we still believe that this exercise is useful in discussing the short-term impact of deregulation on the structure of banking system. The other limitation is that there are differences in entry costs and therefore, the impact of entry costs on the banking structure can vary, when Japan and Korea are compared. We tried to explain the banking sector and the real sector coherently by linking the industrial policy development with the evolution of banking sector in East Asia. However, there is scope for future research regarding this link between the real sector and the financial sector.

In this chapter, we have investigated what has already happened with respect to the structure of banking in East Asia in relation to concentration and deregulation. Many of the propositions were supported by the test results both theoretically and empirically. We do, however, believe it is worth having a closer look at the on-going process of deregulation in order to predict the future banking structure in East Asia. For instance, alongside the mergers between domestic commercial banks, M&A activity by foreign banks has just started to become politically socially acceptable in rescuing distressed Korean commercial banks. On the other hand, Japan is expecting

a significant consolidation not only among commercial banks but also across all the financial institutions. The impact of different types of consolidation will definitely be an interesting area for future investigation.

Appendix

Table 2.1 Changes in the Number of Commercial Banks

	Dec-76	*M&A*	*R*	*T*	*A*	*Peak*	*Dec-03*
Japanese Banks						***Dec-85***	
(Total No. = 86)							
Nationwide (22)	13	**-5**	**-1**	0	0	**13**	**7**
Regional (64)	63	**0**	0	0	+1	**64**	**64**
Korean Banks						***Dec-97***	
(Total No. = 28)							
Nationwide (18)	5	**-9**	0	+3	+9	**16**	**8**
Regional (10)	10	**-4**	0	0	0	**10**	**6**

Source: Japanese Banks – Principal Financial Institutions by Zenginkyo, and Korean Bank Management Statistics by Financial Supervisory Service (FSS).

N.B.:

1) *M&A: mergers and acquisition; R: revocations; T: transformations; A: authorisation of new entities.*
2) *In case of M&As and a subsequent change of bank name for a newly merged one, it has been counted as only one M&A instead of counting as two M&As and an authorisation of a new entity.*
3) *When a bank changed its name, the data set recorded as a new bank although it is not counted as an authorisation of new entity in the above table.*

Table 2.2 Evolution of Industrial Policies in Japan and Korea

Approximate period	*Japan*	*Korea*
1990s	High-tech and service industries	Knowledge-intensive industries
1980s	Knowledge-intensive (or high-tech) industries	Heavy industries
1970s	Knowledge industries and heavy industries	Heavy industries (steel, chemicals, ships, electronics)
1960s	Heavy industries(steel and ships)	Light industries (textiles)
1950s	Light industries (textiles)	Primary products (food products)

Source: Castley (1997), Korea's Economic Miracle

Table 2.3 Japanese Banking Liberalisation: post-1978

Liberalisation measure	*Date effective*
Short-term interest rates liberalised	1978
Issuance of CD started	May 1979
FX control eased by amending the Law	Dec 1980
Regulation on conversion of foreign currency into the yen abolished	Jun 1984
Money market certificate created	Apr 1985
Interest rates of large amount time-deposits liberalised	Oct 1985
Investment business law enacted	Nov 1986
Overseas deposits by residents liberalised	Jul 1989
Financial System Reform Act allowed banks to enter securities business	Apr 1993
Interest rates of Time deposits liberalised completely	Jun 1993
Interest rate on demand deposits liberalised (ex. current account)	Oct 1994
Restrictions on the number of a bank's new branches removed	Jun 1995
Regulation on deposit products relaxed	Oct. 1995
'Big Bang' reform announced – PM Hashimoto's idea of 1/freedom 2/fairness 3/globalisation	Nov 1996
Ban on financial holding companies lifted	Dec 1997
Amended FX and Foreign Trade Law making FX transactions free from governmental authorisation	Apr 1998
Bank allowed to sell investment trust over-the-counter	Dec 1998
Restriction on trust bank subsidiaries/securities company subsidiaries abolished	Oct 1999
Bank allowed to issue straight bonds	Oct 1999
Banks, securities companies to be allowed to enter insurance business A new Financial Services Law to be enacted	End 2000

Source: Japanese Banks 2000 (Zenginkyo, 2000)

Table 2.4 Korean Banking Liberalisation: post-1990

Liberalisation measure	*Date effective*
Short-term interest rates and interest rates on time deposits with maturity over 3 years liberalised	Nov 1991
Liberalised interest rates on time deposits with maturity over 2 years	Nov 1993
Rates on strategic loans (BOK induced) were partially liberalised as the band of preferred rates for this category was guided by the Government	Dec 1994
Liberalised interest rates on time deposits with maturity over 1 years	Dec 1994
Liberalised interest rates on time deposits with maturity over 6 months	Jul 1995
Fully liberalised interest rates on strategic loans	Jul 1995
Liberalised interest rates on time deposits with maturity below 6 months (completed 4 stage deregulation on interest rates: 1991-1997, earlier than planned)	Nov 1995
Allowing cross-sectoral entries within financial sector Banks' securities business Banks' insurance business	 Early 1970s Not Applicable
Branching restriction still remains	Not Applicable

Source: Korean Financial System (BOK, 1998)

N.B.:

1) No further announcement of allowing banks to conduct insurance business as of Dec. 2004.

2) No indication for liberalising branching restriction as of Dec. 2004

Table 2.5 Description of Variables

Variables	*Type*	*Operational Definition*
Dependent Variables		
CNC_t	C	Banking concentration ratio indexed as $\ln[C_{5t}/1-C_{5t}]$
$BCNC_t$	C	Branch concentration ratio indexed as $\ln[BC_{5t}/1-BC_{5t}]$
AVB_t	C	Log of average branch network size
HHI_t	C	Banking concentration rescaled by HHI/100
$HHIN_t$	C	Concentration in nationwide banking rescaled by HHIN/100
$HHIR_t$	C	Concentration in regional banking rescaled by HHIR/100
Independent Variables		
MKS_t	C	Log of total deposit market size rescaled and deflated by GNP
IRD_{t-1}	C	Market average interest rates on deposits (1-2 year time & savings)
IRL_{t-1}	C	Market average interest rates on loans (3 year fixed term)
ROD_{t-1}	C	Average return on deposits
Lagged Dependent Variables		
CNC_{t-1}	C	1 year lagged banking concentration ratio of CNC_t
$BCNC_{t-1}$	C	1 year lagged branch concentration ration of $BCNC_t$
AVB_{t-2}	C	2 year lagged average branch network size of AVB_t
HHI_{t-1}	C	1 year lagged banking concentration of HHI_t
$HHIN_{t-1}$	C	1 year lagged nationwide banking concentration of $HHIN_t$
$HHIR_{t-1}$	C	1 year lagged regional banking concentration of $HHIR_t$
Deregulation Dummy Variables		
D_{1t}	L/D	Deregulation on deposit interest rates measured between 0 and 1: 1=completely deregulated; 0.5: halfway through in the deregulation process; 0=fully regulated
D_{2t}	L/D	Deregulation of branching restriction measured between 0 and 1: 1=completely deregulated; 0.5: halfway through in the deregulation process; 0=fully regulated
D_{3t}	L/D	Deregulation of cross-financial sector entry measured between 0 and 1: 1=completely deregulated; 0.5: halfway through in the deregulation process; 0=fully regulated

N.B.: Binary (B), Likert (L), Continuous (C), and Discrete (D)

Table 2.6 Structure of Japanese and Korean Banks by TSLS

Country	*Japan*			*Korea*		
Dependent Variables	CNC_t *Coeff. (s.e.)*	$BCNC_t$ *Coeff. (s.e.)*	AVB_t *Coeff. (s.e.)*	CNC_t *Coeff (s.e.)*	$BCNC_t$ *Coeff. (s.e.)*	AVB_t *Coeff. (s.e.)*
Independent Variables						
MKS_t	.56*	.34	-.05*	-.09	.35	.03
	(.30)	(.23)	(.03)	(.87)	(.40)	(.16)
$BCNC_t$			.06***			-.08
			(.02)			(.05)
IRD_{t-1}	-7.94	-10.28**		.03	-.03	
	(6.52)	(5.23)		(.01)	(.04)	
IRL_{t-1}	6.98	12.51**		.00	.05	
	(6.73)	(5.50)		(.11)	(.05)	
AVB	-.49	-.80		.32	-.02	
	(.82)	(.65)		(.65)	(.27)	
ROD_{t-1}	-.02	-.01	-.01	-.04	-.06*	.02
	(.09)	(.07)	(.01)	(.07)	(.03)	(.02)
Lagged Dependent Variables						
CNC_{t-1}	0.68***			.97***		
	(.22)			(.18)		
$BCNC_{t-1}$		.55***		.	1.01***	
		(.22)			(.17)	
AVB_{t-2}			1,31***			.93***
			(.11)			(.11)
Deregulation Dummy Variables						
D_{1t}	-.32	.29	-.14***	-.19	-.11	.07
	(.42)	(.34)	(.04)	(.47)	(.21)	(.08)
D_{2t}	.07	.05	-.04***	-	-	-
	(.12)	(.10)	(.01)			
D_{3t}	.27	.12	-.06***	.26	-.82	.31
	(.18)	(.15)	(.02)	(1.57)	(.74)	(.28)
Constant	.27	2.28	-1.22***	-2.05	-.28	.31
	(3.56)	(2.84)	(.45)	(3.59)	(1.50)	(.60)
Obs. No.	27	27	26	27	27	26
Adj. R^2	.689	.682	.995	.895	.878	.99
DW-h	.003	.138	.027	3.249	.619	.076
$\chi^2(1)$						

Standard errors are in the parentheses.

*, **, *** *t-values significant at the 10%, 5% and 1% levels respectively*

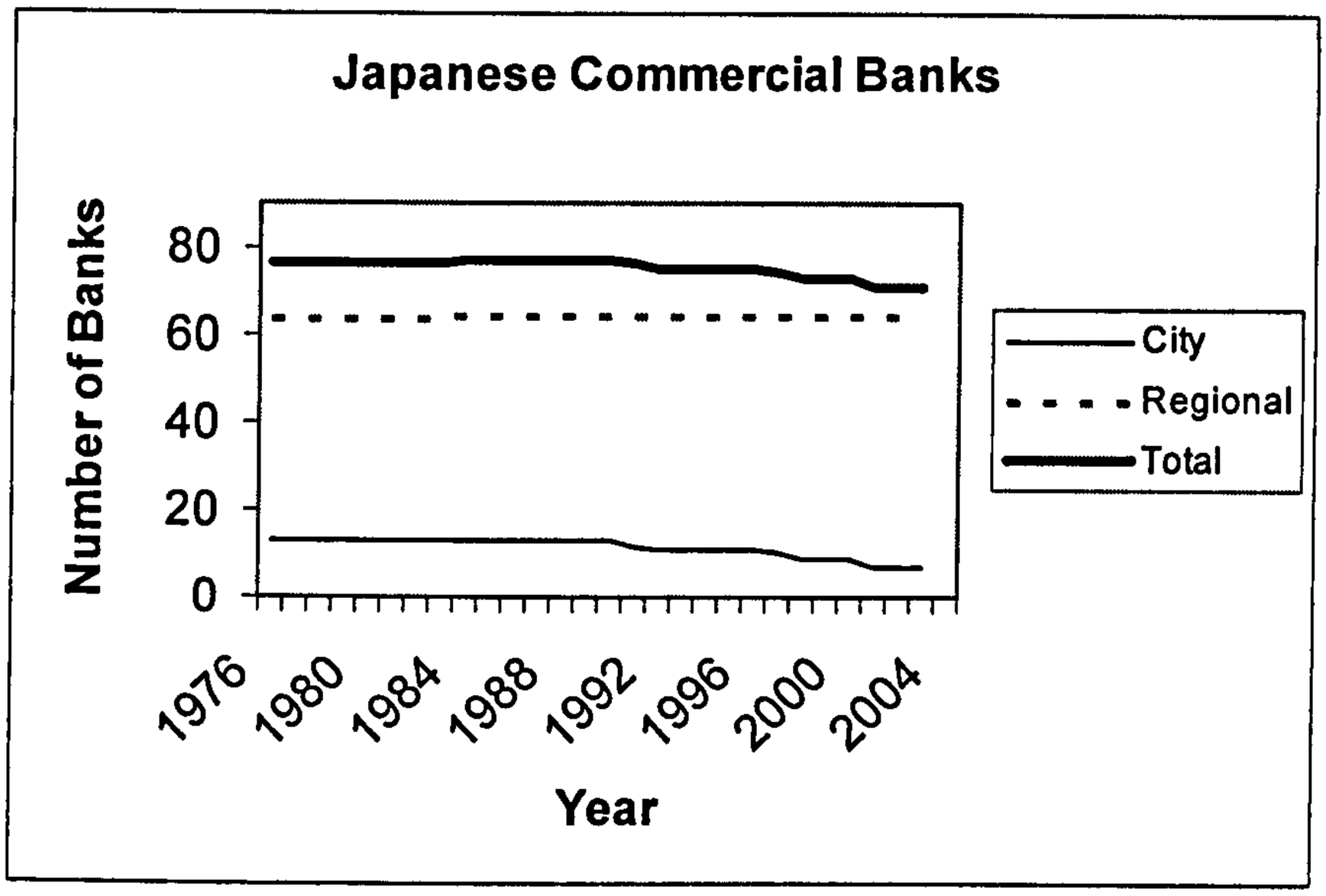
N.B. Observation numbers vary due to the missing lagged dependent variables for years 1976 (lag 1) and 1977 (lag 2).

Table 2.7 Comparison between Nationwide and Regional Banking Structure

Country		*Japan*			*Korea*	
Dependent Variables	HHI_t *Coeff. (s.e.)*	$HHIN_t$ *Coeff. (s.e.)*	$HHIR_t$ *Coeff. (s.e.)*	HHI_t *Coeff (s.e.)*	$HHIN_t$ *Coeff. (s.e.)*	$HHIR_t$ *Coeff. (s.e.)*
Independent Variables						
MKS_t	*2.23***	*4.50**	*.13*	*4.42*	*5.42*	*5.10****
	(.96)	*(2.69)*	*(.10)*	*(4.09)*	*(4.60)*	*(1.86)*
IRD_{t-1}	-30.86	*-102.75**	3.05	.26	.24	.00
	(21.39)	*(61.74)*	(2.14)	(.47)	(.52)	(.26)
IRL_{t-1}	*30.42*	*95.61*	-4.12**	*-.11*	-.06	.24
	(22.30)	*(64.74)*	(2.00)	*(.53)*	(.59)	(.30)
AVB_t	*-2.87*	*-2.69*	.03	*-2.50*	*-2.31*	.48
	(2.66)	*(7.93)*	(.24)	*(2.94)*	*(3.30)*	(1.29)
ROD_{t-1}	*-.07*	-.53	*.02*	*-.21*	-.16	*-1.25****
	(.28)	(.82)	*(.02)*	*(.37)*	(.41)	*(.21)*
Lagged Dependent Variables						
HHI_{t-1}	*.72****			*.69****		
	(.20)			*(.21)*		
$HHIN_{t-1}$		.82***			.82***	
		(.20)			(.19)	
$HHIR_{t-1}$			.21			.72***
			(.24)			(.05)
Deregulation Dummy Variables						
D_{1t}	*-.64*	*-3.30*	-.07	*.25*	*.50*	-.70
	(1.36)	*(4.00)*	(.13)	*(2.22)*	*(2.49)*	(1.28)
D_{2t}	*.28*	.63	*-.04*	-	-	-
	(.40)	(1.16)	*(.04)*			
D_{3t}	*.91*	*2.87*	-.17**	4.93	*6.27*	*2.35*
	(.60)	*(1.81)*	(.07)	(8.00)	*(9.01)*	*(4.30)*
Constant	*12.19*	*9.59*	1.73*	*15.87*	*13.00*	*2.81*
	(11.78)	*(35.17)*	(1.03)	*(17.61)*	*(19.51)*	*(7.13)*
Obs. No.	27	27	27	27	27	27
Adj. R^2	.682	.858	.920	.842	.882	.962
DW-h	.001	.241	.411	.157	1.173	.078
$\chi^2(1)$						

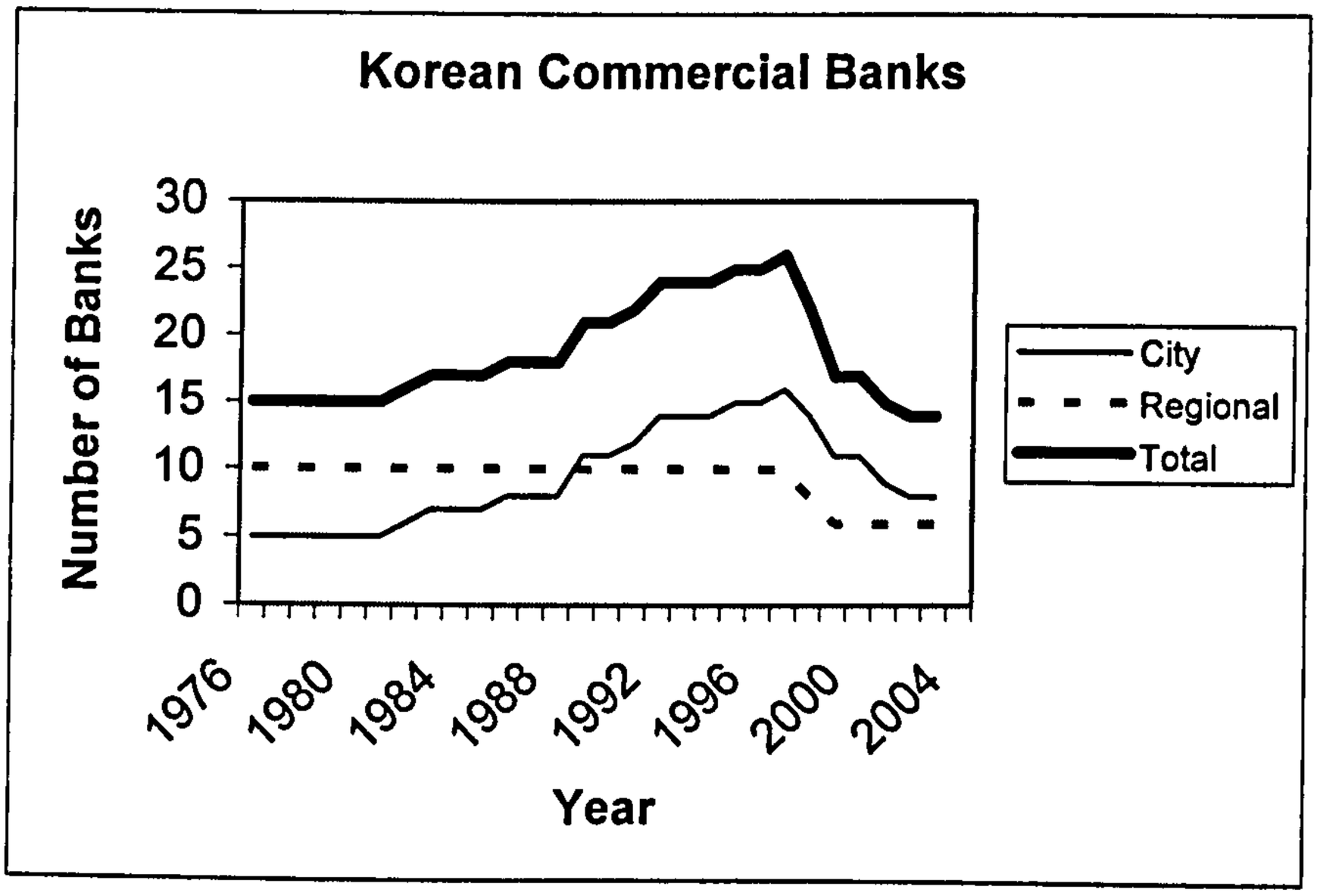
Standard errors are in the parentheses.
*, **, *** *t-values significant at the 10%, 5% and 1% levels respectively*
N.B. Observation numbers vary due to the missing lagged dependent variables for years 1976 (lag 1)).

Figure 2.1 Japanese Commercial Banks



Source: Japanese Bankers Association(Zengynkyo)

Figure 2.2 Korean Commercial Banks



Source: Financial Supervisory Service (FSS)

Figure 2.3 Banking Concentration ($\ln[C_{5t}/(1-C_{5t})]$) in Korea and Japan

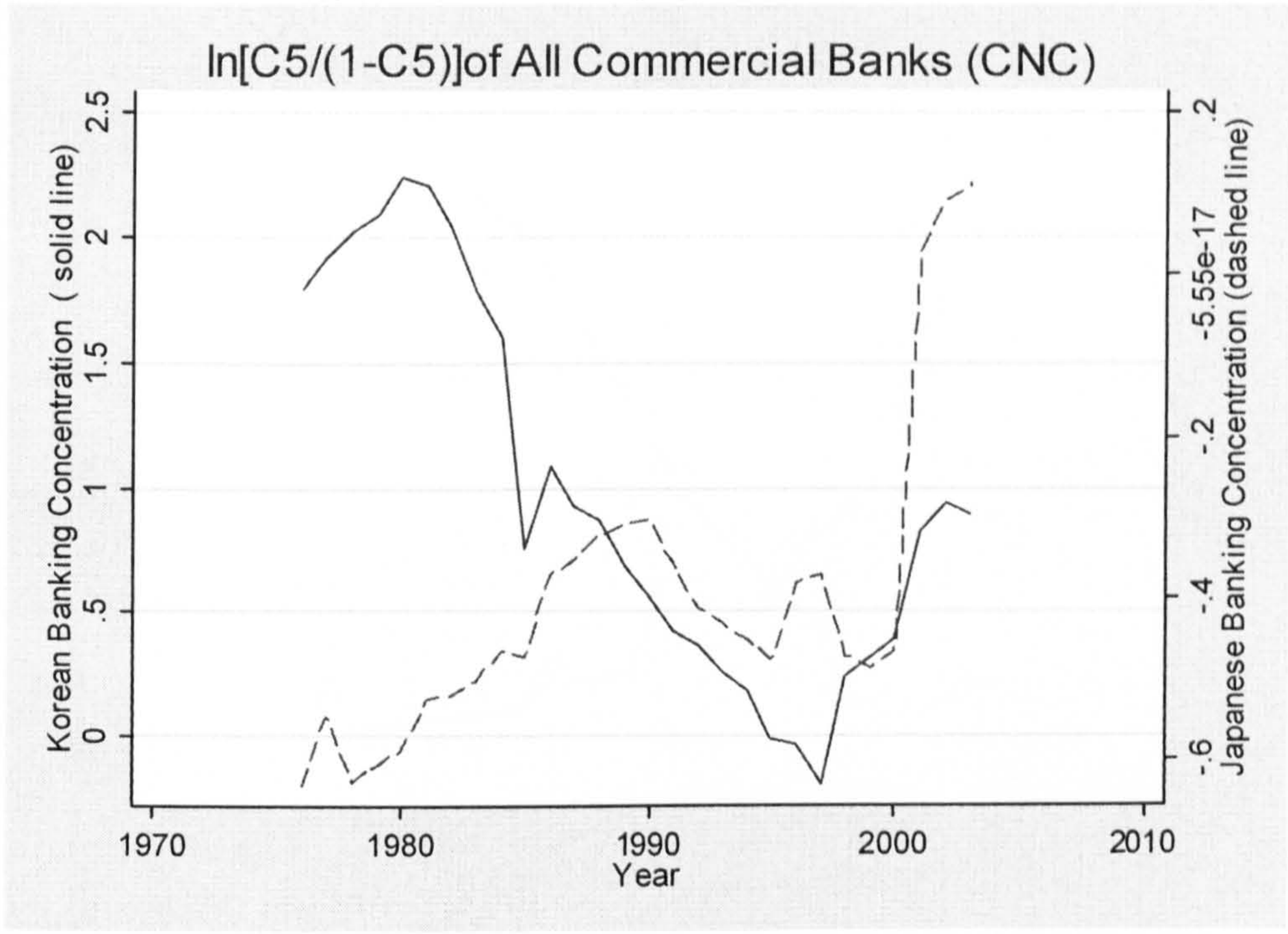


Figure 2.4 Banking Concentration (HHI_t) in Korea and Japan

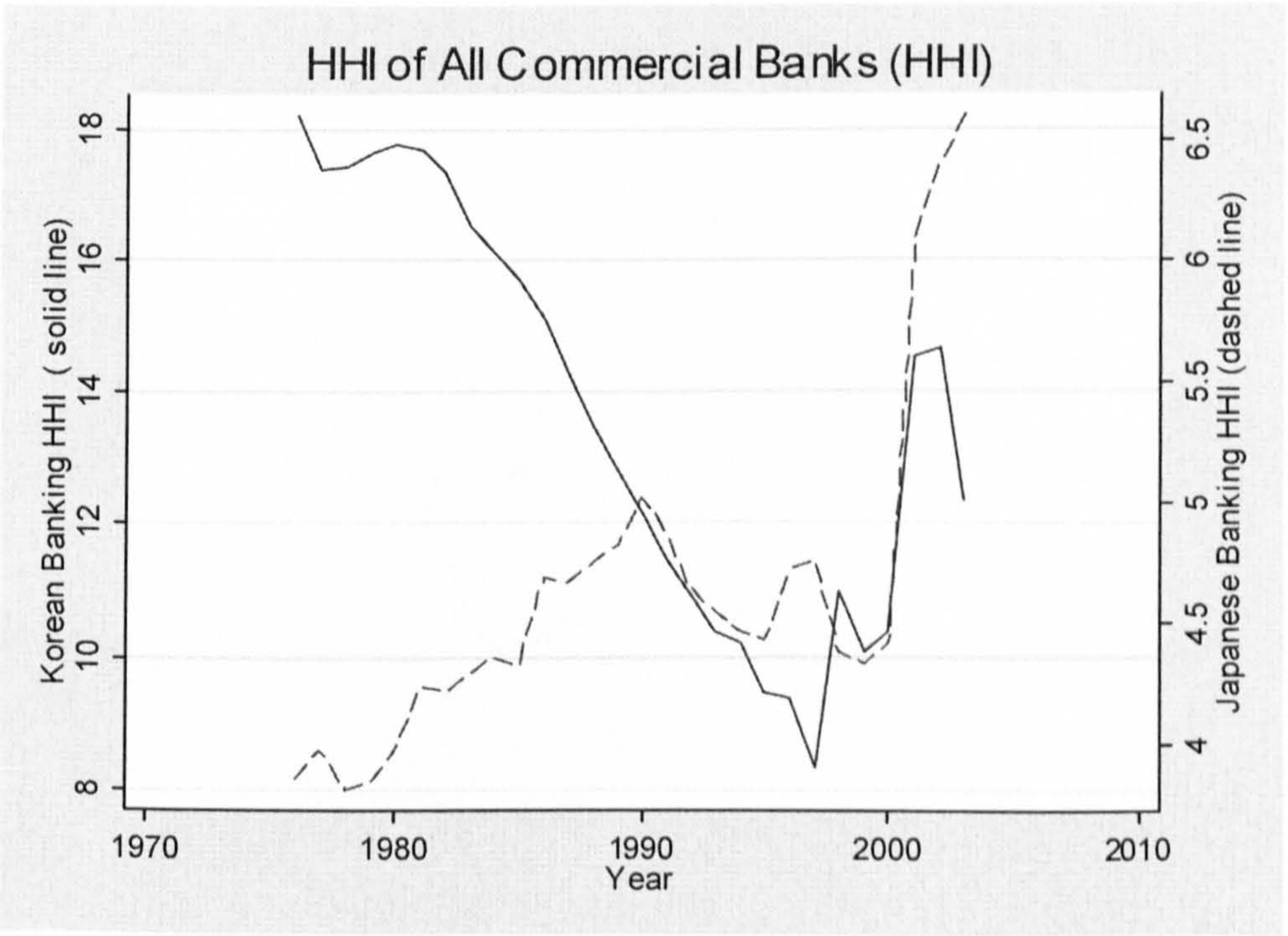


Figure 2.5. Nationwide Banking Concentration ($HHIN_t$)

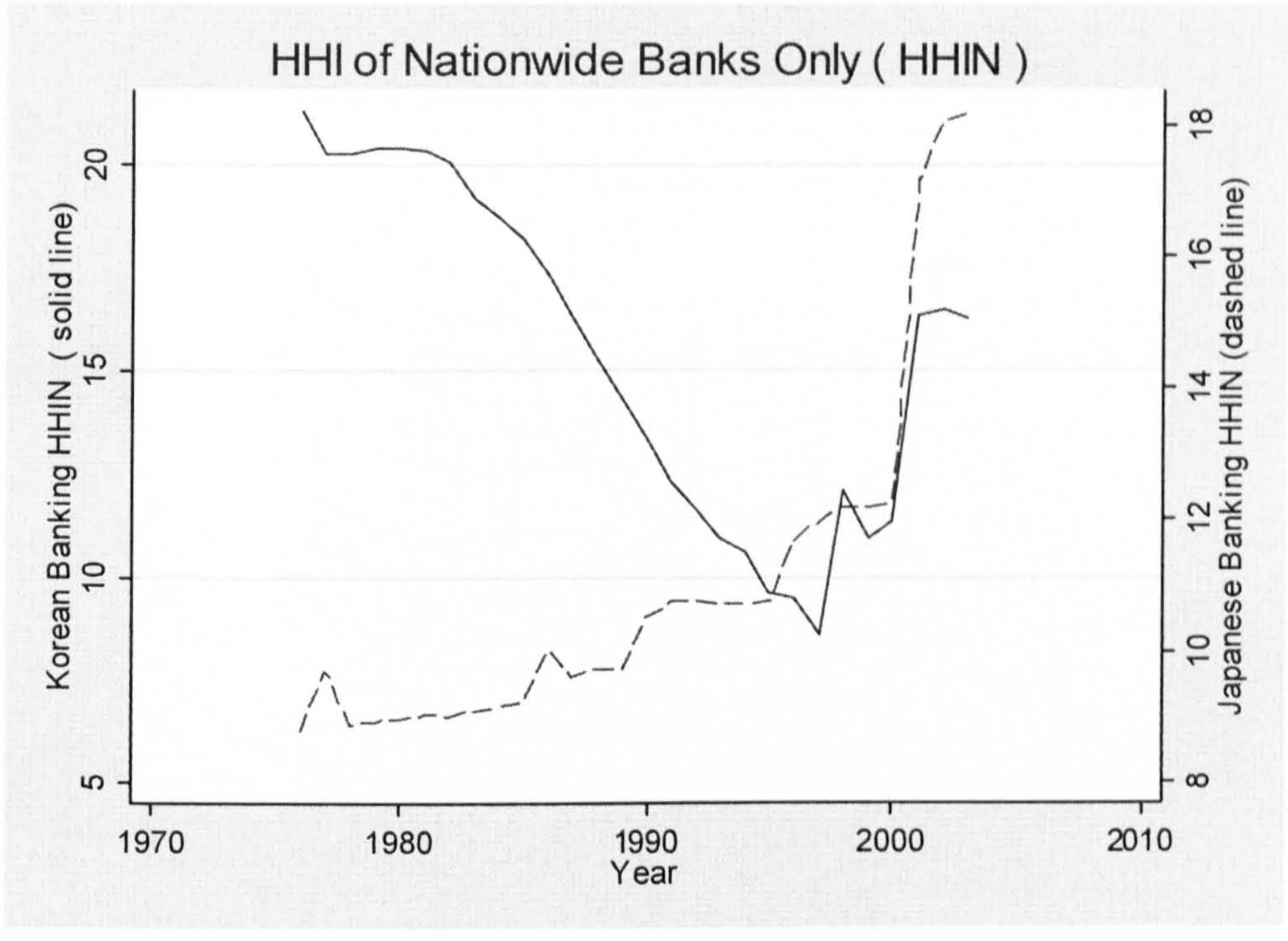


Figure 2.6 Regional Banking Concentration ($HHIR_t$)

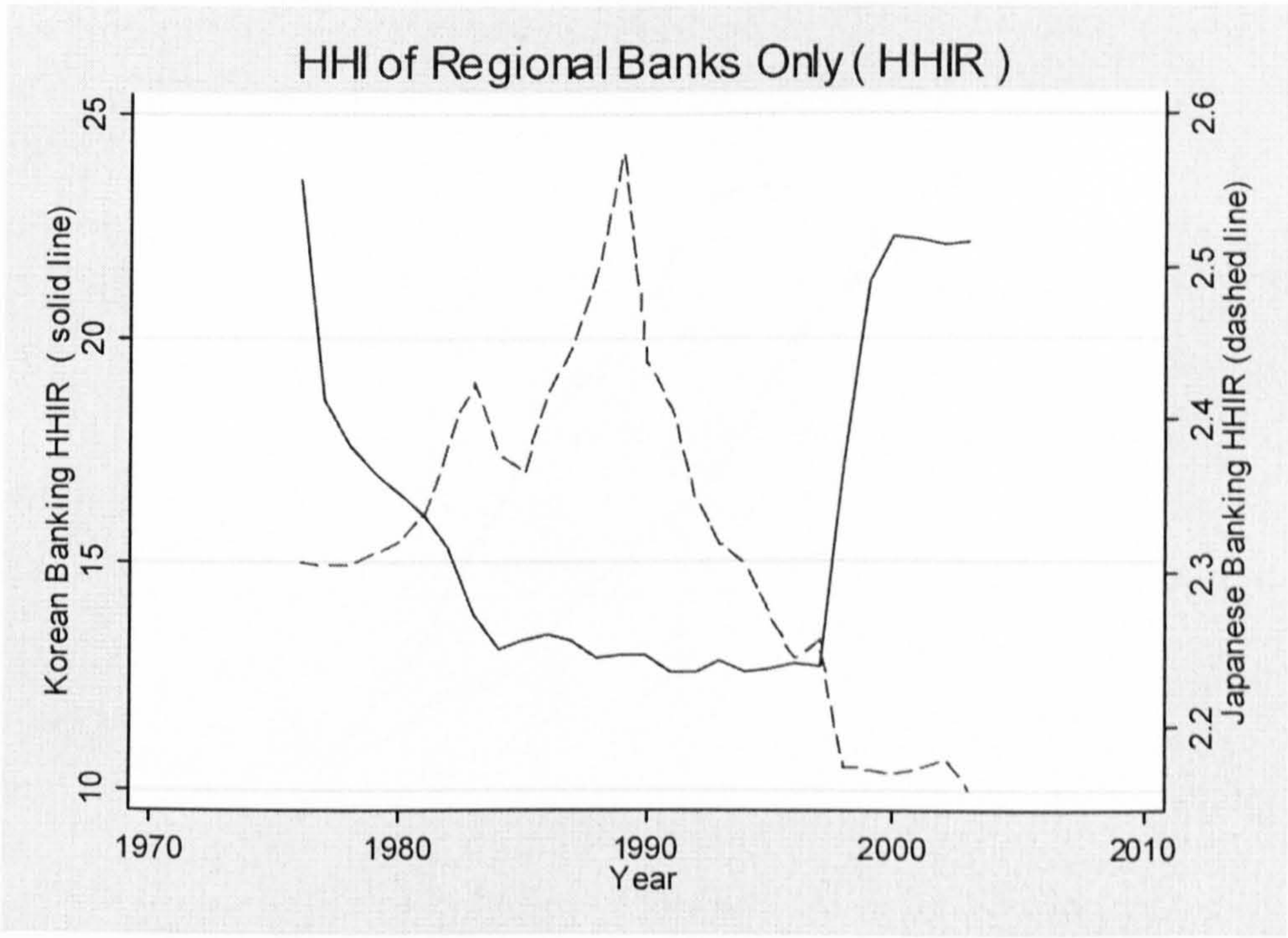


Figure 2.7 Branch Concentration ($BCNC_t$)

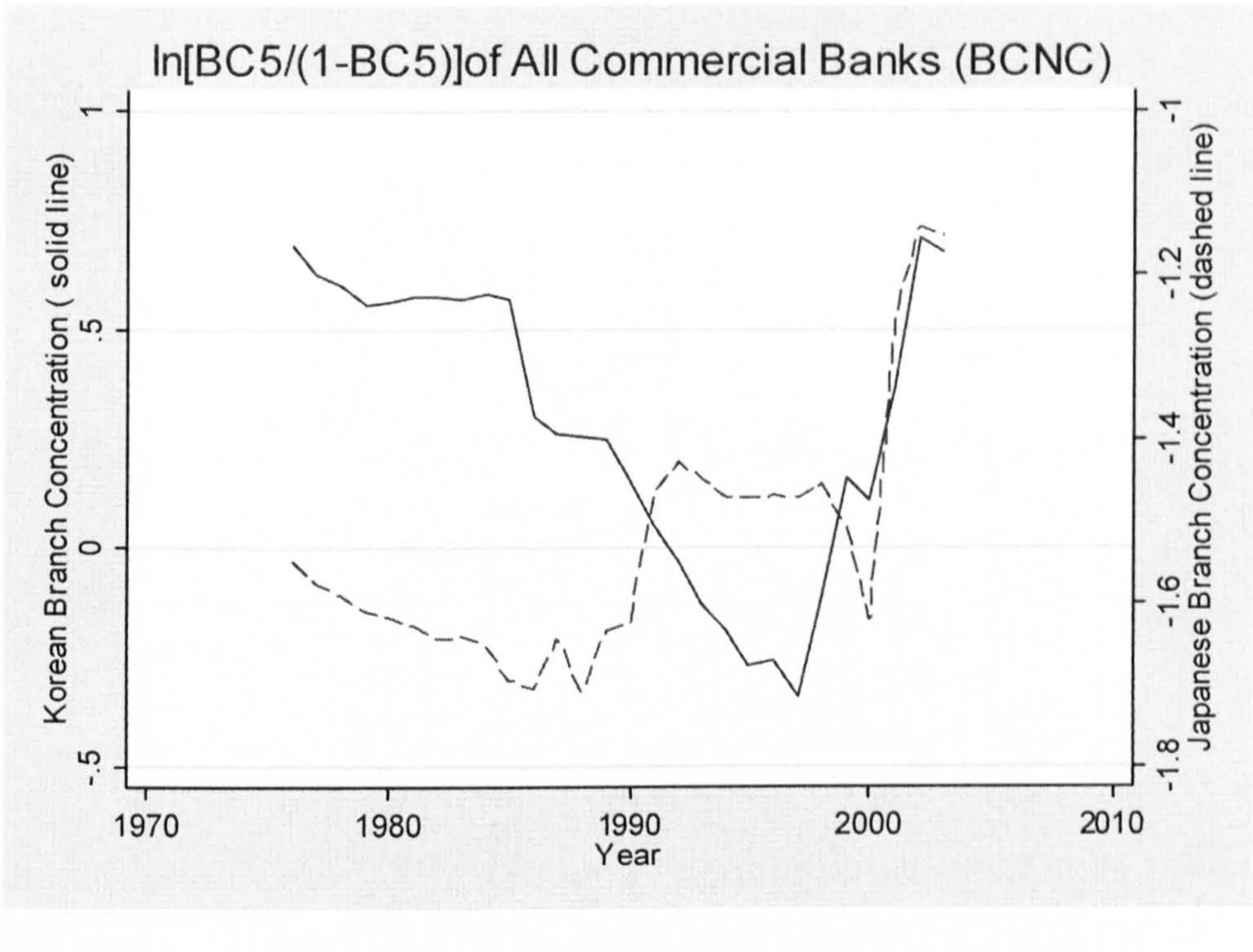


Figure 2.8 Average Branch Network (AVB_t)

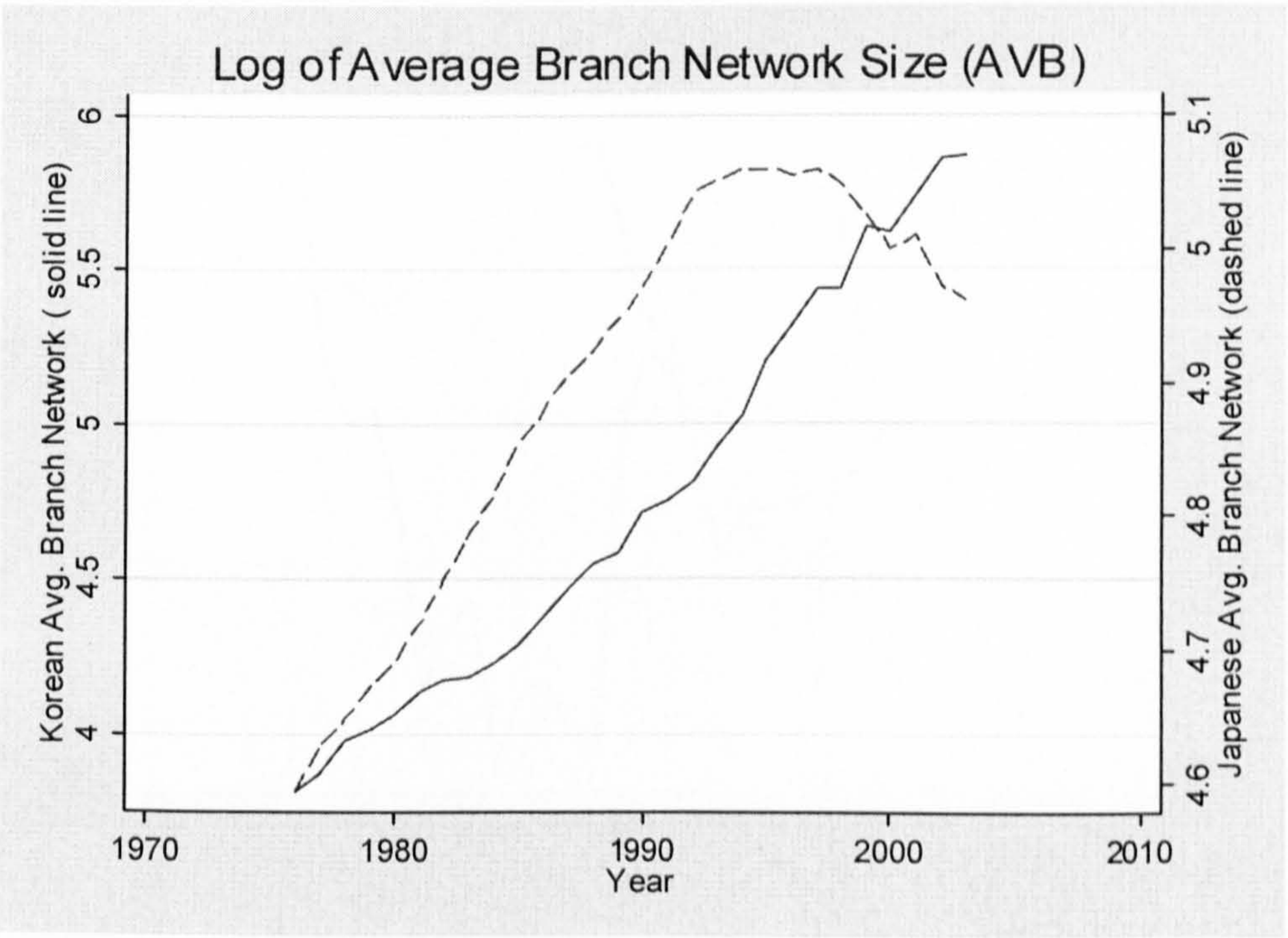


Figure 2.9 Interest Rates in Japan

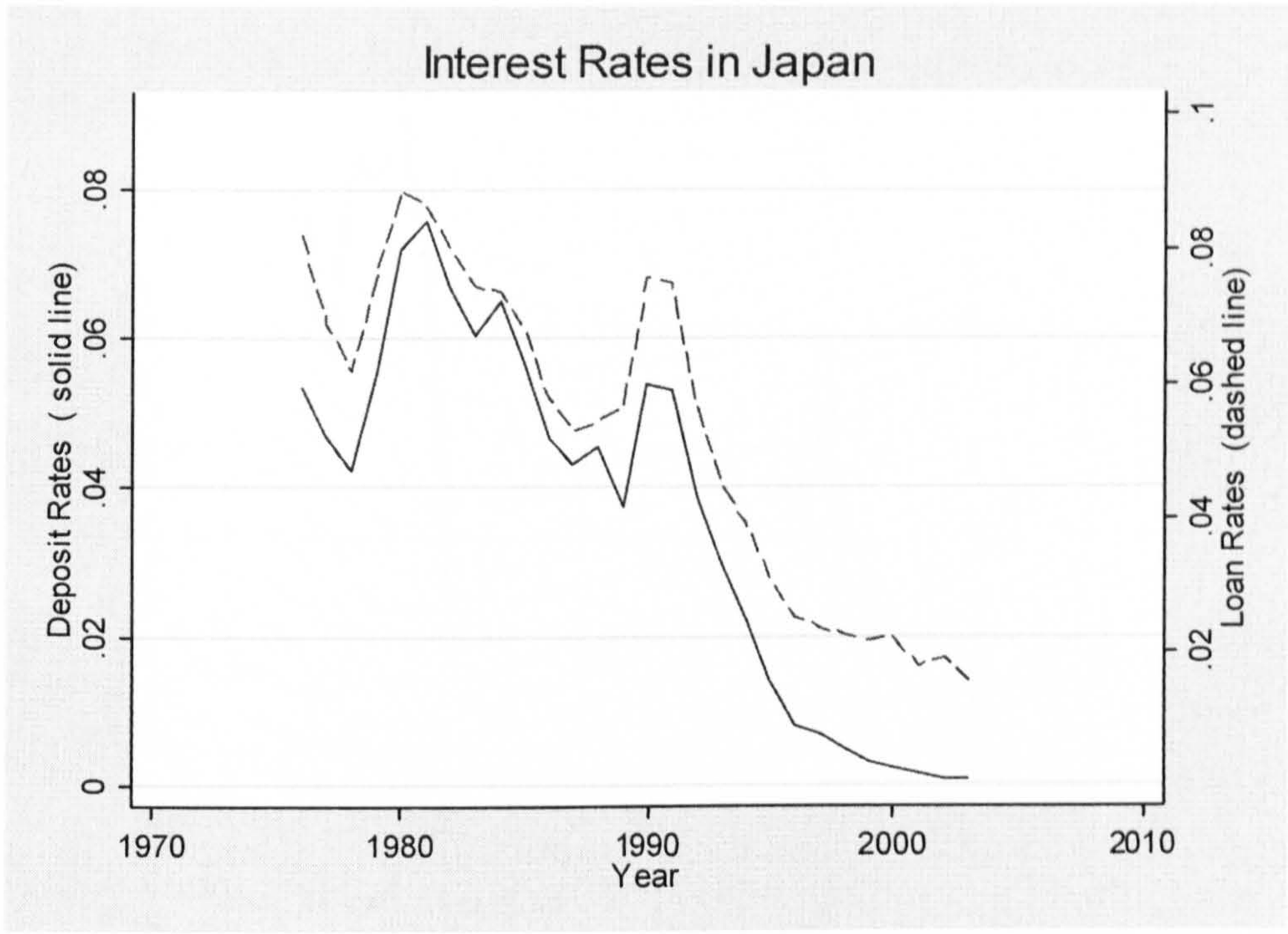


Figure 2.10 Banking Margins and Returns in Japan

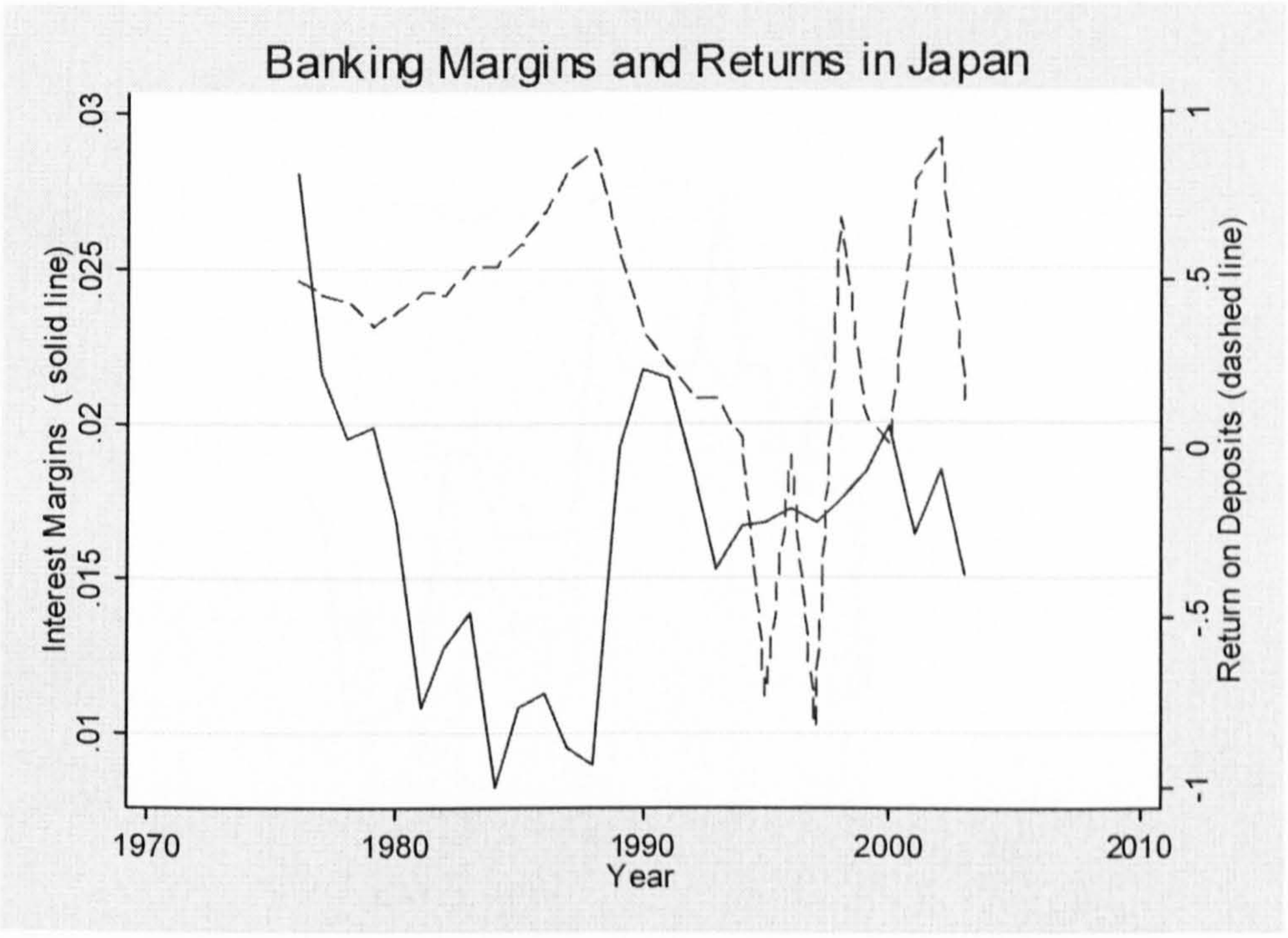


Figure 2.11 Interest Rates in Korea

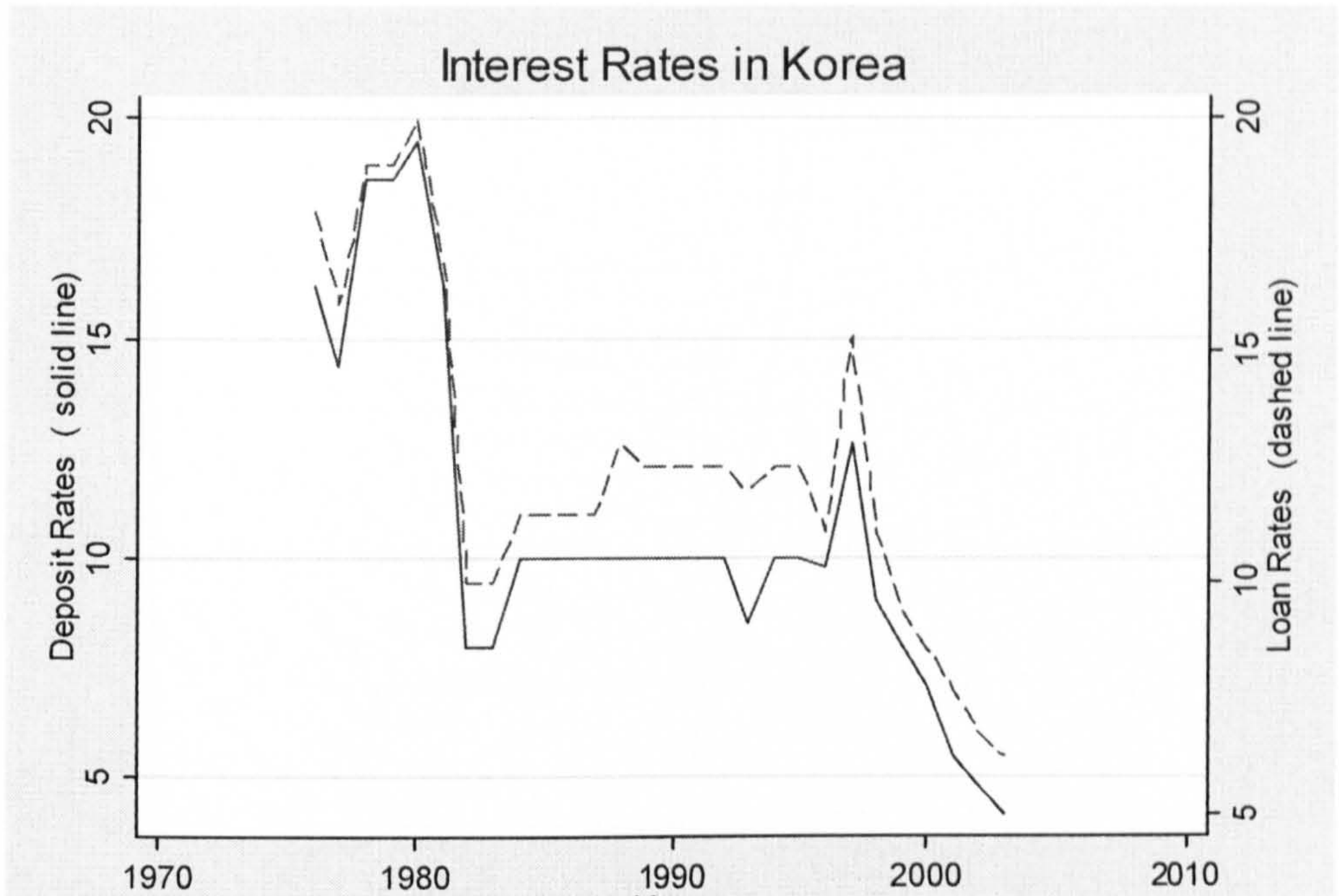


Figure 2.12 Banking Margins and Returns in Korea

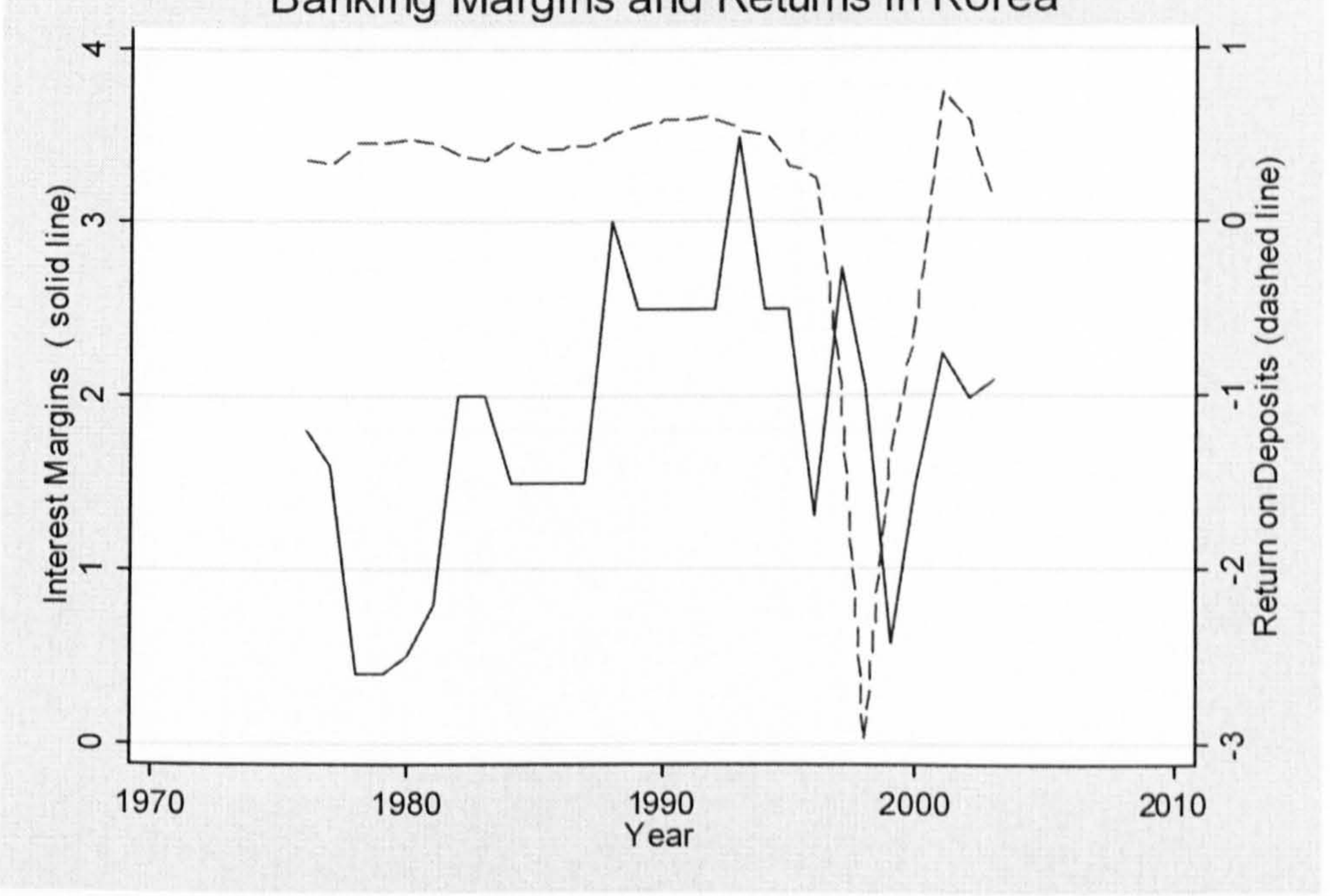


Figure 2.13 Deregulation on Deposit Interest Rates (D_{1t})

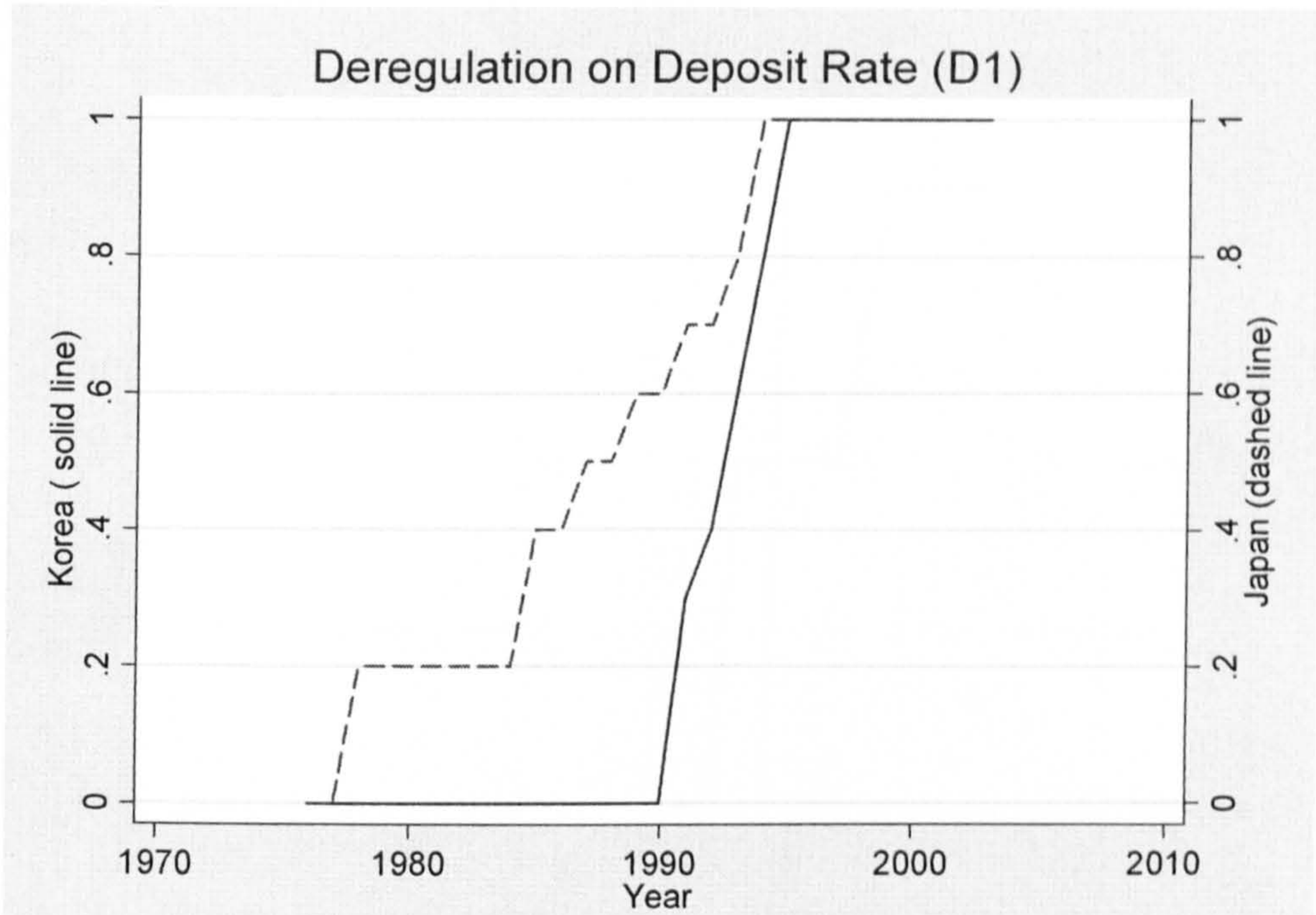


Figure 2.14 Deregulation of Branching Restriction (D_{2t})

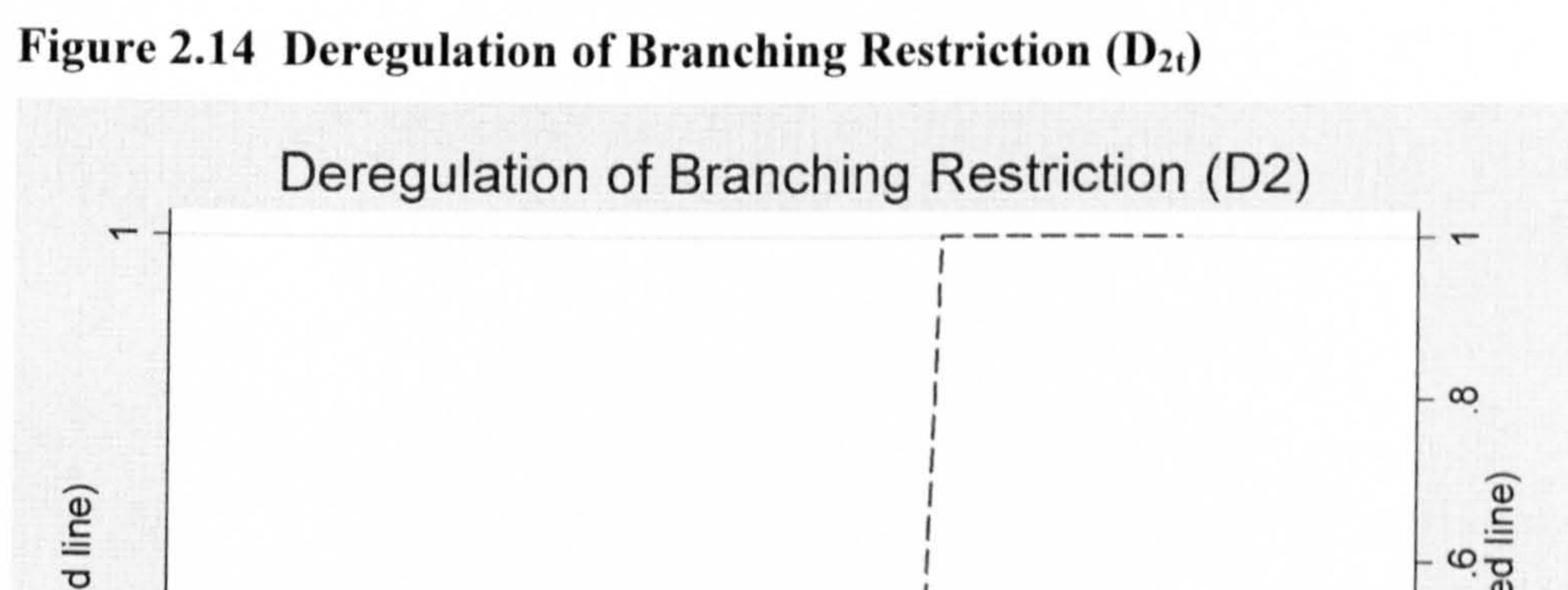


Figure 2.15 Deregulation of Cross-financial Sector Entry (D_{3t})

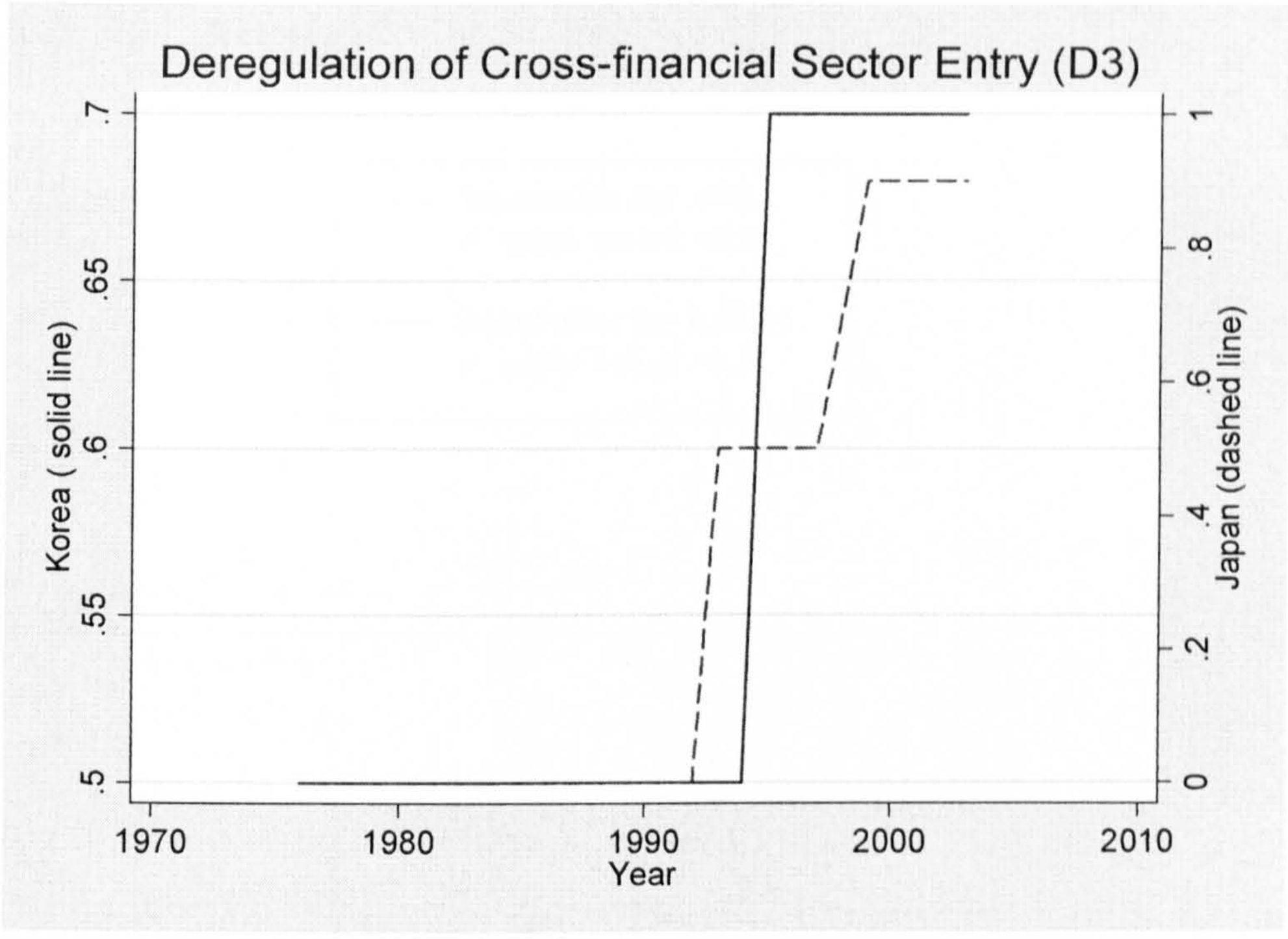


Figure 2.16 Equilibrium Number of Banks (n) vs. Regulation on Interest Rates (θ)

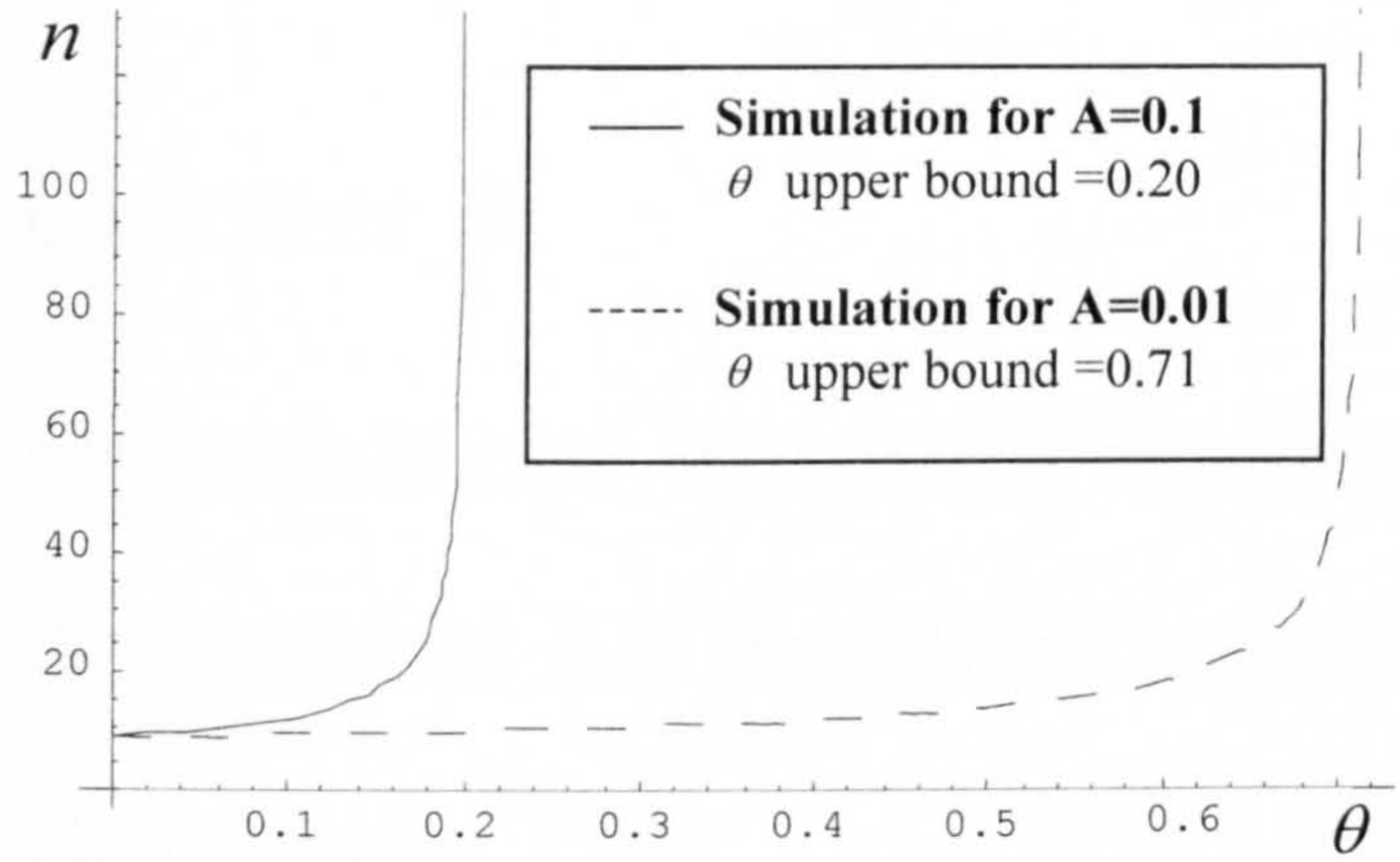
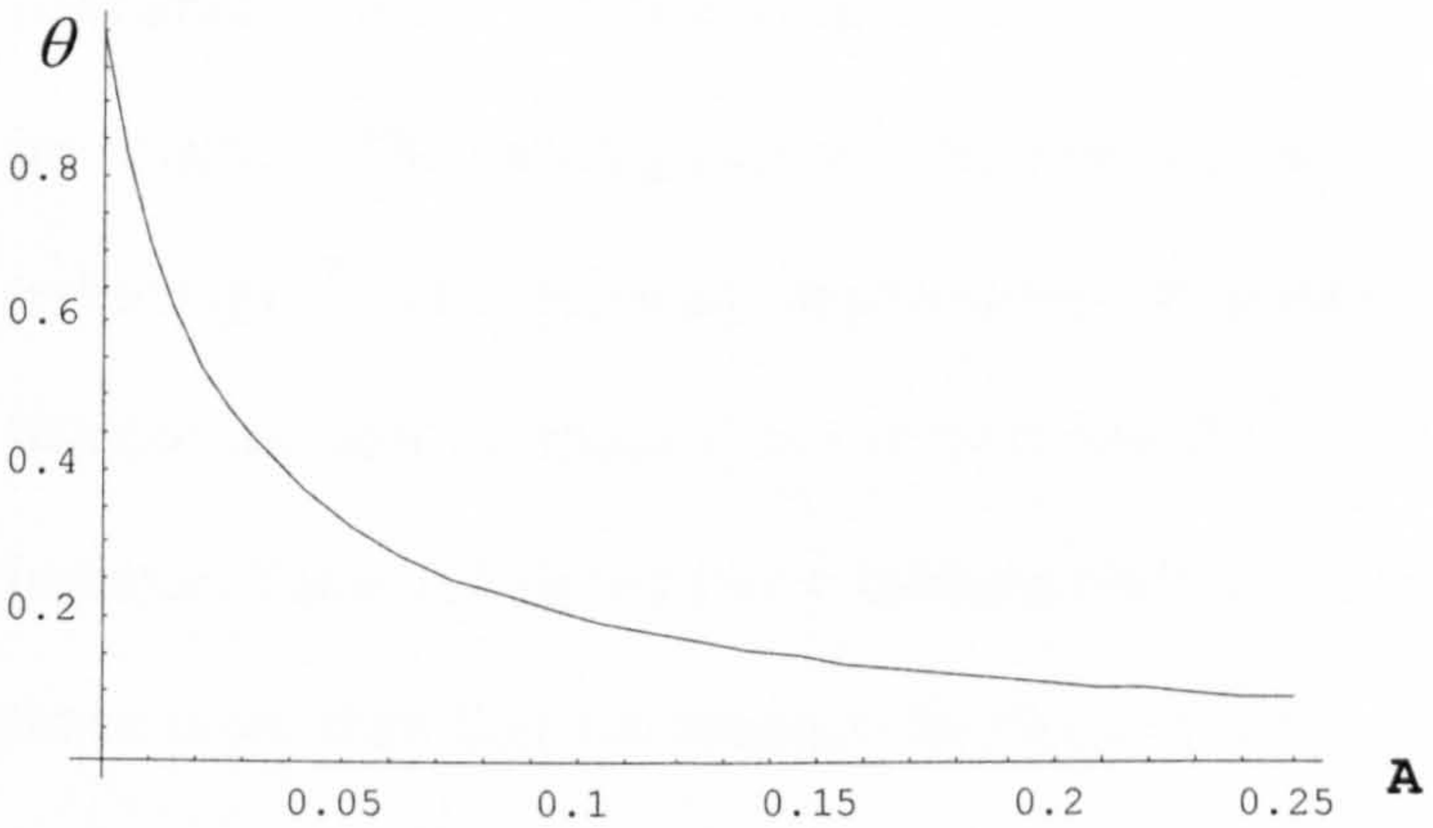


Figure 2.17 Regulation on Interest Rates (θ) vs. Paid-in-Capital Size (A)



Chapter 3

Dynamics of Banking Technology Adoption: An Application to Internet Banking

3.1 Introduction

This chapter is concerned with examining the behaviour of firms (*banks*) and consumers (*banks' customers*) in the event of a new technology (*internet banking*) introduction. The banking industry has been significantly influenced by evolution of technology.[77] The growing applications of computerised networks to banking reduced the cost of transaction and increased the speed of service substantially. For instance, Table 3.2 shows that a banking transaction using a branch teller costs 100 times more than that via internet. In addition, the speed of service is improved as customers do not have to physically travel to a branch. The nature of financial intermediaries made banks improve their production technology by focusing on distribution of products. In other words, the evolution of banking technology has

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[77] See Hannan and McDowell (1984), Haynes and Thompson (2000), Gourlay and Pentecost (2002).

been mainly driven by changes in distribution channels as we see evidence from over-the-counter (OTC), automated-teller-machine (ATM), phone-banking, tele-banking, pc-banking and most recently internet banking (IB).[78]

Network effects and standardisation have become topical research subjects with the growing number of networked industries. The application of new technologies, including the internet, has created new ways of doing business. For instance, internet application to e-commerce and finance has certainly changed the business environment. In the presence of network effects and standardisation, technology intensive industries seem to establish concentrated market structure.[79] Hence, it seems natural to consider progress in banking technology as a reason for market consolidation, given the nature of the network in banking. However, there are only a few studies on consumer behaviour relative to the vast amount of literature on firms' behaviour regarding technology adoption and market structure. We argue that customer inertia and risk aversion in characterising internet banking users (IBU) suggest that aggressive expansion in internet banking is simply a pre-emptive action by banks with little impact on the market structure.

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[78] The FSS in Korea defines the internet banking as computer network based banking, which includes automated transfer of money, settlement of bills, and realisation of general financial service network. On the other hand, Cave and Mason (2001) define internet as a global network of networks. Their paper elaborates the mechanism of internet

[79] For example, the internet browser industry has two leading technologies Netscape and Microsoft Internet Explorer. VHS vs. Beta Max in the 70s can also be a good example. On the other hand, Hannan and McDowell (1984) investigate a concentrated market structure in banking with respect to the diffusion of ATM machines. Sutton (1999) also illustrates network effects and standardisation in detail with respect to market structure.

This chapter uses online survey data from Korea on internet banking to analyse the adoption pattern of banking technology diffusion across customers.[80] Firstly, we characterise the determinants for consumer adoption of a new banking technology (*internet banking*). We examine the internet banking adoption process in both a static and dynamic framework to explain why new banking technologies are not always taken up by the mass-market. Subsequently we identify different characteristics between early adopters and late (i.e. *delayed*) adopters using parametric and semi-parametric duration models and show how the results differ between different model specifications.

We investigate empirical issues of banking technology concerning customer inertia, risk aversion and pre-emption. We find evidence that given the possibility of multiple equilibria when the bank products are incompatible, the reputation of the bank becomes important. The new banking technology can also face excess inertia as bank customers are somewhat tied to old technologies. More importantly, risk aversion plays an important role in determining the probability of adoption. Furthermore, we show these empirical issues related to internet banking provide grounds for incumbent banks to take pre-emptive actions.

On the other hand, with continuous introduction of new technologies in banking, additional concerns were raised regarding new ways of banking. As the survey by the Bank of International Settlements (BIS, 2000) pointed out, most Governments believe that new supervisory or regulatory measures are necessary for

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[80] Recall Korea refers to South Korea throughout this thesis.

internet banking although it will take time for them to prepare prudential regulatory guidelines. On the basis of my results, we show the relevant banking regulation has an important implication for adoption of a new banking technology.

We find evidence that adoption of internet banking is influenced by sex, age, marital status, and degree of exposure to internet banking as well as the characteristics of the banks. We also find the adoption is dominated by social norm effects. Using a duration analysis, we find no evidence of first mover advantage (*order effects*) in internet banking whilst the largest bank (*rank effects*) in commercial banking remains dominant in internet banking.

In section 3.2, we describe the new banking technology (*internet banking*) and factors likely to affect its diffusion. Section 3.3 investigates theoretical and empirical literature related to technology diffusion. We develop and compare econometric models of adoption in Section 3.4 and report estimates from these models and discuss the analysis in Section 3.5 to 3.7. Finally, Section 3.8 concludes.

3.2 Overview of Internet Banking

One might remember the days when a person had to go to a bank branch to deposit or withdraw money and get a bank statement book manually updated by a teller over the counter (OTC). With the introduction of computer networks, a networked printing machine started replacing the manual update of statements. Then, cash dispensers (CDs) and automated teller machines (ATMs) were introduced to facilitate withdrawals, deposits and even transfers accommodating mobility in much

wider geographical areas. Phone banking was a revolutionary concept in banking since it made banking accessible from anywhere as long as phones were available. With the successful diffusion of mobile phones, phone banking is moving into a next phase of development. However, one of the most substantial changes in banking technology is the recent introduction of internet banking.

Table 3.1 Comparison of Banking Delivery Channels in Korea

	Internet Banking	***Mobile Banking***	***Phone Banking***	***CD/ATM***
Delivery Channel	PC, Internet	Mobile Phone	Phone	CD/ATM terminal
Diffusion of technology	PC: 10m(0.23/pers) Internet: 16m(37%)	23.4m (54%)	20.8m (48%)	0.04 m (0.9/1000pers)
Information type	Text, Audio-visual	Text	Audio	Text, Audio-visual
Cash transaction	N/A	N/A	N/A	Available
Location	Home, work	No restriction	No restriction	Main streets
Visual	Good Wide-screen	Limited Small-screen	None	Good Wide-screen
Manual	Need to use keyboard	Uneasy with small button	Push button	Touch panel
Mobility	low	high	low	N/A
Information search/memory	Available	N/A	N/A	N/A
Terminal fee	High on customer	Low on customer	Low on customer	High on banks
Network fee	On customer	On customer	On banks	On banks

Source: Bank of Korea 2001

From the comparison of banking delivery channels presented in Table 3.1, we first notice that the evolution of banking technology from CD and ATM to internet makes banking transaction more mobile (or less locational restriction) at a lower fee

at the terminal. In addition, internet added a new feature of information search in banking when it retains the advantage of various information types, e.g. in text and audio-visual, which are provided by CD and ATM. However, despite the benefits of internet banking, this medium has not yet replaced traditional banking channels and the banking industry seems to maintain the multi-channel distribution approach.

Innovation:

As illustrated above, banking technology has focused on reducing cost of distribution. In Table 3.2 we notice a transaction via phone banking costs less than a half of the cost via branch banking. This cost per transaction halves for banks when the customer switches from phone banking to using ATMs. However, the reduction in cost of distribution is much more significant when the customer switches to PC or internet banking, which is nearly hundred times less costly.

Table 3.2 Cost per Transaction in the US: Money Transfer Unit: US dollars

Type	*Branch*	*Cheque*	*Phone*	*ATM*	*PC*	*Internet*
Cost per transaction	1.07	0.95	0.45	0.27	0.015	0.01

Source: Furst, Lang & Nolle (1998), Booz- Allen & Hamilton (Apr.1997)

In this context, we consider internet banking as a process innovation that makes customers handle their banking without going to bank tellers at a lower price given the lower cost to the bank. In addition, it allows new customers to visit virtual banks via public web-network whilst phone-banking and PC-banking provide only closed network limited to the existing clients. Considering new products and services

specifically designed and offered on the internet given the new technology feature, one might also argue that internet banking has an aspect of product innovation as well.[81]

Products and Services:

Regarding product innovation tied to internet banking, increasing competition amongst the leading banks also promotes product and service differentiation. For example, despite the Internet Banking System (www.banktown.com) developed in 1999 by the consortium led by Korea Telecom and several banks, most leading internet banking providers are now using their own system to differentiate their service products rather than using Banktown. Moreover, banks offer comprehensive asset management packages on the internet putting together non-traditional banking products (*bundling*).

Table 3.3 Services Available on Internet Banking in Korea

	Information	*Balance Check*	*Fund Transfer*	*Loans*	*Other*
Type of Service	-Financial products -Stockmarket -Exchange rate	-Account balance -Credit/ DebitCard balance -Personal check balance	-Transfer -Loan repayment -Direct debits -Card payments -Cash withdrawal	-Loan limit -Application -Approval -Loan delivery	-Open accounts -Live time financial advice -Accident report -Personal finance management -Other financial product sales

Source: Bank of Korea 2002

[81] Most banks offer comprehensive personal financial management packages on the internet. For example, the package is tailor made for each client combining commercial banking, investment in stockmarket, bondmarket, and mutual funds and sales of insurance products and pension schemes.

Currently all 17 commercial banks in Korea are providing internet banking although their range of services may vary. Table 3.3 summarises the services available on internet banking into 4 main areas: 1/ information search engine; 2/ balance check; 3/ fund transfer, and 4/ activities related to loans, in addition to the basic services such as opening an account, financial product sales and etc. Although internet banking does not have the same capacity as CDs and ATMs in delivering cash, there are many more informational features which enable customers to search for appropriate products and services; make a decision, and act on it over the internet. One important observation to make is that customers need to become more proactive in their information search in the absence of bank tellers or financial advisors on the phone.

Competition:

Banking competition is assessed in three different ways, price (*interest rate*), quantity (*deposit and loan size*) and quality (*reputation-relationship*). Traditionally banks have competed in branch network (*quantity*) to increase the number of clients, i.e. the deposit and loan size. However, with the benefit of new technologies, the quantity competition seems to be replaced by the network competition in ATM or internet banking. Internet creates a potentially competitive market outcome in the presence of both internal and external threats. Threats within the industry increase as product and service information becomes more transparent on the internet. On the other hand, there are external threats with lower entry barriers for those with

advanced technology in internet. It would be interesting to see if changing competition environment would have an impact on market structure.

Diffusion:

"While the dot-com party may be over, U.S. retail bankers are just beginning to celebrate their online banking accomplishments. With national adoption rates reaching 20% in North America, online banking is becoming a mainstream phenomenon. Twenty percent, however, is just the tip of the iceberg. Banks in Nordic countries and South Korea have pushed adoption beyond 35%," (*Alenka Grealish from Celent Report 14 Nov. 2002*)

Korea has been quoted as a country with one of the highest internet banking penetration ratios per head alongside Scandi-Nordic countries and Canada. The internet banking user map (Figure 3.11) produced by BOK in 2002 illustrates that 60% of the population use internet and 35% internet banking users. This high penetration ratio is realised as a result of the infrastructure of the internet network in Korea, the high-speed network in particular. According to Ofcom's (2004) Strategic Review of Telecommunications Phase I Consultation, Annex H23, the broadband take-up in Korea is increasing significantly faster than in other countries. This consultation report also points out the public financing in the network infrastructure as one of the reasons for the high rate of broadband take-up. Given the network

infrastructure, currently almost a half of the population is using the internet banking, e.g. 24.3 million out of 47.9 million (BOK, 2004).

> "As of December, 2004, the number of users of internet banking services in twenty domestic banks (excluding the Korea Development Bank (*KDB*) and the Export-Import Bank of Korea), Citibank and post offices amounted to 24.3million. This represented a 6.7 percent increase from 22.8 million at the end of December 2003." (*Bank of Korea 2005, Press Release 2005-1-38, p.1*)

Internet banking was first introduced by Chohung Bank in Korea at the beginning of 1998, which was followed by rival banks throughout 1998. The number of banks which offer internet banking reached 13 by the end of 1999 and continuously increased to 20 by the end of 2000 and currently all 14 commercial banks offer internet banking alongside four specialty banks (*cooperatives*), two foreign banks, postal savings, and district banking corporation (*Saemaul Geum-ko*).[82] Not only the speed of internet banking adoption by banks has been extraordinary but also the adoption by customers has been extremely fast. The number of registered internet banking users has nearly doubled every quarter until the end of 2000, since

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[82] The information is as of Dec. 2004.

when the speed of adoption has slowed down. It is worth identifying why so many people adopted internet banking at such an extraordinary speed.

3.3 Background Literature and Facts

The importance of technological progress in economic growth and social welfare has long been recognised by many economists. Schumpeter (1934, 1943) pioneered studies on technology, which was subsequently emphasised by Solow (1957) in his economic growth literature. Schumpeter's view on technology rejected the anti-trust orthodox and argued large firms operating in a concentrated market structure would encourage technological progress, whilst Solow claimed that a good proportion of growth residual might be explained by changes in technology. On the other hand Davies (1979) argued that society fully benefits from a process or product innovation only when the innovation is diffused enough to enhance the firm's productivity or the consumer's utility. However, most of the earlier literature on technological progress focused on the firm's behaviour analysing how process innovation would influence its productivity. On the other hand, the consumer behaviour in relation to product innovation has been less frequently discussed.[83]

Gourlay and Pentecost (2002) points out that research into the inter-firm diffusion of new technology has paid relatively little attention to the determinants of

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[83] In the same context, Waterson (2003) draws attention to consumers' reluctance to search and switch suppliers in relation to competition and competition policy analysis.

innovation diffusion in the financial sector compared to other industries. In addition, study on consumer behaviour of financial technology adoption is almost next to none.

Amongst various approaches in analysing technology-intensive industries, network effects have recently become important topics with the growing applications of internet network.[84] Katz and Shapiro (1985) examines network compatibility as an element of competition and shows consumers' expectations on externalities play an important role in determining an equilibrium, in other words, firms' reputations are important. They also claim that consumers' benefit from the use of a product increases when there is a large number of other consumers purchasing compatible items (Katz and Shapiro, 1986). In internet banking, the installed base should also increase customer utilities via physical network. Another important contribution of their work is intertemporal substitution in technology adoption. Some consumers may choose to wait for cost and demand uncertainty to be resolved before they commit themselves to a specific technology. This aspect is yet to be proved empirically in banking technology.

Farrell and Saloner (1986) also investigate installed base and compatibility.[85] They claim a new standard can face excess inertia as installed-base users are somewhat tied to the old technology, which explains why new technologies are not always taken up by the mass-market. More recently, Mason and Weeds (2001) identify three different inefficiencies of premature adoption in the presence of

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[84] Saloner and Shepard (1995) acknowledge the importance of networks with the recent proliferation of information technology.
[85] Installed base represents the number of users who are networked via a technology.

network externalities and examine the effects of uncertainty, network effects and pre-emption on inefficiencies.

Early epidemic models of diffusion use an analogy between the contact among firms or consumers and the spread of disease (Mansfield, 1968). For example, some consumers adopt a new technology before others because they happen to become infected first. Similarly, some technologies diffuse faster than others, as they are more contagious due to its profitability and risk factors. In contrast, Karshenas and Stoneman (1993) point out that contemporary approaches have put less emphasis on information spreading as the key explanatory variable of innovation diffusion. Then, they summarise the recent approach into three different mechanisms:

1/*Rank effects,* suggest that only firms with sufficiently high ranking will adopt when an innovation first becomes available. However, as the cost of adoption falls over time, lower ranked firms will adopt as well.[86]

2/*Stock effects*, result from the assumption that are early movers obtain higher returns on the new technology and the marginal return of adoption decreases with an increase in the number of adopters.[87]

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[86] See Davies (1979) and Ireland and Stoneman (1986) for further examples of rank effects.
[87] Reinganum (1981b) discusses the strategic behaviour of firms in this context.

3/*Order effects*, are applicable when there is a fixed amount of critical input into production. In such situations, only early movers who secure access to the critical input will find it profitable to adopt. The order of adoption clearly matters.

Hannan and McDowell (1990) examine the impact of bank adoptions of automated teller machines (ATMs) on subsequent levels of concentration in local banking markets. They find strong support for the existence of rank effects in the diffusion of ATMs, while rejecting the existence of epidemic effects. However, their approach has to be further tested as they left out the aspects of consumer adoption, which we believe plays an important role in banking industry structure. They propose if larger banks adopt ATMs, markets tend to be more concentrated and vice versa. However, the diffusion of a new banking technology is relatively fast across large and small banks nowadays and sometimes a government consortium leads the market toward a new technology simultaneously.[88] Therefore, it is difficult to justify that market concentration is due to early adoption by larger banks.

Waterson (2003) suggests consumer search behaviour is sub-competitive in current account banking compared to motor car insurance and therefore the market structure tends to be more concentrated in banking than in motor car insurance. One of the main differences between the two industries lies in credit rating system. Bank-specific credit rating builds up over time whereas credit rating for motor insurance is transferable between insurance companies. Thus, long-term aspects of credit rating in

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[88] In Korea, the Korea Telecom consortium introduced the Internet Banking technology to most banks (www.banktown.com).

banking may explain why consumers are reluctant to switch their banks. This coincides with my pilot test results where the majority did not switch their banks despite more favourable internet banking offers from rival banks.

Following Gilbert and Newbery's (1982) approach, we consider product differentiation on internet banking as a preemptive invention. We argue internet banking creates a new dimension of banking competition where banks compete in different networks via product diversification and differentiation. Fudenberg and Tirole (1985) also use a similar approach using the adoption of a new technology to illustrate the effects of pre-emption in games. However, they argue that threat of pre-emption equalises rents in a duopoly but does not extend to the general oligopoly. If the gain to pre-emption is sufficiently small, the optimal symmetric outcome (late adoption) is an equilibrium. This contrasts with Reinganum's (1981b) result in pre-commitment equilibria, which leads to diffusion. In other words, despite the small gain, the adoption of new technology prevails in oligopoly, especially when the information lags are short and firms can observe and respond to their rivals' actions. Reinganum (1981b) applies game theoretic approach to market structure to investigate firms' strategic behaviour in adoption of new technologies.

More recently, Akhavein et al. (2001) point out few quantitative studies on the diffusion of new financial technologies and the weakness where the technology is limited to ATMs. In the hazard model analysis, they suggest large banks innovate earlier (*pre-emption*) and the tobit model also suggests banks with fewer separately chartered, but with more branches, innovate earlier.

Probably, it is most common to use duration model for analysis of technology diffusion whilst a game theoretic approach forms another group investigating diffusion of technology as a strategic reaction in games (Rose and Joskow, 1990; Karshenas and Stoneman, 1993; Saloner and Shepard, 1995; Gourlay and Pentecost, 2002). On the other hand, Stoneman and Battisti (2000) use Deaton and Muellbauer's (1980) model, which reflects the diversity of factors that impact the diffusion process. They assume a Weibull underlying distribution of diffusion,[89] while drawing attention to the weakness of the epidemic model, which assumes underlying hazard rate is constant over time and all individuals have equal chance of getting the disease.

With internet banking, innovation certainly improves productivity via cost cutting in distribution but diffusion pattern amongst consumers is equally important. In order to link the firm behaviour and the consumer behaviour, we take some insight from behavioural studies on adoption.

Diffusion research did not develop from a single discipline. Different disciplines led to the development of this theory and the history goes back to Tarde's *Laws of Imitation* (1890, 1903), which conceptualised imitating behaviour using a selectionist rationale. Throughout the last century, his laws of imitation have influenced a substantial amount of diffusion studies across many disciplines, including sociology, anthropology, general economics and many others. Since Tarde, there have been a plethora of studies that have tried to link imitation within a social

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[89] Discussion on Weibull distribution will be later in section 3.4.

structure, consumer behaviour, industrial structure and welfare economics. However, the effort to link the above sociological aspects of economics were somewhat neglected recently with an increasing focus on technological development. Technological development could be one of the main factors for economic growth since the 20th century. However, without identifying why and how consumers adopt new technologies in the social context, the research on technology is incomplete.

A similar example can be found as the Asian crisis has added new impetus to the quest for comprehending relationships between economy and culture whilst most research on Asia prior to the crisis focused on conventional macroeconomic variables, such as human capital and investment. Janelli and Yim (1997) criticise that a Western intellectual tradition has sought to dichotomise explanation of human actions into the ideal and the material and suggested the rational choice theory must be considered in the social context. It is important to recognise the existence of mutually supportive relationships between cultural understandings and the pursuit of development goal (*material*) in Korea. Greif (1994) uses a similar approach and argues that a path of economic growth is not a mere function of endowment, technology, and preferences but a complex process in which the organisation of society plays a significant role. The organisation of society reflects historical, cultural, social, political and economic processes.

According to Tarde (1903), consumers imitate from their immediate social contacts or networks. In this context, it is necessary to look at idiosyncratic Korean society and culture. Macdonald (1990) points out strong family ties and importance of community life in Korea. For example, Koreans tend to place the concept of "We"

ahead of "I" and this leads the society to conformity and collectivity rather than individualism. Hence, it looks natural to see such a fast diffusion of internet banking in Korea whilst most developed countries are not yet ready to adopt internet banking as their main channels for banking. Koreans are known to conform to their social norm and the adoption of internet banking in this case is certainly perceived as their social norm which narrowed the socio-economic gaps by the conformity.

For diffusion, one of the most common approaches is applying social leader concept. Becker (1970) finds substantial correlation between an individual's adoption timing of an innovation and both his/her relative position in sociometric network and his/her most valued source of information and suggests that early adopters are opinion leaders. Rogers (1995) overviewed a vast amount of publications related to innovation diffusion and summarises socio-economic characteristics of adopter categories: early adopters to laggards. He also claims that opinion leaders are at the core of respective networks.

Another approach adopts rational decision process. Rosenberg (1976) argues that in many markets prospective buyers for an innovation are strongly influenced by expectations concerning the timing and significance of future improvements. In other words, the optimal decision process of innovation adoption depends on technological expectations and learning. As a similar approach of rational decision process, McFadden and Train (1996) explain when a new product with unknown attributes are offered, customers determine whether they like the product by trying it themselves or wait to observe the experience of other customers who try the product.

They investigate the implications of learning from others on the sales of new products and the impact of advertising.

Rational decision approach can be useful for analysing early adopters of new technology as they are usually tech-savvy users. According to International Data Corporation report (IDC, 2002), early adopters of wireless internet are usually young (28 years old on average) and male (64%) tech-savvy users. This report categorises consumers into 4 adoption stages along the S-shaped diffusion curve: 1/early adopters are dominated by male tech-savvy group, 2/early majority are young working group, 3/ late majority are young working group with larger female group, and 4/laggards are predominantly older group.

On the other hand, Stoneman and Diederen (1994) raise another important issue of public policy for technology diffusion. They explain diffusion may be too fast if firms adopt a technology before it is profitable to do so, or if firms adopt a new technology today that effectively preempts the adoption of a superior technology in the future. For instance, when customers are exposed to unidentifiable amount of risks via internet banking, the important role of public policy is to mitigate the risks in early adoption.

Rogers (1995) points out that a common problem in diffusion research is the individual-blame bias, i.e. the tendency to hold an individual responsible for his or her problems, rather than the system of which the individual is a part. Following the criticism, he suggested five main variables determining the rate of adoption. Table 3.4 presents his five variables, to which we link the potential attributes associated with internet banking, and which are: 1/ perceived attributes of innovations; 2/ type

of innovation decision; 3/ communication channels; 4/ nature of the social system, and 5/extent of change by agents' promotion efforts.

Furthermore, it is worth sketching out some cultural aspects of Korean society as diffusion is considered to be a social phenomenon and in doing so, the Confucian tradition and its impact on education would be the key elements.

Table 3.4 Adoption Variables and Attributes in Internet Banking

Variables (Rogers, 1995)	*Attributes in Internet Banking*
1. Perceived Attributes of Innovations	• Internet communication as a channel of banking • Flexible services in terms of time and location
2. Type of innovation-decision (optional, collective, authority)	• Optional • *Collective* considering Korean culture
3. Communication channels (mass media, interpersonal, etc.)	• Multi-channels: the survey suggests interpersonal, mass-media, internet and many others
4. Nature of the social system	• Internet adoption as a social norm • High degree of technological network interconnection • High degree of social network: strong family tie, peer group and social clubs in a broader sense
5. Extent of change by agents' promotion efforts	• High effort level of promotion with special offers on interest rates, fees, etc. • Supported by Government institutions

Macdonald (1990) claims that the enormous importance attached to education in Korea is a principal reason for the nation's rapid development. This general attitude towards education is rooted in the Confucian tradition, where entry into government

service was obtained through years of study of the Confucian classics,[90] proven by examination. Among the traditional 4 classes of Caste; Sa (Scholar-official), Nong (farmers), Gong (Artisans, Engineers), Sang (Businessmen), the social ideal was the *Sa (scholar-official)* group. Back then, government positions were the only way to rise in the world and thus, education was the key to fame and fortune. Education is still regarded as the key to success by modern Koreans.

With the official adoption of Confucian philosophy and the examination system, education became a major social activity throughout the Choson Dynasty (1392-1910). These social activities of learning evolved around state schools such as the Confucian University (*songgyun'gwan*) or private academies (*sowon*) run by individual scholars and ex-officials. Hence, Koreans often consider formal schooling and education to be interchangeable. On the other hand, any vocational education related to three other Castes (Nong, Gong, Sang) are not regarded as high as formal schooling. Even the Ministry of Education and Human Resources Development (former Ministry of Education) refers education as formal schooling in most cases.

Another driving force towards formal education in Korea is the community sense, i.e. conformity society. Macdonald (1990) points out that part of the role of the Korean family and community has been taken over by groupings based on common local origin, common *school* experience, and common workplace. People within such groups have a strong sense of shared identity and mutual responsibility. Hence, a certain level of formal education is essential for Koreans to remain in such

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[90] The Confucian classics lay out rules of life and those who follow these rules are highly regarded as the educated group. One can say that it is somewhat analogous to the Bible for Christians.

groups. Another useful approach is a model of observational behaviour by Bikhchandani et al. (1998), which agrees with most conformity research results. They claim people learn from the behaviour of others and therefore conform. Naylor (1989) also uses a similar approach of individual behaviour of a social custom to explain the reason why workers strike. Hence, the education in Korea cannot be explained without the influence of Confucianism (*culture*) as well as conformity (*society*), which made Koreans place high value on education and respect the educated, considering adoption of a new technology as a part of education for new skills.

Rogers (1995) considers the nature of the social system as one of the five variables determining the rate of adoption. For instance, the Korean Government clearly signalled the network technology as the key for the future via various stages of Government-led technology projects.[91] Table 3.5 illustrates the 4 stage technology projects since 1987. The first Korean Backbone Computer Network project (1987-1992) facilitated the distribution and use of personal computers followed by the second project (1992-1996), which promoted more powerful personal computers and versatile applications including internet communications. This second project benefited from a parallel project launched in 1995, called the High-speed National Information Infrastructure project as it established a public high-speed cable network. This parallel project was designed to provide a favourable environment in

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[91] The Ministry of Information and Communication has been in charge of these projects since 1987.

delivering multimedia services across the nation. Currently, Korea is undergoing the second stage of this parallel project, namely the Cyber-Korea 21 project (1998-2002). The Government has been reinforcing the nationwide communication network system and its applications to build a knowledge-based information society. The Government budget of 28 trillion won (approx. 20 billion US dollars) was set for the Cyber-Korea 21 project to increase the information infrastructure by 100 times and educate people across the nation.

Table 3.5 Technology Projects in Korea since 1987

Year	*Project*	*Objective*
1987-1992	1st Korean Backbone Computer Network project	To establish the basic infrastructure for computer network focusing on distribution and use of personal computers.
1992-1996	2nd Korean Backbone Computer Network project	To promote more powerful computers and diverse applications.
1995-1998	1st High-speed National Information Infrastructure project	To build a high-speed cable network nationwide to facilitate the network communication.
1998-2002	Cyber-Korea 21 project (2nd High-speed National Information Infrastructure project)	To build a knowledge-based information society facilitating the 100 times of information infrastructure within the 5 years.

The pro-technology policy by the Government certainly encouraged general public to adopt new technologies including the internet.[92] Not only the Government campaign set a clear social objective regarding the new technology of internet, but

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[92] The Times (1 Dec. 2004 UK) reported, "South Korea is the most geeky, tech-savvy country almost anywhere and about 73% households have high-speed broadband."

also it took the initiative in adopting and implementing the internet technology nationwide. For instance, most civil service documents have been distributed and communicated via the internet since July 2000. Over two decades, the Government technology projects have established a new social norm, computer and internet-literacy. It seems natural that Koreans worry about being left behind in the information society and that therefore adopt the new technology sooner rather than later to remain in the respective groups.

3.4 Econometric Models

In order to test the following propositions, a set of econometric models in both static and dynamic set-up are used and compared. For a static version of maximum likelihood estimation, we apply a logistic distribution to test the probability of internet banking adoption as a point estimate at the end of 2001. On the other hand, we use a duration model in order to detect the dynamics of IB adoption process.[93] The latter approach is useful in identifying the determinants of early adopters versus delayed adopters as the data now contain the sequential information of adoption time.

[93] Duration analysis is often called as Survival analysis or failure time analysis.

***Proposition 1**: individual characteristics affect their behaviour of internet banking adoption (static).*

Firm characteristics have often been used for determining firms' technology adoption behaviour in the literature (Gourlay and Pentecost, 2002; Katz and Shapiro, 1985). For similar reasons, we suggest individual characteristics would affect their internet banking adoption. This proposition follows the argument brought forward by Rogers (1995) that characterises the different types of individuals according to their adoption timing, e.g. early adopters to laggards.

***Proposition 1.1**: males are more likely to adopt internet banking than females.*

Internet banking requires a minimum level of proficiency in computer skills and internet communication. Thus, we expect that males are more likely to adopt internet banking given that they tend to be more tech-savvy as the International Data Corporation report (IDC, 2002) suggested in the literature review section.[94]

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[94] IDC has an extensive global network of consultancy on technology information and reports up-to-date facts in the industry. Their report (2002) about adoption of wireless communication confirmed that young (average 28 years old) male group are more likely to adopt earlier.

***Proposition 1.2**: younger generations are more likely to adopt internet banking than older generations.*

One way to look at the age factor is younger generations are more likely to adopt internet banking due to their familiarity with contemporary network technology. Some might argue otherwise that Asian countries, including Korea, are obsessed with learning of new technologies and thus, the age factor might not be significant. According to Rogers' (1995) survey on diffusion publications show that more than half of the publications find the age factor as not significant but in the cases where significance is apparent, younger generations are more likely to adopt a new technology.

***Proposition 1.3**: people with higher education (university or above) are more likely to adopt IB than those with less education.*

Having said that the proficiency in computer technology and network communications would have a positive impact on internet banking adoption, education would enhance the proficiency in network technology and thus would increase the probability of IB adoption. University or above level of education is critical as universities in Korea are heavily relying on internet communication for their foundation of educational system. This argument applies to across different degree majors regardless of art or music degrees. Exposure to a university network system is more important than anything else.

Proposition 1.4: *married people are less likely to adopt internet banking than single individuals or those with alternative marital status e.g. separated or divorced.*

We consider that married people are relatively conservative compared to those who choose alternative marital status, e.g. divorced, separated, co-habit, or single. Choice of alternative marital status would have a positive effect on their tendency to try out new technologies as they tend to be less risk-adverse.[95] This proposition is also rooted in the characteristics set out by Rogers (1995) who points out that adopters of a new technology would be less likely to be risk-adverse.

Proposition 1.5: *High-income group is more likely to adopt internet banking than low-income group.*

We expect that banking intensity of high-income group would be higher than low-income group would and hence expect the incentive of IB adoption is larger for high-income group. This once again follows Rogers (1995) adoption characteristics and we expect to see some significant results given the cost of adopting internet banking.

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[95] One could argue that single individuals are also risk adverse by postponing or opting out of marriage but in trying out new technologies, we expect them to be more open-minded.

Proposition 1.6: *residential property owners are less likely to adopt internet banking.*

Outright owners of residential properties are less likely to have complex banking than those who 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 internet banking. Becker (1970) points out substantial correlation between an individual's adoption timing of an innovation and his/her relative position in sociometric network.

Proposition 1.7: *residents in Seoul and Kyungki metropolitan area are more likely to adopt internet banking than those who reside in regional provinces.*

This proposition is based on stronger epidemic effects (Mansfield, 1968; Karshenas and Stoneman, 1993) in the metropolitan area than the remote regions. We also expect that the easier access to computers and internet facilities in the metropolitan area, which would provide better grounds for people to adopt internet banking.

Proposition 1.8: *those who were exposed to internet banking recommendations are more likely to adopt internet banking.*

This proposition is also applying epidemic effects (Mansfield, 1968; Karshenas and Stoneman, 1993) as we argue those who are exposed to the risk of internet banking

via recommendation are more likely to adopt than those who are not yet exposed to recommendation.

Proposition 1.9: *those who are aware of interest rate information in the market are more likely to adopt internet banking.*

The reasoning for this proposition is that those who are active information seekers would benefit more from internet banking as they can search around for the best services and products without going to individual bank branches. Hence, they have more incentive to adopt internet banking. This is related to the principle brought forward by Becker (1970) which characterises early adopters value source of information and more likely opinion leaders.

Proposition 1.10: *frequent visitors to bank branches are more likely to adopt internet banking.*

Those who visit bank branches (OTC) frequently are considered to be keen customers and have more incentive to adopt internet banking as they can save the time travelling to the branches. There might be some customers who prefer more human contact but we expect this preference can be outweighed by substantially lower transaction fees and new services, e.g. enhanced information search facility and live-time financial portfolio management services, offered via the internet when banks aim to substitute most of branch activities with internet banking. Consumer

search behaviour provides the base of this proposition and Waterson (2003) discusses consumer search and switching behaviour to a certain degree that we find useful for this proposition.

Proposition 1.11: *frequent visitors to banks' websites are more likely to adopt internet banking.*

The more visits to banks' websites customers make, the greater the chance they would adopt internet banking as the banks advertise various services and benefits of internet banking on the web. Once again, the epidemic effects presented in the literature earlier (Mansfield, 1968; Karshenas and Stoneman, 1993) can be applied in explaining this proposition. The more customers exposed to internet banking information, via websites in this case, the higher the probability they would adopt it.

Proposition 2: *the determinants of IB adoption timing (dynamic) would differ from those of IB adoption probability (static).*

Although we expect that the overall level of IB adoption would vary depending upon individual characteristics, we claim that the adoption timing would also vary among individuals with different characteristics. For instance, not only do we expect males to be more likely IB adopters, but we believe they are more likely early adopters. This proposition adopts the theories set out by Becker (1970) and Rogers (1995).

Proposition 3: *the first mover (bank) would not increase its market share, i.e. no order effects.*

Since the technology of internet banking is not exclusive to the first mover, we are bound to see some spillovers within the industry and would not see significant impact on the first mover's market position. Consumers being cautious about their banking, the first mover would not necessarily capture early adopters. Mason and Weeds (2001) explains the inefficiencies of premature adoption in the presence of network effects.

Proposition 4: *the largest bank would increase its market share via internet banking, i.e. rank effects.*

We expect customers to prefer banking with a larger bank, which has a wide customer network as they believe the larger the better, i.e. network effects. Traditionally, large banks have been perceived as better banks in Korea and in addition, the network effects of internet banking would reinforce the perception of bank size. Therefore, the largest bank is expected to benefit more from internet banking by capturing early adopters. This proposition aims to test the rank effects (Karshenas and Stoneman, 1993) directly.

***Proposition 5**: the duration dependence is likely to be positive.*

The hazard associated with internet banking adoption is expected to increase with time since customers are exposed to more IB adopters. The epidemic effects can be applied to this proposition. In the same context, the law of imitation can be also borrowed from sociology to support the argument. The forefather of the diffusion studies, Tarde (1903) observed certain patterns of innovation diffusion called the laws of imitation (*Les Lois de l'imitation*), which we today call the adoption of an innovation. People are more likely to adopt internet banking with the increasing number of IB users as they have more chance to imitate other users as time goes by.

***Proposition 6**: the determinants of non-users' future IB adoption would differ from those of IB users'.*

For IB non-users who have delayed the adoption of internet banking, we assume that their individual characteristics differ from those of IB adopters. We argue that factors affect non-IB users to adopt IB in the future would differ from those for the current IB users. This proposition reiterates the argument brought forward by Becker (1970) and Rogers (1995).

First, we use the fully non-parametric duration model to determine the shape of the survival function as well as the hazard function.[96] The Kaplan-Meier (1958)[97] survival estimate indicates the IB adoption follows a S-shaped curve considering the data are right censored for non-IB users.[98] This agrees with the results from most technology diffusion literature.[99] On the other hand, the hazard function shows a non-linear monotonic increase in time, more precisely increasing with oscillation. In order to capture this increasing hazard over time, we chose a Weibull distribution, as shown in Figure 3.6 and 3.8, for the underlying hazard function of duration analysis and compared three different specifications: 1/continuous time Weibull model (*parametric*), 2/discrete time proportional hazard (PH) model with Weibull baseline hazard (*parametric*) and 3/ discrete time proportional hazard (PH) model with flexible baseline hazard (*semi-parametric with non-parametric baseline hazard*).

The Weibull distribution is one of the most widely used survival distribution. It is a versatile distribution that can take on the characteristics of other types of distributions, based on the value of the shape parameter p. The Weibull probability density function can be written with one to three parameters (e.g. scale parameter η, shape parameter p, location parameter γ) and the density function can have a

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[96] Kalbfleisch and Prentice (1980) suggest a non-parametric duration analysis has an advantage of not imposing any restriction on the underlying hazard but there are theoretic difficulties in interpreting non-parametric maximum likelihood estimate. Thus, alternative specifications were chosen for the analysis.

[97] Despite the incompleteness of the data, Kaplan-Meier (1958) use the product-limit estimate to derive the proportion of events in the population whose lifetime would exceed t, without making any assumption about the form of the probability function.

[98] Figure 3.5 illustrates the S-shaped diffusion path from the Kaplan-Meier estimation.

[99] The evidence of a S-shaped diffusion of technology can be found in Davis (1976), Stoneman and Battisti (2000) and many others.

flexible form depending on these parameters.[100] The most commonly used density function for duration model takes the two parameter form with scale and shape, but $\gamma = 0$:

$$f(t) = \frac{p}{\eta}\left(\frac{t-\gamma}{\eta}\right)^{p-1} \cdot e^{-\left(\frac{t-\gamma}{\eta}\right)^{p}} \tag{3.1}$$

where most duration literature denotes the hazard rate $\lambda = \frac{1}{\eta}$.

Therefore, the hazard function with Weibull distribution is

$$\lambda(t) = \lambda p(\lambda t)^{p-1} \tag{3.2}$$

and the survival function is

$$S(t) = e^{-(\lambda t)^{p}} \tag{3.3}$$

The Weibull distribution is suitable for a model where hazard rate increases or decreases monotonically since it parameterises the exponential term with p-1 where $p>1$ can be used for increasing hazard rate, whilst $p<1$ can be used for decreasing hazard rate. The special case of $p = 1$ converges to an exponential model in which the hazard rate is constant over time.

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[100] For further details of the probability distribution, see Kiefer (1988), Spiegel (1992) and Greene (2003).

3.4.1 Logit Specification

With respect to individual characteristics, it is relatively simple to apply a logit specification to the probability of IB adoption as well as to interpret the estimates. Binary choice model has a non-linear probability distribution. Hence we rewrite the cumulative probability function in a logistic form as shown in equation (3.4).

$$\text{Cumulative probability: } P_i = F(z_i) = \frac{1}{1+e^{-z_i}} \tag{3.4}$$

where $Z = \beta' X + u$

$$\text{Probability at } Z_i\text{: } f(z_i) = \frac{dP}{dz} = \frac{e^{-z}}{\left(1+e^{-z}\right)^2} \tag{3.5}$$

$$\text{Marginal Effects: } \frac{\partial P}{\partial X_i} = \frac{\partial P}{\partial z} \cdot \frac{\partial z}{\partial X_i} = \frac{e^{-z}}{\left(1+e^{-z}\right)^2} \cdot \beta_i \tag{3.6}$$

This logit model specification is used for adoption probability for the pooled sample and for non-users' future adoption behaviour. The future adoption behaviour of non-adopters was also investigated by using logit and conditional logit specifications. Equation (3.4) is the cumulative probability distribution where Z is the individual

characteristics function.[101] As Z tends to infinity, e^{-z} tends to 0 and the cumulative probability has a limiting upper bound of 1. As Z tends to minus infinity, e^{-z} tends to infinity and the cumulative probability has a limiting lower bound of 0. Hence the equation (3.4) is bounded between 0 and 1. The marginal effect of Z on the probability which will be denoted $f(Z)$ is given by the derivative of $F(Z)$ with respect to Z (equation 3.5). Equation (3.6) indicates the marginal effects for each variable.

3.4.2 Duration Model Specification

We are interested in the length of time that elapses before customers adopt a new banking technology (*internet banking*). We estimate a hazard rate i.e. the conditional probability of an adoption in each month given that the customer has not adopted IB by that time.

The duration to adoption of internet banking was defined as follows: we set the time origin at Jan. 1998 and thereafter, a monthly time scale was set in sequence. The choice of a monthly time scale is due to the nature of survey data. We define the event ending the duration as the first use of internet banking, i.e. IB adoption. Different individuals may have different time origins but my specification assumes everyone was already exposed to the news of IB introduction prior to the actual introduction of IB.[102]

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[101] Note Z function for individual characteristics here has nothing to do with the z-statistics reported in logit and duration model estimations.

[102] Davies (1979) claims no potential adopter is prevented from adopting by total ignorance or patent restrictions when potential adopters in the industry are assumed to know of the existence of the innovation once it is first commercially available.

3.4.2.1 Continuous Time Parametric Duration Model (Weibull)

Parametric specification assigns a certain type of distribution on the hazard function, a Weibull distribution in this chapter. It is relatively easy and straightforward to apply this specification but the choice of hazard function is extremely important. Various distributions including exponential, lognormal and log-logistics were tested and the Weibull distribution was chosen, as its log-likelihood is higher than those of other specifications as shown in the table below.

Table 3.6 Survival Distributions: log-likelihood[103]

Distribution	*Hazard Function, $\lambda(t)$*	*Survival Function, S(t)*	*Log Likelihood*
Exponential	λ	$S(t)=e^{-\lambda t}$	-313.63
Weibull	$\lambda p(\lambda t)^{p-1}$	$S(t)=e^{-(\lambda t)^p}$	-263.55
Lognormal[104]	$f(t)=(p/t)\phi[p\ln(\lambda t)]$	$S(t)=\phi[-p\ln(\lambda t)]$	-337.76
Log-logistic[105]	$\lambda(t)=\lambda p(\lambda t)^{p-1}/[1+(\lambda t)^p]$	$S(t)=1/[1+(\lambda t)^p]$	-312.11

In addition, the survival function and hazard function seem to fit the non-parametric specification results best. Finally, the time interval is assumed to be small enough to apply continuous time. The Weibull model is specified as:[106]

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[103] For further details of each distribution, see Kiefer (1988) and Greene (2003).

[104] ln(t) is normally distributed with mean $-\ln(\lambda)$ and standard deviation $1/p$.

[105] ln(t) has a log-logistic distribution with mean $-\ln(\lambda)$ and variance $\pi^2/(3p^2)$.

[106] Let T be the length of a complete spell and t is a random time variable with a cumulative distribution function of $F(t)$ and probability density function of $f(t)$. Therefore, the diffusion of IB adoption is represented in the failure function, which is $1-S(t)$. If the ancillary parameter, $p>1$, the hazard rate rises monotonically with time and falls if $p<1$.

Hazard function(Weibull):

$$\lambda(t) = \lim_{\Delta \to 0} \frac{Prob(t \le T \le t+\Delta | T \ge t)}{\Delta} = \lim_{\Delta \to 0} \frac{F(t+\Delta) - F(t)}{\Delta S(t)}$$

$$= \frac{f(t)}{S(t)} = \lambda p(\lambda t)^{p-1} \qquad (3.7)$$

Probability density function: (3.8)

$$f(t) = \lambda p(\lambda t)^{p-1} \cdot S(t) = \lambda p(\lambda t)^{p-1} \cdot e^{-(\lambda t)^p}$$

Survivor function: $S(t) = Pr(T > t) = 1 - F(t) = e^{-(\lambda t)^p}$ (3.9)

Failure function: $F(t) = Pr(T \le t) = 1 - S(t)$ (3.10)

where $\lambda \equiv exp(\beta' X)$

The hazard rate, $\lambda(t)$ is the conditional probability of having a spell length exactly t, i.e. adopting IB in interval $[t, t+\Delta t]$, conditional on survival up to time t. The equation (3.7) shows the hazard function is a limiting case of conditional probability of event. But the hazard rate is not a probability in a pure sense since it can be greater than 1. The Weibull distribution allows the hazard rate for an individual to change monotonically. In the case of IB diffusion, we expect to see positive duration dependence ($p>1$). We derive the hazard function by conditioning on survival up to

time *t* and write the survival function as in equation (3.9). Then, the failure function takes the form, 1-*S(t)* as in equation (3.10).

3.4.2.2 Discrete Time Proportional Hazard (PH) duration Model (with parametric baseline hazard)

A discrete time duration model is appropriate as my data set observations are made in discrete time, i.e. adoption in monthly intervals, although the intrinsic nature of the IB adoption is in continuous time. We chose a complementary log-logistic (*cloglog*) hazard function over a logistic one as the adoption process of internet banking is intrinsically continuous but only the observations are in discrete time. In principle this specification is an extended version of Cox proportional hazard model as illustrated in Kiefer (1988) for discrete data analysis.[107]

Hazard Function: $\lambda_{it} = \lambda_0(t) \cdot exp(X_{it}'\beta)$ (3.11)

$$S(t;X_{it}) = exp\left[-\int_0 \lambda(\tau;X_{it})\,d\tau\right] = exp\left\{-exp\left[X_{it}'\beta + log(H_t)\right]\right\} \quad (3.12)$$

where $H_t = -\int_0 \lambda_0(\tau)\,d\tau$ and $\lambda_0(t)$ is the baseline hazard at *t*

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[107] Kiefer (1988) provides a comprehensive list of survivor, probability distribution and hazard functions, which is useful at a starting point of duration analysis. However, Lancaster (1990) discusses transition data most thoroughly with a focus on duration data analysis.

The hazard function (equation 3.11) takes a proportional form assuming that for some unknown β and some nonnegative measurable function $\lambda_0(t)$, the baseline hazard at time t. Subject to a complementary log-logistic transformation for the discrete time, the survival function can be written as equation (3.12).

With censoring c_i =0 for those who are not yet adopters, the log-likelihood can be written as:

$$log\,L(\beta,\delta)=\sum_{i=1}^{n}\left\{c_i\,log\left[S(t_i-1;X_{it})-S(t_i;X_{it})\right]-(1-c_i)\,log\,S(t_i;X_{it})\right\} \tag{3.13}$$

where $\delta = log(H)$,

$$log\,L=\sum_{i=1}^{n}\left\{c_i\,log\left\{\lambda_{it}(X_{it})\prod_{s=1}^{t_i-1}\left[1-\lambda_s(X_{is})\right]\right\}+(1-c_i)\,log\left\{\prod_{s=1}^{t_i}\left[1-\lambda_s(X_{is})\right]\right\}\right\} \tag{3.14}$$

where the discrete time hazard is

$$\lambda_t(X_{it})=1-exp\left[-exp\left(X_{it}'\beta+\gamma_t\right)\right] \tag{3.15}$$

with $\gamma_t = log\int_{a_{t-1}}^{a_t}\lambda_0(\tau)\,d\tau$

The log likelihood function in equation (3.13) shows the weighted average form of maximum likelihood from both censored and uncensored groups. The first half of the equation represents the likelihood of an exit (i.e. IB adoption) at time *t*, thus a product of all the previous periods' survival likelihood, whereas the second half of the equation illustrates the case of non-exit. The equation is simply weighted by c_i and 1- c_i for that matter: c_i =0 for censored group and c_i =1 for uncensored group. The hazard function with a complementary log-logistic transformation for the discrete time is shown in equation (3.15).

3.4.2.3 Discrete Time Proportional Hazard (PH) Duration Model (semi-parametric with flexible baseline hazard)

By adding duration dummy variables for each interval to the above specification, a semi-parametric estimation is also feasible. The advantage of using a semi-parametric specification is that we do not impose any assumption on the baseline hazard function and allow it to be fully flexible. In principle, this model calculates hazard rate for each interval under no restriction. Given the advantage of flexible baseline hazard function and the nature of my data being discrete in time, this model specification is preferred to others. However, we expect to see similar results from all three specifications despite the different underlying assumptions.

3.4.2.4 Unobserved heterogeneity in duration Model

The estimation in the presence of unobserved individual specific effects (i.e. heterogeneity) without control causes misleading inferences due to inconsistent parameter estimators (Lancaster, 1990). If there are other (unobserved) characteristics that influence the hazard function, such omitted heterogeneity generally leads to a downward biased estimate of duration dependence (Kiefer, 1988). The above duration models can be extended for this purpose by including a random error term along with the vector of individual characteristics X (i.e. use $X'\beta + v$). A most commonly used correction model is based on the gamma distribution with mean 1 and variance θ. The gamma distribution and the inverse Gaussian distribution are often used for the heterogeneity distribution in parametric duration models since they give a closed form expression for the likelihood, avoiding

numerical integration. However, other distributions could in principle be used (see Meyer, 1990). By incorporating heterogeneity into the distribution, we get the conditional survival function for the Weibull model specified as

$$S(t|\nu) = \nu \cdot e^{(-\lambda t)^p} \tag{3.16}$$

Thus, the unconditional survival function is

$$S(t) = \left(1 + \theta(\lambda t)^p\right)^{-1/\theta} \tag{3.17}$$

and the hazard function is

$$\lambda(t) = \lambda p(\lambda t)^{p-1} \cdot \left(S(t)\right)^{\theta} \tag{3.18}$$

where θ=0 corresponds to the model without unobserved heterogeneity and the further θ deviates from zero, the greater is the effect of heterogeneity. For simplicity of the estimation, a normal distribution of heterogeneity for the complementary log-logistic model is used for the proportional hazard models. However, we fail to reject the null hypothesis of no heterogeneity for all three duration models. Therefore, the mixed models with unobservables converge to the models without unobservables. Only the results from models without unobservables are presented.

3.4.3 The Data

Yahoo Members' Directory[108] was used to collect email addresses of Korean residents with age 13 or above, applying a systematic and stratified sampling.[109] The online survey forms were sent out via email requests to 3200 addresses, of which 407 responded after two follow-ups.[110] In total, 393 replies were used in the analysis having discarded duplicates or incomplete replies. A random sampling of the population was not used as our research focus lies in those who already have access to the internet. However, one should note that the above systematic and stratified sampling of the internet users would capture more meaningful results for our research purpose. More importantly, a significantly large proportion of the population in Korea uses internet. A recent survey conducted by the National Internet Development Agency (NIDA) commissioned by the Ministry of Information and Communications (MIC) indicates that 31.6 million people are using the internet more than once a month (i.e. 70.2% of the population). Considering the under age and elderly groups who are not able to and do not want to use the internet, this is a substantially large proportion of the population.

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[108] www.yahoo.co.kr is one of the largest digital media companies in Korea, which provides a variety of information through the internet. Yahoo also offers free email accounts for their members.
[109] The 3200 email addresses were collected across 107 different cities throughout 11 provinces (see Table 7 for the details of *stratified sampling*). Every 3rd person from Yahoo Members' Directory was selected in proportion to the population density data from the Korea National Statistical Office (*systematic sampling*). The response rate was at 12.7%, which was below the expected rate of 20%. The expected rate of reply was initially drawn from interviews with local online survey companies in Korea (e.g. www.koreanclick.com and www.internetmetrix.co.kr). The lower response rate seems to be due to the sensitivity of survey questions, e.g. personal banking.
[110] The sampling period is between 13 November, 2001 – 13 February, 2002

A cross-sectional data set of 393 individuals was used in the static analysis of internet banking adoption and the data were expanded into panel data by assigning binary choice dummies for each monthly interval for the dynamic analysis (*duration analysis*). The last event was observed in the 48th month (*December 2001*) from the introduction of Internet Banking (IB) in January 1998. Thus, an unbalanced data set of 6407 observations were obtained, with 246 individuals responding as internet banking users and 147 identified themselves as non-users (*right-censored*).

Questionnaire:

Following a pilot survey, an online survey form is constructed.[111] The questionnaire on internet banking consists of 37 questions. The first section contains 10 questions on demographics. The second section has two parts, 1/aimed at those who used internet banking at least once, identified as a user group (IBU) and 2/for those who have not yet used internet banking, identified as a non-user group (NU). The user group is questioned on IB adoption timing, their banks, internet banking details in terms of average amount of transaction and the frequency. Also commonly used IB services are asked alongside their IB selection criteria. Equivalently, the non-user group is questioned on their reasons for no-adoption and adoption criteria if they plan to use IB in the future. The final section includes questions on information seeking behaviour in banking and their general banking pattern such as length of long-term

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[111] The pilot survey was conducted between 7-28 Mar.2001 targeting 120 residents in Seoul. Out of 120 target residents, 99 responded and these were used in the preliminary analysis. However, the online survey allowed me to reach 3200 Korean residents over the internet without any geographical distance.

relationship with the bank, frequency of visit to OTC and banks' web pages. Table 3.10 shows the outline of the survey questions.

Variables:

The non-parametric log-rank inequality test and the Wilcoxon test are conducted on potential explanatory variables and the test results are presented in Table 3.11 for the variables. For example, the Wilcoxon test divides the sample into subgroups and tests the null hypothesis of identical survival function across the subgroups, i.e. $S_i(t) = S_j(t)$. As the Wilcoxon test gives higher weights to earlier failure times, it is more likely to detect early differences in failure times. On the other hand, the log-rank test is based on scores assigned to the observations, which are functions of the logarithm of survival function. The test statistic is the sum of scores over all observations standardised by standard deviation in this case. The log-rank test gives equal weights to all failures and therefore is more powerful in detecting failures in proportional hazard models, which is the case of this chapter. The explanatory variables included in the model are described in Table 3.9, which are classified in: 1/ demographics; 2/exposure to internet banking; 3/awareness; 4/banking behaviour, and 5/first mover and largest bank dummies. The summary statistics of the variables are presented in Table 3.11.

3.5 Results

3.5.1 Descriptive Statistics of the Sample

Before presenting results from the probability and duration models of the adoption process, we examine some simple descriptive statistics. Table 3.11 reports means and standard deviations of the key variables used in the analysis. It is worth noting that the research interest of this chapter does not lie in the entire population in Korea but in those who have access to the internet. Considering the nature of technology involved with internet banking itself and the random online survey of the internet user population, the high proportion of male group (i.e. 69.2% is *Sex=1*) responses seems to be right and this coincides with the report by the International Data Corporation (IDC, 2002) on web users in Asia, of which the 64% are male.

The survey takes 7 different levels of final educational attainment. However, only a grouped dummy for higher education (*Edu*), i.e. university or above is used in the analysis in order to minimise the loss in degree of freedom by having too many insignificant variables suggested by the non-parametric tests (log-rank and Wilcoxon). A very high proportion (84.7%) indicated educational attainment of university or above with little variation. However, it is not surprising since more than 70% of the population between 18 and 21 are involved in some form of higher education (end of 2001) with a growing tendency according to the statistical report by the Ministry of Education and Human Resources Development (MOE, 2001).[112]

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[112] See http://www.moe.go.kr/ for more details.

Given the conditioning on internet access and the banking related questions would possibly explain the relatively high level of education compared to that of the MOE's. One important observation to make is Korea has traditionally favoured higher education in the belief that investment in human capital is the only way to rebuild the country from the aftermath of Korean war. Hence, university education in Korea has become more or less an essential certificate for employment.

Therefore, the education variable needs to be explained by the influence of Confucianism (*culture*) as well as conformity (*society*), which made Koreans place high value on education and respect the educated. Education is given a high priority by Koreans from all backgrounds and this has been a major driving force behind Korea's economic development. For instance, the student population is about a quarter of the total population and the average length of schooling is now over 12 years, which means more than high school graduation. This is also reflected in my sample data where we find a high proportion of university graduate or equivalent. Culturally driven efforts into education set higher education as a social norm in Korea. A high proportion with higher education is not because of the sample bias but because of the country specific characteristics regarding education.

The age variable was grouped into three, 1/ young (*Age1*=13-24), 2/ middle (*Age2*=25-44), and 3/ old (*Age3*=45 or above). The majority of people are categorised in 25-44 years old (74.8%) whereas 15.5% is in the young group between 13 and 24 years old and 9.7% is above 45 years old. Although we have classified groups into three for simplicity to obtain more meaningful estimation results, a detailed age breakdown (10-year interval) is compared to the internet user profile of

the Korea National Statistical Office (KNSO) data 2000 in Table 3.8. We notice that the general internet user profile has a more weight on the young teenage group compared to the internet banking survey profile. We expected to see such difference given the nature of the survey on the banking activity. Otherwise, the age profile of the survey sample represents more or less the Korean internet user profile.

More than half of the respondents are married (*Marm*) whereas 44.5% indicates as single (*Mars*) and only 2.5% indicates as divorced or separated (*Maro*). Given the cultural background being still conservative, it is not surprising to see no respondents in the co-habit category. On the other hand 2.5% of non-traditional marital status suggests the society is changing as well. According to the census 2000 data of the Korea National Statistical Office (KNSO), 50% of the population are married, 23% are single, 1.8% are divorced and the rest take other alternative marital status such as separated or co-habiting. The over-representation of the single group was expected given the survey sample focused on the internet users only[113] and covering from the age 13 instead of the KNSO census's 15 and above.

Regarding income levels (*Inc0, Inc1 and Inc2*), we set the middle range incomers (*Inc1*) around the average personal income of 3 million won per month suggested by the census 2000 data of the KNSO. A small proportion of 4.8% indicated the income category below 2 million won per month. The majority (66.2%) was in the category between 2 million – 4 million won per month while 29% indicated their income above 4 million won per month.

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[113] The Ministry of Information and Communication (MIC) 2000 report on internet users indicates a higher proportion of singles in the internet user profile.

The housing type dummy (*Hse1*) shows 61.1 % of the respondents own their housing outright, which closely reflects the KNSO data (61.87%) as of 1999. The residential area dummy indicates (*Area1*) the 61.6% of the sample is drawn from the Seoul and Kyungki metropolitan area. This figure is higher than the KNSO data of 46.7% as of 2001 end based on the district registrar. This can only be explained by the metropolitan population's more favourable attitude towards online surveys since the survey forms were sent out to each province in proportion.

Most respondents had received recommendation (*Rc*) of internet banking (78.6%) and a high proportion (62.6%), responded as current internet banking users (*IB*).[114] Almost half (47.6%) of non-users (NUs) consider security reasons (*risk-aversion*)[115] as one of the main obstacles in using internet banking and the second common reason not to use internet banking was because they feel happy with the existing banking services (37.4%, *inertia*). Feeling safe with the old technology once again supports the idea of inertia. However, 85.0% of NUs replied that they would use internet banking in the future (*Uplan*) and consider the following criteria in order of priority: 1/ reputation of the bank, 2/ lower fees, and 3/user friendly web page.

In terms of banking behaviour, the over-the-counter tellers at bank branches (*Otcfr*) were visited 2.582 times per month on average whilst banks websites (*Ibfr*) are visited 5.548 times per month on average. This suggests any regular internet users would visit respective bank websites 1.3 times per week. On the other hand,

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[114] Pilot test showed most customers are internet banking with their current banks. This suggests that switching banks for better internet banking services rarely happens and consumer inertia exists

[115] Appropriate regulation and technology can prevent IBUs from exposing themselves to risks.

17.1% of the internet banking users are banking with the first mover bank (*Bk1*) while 40.2 % of the users are banking with the largest bank (*Bk6*).

3.5.2 Logit Result ($\Pr(y_i = 1)$)

Table 3.12 looks at probability of having adopted IB and provides the results of logit estimation with the marginal effects. Regarding the proposition 1 in static framework, most demographic variables are insignificant whilst the age dummy for the young group (*Age1*), exposure to internet banking (*Rc*) and banking behaviour (*Ibfr*) are significant. The answer as to why demographic variables do not appear as significant as expected, is that the Korean society has a somewhat unique attitude towards new technology. We should probably borrow the imitation concept from sociology (Tarde, 1890) for the insignificant results. It draws attention to the importance of social structural characteristics, which might influence the amount and/or rate of adoption as well as any potential advantage for some segments of the social system in adopting the innovation. We believe this is an important aspect to investigate further, not only for diffusion among consumers but also among firms as the social structure can determine level of welfare increase with the innovation.

For age variables, it strongly indicates the reference group of 45 years old or more is more likely to adopt IB than younger generations between ages 13-24. The age group between 13-24 (*Age1*) appears to adopt IB significantly less than those in the age group 45 or above (*Age3*) as banking activities grow larger and more

complex as people become older.[116] Its marginal effect suggests that those who belong to the age group of 13-24 would have the probability of IB adoption lowered by .439 compared to the reference group. The middle age group between 25-44 also indicates less likely to adopt IB than those above 45 years old, although it is not significant. This contradicts the proposition 1.2 and suggests that the age effect on internet banking adoption cannot be assessed solely on tech-savvy grounds but should also consider active banking age groups as banking activities grow larger and more complex as people become older.

We find evidence that those who have received a recommendation of internet banking and make frequent visits to banks' websites are more likely to adopt internet banking. This result confirms proposition 1.8 and 1.11. These two propositions are related to the epidemic theory of diffusion. More exposure to risk of adoption, i.e. information and advertisement on internet banking, creates higher probability of diffusion.

Most demographic variables are insignificant with the exception of young age group dummy (*Age1*) but given the join significance test, the signs of the coefficients are noteworthy: Females are marginally more likely to adopt internet banking than males, which disagrees with proposition 1.1. However, given the insignificance, it is not right to draw any firm inference. Older generations are more likely to adopt internet banking unlike our initial expectation. The age effect should be seen in the

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[116] The omitted group for age dummies is 45 years old or more (*Age3*), for marital status dummies is the group for divorced, separated or co-habit (*Maro*), for personal income dummies is high incomers group (*Inc2*) of 4 million won per month or above.

industry specific context since younger generations' banking activity is relatively limited than that of older ones' despite their tech-savvy behaviour and willingness to adopt new technologies.

People with higher education (*Edu*) are less likely to adopt internet banking than those with less education, which indicates the cautious behaviour toward internet banking. The result on marital status (*Mar*) agrees with proposition 1.4. Those with alternative marital status rather than single or married are more likely to adopt the internet banking. Proposition 1.5 on income level (*Inc0, Inc1, and Inc2*) is proved to be true where high income group is more likely to adopt internet banking than low income group. We can suggest that banking activity tends to increase with income level and thus it creates more incentive to adopt internet banking.

Regarding housing type dummy, the result shows that outright house owners are less likely to adopt internet banking as in proposition 1.6. This might be explained by the fact that outright ownership would actually reduce the complexity of banking. Those who lease the property tend to have more complex financial management in order to arrange loans tied in the key money scheme.[117]

The result on the area dummy contradicts proposition 1.7. This can be explained by higher incentives to adopt internet banking for those who are in remote

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[117] The key money scheme in Korea is a unique mechanism. An owner retains his/her ownership rights while the property is leased out to a tenant by a long-term contract. The tenant should put a lump-sum deposit in the owners account so that the owner can earn some interest income from the deposit. The deposit amount varies depending upon the property market condition but usually 50%-90% of the actual property value has to be kept in the owner's bank account for a deposit.

provinces as they can save substantial amount of time when bank branches are not closely located.

The proposition on information seeking behaviour (Irinfo) is supported by the results as well. The number of visits to OTC (*Otcfr*) affects the likelihood of IB adoption positively although it is marginal and insignificant.

In summarising the results from the binary static model, traditional demographic variables; sex, education, marital status, personal income level, housing type and residential area are not significant for the likelihood of IB adoption with the exception of the age dummy variable. By contrast, the exposure to the new technology (*Rc*) and banking behaviour (*Ibfr*) play an important role in IB adoption decision. For example, those who received IB recommendation would have the probability of IB adoption increased by 0.265 compared to the non-recommended group, and each additional visit to banks' websites per month would increase the probability of IB adoption by 0.011.

3.6 Duration Models

Before we compare the results of static and dynamic specifications, it is essential to assess the differences in the results of the respective duration models. The results are similar across models. The parametric Weibull model and proportional hazard model with Weibull baseline are very similar. The non-parametric baseline model seems to detect more significant variables than other models as expected due to the non-parametric approach. Since the discrete-time PH model with non-parametric baseline

(i.e. semi-parametric) is more appropriate for our data, not to mention the advantage of having imposed few restrictions, we choose this as the preferred specification.

First, the demographic variables tend to be more significant in the duration model (*dynamic*) than in the binary choice model of logit (*static*). The timing of IB adoption by male is significantly different from that by female, whereby males are more likely to be early adopters. The age dummy for the group between 25-44 is also significant in decreasing the likelihood of early adoption compared to the reference group of those above 45. This coincides with Rogers (1995) core group claim. Those who are 45 or above are more likely to be early adopters as opposed to other age groups and also the male group is more likely to be early adopters than the female group. The core of banking network in Korea tends to be middle aged or above male since they are the ones who make key financial decisions for the household.

Although insignificant, education affects IB adoption negatively both in logit and duration models. In Table 3.14, the Weibull model suggests the predicted time of adoption for males is 3.245 month earlier than females at the mean or according to the non-parametric baseline model, the probability of adoption at each discrete time interval increases by 0.01 for males. Regarding the age dummies, the non-parametric baseline model suggests that the age group between 25-44 lowers the probability to adopt IB in each discrete time interval by 0.013. On the other hand, marital status dummies become more significant with the same negative effects. Singles or married people are less likely to be early adopters than either divorced or separated people. For instance, the probability of IB adoption for singles is lower by 0.02 and that for married people is lower by 0.017 than the reference group of divorced or separated at

each discrete time interval. However, personal income dummies remain insignificant in the duration models.

Second, it is worth noting that recommendation of IB affects the likelihood of early adoption negatively. Perhaps early adopters are opinion leaders who act on their own initiatives rather than being persuaded by bank's recommendation. However, information-seeking behaviour remains as a positive impact on the likelihood of early adoption.

Finally, the results on general banking behaviour are substantially different than those from the logit specification. It is strongly suggested that those with less frequent visits to banks' branches and frequent visits to banks' websites are more likely to be early adopters. The Weibull model shows that each additional visit to banks' website per month makes the IB adoption earlier by 0.186 month or 5.58 days while the non-parametric baseline model indicates 0.001 increase in probability for a discrete time interval, i.e. a month. The latter marginal effect might appear to be very small but it is equivalent to 2.16% increase in probability of adoption at the mean probability, which is 0.023.

All in all, we can conclude that proposition 2 is strongly supported by the above results and say that the determinants of IB adoption timing (*dynamic*) differ from those of IB adoption probability (*static*).

In order to detect order effects, whether the first mover (*bank*) in internet banking actually captures early adopters and improves the bank's market position (*market share*), a dummy variable of the first mover, Chohung Bank (*Bk1*) was included. For rank effects, a dummy variable of the largest bank in commercial

banking, Kookmin Bank (*Bk6*) was added.[118] All three duration models show more or less similar results on these dummies.[119] The coefficient of order effect dummy is negligible and not significant whilst that of the rank effect dummy is not only large but also significant. In other words, customers of the largest bank tend to adopt earlier than those of smaller banks while customers of the first mover bank are not particularly early adopters.

The discrete duration models suggest that those who are banking with the largest bank (*Bk6*) increase their probability of IB adoption by 0.007 compared others at mean for the discrete interval as shown in Table 3.14. This confirms proposition 3 and 4 and suggests that consumers tend to value the size of bank's asset size, i.e. banks' network size measured in market share more than the first mover advantage in the timing of adoption decision.

Having said that early adopters are opinion leaders, the largest bank's market share is expected to rise with internet banking due to the network. Figure 3.1 supports the result, as the market share of the largest bank (*Bk6*) in internet banking is more dominant than in commercial banking while that of the first mover (*Bk1*) remains constant. Although we fail to show order effect, significant rank effects provide grounds for banks to take preemptive actions since banks can reinforce their market dominance via internet banking.

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[118] Kookmin bank (Bk6) has been the largest bank in terms of deposit size since 1995, thus the largest bank over the period of analysis.

[119] Narendranathan and Stewart (1993) have a good example of comparing different duration models where the results are actually similar.

Despite the different duration model specifications, the result on duration dependence is identical and confirms the positive duration dependence expected in proposition 5. The positive parameter estimate of p in the parametric Weibull model suggests a positive duration dependence as p is greater than 1 (p=1.888). This can be easily detected in the proportional hazard model with parametric Weibull baseline, as the coefficient of log(time) is positive and significant. The non-parametric baseline model also suggests the same positive duration dependence as the coefficients of time duration dummies are increasing from more negative numbers to less negative numbers.

3.7 Internet Banking Non-Users (NU)

Finally, we analyse the characteristics of IB non-users (NU) regarding their future IB adoption and see how they differ from the adoption of the current IB users. Table 3.15 provides a static comparison of the following three specifications: 1/ the probability of IB adoption on the full sample (*Model 1*); 2/ the non-users' probability of future IB adoption (*Model 2*), and 3/ the conditional probability of future IB adoption having not adopted (*Model 3*). The simple logit estimation discussed earlier in section 3.5.2 is used as our benchmark specification of Model 1. On the other hand, Model 2 characterises the probability of future IB adoption (*Uplan*) based on a simple logit estimation. We estimate Models 2 and 3 on the sub-sample of 147 individuals who did not adopt IB as of 2001 end. Model 3 is a modification of Model 2 using a conditional logit estimation for future IB adoption conditioning on current

non-adoption. The results from Model 2 and 3 are extremely similar except that the conditional logit (Model 3) provides less significant results given the small number of observations for non-IB users (NU). One noticeable difference among the three models is that age dummies are not significant for non-users' future adoption decision and the residential area is now a significant factor. It strongly suggests that non-users who reside in the Seoul metropolitan area are more likely to adopt internet banking in the future. Again, the epidemic effects can explain this result. The variables such as recommendation (*Rc*) and frequency of visits to bank's website (*Ibfr*) remain as significant for non-users as well. For instance, each additional visit to banks' website increases non-users' probability of future adoption by 0.014 at mean.

It is difficult to test the notion of consumer inertia and risk aversion directly from the above 3 models. However, it can be deduced indirectly by the fact that the reasons not to adopt IB (i.e. delayed IB adoption) are being happy with the existing banking methods (inertia) and the concerns over uncertain security (risk-aversion). This is where public policy has to intervene to optimise the adoption path of internet banking. When consumers face unidentifiable amount of risks associated with internet banking such as human errors in inputting data on the web or security breakdown on personal information protection, the public policy should intervene to reduce the potential welfare loss associated with such inefficient early adoptions.

We are living in a society increasingly reliant on the internet. However, unfortunately the internet is largely unregulated and anyone from anywhere in the world can set up shops and offer products and services through the internet. The

analyses and the discussion in this chapter only focus on the adoption of internet banking but the lessons from the Korean internet banking and the government policies regarding internet banking and general technology shed some light to research on new industries and markets using internet technology.

On the other hand, when consumers are delaying their adoption simply due to inertia despite the substantial benefits of new technology, the public policy should now encourage the adoption to increase the social welfare. Hence, an appropriate balance between the above policies is desirable for an optimal technology adoption path.

3.8 Conclusions

The results presented in this chapter provide strong evidence that a probability of internet banking adoption and its duration is affected by individual characteristics. The individual characteristics include, demographics, the exposure to the hazard, information seeking behaviour and general banking behaviour. Moreover, the demographics are less important than banking-specific behaviour for the probability of a new banking technology adoption whilst they are equally important in the duration models.

The results also suggest that rank effects of banks have significant impact on customers' adoption timing of internet banking whilst order effects of banks are negligible. Hence, aggressive expansion in internet banking by dominant banks may be justified by the notion of pre-emption.

By contrast, duration dependence is a significant factor when a society is driven by a social norm, i.e. the adoption of internet banking. The social behaviour of East Asian countries is often represented by conformity and imitation based on the Confucian tradition. This unique social structure of Korea has driven Koreans to act collectively rather then individually and this is why the country is experiencing such rapid diffusion of internet banking across banks as well as consumers.

In establishing the social norm of internet banking, the Government plays a significant role by narrowing the socio-economic gaps. Internet banking seems to be a national phenomenon in Korea where favourable behaviour towards new technology of a country outweighs individual characteristics. This is why we do not find significantly different results in the adoption process regarding many of the demographic variables.

Finally, the analysis provides evidence on the possible consumer inertia and risk-aversion when a new banking technology is introduced as non-IB users identify their reasons to delay the adoption as being happy with the existing banking methods (*inertia*) and the aspects of uncertain security (*risk-aversion*).

If the security issue is one of the main concerns for both adopters and non-adopters, appropriate public policy and regulation are required to mitigate the potential loss of welfare in case of financial accidents on the internet as well as to optimise the speed of adoption.

This chapter focuses on Korean internet banking in particular by drawing attention to aspects of social structure concerning education and technology. However, given that Korea has the highest IB penetration ratio in the world, we

believe the empirical evidence of this study will add some value to those who are involved with internet banking in other countries.

Appendix

Figure 3.1 Market Share: Commercial Banking vs. Internet Banking[120]

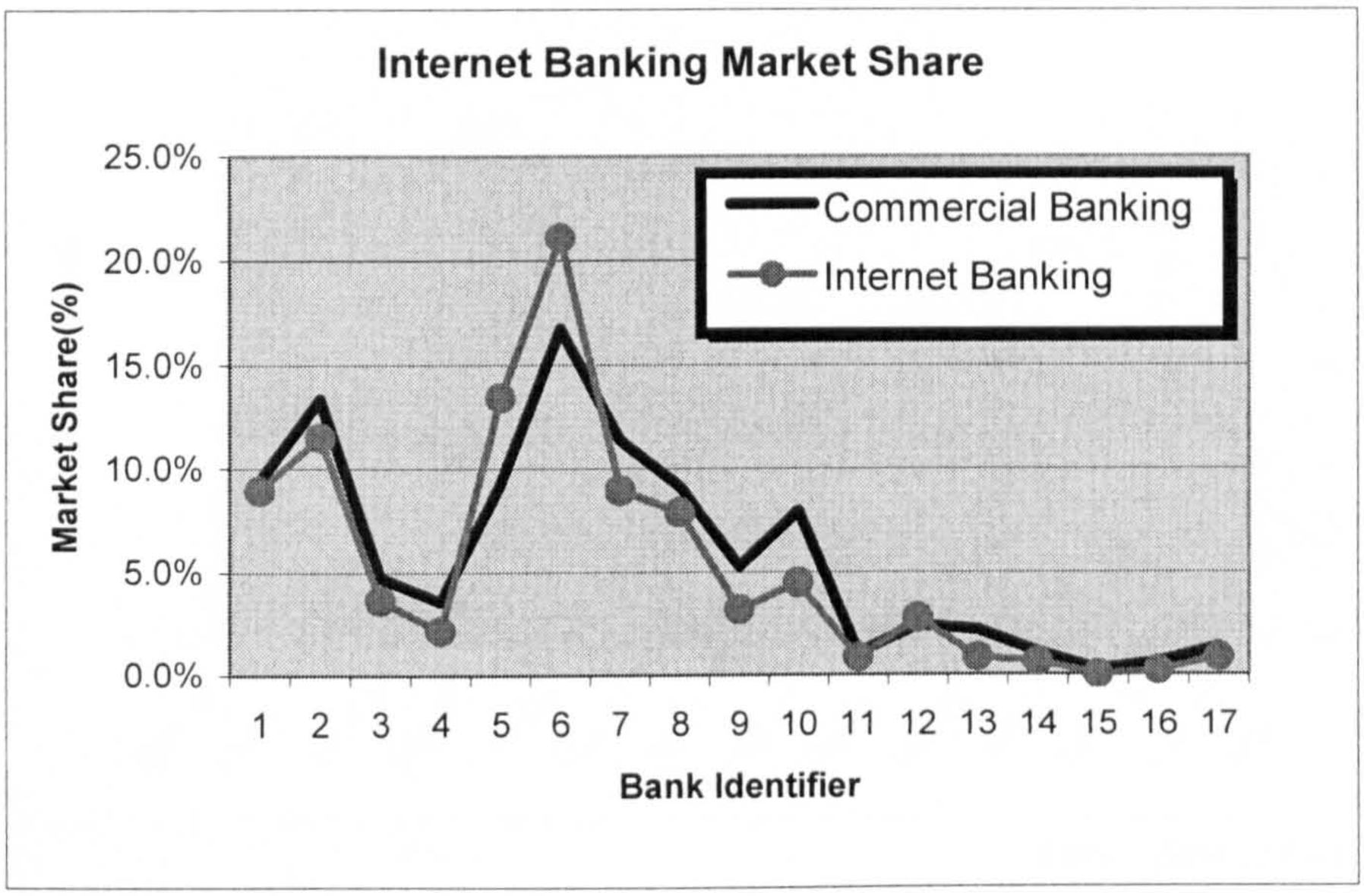
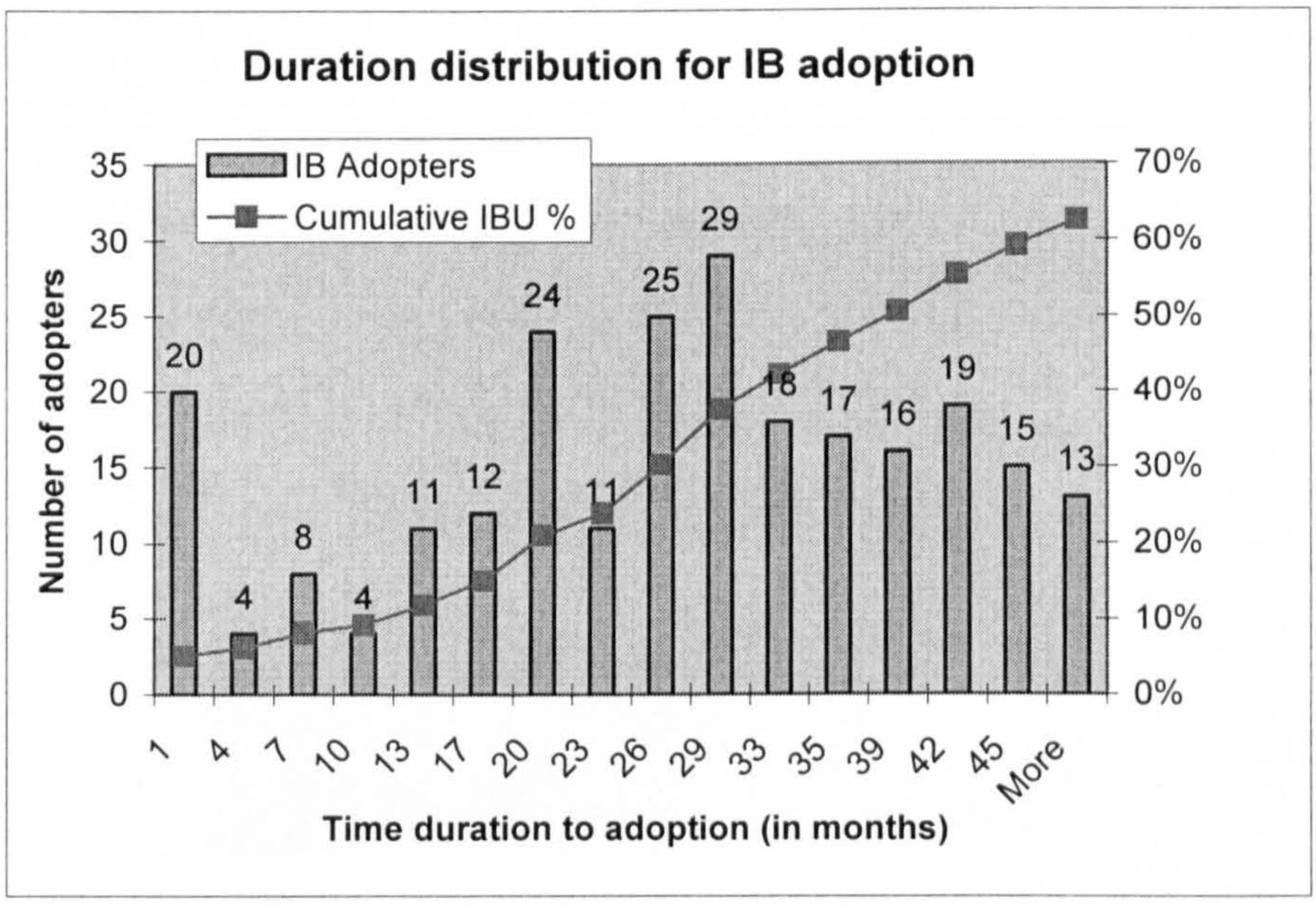


Figure 3.2 Internet Banking (IB) Adoption per Month



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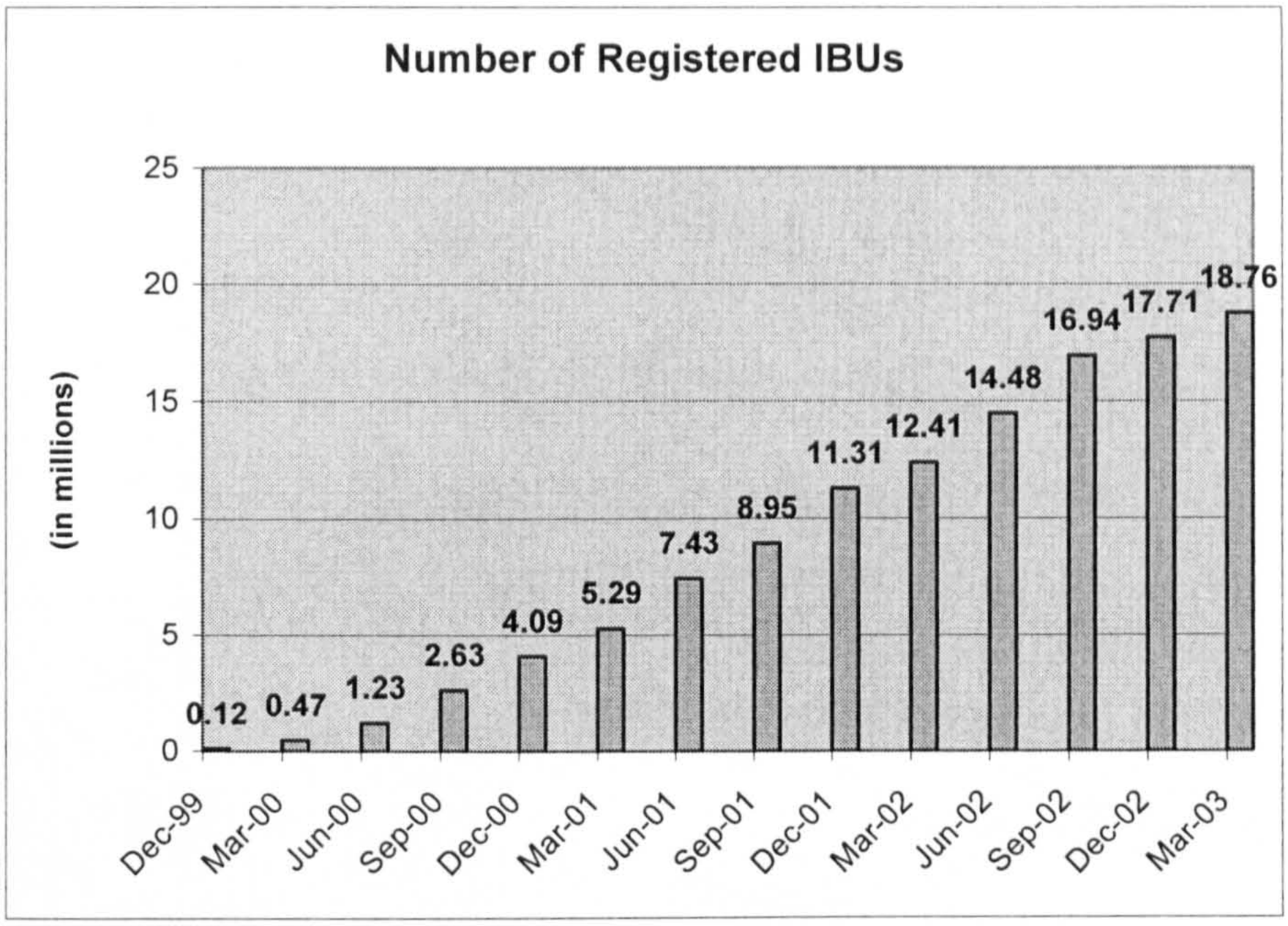
[120] The market share in commercial banking is in terms of asset size at the end of 2001 and that in internet banking is based on the survey data.

Figure 3.3 Number of Registered Internet Banking Users (IBUs)



Source: Bank of Korea

Figure 3.4 Estimated Hazard (Semi-Parametric PH)

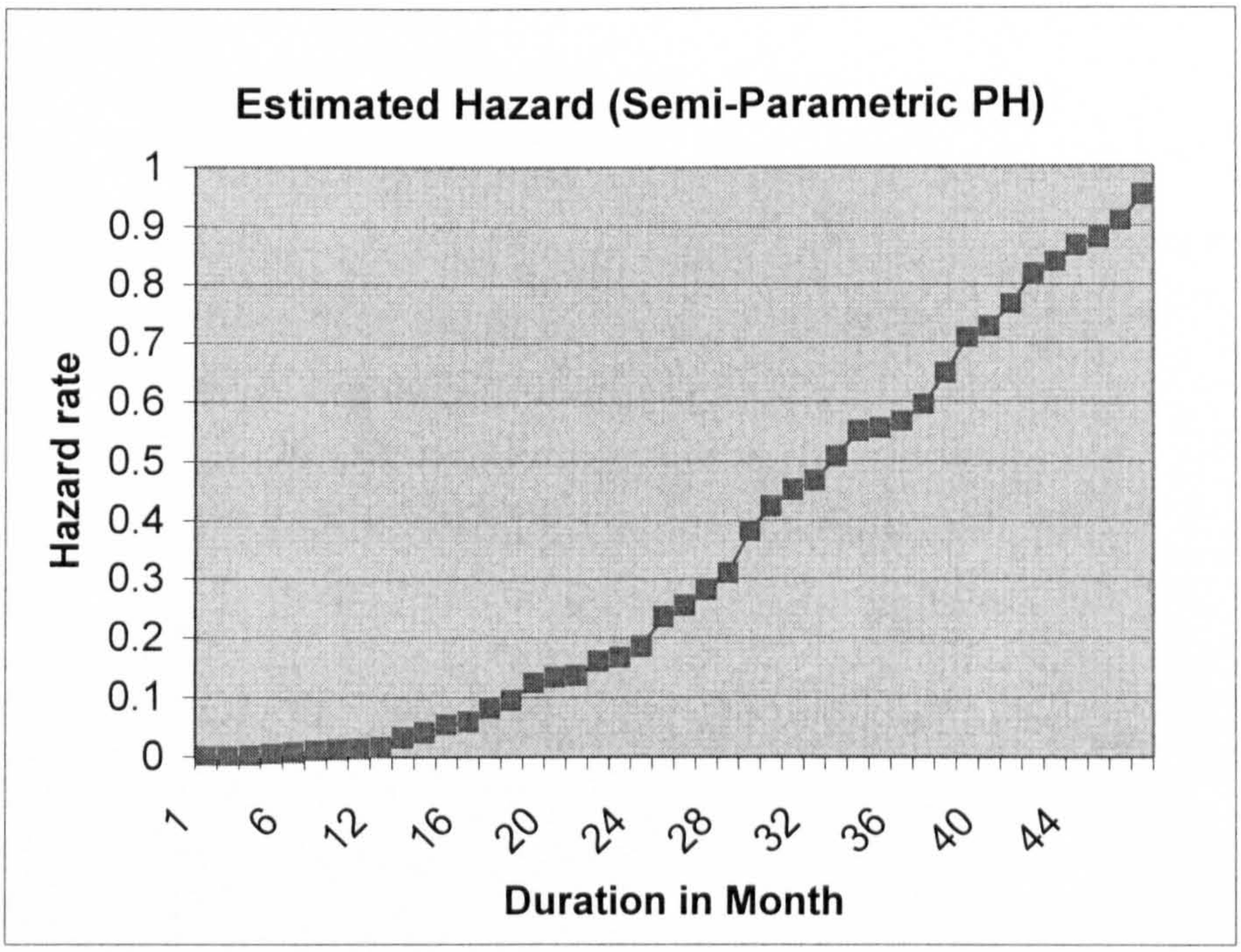


Figure 3.5 Fully non-parametric estimate (Kaplan-Meier)

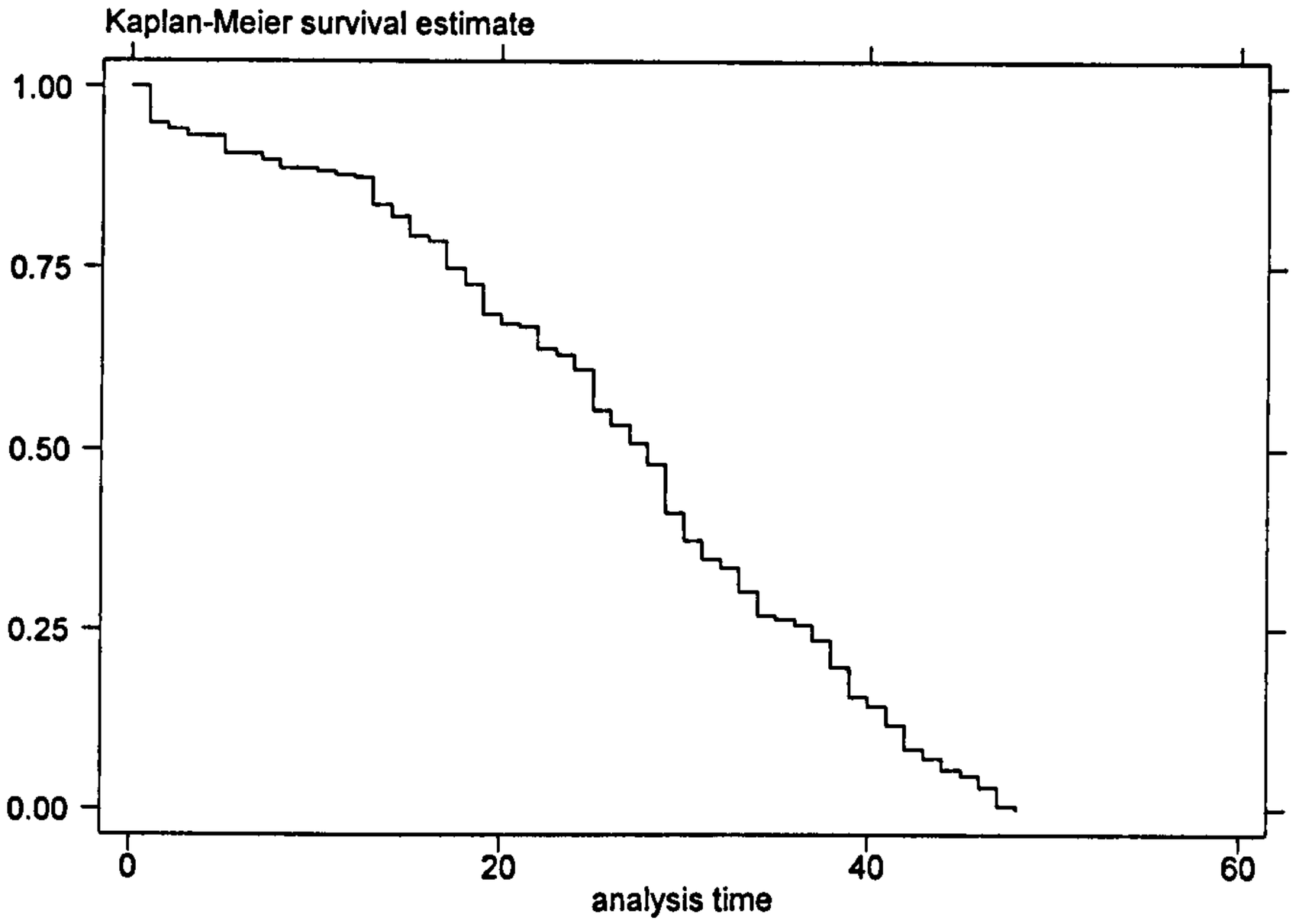


Figure 3.6 Parametric estimate (Weibull distribution)

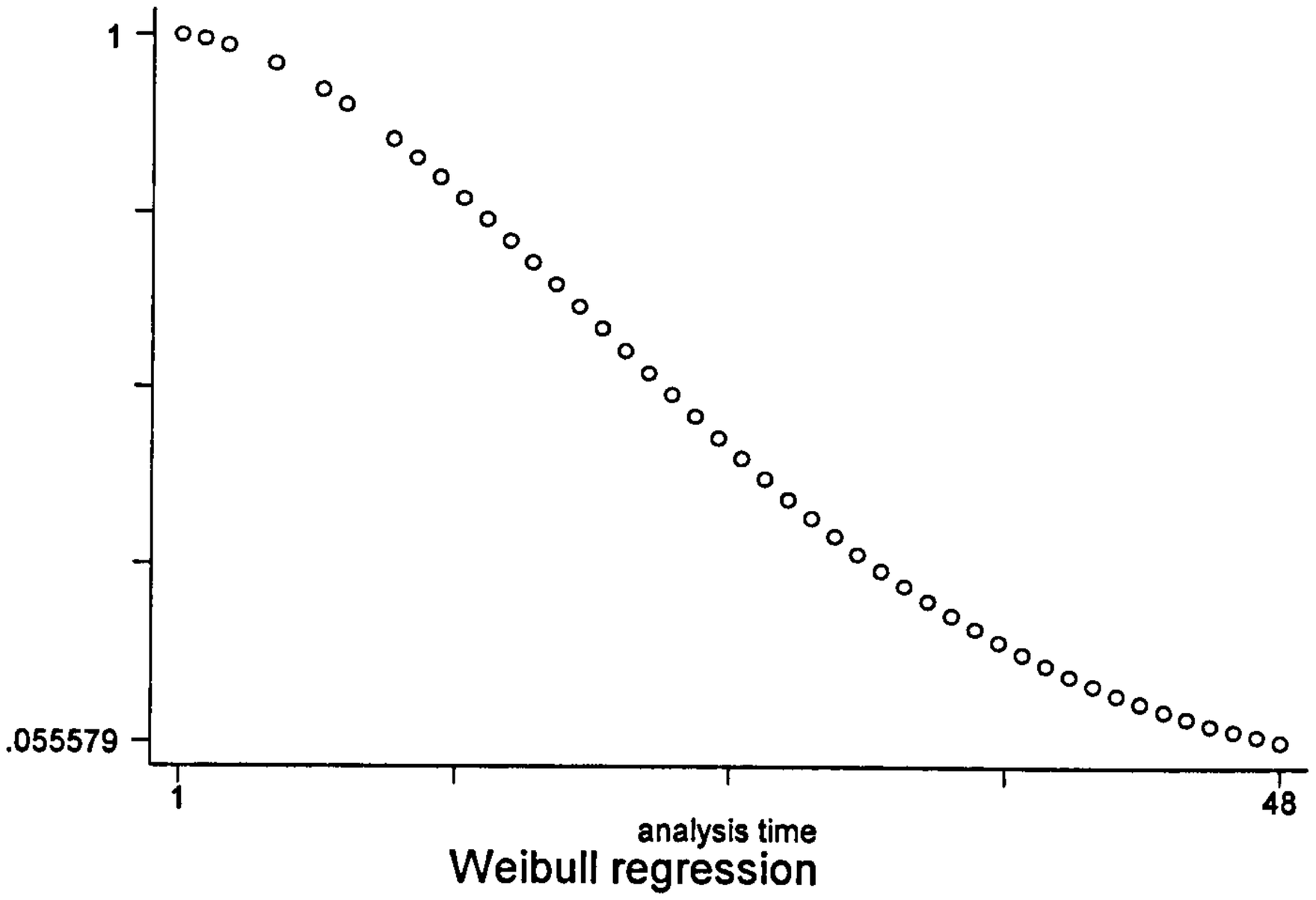


Figure 3.7 Predicted duration to IB adoption (Weibull)

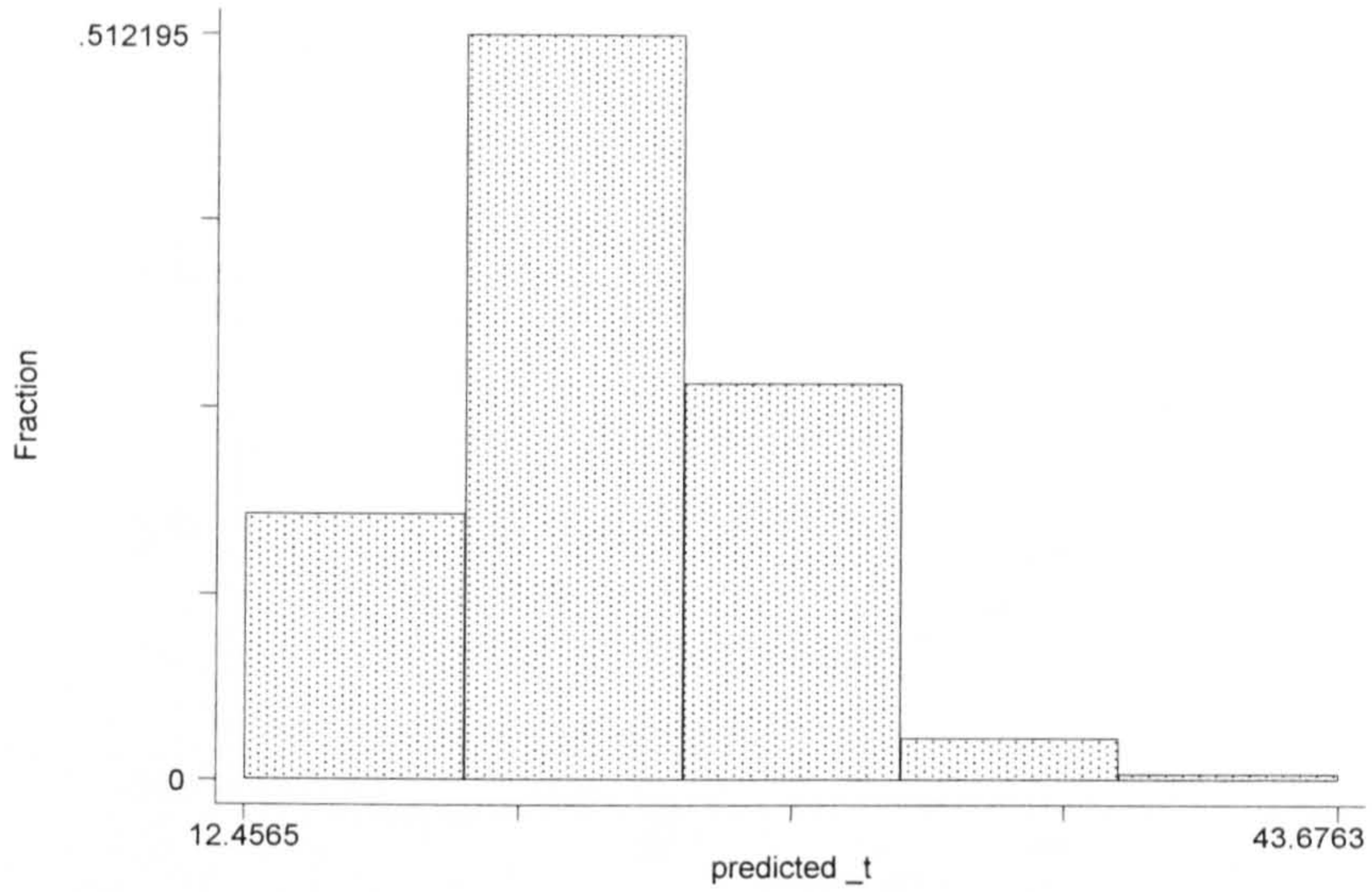


Figure 3.8 Predicted Hazard (Weibull)

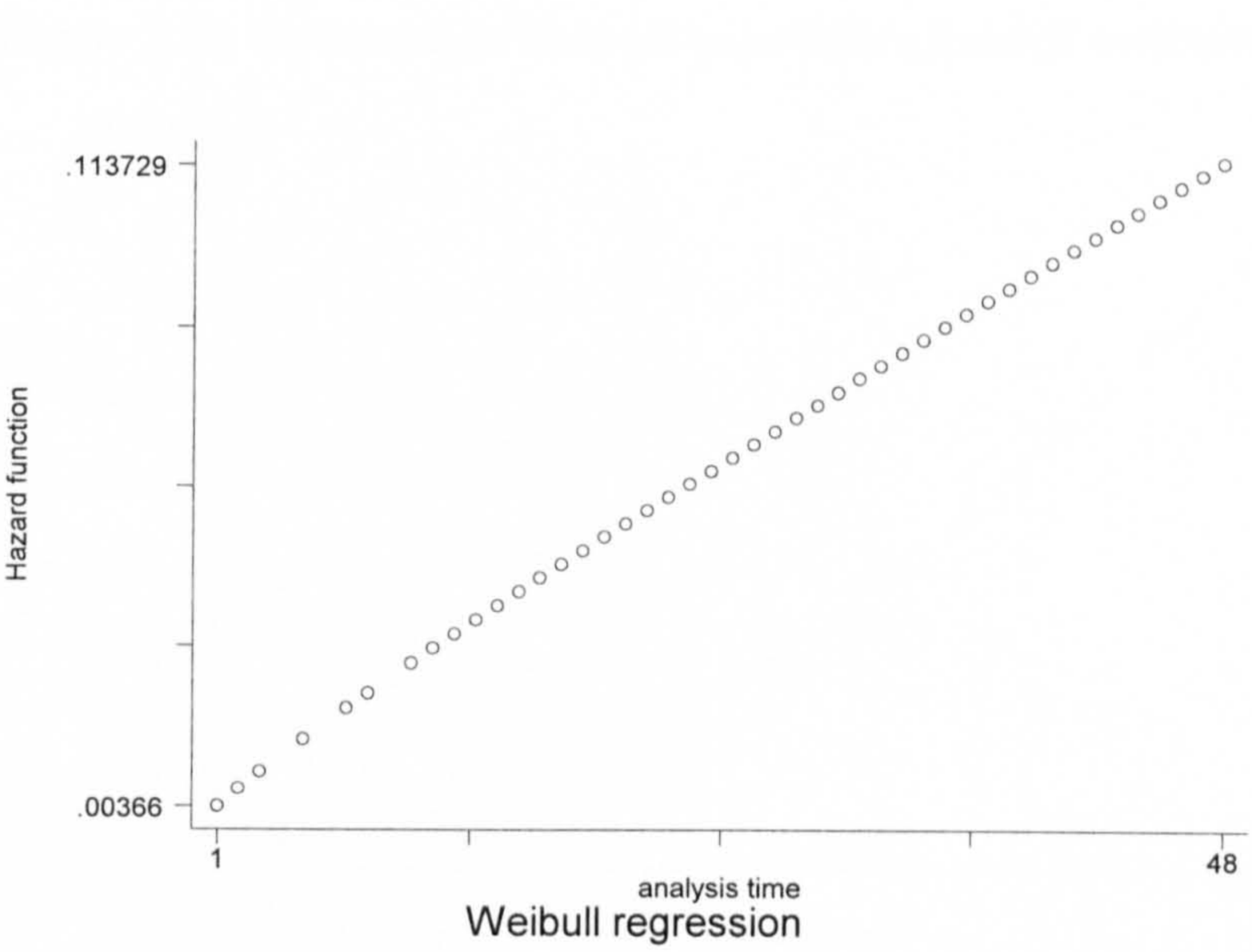


Figure 3.9 Non-parametric cumulative hazard estimate

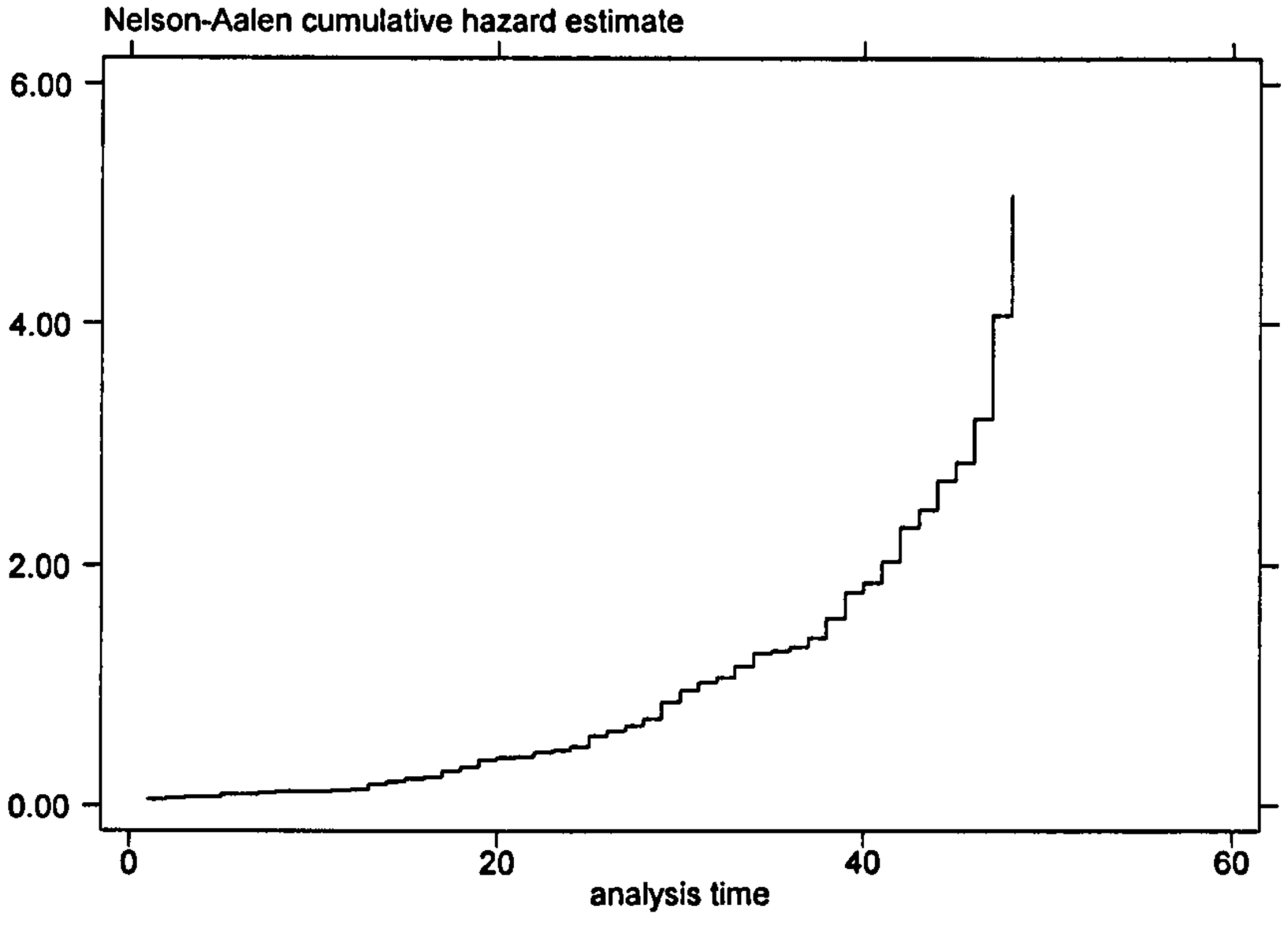
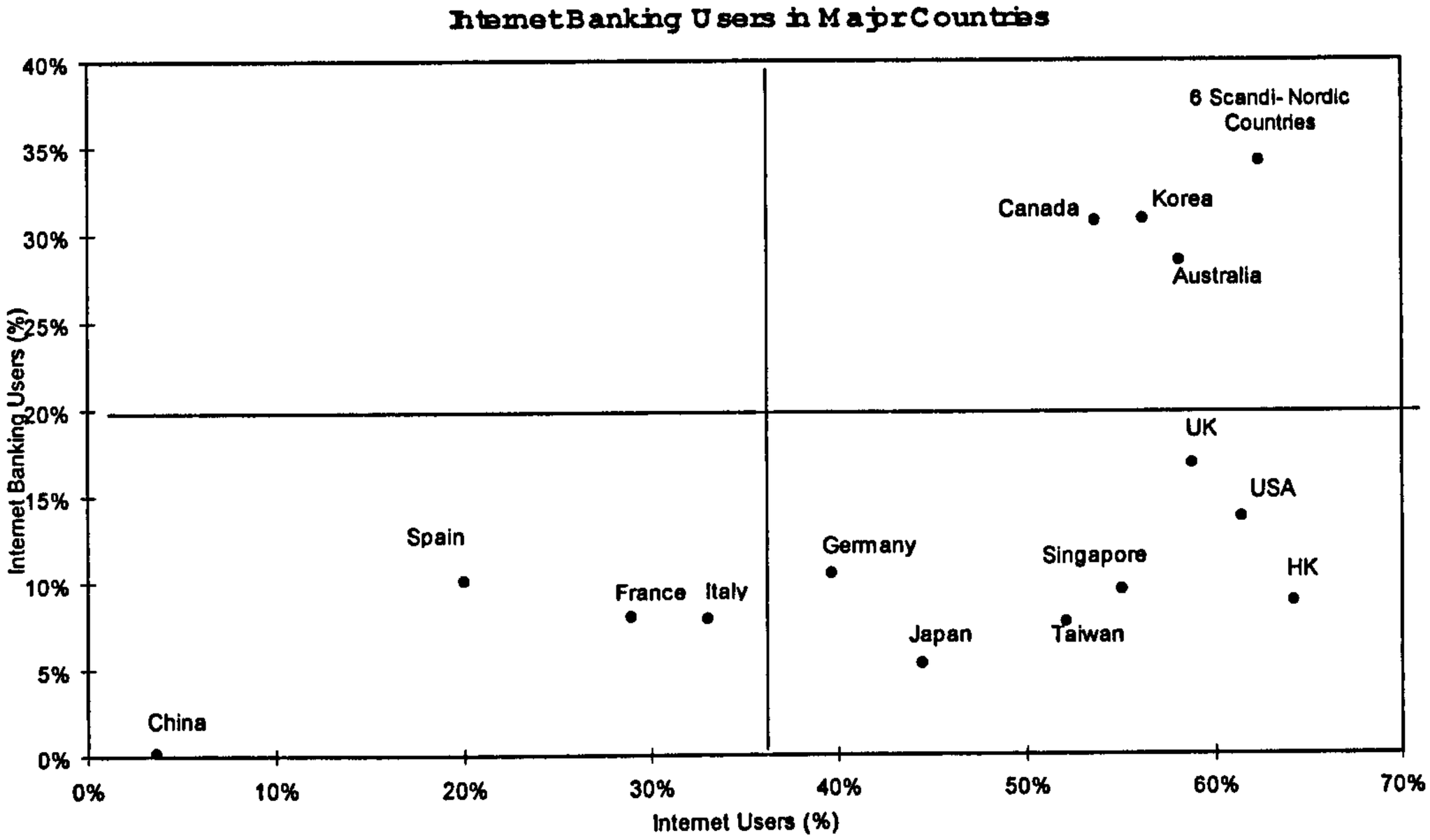


Figure 3.10 Parametric Weibull cumulative hazard estimate

Figure 3.11 Internet Banking Users in Major Countries



Sournce: Bank of Korea (2002)

Table 3.7 Sampling Area for Email Addresses

Province ***(No. of cities included)***	***City***
Seoul Metropolitan (1)	Seoul
Pusan Metropolitan (2)	Pusan, Haewoondae
Kyungki (23)	Ansan, Anyang, Buchon, Dongduchon, Eujongbu, Euwang, Inchon, Koonpo, Koyang, Kwachon, Kwangmyung, Mikeun, Osan, Paju, Pyungtaek, Shihung, Sungnam, Suwon, Yongin, Yongjin, Ilsan, Icheon, Songtan
Kangwon (14)	Chuncheon, Donghae, Heonggye, Heongsung, Hongchon, Jeongsun, Jomunjin, Kangreung, Samcheok, Sokcho, Taebaek, Wonju, Youngwol, Wondang
Chungbuk (2)	Cheongju, Jecheon
Chungnam (15)	Deajeon, Buyeo, Cheonan, Daecheon, Daesan, Gongju, Hongsung, Jochiwon, Kanggyung, Kwangcheon, Nonsan, onyang, Seosan, Shintanjin, Sunghwan
Kyungbuk (11)	Daegu, Andong, Dalsung, Hayang, Jeomchon, Koomi, Kyungju, Kyungsan, Pohang, Sangju, Youngcheon
Kyungnam (18)	Changnyung, Changwon, Choongmoo, Geochang, Hamyang, Jangseungpo, Jinhae, Jinju, Kimhae, Kosung, Masan, Milyang, Namhae, Sacheon, Samcheonpo, Ulju, Ulsan, Yangsan
Jeonbuk (9)	Iri, Jeonju, Koori, Kunsan, Jeongju, Namwon, Kimje, Buan, Kochang
Jeonnam (11)	Kwangju, Haenam, Jangheung, Kangjin, Kwangyang, Mokpo, Naju, Sooncheon, Wando, Yeochon,Yeosu
Jeju (1)	Jeju
Total 11 provinces	**Total 107 cities**

Table 3.8 Age Profile Comparison

Age Group	***Internet User Profile***	***Survey Sample Profile***
Ages 6-19	38.6%	5.3%
20's	27.3%	32.5%
30's	20.7%	36.2%
40's	10.0%	19.5%
50's	2.6%	4.5%
Over 60	0.7%	2.0%
Total	**100%**	**100%**

Source: KNSO & MIC 2000 (Internet User Age Profile)

Table 3.9 Description of Variables

Variable	*Type*	*Operational Definition*
Demographics		
Sex	B/D	1= Male; 0=Otherwise
Age1	B/D	1= if age group 13-24; 0=otherwise
Age2	B/D	1= if age group 25-44; 0=otherwise
Age3	B/D	1= if age group 45 or above; 0=otherwise
Edu	B/D	Education (1=university or above; 0=otherwise)
Mars	B/D	Marital status (1=single, 0=otherwise)
Marm	B/D	Marital status (1=married, 0=otherwise)
Maro	B/D	Marital status (1=divorced, separated, co-habit, 0=otherwise)
Inc0	B/D	Personal Income (1= no income, 0=otherwise)
Inc1	B/D	Personal Income (1=up to 3 million won per month, 0=otherwise)
Inc2	B/D	Personal Income (1=more than 3 million won per month, 0=otherwise)
Hse1	B/D	Housing Type (1= Outright owned; 0=otherwise)
Area1	B/D	Area of Residence (1= Seoul metropolitan area; 0=otherwise)
Exposure to Internet Banking		
Rc	B/D	IB recommended (1= yes; 0= otherwise)
Awareness of Information		
Irinfo	B/D	Awareness of interest rate information, information seeking behaviour (1= yes; 0= otherwise)
Banking behaviour		
Otcfr	C	Frequency of visiting bank tellers per month
Ibfr	C	Frequency of visiting banks' website per month
Bank dummies: First Mover & Largest Bank		
Bk1	B/D	First mover dummy (1=if use the first mover bank; 0= otherwise)
Bk6	B/D	Market leader dummy (1= if use the largest bank; 0= otherwise)
Internet Banking Adoption		
IB	B/D	IB used (1=yes; 0= otherwise)
Plan to Adopt Internet Banking		
Uplan	B/D	Plan to use IB (1= yes; 0= otherwise)
Duration		
Time	L/D	Time of IB adoption (1= Jan. 98; 2=Feb. 98;...monthly observation hereafter)

N.B.: Binary (B), Likert (L), Continuous (C), and Discrete (D)

Table 3.10 Questionnaire

Section	*Category (No. of questions)*	*Question*
1.	Demographics (10)	Sex, Age, Nationality, Education, Marital status, Type of job, Personal income, Household income, Type of housing, Area of residence
2.	Internet Banking Experience (3)	1. Exposure to the internet banking recommendation 2. Type of recommendation 3. Have they ever used IB before?
3.	User Group (IBU) (14)	1. Timing of adoption (month/year) 2. Banks dealt with 3. Main reason for IB adoption 4. Frequency of internet banking 5. Average amount dealt via internet banking 6. Recently used IB services 7. Initial reason for IB adoption 8. IB selection criteria 9. Expected fee savings by IB 10. Actual fee savings by IB 11. Cost increase due to IB 12. Reason for cost increase in adopting IB 13. Main banking method prior to IB 14. Location of IB
4.	Non-user Group (NU) (4)	1. Reason not to use IB 2. Do they plan to use? 3. IB selection criteria if they plan to use IB 4. Expected fee savings
5.	General banking (6)	1. Awareness of interest rate information 2. Awareness of banks competitiveness 3. Banking duration (overall commercial banking) 4. Frequency of OTC visit 5. Frequency of visit to banks' homepages 6. IB location believed to be ideal

Table 3.11 Descriptive Statistics of Data & Inequality Tests for Duration

Variable	*Obs*	*Mean*	*St.Dev*	*Min*	*Max*	*Log-rank Test (χ^2)*	*Wilcoxon Test (χ^2)*
Demographics							
Sex	393	.692	.462	0	1	17.76	14.08
(1=Male)						(P-value<.001)	(P-value<.001)
Edu	393	.847	.360	0	1	.25	.01
(1=Univ/College & above)						(P-value=.618)	(P-value=.910)
Age1	393	.155	.363	0	1	.21	1.80
(1=Age 13-24)						(P-value=.650)	(P-value=.179)
Age2	393	.748	.434	0	1	3.52	.50
(1=Age 25-44)						(P-value=.061)	(P-value=.481)
Age3	393	.097	.296	0	1	9.96	4.61
(1=Age 45 & above)						(P-value=.002)	(P-value=.032)
Mars	393	.445	.498	0	1	7.28	12.78
(1=Single)						(P-value=.007)	(P-value<.001)
Marm	393	.529	.500	0	1	4.27	8.38
(1=Married)						(P-value=.039)	(P-value=.004)
Maro	393	.025	.158	0	1	5.28	3.86
(1=Divorced/separated,etc.)						(P-value=.022)	(P-value=.050)
Inc0	393	.048	.215	0	1	1.05	2.21
(1=No income)						(P-value=.306)	(P-value=.138)
Inc1	393	.662	.474	0	1	8.78	12.00
(1= < 3mn KRW p.m.)						(P-value=.003)	(P-value<.001)
Inc2	393	.290	.454	0	1	7.41	9.57
(1= > than 3mn KRW p.m.)						(P-value=.007)	(P-value=.002)
Hse1	393	.611	.488	0	1	1.17	1.19
(1=Outright owned)						(P-value=.279)	(P-value=.275)
Area1	393	.616	.487	0	1	.91	1.24
(1=Seoul metropolitan)						(P-value=.339)	(P-value=.265)
Exposure to Internet Banking							
Rc	393	.786	.410	0	1	5.70	3.68
(1=IB recommended)						(P-value=.017)	(P-value=.055)
Awareness of Information							
Irinfo	393	.351	.478	0	1	6.45	5.08
(1= IR awareness)						(P-value=.011)	(P-value=.024)
Banking Behaviour							
Otcfr	393	2.582	3.498	0	30	25.24	24.65
(Frequency of OTC visits)						(P-value=.032)	(P-value=.038)
Ibfr	393	5.548	8.108	0	50	73.84	58.04
(Freq. of bank Web visits)						(P-value<.001)	(P-value<.001)
Bank dummies: First Mover & Largest Bank							
Bk1	246	.171	.377	0	1	.91	.22
(1=First mover dummy)						(P-value=.341)	(P-value=.638)
Bk6	246	.402	.491	0	1	4.19	6.10
(1=Market leader dummy)						(P-value=.041)	(P-value=.014)
Internet Banking Adoption							
IB	393	.626	.484	0	1	-	-
Plan to Adopt Internet Banking							
Uplan	147	.850	.358	0	1	-	-

Table 3.12 Logit Estimation of IB adoption

Dependent Variable: *IB adoption (IB)*	**Logit[121]**	**Marginal Effects** $\left(\overline{Y}=.642\right)$
Sex (=Male)	-.019 (.268)	-.004 (.062)
Edu (=Univ/College or above)	-.419 (.443)	-.092 (.092)
Age1 (=13-24)	-1.889 (.625)***	-.439 (.124)***
Age2 (=25-44)	-.262 (.431)	-.059 (.095)
Age3 ($\geq$45: Reference age group)		
Mars (=Single)	-.1.255 (1.116)	-.286 (.245)
Marm (=Married)	-1.362 (1.104)	-.301 (.227)
Maro (=Others: Reference marital status)		
Inc0 (=No income)	-.973 (.633)	-.238 (.153)
Inc1 (< 3mn KRW p.m.)	-.172 (.303)	-.039 (.068)
Inc2 ($\geq$ 3mn KRW p.m.: Reference income group)		
Hse1 (=Outright owned)	-.128 (.240)	-.029 (.055)
Area1 (=Seoul metropolitan)	-.202 (.252)	-.046 (.057)
Rc (=IB recommended)	1.105 (.282)***	.265 (.067)***
Irinfo (=Interest rate awareness)	.204 (.250)	.047 (.057)
Otcfr (=Frequency of OTC visits)	.015 (.033)	.004 (.008)
Ibfr (=Frequency of bank web visits)	.048 (.018)***	.011 (.004)***
Constant	1.838 (1.270)	
χ^2	67.11***	
Log likelihood	-226.25	
Pseudo R^2	.1292	
No. of obs[122]	393	
No. of adoptions	246	

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

[121] The logit specification is a point estimate at the time of survey. Thus, the timing of internet banking adoption is not considered here.
[122] The Weibull baseline hazard model uses 6260 observations of the expanded panel for 48 monthly intervals, whereas the fully non-parametric baseline hazard model excludes the intervals with no event of adoption as well as the last duration interval which has only one adoption event, thus only 5610 observations.

Table 3.13 Duration Analysis of IB adoption

Dependent Variable: *IB adoption (IB)*	Continuous Time Parametric Weibull[123]	Discrete Time PH model parametric Weibull baseline	Discrete Time PH model Non-parametric baseline
Sex (=Male)	1.301 (.203)*	.263 (.156)*	.497 (.164)***
Edu (≥Univ/College)	1.011 (.256)	.011 (.253)	-.033 (.255)
Age1(=13-24)	.821 (.310)	-.197 (.377)	-.322 (.382)
Age2 (=25-44)	-.807 (.186)	-.214 (.230)	-.494 (.238)**
Mars (=Single)	.533 (.205)*	-.628 (.384)*	-.886 (.386)**
Marm (=Married)	.640 (.238)	-.446 (.373)	-.737 (.377)**
Inc0 (=No income)	1.200 (.532)	.183(.443)	0.235 (.449)
Inc1 (< 3mn KRW p.m.)	.917 (.152)	-.086 (.166)	-.033 (.168)
Hse1 (=Outright owned)	.929 (.131)	-.074 (.141)	-.077 (.145)
Area1 (=Seoul metropolitan)	.875 (.124)	-.134 (.142)	-.132 (.145)
Rc (=IB recommended)	.862 (.167)	-.149 (.194)	-.297 (.199)
Irinfo (=Interest rate awareness)	1.171 (.164)	.158 (.140)	.229(.144)
Otcfr (=Frequency of OTC visits)	.975 (.019)	-.026 (.019)	-.031(.020)
Ibfr (=Frequency of bank web visits)	1.016 (.007)	.016 (.007)**	.022(.007)***
Bk1 (=First mover dummy)	1.065 (.193)	.063 (.181)	.121 (.185)
Bk6 (=Market leader dummy)	1.262 (.171)*	.232 (.136)*	.291 (.141)**
Constant		-5.000 (.598)***	
Log(time)		.882 (.107)***	
Parameter P	1.888		
Duration Dummies[124]			*Increasing (-)ve numbers in time*
χ^2	30.08*	104.03***	1783.57***
Log likelihood	-263.55	-985.29	-846.11
Pseudo R^2			
No. of obs[125]		6260	5610
No. of adoptions	246	246	245
Time at risk	6260		
Unobserved Heterogeneity	*N.S.*	*N.S*	*N.S.*

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

[123] The Parametric Weibull estimation shows hazard ratios i.e. if >1, it indicates a positive effect on adoption and vice versa.
[124] The coefficients of the duration dummy variables, d1 to d48 are non-monotonically increasing from a larger negative number to a smaller negative number, which confirms the baseline hazard of internet banking adoption is increasing over time.
[125] The Weibull baseline hazard model uses 6260 observations of the expanded panel for 48 monthly intervals, whereas the fully non-parametric baseline hazard model excludes the intervals with no event of adoption as well as the last duration interval which has only one adoption event, thus only 5610 observations.

Table 3.14 Marginal Effects after the Duration Analysis

dy/dx	Continuous Time Duration (*Weibull*)	Discrete Time Duration (*Weibull Baseline*)	Discrete Time Duration (*Non-parametric Baseline*)
Y	**Predicted Time of Adoption**	**Pr(Ibu)[126]**	**Pr(Ibu)**
Mean	**22.522**	**.031**	**.023**
Sex (=Male)	-3.245	.007*	.010***
	(2.131)	(.004)	(.003)
Edu (≥ Univ/College)	-.134	.000	-.001
	(3.037)	(.008)	(.006)
Age1(=13-24)	2.457	-.005	-.006
	(4.958)	(.010)	(.007)
Age2 (=25-44)	2.476	-.007	-.013**
	(2.636)	(.008)	(.007)
Mars (=Single)	7.792	-.019*	-.020**
	(5.279)	(.011)	(.009)
Marm (=Married)	5.260	-.014	-.017*
	(4.509)	(.012)	(.009)
Inc0 (=No income)	-2.082	.006	.006
	(4.827)	(.016)	(.013)
Inc1 (< 3mn KRW p.m.)	1.021	-.003	-.001
	(1.965)	(.005)	(.004)
Hse1 (=Outright owned)	.880	-.002	-.002
	(1.678)	(.004)	(.003)
Area1 (=Seoul metropolitan)	1.581	-.004	-.003
	(1.695)	(.004)	(.003)
Rc (=IB recommended)	1.728	-.005	-.008
	(2.227)	(.007)	(.006)
Irinfo (=Interest rate awareness)	-1.868	.005	.005
	(1.704)	(.004)	(.004)
Otcfr (=Frequency of OTC visits)	.305	-.001	-.001
	(.242)	(.001)	(.000)
Ibfr (=Frequency of bank web visits)	-.186*	.000	.001***
	(.096)	(.000)	(.000)
Bk1 (=First mover dummy)	-.741	.002	.003
	(2.120)	(.006)	(.005)
Bk6 (=Market leader dummy)	-2.744	.007*	.007**
	(1.711)	(.004)	(.004)
Log (time)		.026***	
		(.003)	

Standard errors are in the parentheses.
,,*** Z-values significant at the 5%, 2.5%, and 1% levels respectively*

[126] Ibu is the dependent variable for the discrete time duration models. This variable is equivalent to IB in the continuous time model.

Table 3.15 Comparison: Non Users' Future Adoption vs. Overall adoption

	(Model 1) Logit	(Model 2) Logit	(Model 3) Conditional Logit *(IB=0)*
Variable:	**IB adoption *(IB)***	**Plan to use IB *(Uplan)***	**Plan to use IB *(Uplan)***
Sex (=Male)	-.019 (.268)	.632 (.677)	.594 (.757)
Edu (≥Univ/College)	-.419 (.443)	.159 (1.224)	1.364 (2.133)
Age1(=13-24)	-1.889 (.625)***	1.799 (1.778)	1.339 (1.285)
Age2 (=25-44)	-.262 (.431)	-.221 (1.239)	-.357 (2.498)
Mars (=Single)[127]	-.1.255 (1.116)	-	-
Marm (=Married)	-1.362 (1.104)	-.759 (.683)	-.720 (.682)
Inc0 (=No income)	-.973 (.633)	.582 (1.183)	.589 (2.049)
Inc1 (< 3mn KRW p.m.)	-.172 (.303)	.537 (.777)	.492 (1.235)
Hse1 (=Outright owned)	-.128 (.240)	1.278 (.571)**	1.146 (.568)**
Area1 (=Seoul metropolitan)	-.202 (.252)	-.420 (.655)	-.375 (1.084)
Rc (=IB recommended)	1.105 (.282)***	.986 (.579)*	.930 (.592)
Irinfo (=Interest rate awareness)	.204 (.250)	-.378 (.659)	-.241 (1.018)
Otcfr (=Frequency of OTC visits)	.015 (.033)	.175 (.142)	.137(.125)
Ibfr (=Frequency of bank web visits)	.048 (.018)***	.227 (.133)*	.135 (.083)
Constant	1.838 (1.270)	-1.666 (1.987)	
χ^2	67.11***	30.26**	30.10**
Log likelihood	-226.25	-46.92	-44.62
Pseudo R^2	.1292	.2438	.2522
No. of obs.	393	147	147
No. of events	246	125	125

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** *χ^2 -values significant at the 5%, 1%, and 0.1% levels respectively*

[127] The variable, Mars was omitted from Model 2 and Model 3 due to hidden collinearity, which arise when the independent variables are all dummy variables and/or continuous variables with multiple values.

Table 3.16 Plan to Use IB (Uplan): Marginal Effects at Mean

Mean .936	Pr(Uplan)	dy/dx
Sex (=Male)	.632 (.677)	.041 (.049)
Edu (≥Univ/College)	.159 (1.224)	.143 (.155)
Age1(=13-24)	1.799 (1.778)	.085 (.074)
Age2 (=25-44)	-.221 (1.239)	-.013 (.071)
Mars (=Single)	-	-
Marm (=Married)	-.759 (.683)	-.047 (.046)
Inc0 (=No income)	.582 (1.183)	.028 (.048)
Inc1 (< 3mn KRW p.m.)	.537 (.777)	.036 (.057)
Hse1 (=Outright owned)	1.278 (.571)**	.090* (.050)
Area1 (=Seoul metropolitan)	-.420 (.655)	-.026 (.038)
Rc (=IB recommended)	.986 (.579)*	.070 (.051)
Irinfo (=Interest rate awareness)	-.378 (.659)	-.024 (.046)
Otcfr (=Frequency of OTC visits)	.175 (.142)	.010 (.009)
Ibfr (=Frequency of bank web visits)	.227 (.133)*	.014** (.006)

Standard errors are in the parentheses.
,,*** Z-values significant at the 5%, 2.5%, and 1% levels respectively*

Chapter 4

Collective Relationship Banking: Private Information & Monitoring

4.1 Introduction

Having investigated the impact of banking regulation and the new technology adoption on the industry structure in the previous chapters, this chapter aims at explaining the economic principles underlying the relationship between the real sector (*non-financial*) and the banking sector. Most literature has focused on either the structure of conglomerates (*Keiretsu/Chaebol*) in East Asia in explaining the fast economic growth (Cho, 1994) or the banking structure for the recent crisis in the region (Agenor et al., 1999). Traditionally, the vertical relationship between core companies and their subsidiaries in the real sector was believed to be a driving force for the economic success in the region. However, the degree of vertical relationship, often measured in cross-ownership among group companies, varies according to the firms' performance and subsequently affects banking relationships. I argue that sharing of private information via cross-ownership provides an important lending criterion for the banking relationship.

The strong vertical relationship between holding companies and their subsidiaries in the real sector (*non-financial*) was believed to be a driving force for the economic success in East Asia (Cho, 1994; Lee et al., 2002). Hence, throughout the last few decades, there has been a plethora of literature analysing the structure of conglomerates (*Keiretsu/Chaebol*) in East Asia in order to explain the fast economic growth in the region. Many of the advocates for Asian Tiger style growth claimed the rest of the world had much to learn from their economic success.

However, the recent financial crisis in the region put a question mark against the invincible Tigers. Hence, since the turn of the new millennium much emphasis has been place on trying to identify what went wrong in the Asian financial system in the 1990s. When the regional economy is in good shape, the research focus has been on the real sector (*non-financial*). However, when the economy started to get in trouble, some blamed the financial sector, namely the banking system (Agenor et al. 1999) whilst others have focussed on the real sector in crisis (Haggard et al. 2003), more or less in isolation. However, I argue the real sector and the financial sector should not be regarded as two separate fields of investigation.

The novelty of the chapter lies in linking the structure of the real sector and the banking sector using the firms' banking behaviour. This chapter empirically investigates the banking relationship whereby banks provide loans to borrowers (*firms*) with heterogeneous vertical relationships. A '*Relationship Banking (RB)*', is defined as successive long-term contracts between firms and banks. In addition, when a group of borrowers with vertical relationship (i.e. cross-owned) have a banking relationship with the same principal bank of the respective holding

company, we denote it as '*Collective Relationship Banking (CRB).*' By contrast, when a subsidiary remains in relationship banking with a bank different from that of its holding company's, we call it as '*Independent Banking (INDB).*'

It is worth noting that both collective relationship banking (*CRB*) and independent banking (*INDB*) are types of relationship banking (*RB*) as illustrated in Figure 4.1. However, the two types of relationship banking, *CRB* and *INDB*, do differ in how private information is shared between banks and firms. When the subsidiaries are heavily by the group holding companies (*Chaebols*), they do have an advantage of sharing private information at little extra costs as explained in Hart and Moore's (1990) transaction costs literature. The transaction costs are commonly believed to be lower when transactions are carried out within a firm than through the market. We can arguably consider a group of companies networked through holding company's vertical ownership structure as a broader definition of a '*firm*' and anything outside of this cross-owned network as the market. On the other hand, the holding companies provide a vehicle for indirect monitoring of the business activities of the subsidiaries (Cerasi and Daltung, 2003). These two sub-channels of relationship banking (*RB*) will be the main focus of the analyses.

Asymmetric private information between lenders and borrowers often creates problems of adverse selection and moral hazard as *ex ante* screening in approving loans and *ex post* monitoring of outstanding loans becomes costly for lenders. Thus, one of the main roles of banks is to reduce the information cost for financial

intermediation (Diamond, 1991; Boot, 2000)[128] and relationship banking has been one way to resolve problems of asymmetric information alongside credit rationing (Stiglitz and Weiss, 1981). In doing so, relationship banking commonly aims at the accumulation of soft information over time (Berger and Udell, 2002).[129] When dealing with small firms, which are vulnerable with less transparent information, the information gap between insiders and outsiders becomes larger and relationship banking can play an important role in narrowing this gap.

In this context, a strong vertical relationship among borrowing firms, such as cross-ownership between a holding company and its subsidiaries, can mitigate the incentive problems by reducing the information cost via delegated monitoring through holding companies (Cerasi and Daltung, 2003). Moreover, risk diversification tied to a holding company is key to the model as the borrower's risk diversification can moderate banks' exposure to non-performing loans (NPLs) (Diamond, 1984). Collateral or guarantees by diversified holding companies are usually considered to be credit-worthier than those provided by their subsidiaries as diversified investment portfolios of holding companies allow lower risk to lenders (*banks*).

In investigating the structure of conglomerates (*Keiretsu/Chaebol*) to identify the engine for growth, we notice the degree of vertical relationship can vary depending upon the firms' performance and subsequently may affect their

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[128] For the present, the term *bank* and *financial intermediary* are used synonymously.

[129] Soft information is not usually verifiable and relies on a credit officer's subjective judgement whilst hard information is based on more verifiable evidence such as firm's balance sheets, income statements, and so on.

relationship banks. Figure 4.3 illustrates some group ownerships in subsidiaries that fluctuate with no particular pattern over time. The extent of holding companies' ownership stake in their subsidiaries has been a strategic decision of the group. The asymmetric information sharing structure among (a) holding companies (*Chaebols*) and (b) their subsidiaries[130] often takes the form of vertical relationship via cross-ownership and in many cases, an identical bank is used for the group of firms who are in the cross-ownership network. Here, the relationship banking is not only a single firm-bank specific relation over time but it also appears to be a collective relationship banking (*CRB*) as illustrated in Figure 4.1.

Research on the banking industry has so far explored the areas, such as regulatory regime shifts and monetary policy shocks in explaining the recent financial crisis (Agenor et al., 1999). However, I argue that the banking industry restructuring cannot be fully explained by these exogenous shocks in the financial sector without investigating endogenous changes in the real sector, especially changes in vertical relationship among borrowing firms.

The main aim of linking the vertical relationship structure of the real sector and the firms' banking behaviour is to shed some light on the bilateral structure between the real and banking sectors. There are advantages and disadvantages of relationship banking in the presence of asymmetric information. When firms have differentiated incentives and/or disincentives to disclose full information to the banks

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[130] These subsidiaries are not necessarily small and medium size enterprises (SMEs) although they are usually smaller in asset size terms compared to their respective holding companies.

in the process of loan approval, relationship banking provides an alternative channel for private information.

Empirical analysis of the panel data constructed for the top 10 Korean holding companies and their subsidiaries between 1994-2002 provides evidence that firms with a weak vertical relationship in the real sector are more likely to choose *collective relationship banking* (*CRB*) to reinforce the information gap. On the other hand, those with a strong vertical relationship can afford to have *independent banking (INDB)* due to the holding companies' indirect monitoring.

The chapter is organised as follows. Section 4.2 reviews related literature. Section 4.3 presents an econometric specification for the choice of collective relationship banking. The data are explained in Section 4.4 and the variables used in the analyses are described in Section 4.5. Section 4.6 discusses the implications of the empirical results. Section 4.7 studies the cases of switching in banking relationship. Section 4.8 concludes.

4.2 Literature Review

Financial intermediaries arise from the need to overcome the consequences of informational asymmetries between lenders and borrowers (Hauswald and Marquez, 2000). One way to overcome informational asymmetries is to impose strict monitoring and screening of borrowers. Diamond (1984), Ramakrishnan and Thakor (1984), and Allen (1990) have emphasized the different aspects of monitoring and

screening in banking, which essentially advocate the relation-specific nature of information sharing in financial intermediation.[131]

Most literature on relationship banking has so far referred to and explained a single relation between a firm and a bank with successive long-term contracts (Thakor, 2000). However, I argue that relationship banking should not be considered as a single dimensional relation especially when different degrees of vertical relationship among the borrowers in the real sector influence firms' banking behaviour collectively.

Hence, the notion of relationship banking in this chapter refers to two kinds of banking relationships: (a) a successive long-term contracts between a firm and a bank as relationship banking (*RB*) commonly used in the previous literature, and (b) a collective long-term relationship between a group of firms and a bank as collective relationship banking (*CRB*). The primary focus of investigation in this chapter is on collective relationship banking (*CRB*) as illustrated in Figure 4.1.

The deposit market typically takes the form of indefinite contracts without much restriction unless the customer specifies time-deposit terms and conditions. On the other hand, the loan market commonly takes a series of time-limited contracts according to the life of firms' investment projects. This asymmetric length of deposit and loan contracts creates incentives for banks to tie the two markets together by

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[131] Financial intermediation refers to all financial institutions including banks. However, financial intermediation and banking are often used interchangeably in this chapter.

offering loans to those with deposit accounts at the same bank.[132] This chapter assumes firms' banking relationship in both deposit and loan markets, although the latter is more likely to decide the banking relationship when the two markets are tied together.

The benefits of tied contracts for the banks is (a) to monitor the risks indirectly through the firms' deposit account activities and (b) to maintain the banks' balance sheet more stable by having both assets and liabilities tied together. Special attributes of banks are believed to include having access to private or inside information about borrowing firms that is not available to other institutions or investors (Fama, 1985), whereby relationship banking has advantages for such private information.

Boot and Thakor (1999) show information differentiation captures the degree of specialisation in relationship building. In addition, Hauswald and Marquez (2000) claim that there is no reason to assume that banks have equal access to information *ex ante*. Therefore, both of the literature suggest that the banking relationship changes in the process of accumulating information. Shin and Kolari (2003) investigated the hierarchy of the credit market in Japan and indicated that firms with information problems are more likely to carry a higher proportion of relationship loans from main banks than non-main banks.

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[132] Due to the tied nature between deposit and loan markets, interest rates in these two markets are usually determined via mark-down or mark-up from the inter-bank money market rates set by the monetary policy.

Bank failures during economic downturns seem to arise because banks are not always in a position to obtain full information about their borrowers. Moreover, the information regarding the competitiveness of respective subsidiaries can be even less readily available due to the firm's listing type and often more complex due to the industry characteristics. However, the holding companies have the advantage of being more directly involved with these subsidiaries via cross-ownership and may hence, have superior knowledge of the subsidiaries compared to their banks.

In the aftermath of the recent financial crisis in Asia, there has been a substantial consolidation of the banking sector as shown in Figure 4.2 and Table 4.1 whereas in the real sector holding companies have been reducing their ownership within and across subsidiaries. Here, a question arises if there is any particular pattern in the bilateral structure between the real and the financial sectors. On the banking side, as Villas-Boas and Schmidt-Mohr (1999) claimed, more competition may lead to more screening under asymmetric information because banks compete more intensively for the most profitable and creditworthy customers that are now more scarce. On the other hand, firms with less favourable prospects now need to compete more in searching and negotiating borrowing terms.

In firm-bank specific relationships, considering firms as buyers (*borrowers*) of loan products at certain prices (*loan rates*), the bargaining position of the firm against the banks regarding the loan products can be enhanced by forming a group of firms with strong vertical relationship. Hence, collective relationship banking (*CRB*) is considered to be one way for firms to enhance their market power, whilst horizontal mergers are a common solution for banks to raise their market power

(Focarelli and Panetta, 2003). Furthermore, collective relationship banking may have a positive impact on welfare with strong buyers (*borrowers*), who may force their suppliers (*banks*) to reduce prices (*loan rates*) as suggested in Galbraith's (1954) countervailing market power.

The level of direct information disclosure may vary with a firm's true state of business and/or the types of the corporate listings. Even if subsidiary firms do not have an incentive to disclose information directly, their vertical relationship with holding companies can provide information indirectly. In other words, vertical relationship measured in cross-ownership offers delegated monitoring for banks, as holding companies publish consolidated financial statements. The delegated monitoring in this bilateral structure may eventually lead both the real (*firms*) and the banking (*banks*) sectors into successive oligopoly (Waterson 1984; Salinger 1988; Abiru et al. 1998) via the information reinforcing mechanism.

Regarding the monitoring intensity, Carletti (2004) claims that the multiple-bank lending suffers from duplication of effort and sharing of monitoring benefits compared to single-bank lending.[133] If we apply the principles of search and switching cost theories to banking, borrowing from multiple banks should restore competition among banks and consequently improve corporate incentives (Von Thadden, 1992; Padilla and Pagano, 1997). On the other hand, Dewatripont and Maskin (1995) argue that a relationship bank may refinance unprofitable projects and

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[133] Multiple-bank lending when a firm borrows from several banks for a project and single-bank lending when a firm borrows from a single bank instead.

thus reduce corporate incentives to prevent default.[134] However, the theories mentioned above and their predictions are not consistent with the empirical evidence.

In a more general and legal context, Dixit (2004) claims that relation-based governance has the advantage of obtaining private information and therefore, state regulation can be supplemented by private sector monitoring. His argument can be suitably applied to the case of banking sector, where banks do not have full information of the complex and diversified real sector neither do the relevant state regulators of banking. Hence, the private monitoring or delegated monitoring through relationship banking and/or collective relationship banking can be regarded as delegated risk managers in order to supplement the state regulation.

A large proportion of Japanese and Korean companies are established under some sort of vertical relationship with holding companies and their banking behaviour has been driven by either (a) collective relationship banking (*CRB*) or (b) independent relationship banking (*INDB*).[135] However, there has not been any research carried out to identify the causes of different channels in banking relationships. Hence, I address the issues related to collective relationship banking using empirical analysis of firm-level data from Korea.

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[134] Dewatripont and Maskin (1995) analyse the case of a single monitoring only with endogenous level of monitoring.

[135] Recall both collective relationship banking (*CRB*) and independent banking (*INDB*) as used as sub-channels of relationship banking (*RB*).

4.3 Econometric Specification

Traditionally, firms in Korea have maintained long-term relationships with their respective banks. Usually, these relationships are dominated by the banking behaviour set by the holding company and are expected to establish a collective banking relationship with the principal bank appointed by their holding companies. However, the evidence of the banking relationship shows collective relationship banking is not always the subsidiary firm's choice. For instance, Tables 4.2, 4.3, and 4.5 show an equal split between *CRB* and *INDB*.

An immediate question to follow here is what happens to the banking structure when the vertical relationship among their borrowing companies changes. In the empirical analysis, I aim to first explain what determines the choice between collective relationship banking (*CRB*) and independent banking (*INDB*) and to discuss the further implications to the banking sector in Korea, which has experienced a noticeable consolidation.

4.3.1 Discrete Binary Choice Model

The primary objective of the investigation is to characterise the probability of collective relationship banking when the borrowing firms have heterogeneous vertical relationships. Hence, the probability of collective relationship banking $P_{it} = P(y_{it} = 1)$ is the binary dependent variable and the firm characteristics X_{it}

represent the explanatory variables. Therefore, the model takes the following form of the most commonly used discrete choice probability:[136]

$$P_{it} = P(y_{it} = 1) = E(y_{it} = 1 | X_{it}) = F(X_{it}'\beta), \qquad (4.1)$$
$$i = 1,...,N \quad t = 1,...,T$$

where $y_{it} = 1$ if collective relationship banking (CRB)
$y_{it} = 0$ if independent banking ($INDB$)

The observed dependent variable is binary, taking the value of one if the individual subsidiary chooses collective relationship banking at the time, t, and zero otherwise, i.e. independent banking. The sample for the model takes the individual subsidiary firms $(N = 323)$ observed over a 9 year period $(T = 9)$ as an unbalanced panel of $N \times T (= 2222)$ with a row vector of K explanatory factors of the subsidiary firms' characteristics, X_{it}.

The simplest structure ignoring the attributes of panel data is to pool observations and treat the sample as a long independent cross section of size NT :

$$y = X\beta + \varepsilon \qquad (4.2)$$

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[136] A linear probability model for binary panel data has the same problem as in the cross sectional data analysis as it imposes an unnatural restriction on unobserved effects, $X_{it}\beta \le \alpha_i \le 1 - X_{it}\beta$, $t = 1,...,T$ as the observation Y_{it} are bounded between 0 and 1. The probit and logit models are the standard normal distribution and the logistic distribution respectively, that overcome the $[0,1]$ boundary constraint problem.

However, given the panel structure of the data, the following model is used in order to reduce the loss of information assuming the observed binary outcome of collective relationship banking y_{it} are independent conditional on X_{it} and on an unobservable individual subsidiary time invariant effect, α_i:

$$P\left(y_{it}=1\middle|X_{it},\alpha_i\right)=F\left(\alpha_i+X_{it}'\beta\right) \tag{4.3}$$

Assuming the probability $F(\cdot)$ to be logistic we obtain the following standard logit model: [137]

$$P\left(y_{it}=1\middle|X_{it},\alpha_i\right)=F\left(\alpha_i+X_{it}'\beta\right)=\frac{e^{\alpha_i+X_{it}'\beta}}{1+e^{\alpha_i+X_{it}'\beta}}=\Lambda\left(\alpha_i+X_{it}'\beta\right) \tag{4.3}$$

4.3.2 Random Effects Logit Model

The main assumption of the random effects logit model with unobserved effects is:

$$P\left(y_{it}=1\middle|X_i,\alpha_i\right)=P\left(y_{it}=1\middle|X_{it},\alpha_i\right)=\Lambda\left(\alpha_i+X_{it}'\beta\right) \tag{4.4}$$

where α_i is the unobserved effect and X_i contains X_{it} for all t. In other words, $\mathrm{P}\left(y_{it}=1\middle|X_i,\alpha_i\right)=\mathrm{P}\left(y_{it}=1\middle|X_{it},\alpha_i\right)$ implies that X_{it} is strictly exogenous

[137] Two most commonly used binary discrete choice models are probit and logit models. However, the advantage of using logit model is explained in the random effects logit model section later.

conditional on α_i and once α_i is conditioned on, only X_{it} appears in the response probability at time t. This rules out lagged dependent variables in X_{it}, as well as certain kinds of explanatory variables whose future movements depend on current and past outcomes on y (see Wooldridge, 2002).[138] The second equality is a standard logit assumption shown in equation (4.4).

In addition to assumption (4.4), we assume that the outcomes, $y_{i1},...,y_{iT}$, are independent conditional on (X_i,α_i).

The random effects logit estimators are not as simple as in probit models since integrating the logit response, $\Lambda\left(\alpha_i + X_{it}'\beta\right)$ with respect to the normal density yields no simple functional form. However, there is one important advantage of the unobserved effects logit model over the probit model. Under the assumptions in equation (4.4) and the y_{iT} independence conditional on (X_i,α_i), it is possible to obtain a $\sqrt{N}$-consistent estimator of β without any assumption about how α_i is related to X_i.[139] By contrast, the probit model assumes the relationship between α_i and X_i has a normal distribution:

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[138] This can just end up differencing the model and getting rid of the X_i as shown in Arellano and Bond (1991)

[139] Wooldridge (2002) explains in detail how we allow α_i and X_i to be arbitrarily related to the unobserved effects logit models. What he suggests is to find the joint distribution of $y_i \equiv (y_{i1},...,y_{iT})'$ conditional on X_i, α_i and $n_i \equiv \sum_{t=1}^{T} y_{it}$ and claims that this conditional distribution does not depend on α_i, so that it is also the distribution of y_i given X_i and n_i. Hence, we can use standard conditional maximum likelihood methods to estimate β. This does not work for the probit model.

$$\alpha_i | X_i \sim Normal\left(0, {\sigma_\alpha}^2\right) \tag{4.5}$$

which is a strong assumption as it implies that α_i and X_i are strictly independent and that α_i has a normal distribution.

4.3.3 Fixed Effects Logit Model

No control for unobserved heterogeneity in the above random effects model is of concern when unmeasured firm characteristics influence both collective relationship banking behaviour and firm's ownership structure. Hence, Chamberlain's (1980; 1984) fixed effects logit model is applied as an alternative procedure using a conditional likelihood controlling for unobserved individual firm-specific heterogeneity.[140]

The conditional maximum likelihood estimation (MLE) is obtained by maximising the sum of the conditional log likelihood across ***i*** with possible outcomes of $n_i \equiv \sum_{t=1}^{T} y_{it}$. Then, the log likelihood function is:

$$\mathrm{P}\left(y_{i1} = y_1, \ldots, y_{iT} = y_T \middle| X_i, \alpha_i, n_i = n\right) = \frac{\mathrm{P}\left(y_{i1} = y_1, \ldots, y_{iT} = y_T \middle| X_i, \alpha_i\right)}{\mathrm{P}\left(n_i = n \middle| X_i, \alpha_i\right)} \tag{4.6}$$

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[140] Greene (2003) explains that controlling for unobserved heterogeneity using fixed effects in a discrete choice model only works with logit model not with probit model.

Chamberlain's model (fixed effects logit) is consistent and efficient when there is unobserved individual firm-specific heterogeneity. However, when there is no unobserved heterogeneity, his model is inefficient because it does not use all the data and the standard random effects logit model is both consistent and efficient (Greene, 2003).

The basic idea of Chamberlain's (1980; 1984) model is to look at the changes in each individual firm's relationship banking behaviour over time. Therefore, only firms that change their relationship banks are included in the model. However, we need to note that only an extremely small proportion, 9 out of 323 firms as in Table 4.2 and 4.3, had actually changed their relationship banks during the sample period.[141] This lack of variance over time with such small switching in banking relationship (*SW*) does indicate the fixed effects model is not appropriate. Therefore, the fixed effects results were chosen not to be reported. In addition, we expect to obtain little information from dynamic models which will be discussed later in the chapter.

4.3.4 Population-averaged Logit Model

Another consistent estimator for β is to estimate the partial effects of the elements of X_t on the response probability $P(y_t = 1 | X_t, \alpha)$ at the average of α in the

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[141] Switching of banking relationship is denoted as SW in Tables 2 & 3.

population ($\alpha = 0$). Then, the response probabilities are specified conditional only on X_i and we have the following for all t:

$$P\left(y_{it}=1\middle|X_{it}\right)=P\left(y_{it}=1\middle|X_{i}\right),\ \ \forall t \tag{4.7}$$

This is called a population-average model and useful when we are interested in averaging across the distribution of α_i. This is also often known as generalised estimating equations (GEE) model or GEE population-averaged model.

Given the lack of variance in banking relationship over time, this population averaged logit model appears more appropriate than the fixed effects logit model.

4.3.5 Complementary Log-log Population-average Model

An alternative model to the above GEE population-averaged model is a complementary log-log population-averaged model. Complementary log-log models are often used when the probability of an event is very small or very large. This is because the model can fit an asymmetric sigmoid function to the probability between 0 and 1 unlike the logit or probit models, which are symmetric.

Therefore, if the sample data has more or less an equal probability of an event, i.e. collective relationship banking, we do not expect to see much difference between the results from GEE population averaged logit model and complementary log-log population-averaged model. There is a clear advantage of the latter being less restricted model. It would be worth checking whether the results from these two models differ. The log likelihood function for this model is:

$$\ln(L)=\sum_{i=1}^{N}\sum_{t=1}^{T}\left[w_i \ln F\left(X_{it}'\beta\right)+(1-w_i)\ln\left(1-F\left(X_{it}'\beta\right)\right)\right] \tag{4.8}$$

where $F(\bullet)=1-\exp(-\exp(\bullet))$

As in GEE population-averaged model, the probability function for each firm is also $P(y_{it}=1|X_{it})=P(y_{it}=1|X_i),\ \forall t$ while w_i denotes optional weights.

4.3.6 Dynamic Consideration

Since the banking behaviour in the panel data is observed in both cross-sectional and the time series, the dynamic processes of the collective relationship banking raises an interest for research.[142]

As mentioned above in the fixed effects logit model, a significant proportion of the firms in the sample remain with the same relationship bank over the sample period of 1994-2002. Table 4.2 and 4.3 summarise the banking relationship by group holding companies and by industries, indicating 314 out of 323 firms remain with the same relationship bank. This naturally leads to an investigation of state dependence and/or persistence of banking relationship in the dynamic framework. However, the lack of variance in choice of banking relationship over time, T suggests that the dynamic model has little information to add, especially when relationship banking by

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[142] There are many examples of economic persistence including labour force participation (Heckman and Willis, 1977); firm import and export decisions (Roberts and Tybout, 1997); the external debt crisis in developing countries (Hajivassiliou and McFadden, 1998); and the state dependence in unemployment (Arulampalam, 2002).

definition, means a long-term (*persistent*) relationship between a firm (*borrower*) and a bank (*lender*).

Therefore, the results of dynamic estimation are reported only as a reference to how the lagged dependent variable captures all the effects due to the persistence of banking relationship. Subsequently, a cross-sectional logit estimation for each year is presented to illustrate how insignificant the differences in the estimation results are from one year to another. Moreover, a case study for -those firms which switched their banking relationship (*SW*) is presented in a later section.

4.4 Data

The data were collected from the corporate archive provided by The Korea Information Service (KIS), Inc.. The KIS provides comprehensive and up-to-date corporate information on over 310,000 Korean companies, including financial statements and ownership structures. The top 10 largest holding companies (*Chaebols*) between 1994 and 2002 were included in the analysis, which comprise 16 holding companies taking the changes in rankings over time into consideration. The 16 holding companies were selected based on "The Annual Reports on the Top 35 Large Holding Companies' Major Banking Activities" published by the Financial Supervisory Service (FSS).[143]

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[143] By the FSS regulation, the top 35 large holding companies in Korea ought to report their main annual banking relationship to the FSS.

The assets of the companies related to top 10 chaebols represent more than 30% of the Korean GDP and those related to top 35 chaebols would bring this figure up to almost 80%. Although the firm level data are available for all the companies related to top 35 chaebols, only the subsidiaries related to the top 10 largest chaebols are used in the analysis as they represent a large enough proportion of the Korean economy and their group behaviour is often replicated by companies related to relatively smaller chaebols. Another advantage of limiting the list of companies to the top 10 largest chaebols is to obtain more reliable time series data across the subsidiaries as missing data are frequently found for the smaller chaebols and their subsidiaries if we extend the list to top 35 chaebols.

Having discarded incomplete sample observations, an unbalanced panel was constructed from 323 subsidiaries of the above 16 holding companies for the 9 year period and are used in the analysis.[144]

Looking across the columns of Table 4.2, one can notice that holding companies with larger number of subsidiaries tend to be larger in the aggregate sense (e.g. the correlation coefficient of 0.898 between number of subsidiaries and the total asset size of a holding company). Another interesting observation is the size distribution of the subsidiaries. The subsidiaries of the larger holding companies are relatively large in average asset size too (e.g. the correlation coefficient of 0.458 between the average asset size of a subsidiary and the total asset size of a holding

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[144] The Korea Electric Power Corporation (KEPCO) and the POSCO Co. LTD. (POSCO) are not included in the sample as they were initially established as state-owned companies for electricity generation and steel manufacturing respectively.

company). In other words, larger holding companies seem to diversify their business portfolio across subsidiaries which are also relatively large compared to those belonging to smaller holding companies.

In Table 4.2, we notice that some groups have more subsidiaries adopting collective relationship banking (e.g. Hanhwa, Hanjin, and Samsung) whereas other groups have more subsidiaries adopting independent relationship banking (e.g. Daewoo, Doosan, Kohap, LG, and SK). However, it is not obvious what determines these group specific effects. An immediate proposition could have been the group size effect, i.e. the larger the group is, their subsidiaries are more likely to adopt collective relationship banking to benefit from economies of scale. However, there is no clear correlation between the size of the holding company's aggregate assets and the proportion of the collective relationship banking per group (correlation coefficient of -0.031 between the total asset size of the holding co. and the CRB proportion in Table 4.2).

The 9 year period between 1994 and 2002 is long enough to cover most business cycles.[145] Furthermore, the sample period has the benefit of stretching over pre- and post-financial crisis.

The 323 subsidiaries in the data operate their business across 13 different industries as listed in Table 4.3 according to the KSIC's (Standard Industrial

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[145] Most business cycles in Korea fluctuate between 5 to 10 years given the 5 year strategic industrial and technology policies and the long-term economic cycle per decade.

Classification) main industry classification.[146] Subsidiary firms are widely spread over the 13 industries but one of the most significant industries is manufacturing (IND2) with 101 firms (31.3% of 323 companies) followed by business and research support and service (IND11) with 56 firms (17.3% of 323 companies). Nearly half of the firms used in the analysis are accounted for by these two industries.

The next three significant industries are: retail and wholesale (IND5); transportation (IND7), and financial services and insurance (IND9) with each one representing roughly 10% of the firms included. Regarding financial services, it is worth noting that the Korean holding companies do not own group banks as their own subsidiaries unlike in the Japanese Keiretsu system.[147] Although the banking ownership has been liberalised in Korea so that foreign investors can become shareholders of the Korean banks, the large holding companies (chaebols)' stake in the domestic commercial banks used to be regulated and appears still insignificant.

4.5 Variables

The dependent variable of collective relationship banking (*CRB*) and the following explanatory variables are included in the static binary choice models as listed in Table 4.4: 1/ major shareholding by the group company (*OWN*); 2/ net income to asset ratio (*NIAR*); 3/ age of the company (*AGE*); 4/ industry dummies (*IND1 to IND13*), which reflect individual firm characteristics and its industry environment; 5/

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[146] The KSIC code is similar to the 5-digit SIC Code in the US. The industry dummy here refers to the first digit main section classification.

[147] In Japan, Keiretsus often has their own designated banks within the group, which makes the relationship banking further reinforced by the group interest.

holding company group dummies (*G1 to G16*), and 6/ firm creation dummy(*TM*) which indicates whether the firm is created as a result of take-over or mergers.

The above explanatory variables are chosen because they are the most representative assessment measures for the credit ratings in Korea. A typical credit scoring exercise by lenders (*banks*) include: 1/ repayment ability and quality of collateral and guarantees (*reflected in OWN and G1-G16 group dummies*); 2/ firms profitability (*reflected in NIAR*); 3/ firm's general reputation (*business survival in terms of AGE*), and 4/ overall business prospects (*reflected in IND1-IND13 industry dummies and the firm creation dummy TM*). The respective proxy variables, as shown in the parentheses, are used in the analyses.

The dependent variable, collective relationship banking (*CRB*), indicates whether the firm has a banking relationship with the same principal bank that deals with its holding company as illustrated in Figure 4.1. Firms show no particular preferences either way and it appears that the firm's choice on relationship banking is equally split between collective relationship banking (*CRB*) and independent banking (*INDB*).

The vertical ownership structure (*OWN*), we measure the major shareholding in subsidiaries by the respective group companies in aggregate. It is natural for holding companies to increase or decrease its stake in the respective subsidiaries depending upon: (a) their strategic potential for the holding company group, i.e. how complementary it is to the overall group's business, and (b) future business prospects. Hence, the holding company's involvement in the respective subsidiaries via vertical ownership is a good indicator for the positive business potential. As

mentioned in the earlier sections, the vertical ownership structure naturally creates an indirect monitoring of the subsidiaries' business since they share the private information through in-house vertical contracts of buying and selling as well as the hard information in the consolidated financial accounts.

As a performance indicator of each subsidiary, net income to asset ratios (*NIAR*) was used. They vary drastically from –479.26 to 372.46 over the period before and after the financial crisis in Asia. The age of the firms since establishment was included in the analysis to capture the effect of long-term reputation. Although the average age of the firms included is about 18 years old, the analysis covers those from 0 year old for newly start-up companies to 71 years old for well-established ones with substantial business history as shown in Table 4.5.

Firms are widely distributed across 13 different industries. However, the mining (*IND1*) and other public and private repair services (*IND13*) industries have only one firm each in the data. Hence, the models with industry dummies exclude these two industries whilst the largest industry group, manufacturing (*IND2*) is used as a reference group. Dis-aggregating manufacturing (*IND2*) into the next level (second digit) of the KSIC code could have been an alternative idea but due to the limited observation size in the other industries, the industry dummy has been kept at the first digit level.

Given the nature of sample data construction, firms are also widely distributed across 16 different chaebol groups as shown in Table 4.2 and 4.5. Since Samsung group (*G14*) is the largest group by far with 60 subsidiaries it is used as a reference group in the analysis with group dummy variables. Some groups have a

relatively smaller number of subsidiaries such as Hyundai Oil (*G10*), Kohap (*G11*), and Dongah (*G3*) but all 16 groups are included in the analysis.

The firm creation dummy variable *TM* is included as we expect to see some differences in the choice of relationship banking (*CRB vs. INDB*) between firms created as a result of take-overs or mergers (*TM*) and those truly created as new firms, given the persistence of banking relationship. For instance, those taken over or merged into a new holding company may have independent banking as they remain with the previous relationship bank that is not necessarily the same as its new holding company's principal relationship bank. About 31% of the companies in the sample are established as a result of take-overs or mergers and acquisitions.

4.6 Empirical Results

Following the structure of the models discussed in the previous section, first we consider the standard binary choice models of collective relationship banking (*CRB*) without any industry or group dummy variables. The three models of binary choice presented in Table 4.6 are: 1/random effects; 2/population averaged average, and 3/complementary log-log population averaged, taking individual firm characteristics as independent variables. Due to the limited number of switching in banking relationship, fixed effects model is not presented in Table 4.6.

Table 4.6 presents the initial results of the three binary choice models without considering any dummy variables of industry (*IND*), group (*G*), and the firm creation via take-overs and mergers (*TM*). The models including these dummy variables are

discussed later. One of the most noticeable results across the Table 4.6 is the significant negative effect of holding company's ownership (OWN).[148] Subsidiaries with a relatively small holding company's ownership stake appear more likely to establish collective relationship banking (CRB). This result can be explained in two ways.

First, assuming all other conditions are equal for subsidiary firms, collective relationship banking provides incentives to both borrowing firms as well as lending banks as the performance of these firms can be indirectly monitored by group companies, principally by the main holding company.

Second, those with larger holding company stake informs the public that they are strategically important to the holding company either at present or in the future for the business interest of the group as a whole. Given this information about subsidiaries' strategic importance within the holding company's network, these firms have outside options for their loans other than collective relationship banking (*CRB*) since they often find more favourable borrowing terms from an independent bank who is looking for credit-worthy customers. In other words, it is not necessary for them to stick to the collective relationship banking (*CRB*) for bargaining loans but they can look for more competitive loans offered from independent banks, which are not in a long-term relationship with their respective holding companies.

However, one could argue that the strategically better positioned firms within the group can also get a competitive deal from collective relationship banking. Then,

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[148] Marginal effects at the mean are presented in Table 4.7.

the question is which argument is more dominant in the context. Certainly the results suggest that the problem of firms with less interest of holding companies' having limited outside options for loans and relying on an indirect monitoring via holding companies and therefore tagging themselves on to the existing holding companies' banking relationship is outweighing the strategically favourable firms' loan reinforcement via collective relationship banking. In other words, indirect monitoring via holding companies, when firms and banks share private information, plays an important role in subsidiaries' decision on banking relationship.

One could also argue that strategic interests measured by the holding companies' vertical ownership levels represent subsidiary firms' actual performance at present. However, the data show no significant evidence of this argument as the correlation coefficient between the holding companies' ownership level in their subsidiaries (*OWN*) and the performance of their subsidiaries measured by net income to asset ratios (*NIAR*) is only 0.0159. Hence, the chapter adopts the notion of strategic interests of holding companies as a separate concept irrespective of the subsidiary firms' performance.

As for subsidiary firms' performance, profitable subsidiaries are more likely to bank collectively with the holding companies. In general, lenders, banks in this case, provide less favourable loan terms. For instance, higher loan rates are offered towards borrowers with risky assets to offset their potential loss in non-accrual interest payments and the loan provisions in case of default. Profitable firms can search for the best loan contracts offered in the market. However, the reason why they appear to choose collective relationship banking is that banks often ask for

secured assets as collaterals or third party guarantees and these can be more easily arranged when both a holding company and its subsidiaries deal with the same bank.

Subsidiaries' age appears to be positively associated with the collective relationship banking (*CRB*). Those managing to remain in business for long without exiting the market show their ability to run the business appropriately. Hence, the firms with the reputation of being resilient over time tend to choose collective relationship banking. This may be solely due to the signal of long run quality perceived as better or simply because of the convenience in dealing with the same bank since subsidiaries naturally learn the business practice set by the holding companies over time. Then, an immediate question arises as to why this desirable quality of the firm's long run survival does not provide outside options of independent banking (*INDB*). Perhaps, the notion of persistence in banking relationship would answer the question as it appears that the persistent firms, irrespective of whether strategically important to the holding group or not, appear to opt for a collective relationship banking. In this context, one should also make a clear distinction between qualities perceived via its survival in the business, i.e. *AGE*, which and via its strategic position within the holding group, i.e. *OWN*. The former is associated with the persistence whilst the latter reflects the strategic importance within the holding group. One may argue for the reverse causality whereby collective relationship banking enhances the survival of subsidiaries on average. It is plausible but there is no clear evidence for the argument as we do observe firms in collective relationship banking do go bankrupt or exit the market eventually.

Table 4.7 shows marginal effects at the mean after a logit estimation. Considering the probability of collective banking choice being more or less 50% as shown in Tables 4.2, 4.3 and 4.5, the predicted *Y* at the mean around 0.49 suggests population averaged logit and complementary log-log population averaged models are more appropriate for the data than random effects model. The marginal effects look relatively larger in the logit model but we consider the results from the population averaged logit and the complementary log-log population averaged model as more reliable given the poor predictability of random effects logit. We also notice that the marginal effects are generally very small which can be explained by the small size coefficients.

Having investigated the collective relationship banking in general without any dummy variables, the firm creation dummy for takeovers and mergers (*TM*) is included in the analysis and the results are presented in Table 4.8. The coefficient signs for the three main explanatory variables do remain the same and significant. Moreover, the coefficient of firm creation dummy (*TM*) is negative and statistically significant at 1% level. This result suggests that the firms became a subsidiary of the group via takeovers or mergers tend to be in independent banking as they may have remained with the relationship banking prior to becoming a group subsidiary. This makes us question the persistence in banking relationship. We discuss the persistence related results later in this section. Table 4.9 shows the marginal effects after the logit estimation with the firm creation dummy.

The industry dummy variables (*IND1-IND13*) and the firm creation dummy for take-overs and mergers (*TM*) are included in the analysis to detect industry

specific effect of collective banking behaviour and the results are presented in Table 4.10. As we have only one observation each in the mining industry (*IND1*) and the other public and private repair services (*IND13*), these two observations in *IND1* and *IND13* are dropped and the most representative industry of manufacturing (*IND2*) with over 30% of the firms in the sample, is used as a reference group. Since we have set the manufacturing sector as a reference group, the results on industry dummies should be interpreted in relation to the banking behaviour of the manufacturing sector. We also need to note that industry dummy variables are time invariant for the period of investigation. Therefore, only the population averaged models are presented in Table 4.10.

The coefficients on utilities (*IND3*) and sports and entertainment (*IND12*) show most significantly different from that of manufacturing (*IND2*). The results suggest that subsidiaries in these two industries are less likely to choose collective relationship banking than those in manufacturing. One can explain the reason why these industries differ from manufacturing or any other industries is that they are the industries related to the holding company not because of the natural core business link but because of the holding company' diversification. Obviously, those industries linked to the core business of manufacturing and sales of goods produced, would easily set up their relationship banking as the respective holding company does.

Although the coefficient of financial services and insurance (*IND9*) is insignificant in the population-averaged logit, it is significant in the complementary log-log population-averaged model with the take-overs and mergers (*TM*) dummy

variable.[149] The marginal effect of financial services and insurance (*IND9*) in Table 4.11 after the estimation of complementary log-log population-averaged model also shows significant. Otherwise, the results on individual subsidiary characteristics after including industry dummies are largely similar to what we saw in the previous models without the dummies. The rest of the industry dummies show no significant influence on the choice of collective relationship banking although most of them are marginally in the negative side, i.e. less likely to be in collective relationship banking compared to those firms in the manufacturing sector.

Another important point to make regarding Table 4.10 is the significant impact of firm creation dummy (*TM*) on the probability of collective relationship banking (*CRB*). Firms created via take-overs and mergers are less likely to have collective relationship banking since their previous banking relationships persist as discussed above for Table 4.8.

In the estimation with group dummy variables presented in Table 4.12, we find several significant coefficients. As in the estimation with industry dummies, the signs for three main explanatory variables, *OWN*, *NIAR*, and *AGE*, have not changed and they all remain significant. One immediate observation to make is that those significant group dummy variables have all negative signs. In other words, subsidiaries of these groups are less likely to adopt collective banking compared to those of Samsung group (*G14*). We could have expected this kind of result just by looking at Table 4.2 as Samsung group obviously stands out with 40 subsidiaries in

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[149] We do not consider a model with both industry dummies (*IND2-IND12*) and group dummies (*G1-G16*) since the estimation did not achieve convergence.

collective relationship banking (*CRB*) as opposed to 18 subsidiaries in independent banking (*INDB*). Perhaps, the effect of free-riding on group's reputation is more significant with Samsung (*G14*) as the subsidiaries can largely benefit from collective relationship banking as the group reputation is extremely high. On the other hand, the groups less likely to induce collective relationship banking compared to the reference group, are Daewoo (*G2*), Dongah (*G3*), Doosan (*G4*), Hyundai Motor (*G9*), Kumho (*G12*), LG (*G13*), and SK (*G15*). These groups seem to prefer full control over their subsidiaries allowing them to seek independent banking where it is possible. We also find the dummy variable of the firm creation via take-overs and mergers (*TM*) remain significant in Table 4.12.

As discussed earlier for the fixed effects model specification, firms seldom change their relationship banks whether it is collective (*CRB*) or independent (*INDB*). This strongly indicates that the banking relationship has persistence, i.e. state dependence in nature. Therefore, the three base models presented in Table 4.6 were extended to test the persistence of relationship banking by including the lagged dependent variable (CRB_{t-1}) and the results are presented in Table 4.13.

Although the lagged dependent variable of collective relationship banking is considered for the dynamic model, the results are reported only as a reference in the chapter since the lagged dependent variable captures most effects due to the persistence in the banking relationship as indicated. In other words, there is little dynamic change in the banking relationship. Therefore, we focus on the variants of standard logit models and complementary log-log models, i.e. population averaged models without the lagged dependent variable (CRB_{t-1}).

The results shown in Table 4.13 suggest that the choice of collective relationship banking is explained mostly by the lagged dependent variable of collective relationship banking, i.e. the state dependence exists. Firms are more likely to remain in the same banking relationship over time once they choose either collective relationship banking (*CRB*) or independent banking (*INDB*).

Although the dynamic consideration does not add much information as it is already clear that there is strong persistence in banking relationship with only 9 companies that switched the banking relationship. Nonetheless, this result from dynamic consideration reaffirms the importance of long-run banking relationship for information sharing and monitoring as discussed in the previous literature review section (see Ramakirshnan and Thakor, 1984; Allen, 1990). The persistence of long-term collective banking relationship appears to be driven by the accumulation of private information as credit ratings for bank loans are cumulative with which long-term customers are offered preferential loan rates. It is also important to note that all other variables are now insignificant as the persistence variable captures all effects.

In order to test the robustness of the results in Table 4.13, a cross-sectional logit estimation was conducted for each year and the results are shown in Table 4.14. There are marginal changes in coefficients and their significance over time. However, generally the signs of each coefficient remain the same except for the net income to asset ratio (*NIAR*) of which the significant coefficients coincide with the results from logit estimation of the panel shown in Table 4.6. This robustness test reaffirms no significant dynamic fluctuation but a strong persistence in relationship banking instead.

Although the results from different estimation models emphasise rather different aspects of banking relationship, they can be summarised into the following representative arguments.

First, the level of holding companies' vertical ownership interests (*OWN*) in subsidiaries affects the respective subsidiaries' choice between collective relationship banking (*CRB*) and independent banking (*INDB*). Those with relatively smaller stake of holding companies are more likely to choose collective relationship banking to benefit from the group bargaining and indirect monitoring given the lack of outside options.

Second, the profitability of firms (*NIAR*) is positively associated with the choice of collective relationship banking (*CRB*) as they are one of the most commonly used criteria for loan approval.

Third, the age of firm (*AGE*) is also positively associated with the choice of collective relationship banking indicating that the reputation of firms' survival and/or resilience matters for collective relationship banking (*CRB*).

Fourth, the industry where firms belong to has an impact on the firm's choice of banking relationship. Industries that are not so closely related to the core business of holding companies' manufacturing and sales of products tend to choose independent banking (*INDB*).

Fifth, the banking relationship is not a subject of static investigation as most of the above static consideration appears to be captured by the state dependence. The choice of collective relationship banking (*CRB*) is more likely to be maintained over time once the firm establishes a relationship with a bank.

Sixth, there are group specific effects (*G1-G16*) on the choice between collective banking and independent banking. Some group subsidiaries are more likely to choose collective relationship banking (*CRB*) whilst other group subsidiaries to choose independent banking (*INDB*)

Finally, the way that a firm is created matters especially when the relationship banking remains with the former relationship bank in case of takeovers and mergers.

4.7 Case Study on Switching Banking Relationship

Although the number of companies that switched their relationship banking during the sample period is extremely small, investigating these 9 companies out of total 323 companies in the sample as in Table 4.2 and 4.3 appears to be an interesting and useful exercise. The previous analyses so far in the chapter, sufficiently explain the reasons why subsidiary firms choose collective relationship banking instead of independent banking in the static framework. However, the case studies on those switched the banking relationship add value in the dynamic sense and suggest future research opportunities as switching of banking relationship increases.

Due to the limited number of companies that switched banking relationship, it is impossible to find any appropriate econometric specification to bring out the particular characteristics and generalise them.[150] We have already noted from the previous sections that neither the fixed effects logit model nor the path dependent

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[150] All the econometric specifications are applied to the sub-sample of those 9 companies which switched banking relationship. However, none of the results show any significance as expected due to the small number of observations.

models in the dynamic sense could explain much about the banking behaviour over time. Therefore, the following case studies were carried out to detect any idiosyncratic characteristics in the firms that switched banking relationship. However, one should look at these studies as only individual firm specific cases are without making any premature generalisation.

There were 9 companies in total who switched their banking relationship during the sample period: (a) 6 companies switched from independent banking (*INDB*) to collective relationship banking (*CRB*); whilst (b) 3 companies switched the other way around. Although it is difficult to find a clear pattern that separates those who switched from independent banking (*INDB*) to collective relationship banking (*CRB*) and *vice versa*, a descriptive summary of the 9 companies was produced for an overview in Table 4.15 and the individual cases are discussed further here.

In attempt to find out any common factors for switching in banking relationship, some of the frequently used benchmark factors for credit rating are used as summarised in Table 4.15: (a) the historic profitability of the firm prior to the switch, i.e. *NIAR* prior to the switch; (b) the average profitability of the firm prior to the switch, i.e. average *NIAR*; (c) the average vertical ownership stake by the holding company prior to the switch, i.e. average *OWN*; (d) the firms age as of 2002, i.e. *AGE*; (e) the group holding company that they belong to, and (f) the industry sector that they belong to. These factors are based on an extension of the key explanatory variables used in the previous models.

The first thing to notice from Table 4.15 is that these firms are not running a profitable business given the predominantly negative net income to asset ratios (*NIAR*). Furthermore, their business environments are deteriorating or remain extremely bad prior to the switch in many cases as shown in their *NIAR* movement. Given the persistence of banking relationship, it seems natural to observe switching cases when the business is deteriorating or uncertain. This is often the time when firms seek for more project financing and hence search around for alternatives and switch for the better and/or the best.

It seems difficult to form any opinion with respect to the holding companies' ownership levels as they range between 2.58% and 100% without any particular pattern. However, the age factor seems to suggest that younger companies are more likely to switch as all but one are below the average firm age of 18 and they rather noticeably skewed towards left (younger firms) given the age range between 0 and 71. One could also argue that firms in the early stage of business development can shop around for the better fit in terms of loans and project finance.

For group and industry specific effects, it would be inappropriate to comment as they are only a few firms in the respective groups or industries. Although LG group and manufacturing sector appear to be more frequent than others, a large number of firms in LG group and the manufacturing sector suggest that they should be investigated as individual firm specific cases.

4.7.1 Switching from INDB to CRB

This section briefly reviews the background of the 6 individual firms which switched their banking relationship from independent banking (*INDB*) to collective relationship banking (*CRB*). The discussion hereunder mainly focuses on the further firm specific factors that are not discussed in the above section such as the background of the firm establishment although we have already touched upon takeovers and mergers: (a) a new firm created; (b) a firm taken over by another firm via mergers and acquisitions (M&As), and (c) a firm created via spin-off or de-mergers. We will also discuss any other idiosyncratic firm characteristics.

Case 1.1: Keoyang Shipping Co., Ltd. (ID78)

This firm is a relatively young shipping company established only in 1990 and has subsequently made a rapid expansion by purchasing a series of large vessels between 1990 and 1995 but it was taken over by Hanjin group in 1995. Since the takeover, the company went through a substantial restructuring and consolidation by closing down redundant businesses. The switching into collective relationship banking (*CRB*) appears to be encouraged by the takeover.

One can also argue that the shipping industry is the industries running at high setup costs, e.g. purchasing of large vessels and such heavy financial requirements may make collective relationship banking more favourable. Financial constraints are common problems for companies like Keoyang Shipping Co. as they are not big enough. Although this company is classified as a large company by Financial

Supervisory Commission (FSC) employing about 200 people, it has only about US$70mn equivalent of paid-in-capital in operating a revenue of US$220mn as of 2003 end with assets worth of US$300mn approximately.

These financial problems can get much worse especially when the company does not have enough internal financial resources whilst its business heavily relies upon what is happening in the world economy and the imports and exports in and out of Korea. It is an impossible task for a newly established shipping company to predict the world business cycle and acquire new vessels in advance at substantial financial costs. One could easily detect signs of problems in their financial statements as some of their long-term borrowings were replaced by various short-term borrowings.

Case1.2: Hyosung Ebara Environment Engineering Co., Ltd. (ID95)

It is a reasonably young environmental engineering company that was established for recycling wastes and construction of related facilities in 1997. It is also classified as a large company (according FSC) although it only employs about 70 people with a paid-in-capital of US$6mn equivalent. Their asset size is relatively small at US$12.5mn for a firm currently generating revenues of about US$25mn. One concern for this company is that the financing is mostly in short-term borrowings when it does not make much profits or even make losses. On the other hand, its business is mainly in construction of waste processing facilities and pollution protection equipments that is considered to be a rather specialised field.

This firm is a joint-venture establishment between Hyosung Engineering in Korea and Ebara Environment Engineering in Japan. It is not listed on the Korean Stock Exchange (KSE) but adopts external auditing.

From the available information on this company, the only thing that can be deduced here is the joint-venture setup with a Japanese partner influencing the switch and the peculiarity of the business in waste processing that lenders find difficult to evaluate the fair value of their projects. Having emphasised the importance of monitoring and sharing private information in banking in the long-run, this company certainly does not provide enough private information in the long-run.

Case 1.3: LG Cable Co., Ltd (ID155)

Unlike the other switched firms listed in Table 4.15, this firm is a relatively old firm at 33 years, that has experienced major restructuring over time. Initially there was a manufacturer of basic electrical cables that was established 1962 and was taken over by the LG group in 1966. Since then, there has been a series of mergers within the group and the current form of the establishment was set in 1969. In the early 1990s the company started to transform into an international firm by investing in a British firm, Heat Trace, and setting up joint-ventures in various locations in Asia such as Malaysia, Vietnam, and China. It seems that a series of such major expansion led the company to switch relationship banking into CRB.

In addition to the age of the firm, most of the firm characteristics differ from the rest of the switched firms. It is a truly large company listed on the KSE employing over 3,300 people. With a paid-in-capital of US$134mn, the company has

assets of US$1.6bn with the current revenues of US$1.6bn. It also has shown rather steady profits in the long-run from its basic electrical cable manufacturing and sales. The financial statement looks even more different from others as it has a well-diversified portfolio of borrowings including overseas loans, short-term and long-terms. Perhaps it is worth mentioning that its short-term borrowing accounts for a relatively small proportion.

In spite of all the normality in business prospects and the long-term reputation, the only reason for switching into *CRB* seemed to be the major overseas expansion and its financing.

Case 1.4: LG Energy Co., Ltd. (ID163)

This firm is a power generation company involved in both electricity and gas. It was established in 1996 by public funding and went into joint-venture with Powergen (British) in 1999 but Powergen withdrew its stake in 2000 leaving LG group as a major shareholder whilst its expansion in Bugok Combine Cycle in Korea was in progress. Shortly after this event, its relationship banking has been changed in 2001 and project financing long-term corporate bonds were issued. Withdrawal of Powergen's stake in little over a year appears to be a negative factor for the firm and did not have any other option. It seems natural to switch into collective relationship banking when financing projects becomes difficult after Powergen's departure as issuing corporate bonds need strong guarantors or collaterals.

In terms of other firm characteristics, this firm is also classified as a large company by the KSC with 1/ a paid-in-capital of US$99mn; 2/the current revenues

of about US$126, 3/ its assets worth of US$340mn although it employs only 73 people. Perhaps the reason why the firm hires a relatively small number of people for the given size of assets and capital is that the power generation sector is very much capital intensive. It is also interesting to note that the company relies only on long-term borrowings and avoids short-term loans.

The above firm characteristics make the argument for the departure of foreign partner, Powergen, much stronger.

Case 1.5: Dacom Multimedia Internet Co., Ltd. (ID168)

This firm was established as a result of spun-off from LG Traffic Information Inc. in 1999. It is an internet multimedia service company which had an extremely bad start as the band-wagon effect of internet business has finally started to show negative signs.

It is classified as a large company by the KSC employing about 120 people and currently generates about US$20mn in revenues with a paid-in-capital of US$4mn and the assets worth of US$12.5mn. In terms of the industry where the firm is operating in, one should note that there was a rush into internet multimedia at the turn of the millennium as it was perceived as a lucrative business with little capital. Hence, the industry was over-crowded in no time and has experienced a bit of reshuffling via several takeovers and exits.

Although no further information is available for the breakdown of the firm's borrowings, it must have been in trouble securing loans given the negative business

environment of internet multimedia services and hence seemed to have switched the banking relationship into CRB.

Case 1.6: Samsung Investment Trust Management Co., Ltd. (ID238)

There has been a series of mergers between Samsung Investment Trust, JP Morgan, Tongyang Investment Trust, Samsung Securities, Samsung Life Insurance since long and finally Samsung Investment Trust Management was named in 2000. Immediately after that, its banking relationship was switched to collective relationship banking in 2001.

This firm is classified as a large company employing over 160 people with a paid-in-capital of about US$78mn. The firm currently generates about US$47mn in revenues and has assets worth of US$110mn approximately.

A Brief Summary of Cases 1.1 to 1.6

Having investigated the above 6 companies that switched its banking relationship from independent banking (INDB) to collective relationship banking (CRB), one could easily draw an argument that one of the important factors which influences switching of banking relationship is corporate restructuring either through mergers and acquisitions, takeovers, or de-mergers or sales of the stake. In particular, foreign partners' level of stake seems to play an important role in switching the banking relationship. We also find that firms in the capital intensive industries are more likely to switch their banking relationships when faced by financial difficulties.

4.7.2 Switching from CRB to INDB

This section reviews the background of the 3 individual firms which switched their banking relationship from collective relationship banking (*CRB*) to independent banking (*INDB*). As in the cases of switching from *INDB* to *CRB*, the discussion focuses on the further firm specific factors such as the background of the firm establishment. Moreover, the section tries to discuss what causes the difference in switching direction: (a) from *INDB* to *CRB*; and (b) from *CRB* to *INDB*.

Case 2.1: Hyosung Ino Tech Co., Ltd. (ID87)

The company was established as a joint-venture between Hyosung and Dryvit System Inc. (US) in 1987. However, the Hyosung group took over the stake from Dryvit System in 1994 and has subsequently changed its name from Hyosung Dryvit Co., Ltd. to Hyosung Ino Tech Co., Ltd.. The main business is in producing insulation and sound-proof panels.

The firm is classified as a large company by the KSC employing about 40 people with a paid-in-capital of US$1.9mn. It currently generates US$19.4mn and has assets worth of US$12mn.

A couple of points can be made as to why the banking relationship has changed. First, the firm made losses for two consecutive years which suggests it can not be the most favourite borrower for banks. Second, since the entire stake was taken over by the group after the departure of Dryvit System Inc. (US), there must

have been mixed concerns over why the US partner had to sell its stake. A positive scenario is that the business was too good for Hyosung to leave with the US partner. Therefore, the stake was bought back into the group. But a negative scenario more plausible that the US partner sees no prospects with the Korean partner and sells its stake especially when the Korean domestic construction industry is depressed. As a piece of evidence, the company recorded 5 consecutive years of profit decline prior to the switch and has been heavily relying on short-term borrowings.

Case 2.2: Hyosung Ebara Co., Ltd. (ID94)

This is a manufacturing company of pump related products including energy pipes for nuclear and hydropower generation. It was established with foreign capital in 1989 and merged into Hyosung group in 1995. Yet again, the change in foreign capital seems to have triggered the switching of banking relationship.

The firm is classified as a large company externally audited but without listing on the KSE. It employs over 190 people with a paid-in-capital of about US$15mn and generates US$55mn in revenues with assets worth of US$42mn.

The firm has earned a reputation for its special technology in high-tech pumps and pipes benefiting from the expertise of its foreign partners, Ebara in Japan and Flowserve in the US. Given the reputation, the company has the largest market share in Korean pumps and pipes at over 30%. However, its profitability has not been as impressive as its reputation in technology and market share alternating between small profits and losses.

It is worth noting that the above two companies' switching cases seem to be affected by the departure of foreign partners coupled with their subsequently deteriorating profitability.

Case 2.3: Care Camp.Com Co., Ltd. (ID223)

The company provides online pharmaceutical/medicare information services and retail/wholesale of pharmaceutical/medical products. Two things to notice here: 1/ for such a young company, it made a positive net income to asset ratio (*NIAR*) after only one year of establishment only to be followed by losses, and 2/ the industry is not a part of mainstream business of the group but a mere dotcom trial.

It is classified as a large company by the KSC employing over 40 people with a paid-in-capital of about US$8mn. The firm currently generates about US$51mn in revenues and as assets worth of US$26mn. However, the company does not seem to have reached steady profits.

A Brief Summary of Cases 2.1 to 2.3

With only 3 firms in this case of switching from CRB to INDB, it becomes even more difficult to make any conclusive remarks on the switching. However, the changes in the foreign stake seem to definitely have an impact on the changes in banking relationship. With the recent liberalisation of foreign ownership in the local Korean companies, we expect to see more firms with a foreign stake and the degree

of foreign ownership will provide an interesting topic to further investigate for banking relationship.

4.8 Conclusions

This chapter identified main factors determining banking relationship between firms and banks which are about reducing the asymmetric information gap. Lenders are believed to be not always in a position to know the true state of their borrowers' quality of investment projects. Banks often look for this information indirectly via the vertical relationship between borrowers whereby holding companies undertake the responsibility of delegated monitoring. This indirect monitoring becomes more useful when the information is not fully revealed and/or uncertain.

The results from the econometric models provide evidence that subsidiaries with relatively smaller stake by holding companies are more likely to choose collective relationship banking as it allows indirect monitoring via holding companies. Indirect monitoring plays a crucial role when firms do not have any outside option regarding whom to borrow from as it enhance information level to lenders with holding companies' indirect monitoring. For that reason, collective relationship banking seems to be a preferred choice.

Positive scores in usual credit rating criteria such as firms' profitability and reputation seem to work in favour of collective relationship banking as they can only reinforce the bargaining for preferential rates in a collective sense. There is also evidence for industry specific effects on the choice of relationship banking.

However, above all, the persistence of collective relationship banking (CRB) appears to be one of the most significant factors suggesting that accumulation of private information overtime through the long term relationship matters most.

Given the concern over further banking crises in the global context, the results confirm that long-term relationship banking provide advantages and disadvantages for both borrowing firms and lending banks. If the indirect monitoring mechanism is working well as suggested in the literature, banks can avoid unnecessary risks of relationship loans. However, if indirect monitoring is not working well, alternative ways are needed to compensate the ailing private monitoring. As attention paid to private sector corporate governance has increased following the recent scandals such as Enron and Worldcom, indirect monitoring needs further regulatory consideration.

On the other hand, the main results driven by monitoring borrower risks and accumulating private information raises additional concern with respect to small and medium size enterprises (SMEs) that do not belong to large holding companies' network. These SMEs are often in less profitable businesses and have no reputation due to the size and the age of the firm, as result it is difficult for them to find reasonable banks with appropriate loan conditions especially, when the economy is in a downturn.

This chapter uses a unique approach in linking the vertical relationship in the real sector (*non-financial firms*) and their banking behaviour in order to broaden the scope of relationship based monitoring in banking. From a policy perspective, there has been a series of debates regarding vertical integration and restraints in many

industries. However, the policy makers approach towards an abuse of market power needs careful consideration given the above idiosyncratic feature in relationship banking and monitoring.

The chapter tried to shed some light on feasible ways for regulators and/or banks to remedy imperfect information in this context. I would not argue for major reform of policy but would like to provide some economic rationale for a new direction in the event of changing structure of conglomerates and associated banking industry structure when relationship banking is prevailing irrespective of whether they are collective or independent.

Appendix

Figure 4.1 Overview of Banking Relationship

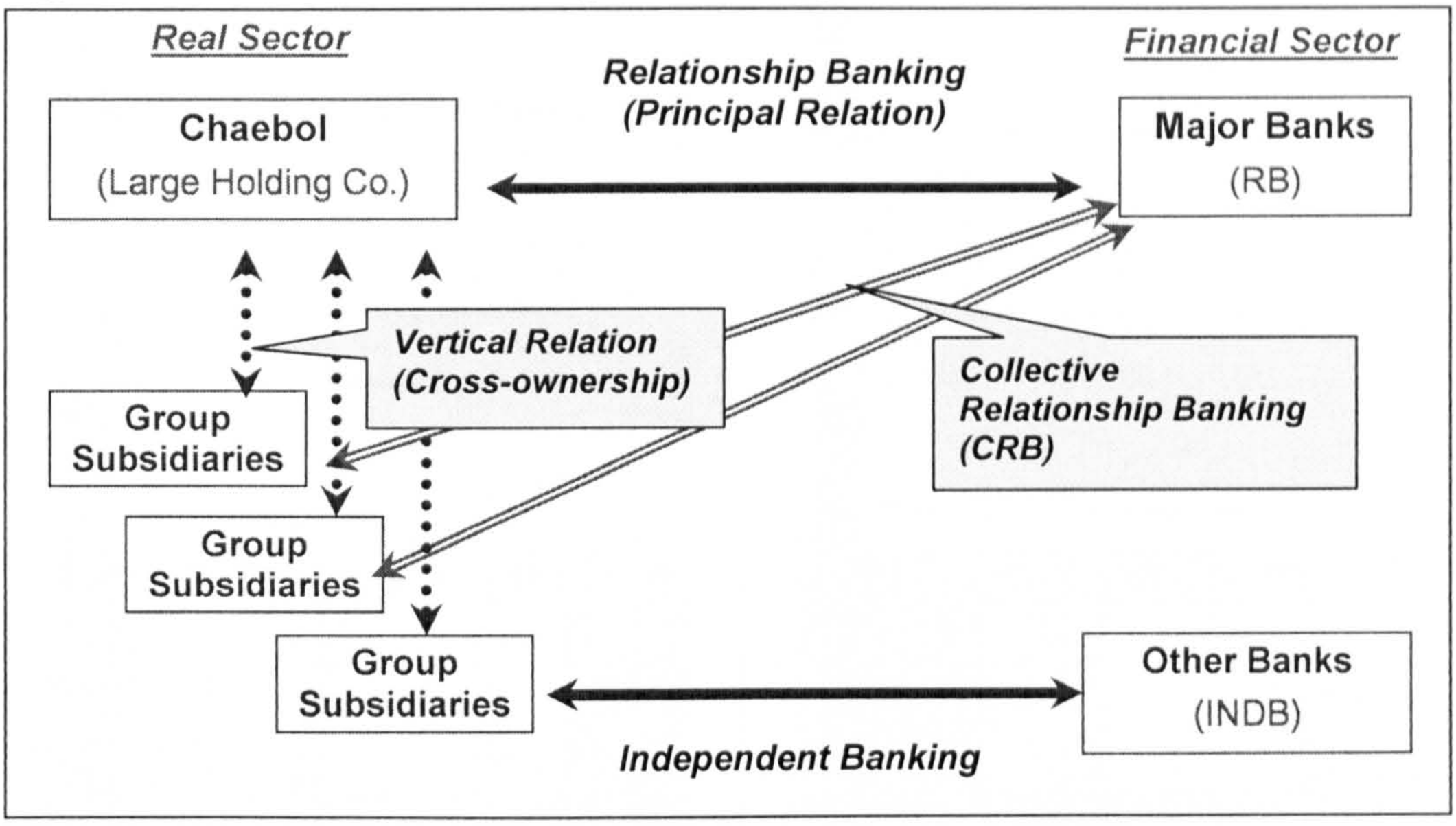
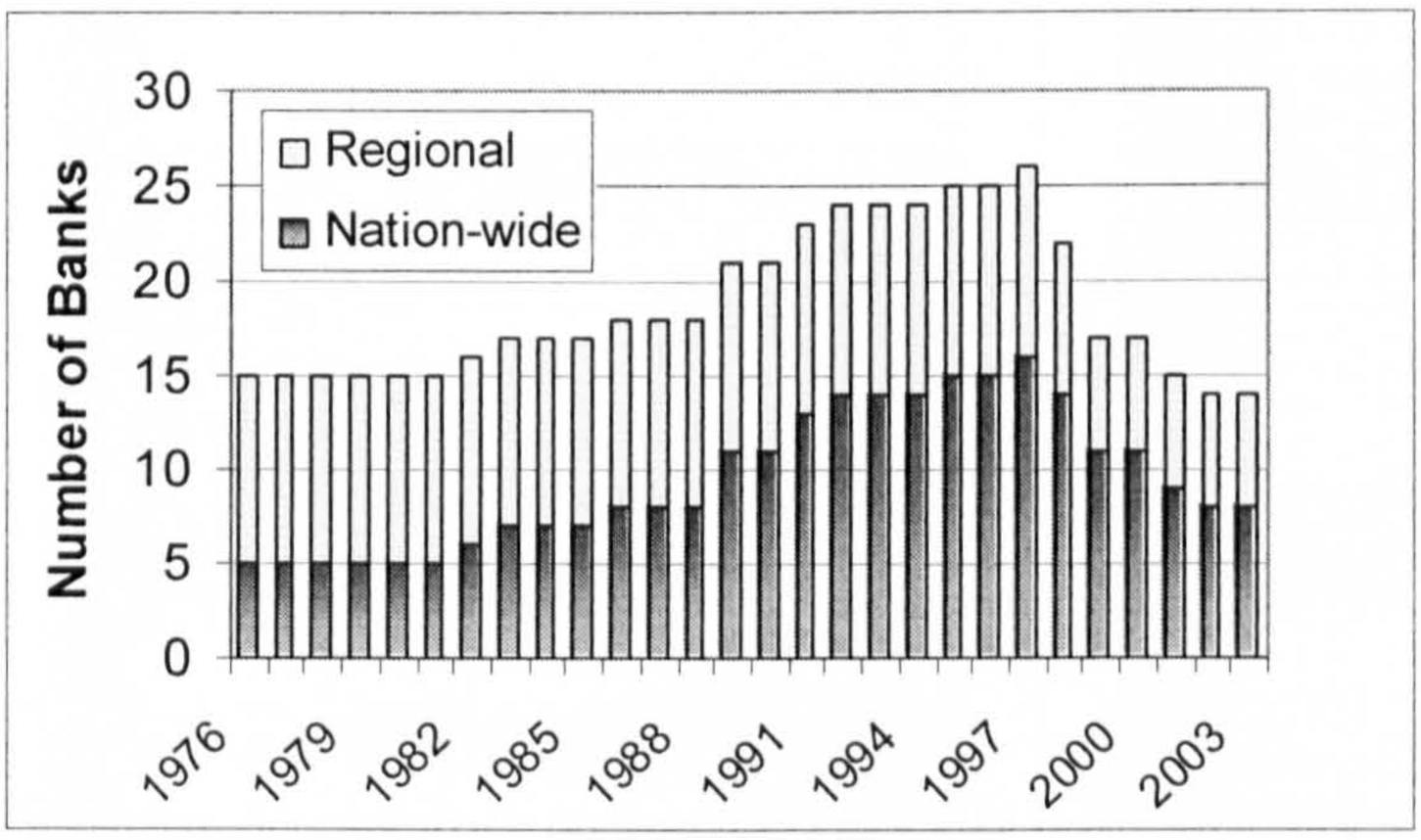


Figure 4.2 Commercial Banks in Korea



Source: Financial Supervisory Service

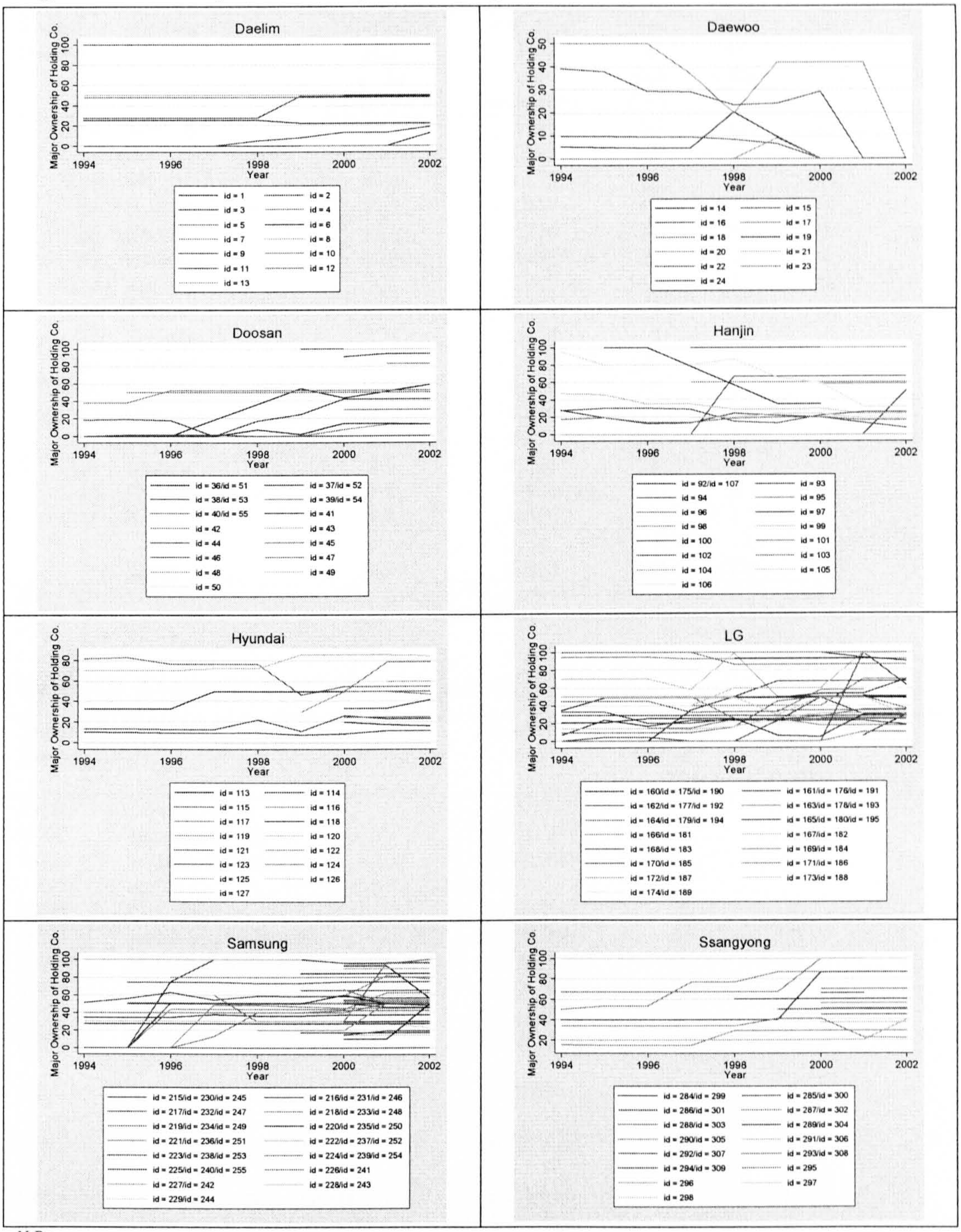
Table 4.1 Number of Commercial Banks in Korea

Korean Banks	***Dec-76***	***M&A***	***R***	***T***	***A***	***Peak Dec-97***	***Dec-03***
Nationwide	5	-9	0	+3	+9	**16**	**8**
Regional	10	-4	0	0	0	**10**	**6**

N.B: M&A: mergers and acquisition; R: revocations; T: transformations; A: authorisation of new entities.

Source: Financial Supervisory Service

Figure 4.3 Examples of Group Ownership Fluctuation



N.B.:

1) *The figures show the fluctuation of holding companies' ownership in their respective subsidiaries over time, which does not indicate any particular trend.*
2) *Given the space, not all the groups or subsidiaries are presented in the figure.*

Table 4.2 Overview of Companies by Group

Group Dummy	*Holding Co.*	*Total Asset Size of the Holding Co.*	*Avg Asset Size per Subsidiary*	*No. of Sub' Co's*	*No. of CRB*	*No. of INDB*	*No. of SW*
G14	Samsung	71.9	1.198	60	40	18	2
G13	LG	58.1	1.186	49	15	31	3
G15	SK	43.4	0.835	52	14	38	-
G9	Hyundai Motor	42.9	2.258	19	9	10	-
G6	Hanjin	24.0	1.714	14	10	3	1
G5	Hanhwa	10.3	0.468	22	18	4	-
G12	Kumho	9.9	0.762	13	3	10	-
G4	Doosan	8.5	0.447	19	5	14	-
G8	Hyundai	7.0	0.636	11	7	4	-
G3	Dongah	6.7	1.117	6	2	4	-
G16	Ssanyong	5.3	0.331	16	9	7	-
G2	Daewoo	4.9	0.445	11	2	9	-
G7	Hyosung	4.9	0.377	13	6	4	3
G1	Daelim	4.6	0.354	13	7	6	-
G10	Hyundai Oil	3.8	1.900	2	2	-	-
G11	Kohap	1.8	0.600	3	1	2	-
	Total	**308.0**	**0.954**	**323**	**150**	**164**	**9**

N.B.: Asset size in trillion Korean won as of Dec. 2002 & the No. of subsidiaries throughout the sample period.

Source: Financial Supervisory Service & Korea Information Service

Table 4.3 Company Breakdown by Industry

Industry Dummy	*Industry*	*No. of Co's (%)*	*No. of CRB*	*No. of INDB*	*No. of SW*
IND1	Mining	1 (0.3%)	-	1	-
IND2	Manufacturing	101 (31.3%)	55	43	3
IND3	Utilities (electricity, gas, water, etc.)	16 (5.0%)	1	14	1
IND4	Construction	17 (5.3%)	8	8	1
IND5	Retail and wholesale	30 (9.3%)	16	13	1
IND6	Hotel and food service	7 (2.2%)	3	4	-
IND7	Transportation	29 (9.0%)	15	13	1
IND8	Telecommunication	11 (3.4%)	3	7	1
IND9	Financial services and insurance	38 (11.8%)	15	22	1
IND10	Real estate conveyance and leasing	3 (0.9%)	1	2	-
IND11	Business and research support and service	56 (17.3%)	31	25	-
IND12	Sports and entertainment	13 (4.0%)	1	12	-
IND13	Other public and private repair services	1 (0.3%)	1	-	-
	Total	**323 (100%)**	**150**	**164**	**9**

N.B.: Estimations with the industry dummy variables had dropped the observations in IND1 and IND13 due to the sample size in the sub-group.

Source: Korea Information Service

Table 4.4 Description of Variables

Variables	*Type*	*Operational Definition*
Dependent Variable		
CRB	B/D	1 = Collective relationship banking; 0 = otherwise
Independent Variables		
OWN	L/C	Major shareholding by the group company (%)
NIAR	C	Net income to asset ratio
AGE	L/C	Age of the company
Industry Dummies		
IND1	B/D	1 = mining; 0 = otherwise
IND2	B/D	1 = manufacturing; 0 = otherwise
IND3	B/D	1 = Utilities (electricity, gas, water, etc.); 0 = otherwise
IND4	B/D	1 = construction; 0 = otherwise
IND5	B/D	1 = retail and wholesale; 0 = otherwise
IND6	B/D	1 = hotel and food service; 0 = otherwise
IND7	B/D	1 = transportation; 0 = otherwise
IND8	B/D	1 = telecommunication; 0 = otherwise
IND9	B/D	1 = financial services and insurance; 0 = otherwise
IND10	B/D	1 = real estate conveyance and leasing; 0 = otherwise
IND11	B/D	1 = business and research support and service; 0 = otherwise
IND12	B/D	1 = sports and entertainment; 0 = otherwise
IND13	B/D	1 = other public and private repair services; 0 = otherwise
Group Dummies		
G1	B/D	1=Daelim; 0=otherwise
G2	B/D	1=Daewoo; 0=otherwise
G3	B/D	1=Dongah; 0=otherwise
G4	B/D	1=Doosan; 0=otherwise
G5	B/D	1=Hanhwa; 0=otherwise
G6	B/D	1=Hanjin; 0=otherwise
G7	B/D	1=Hyosung; 0=otherwise
G8	B/D	1=Hyundai; 0=otherwise
G9	B/D	1=Hyundai Motor; 0=otherwise
G10	B/D	1=Hyundai Oil; 0=otherwise
G11	B/D	1=Kohap; 0=otherwise
G12	B/D	1=Kumho; 0=otherwise
G13	B/D	1=LG; 0=otherwise
G14	B/D	1=Samsung; 0=otherwise
G15	B/D	1=SK; 0=otherwise
G16	B/D	1=Ssangyong; 0=otherwise
Firm Creation Dummy		
TM	B/D	1=Taken over or Merged; 0=otherwise

N.B.: Binary (B), Likert (L), Continuous (C), and Discrete (D)

Table 4.5 Summary of Descriptive Statistics

Variables	*Mean*	*Std. Dev.*	*Min*	*Max*
Dependent Variable				
CRB	.516	.500	0	1
Independent Variables				
OWN	33.159	32.055	0	100
NIAR	-.768	21..498	-479.26	372.46
AGE	17.827	14.208	0	72
Industry Dummies				
IND1	.004	.064	0	1
IND2	.341	.474	0	1
IND3	.056	.230	0	1
IND4	.063	.243	0	1
IND5	.091	.288	0	1
IND6	.025	.155	0	1
IND7	.085	.279	0	1
IND8	.022	.147	0	1
IND9	.125	.331	0	1
IND10	.010	.099	0	1
IND11	.135	.342	0	1
IND12	.040	.195	0	1
IND13	.002	.042	0	1
Group Dummies				
G1	.037	.190	0	1
G2	.039	.193	0	1
G3	.023	.148	0	1
G4	.056	.230	0	1
G5	.071	.257	0	1
G6	.051	.221	0	1
G7	.041	.198	0	1
G8	.036	.187	0	1
G9	.055	.228	0	1
G10	.008	.090	0	1
G11	.009	.094	0	1
G12	.045	.207	0	1
G13	.154	.361	0	1
G14	.173	.378	0	1
G15	.149	.357	0	1
G16	.053	.223	0	1
Firm Creation Dummy				
TM	.305	.461	0	1

Number of companies:	$i = 1,\ldots, 323$
Number of years:	$t = 1,\ldots, 9$
Total number of observation (unbalanced panel):	$NxT = 2222$

N.B.: Some of the figures may differ from those in Tables 4.2 & 4.3 as they were constructed from the firm-level cross-sectional data whilst Table 4.5 is based on the entire panel N x T.

Table 4.6 Binary Choice Models for Collective Relationship Banking (*CRB*)

Dependent Variable: (CRB)	*Random Effects Logit*		*Population Averaged Logit*		*Complementary Log-log Population Averaged*	
	Coef (S.E)	*Z*	*Coef (S.E)*	*Z*	*Coef (S.E)*	*Z*
OWN	-.024	-2.43**	-.001	-2.17**	-.001	-2.13**
	(.009)		(.000)		(.000)	
NIAR	.009	1.67*	.001	2.20**	.001	2.12**
	(.006)		(.000)		(.000)	
AGE	.020	0.96	.008	3.68***	.006	3.64***
	(.021)		(.002)		(.002)	
Constant	.639	1.00	-.154	-1.33	-.479	-5.55***
	(.642)		(.116)		(.086)	
$\chi^2(3)$	11.65**		21.03***		20.24***	
Log likelihood	-308.11					
No. of groups	323		323		323	
No. of obs	2191		2191		2191	

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*
N.B.: Due to the missing values in NIAR, the total number of observations is 2191 instead of 2222

Table 4.7 Marginal Effects after the Binary Choice Estimations

Dependent Variable: (CRB)	*Random Effects Logit (dy/dx)*	*Population Averaged Logit (dy/dx)*	*Complementary Log-log Population Averaged (dy/dx)*
OWN	-.0059**	-.0003**	-.0003**
NIAR	.0023*	.0002**	.0002**
AGE	.0050	.0021***	.0020***
Y predicted at the mean	.202	.490	.489

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

Table 4.8 Population Averaged (PA) Models with Take-over and Merger Dummy (TM) Variable

Dependent Variable: (CRB)	*Population Averaged (PA) Logit*		*Complementary Log-log Population Averaged(PA)*	
	Coef (S.E)	*Z*	*Coef (S.E)*	*Z*
OWN	-.0009	-2.22**	-.0006	-1.99**
	(.0004)		(.0003)	
NIAR	.0007	2.52***	.0004	2.40***
	(.0003)		(.0002)	
AGE	.0079	3.94***	.0053	3.84***
	(.0020)		(.0014)	
TM	-1.0518	-4.24***	-.7775	-4.00***
	(.2479)		(.1942)	
Constant	.1986	1.41	-.2372	-2.45***
	(.1408)		(.0970)	
$\chi^2(4)$	41.89***		40.46***	
Log likelihood				
No. of groups	323		323	
No. of obs	2191		2191	

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*
N.B.: Due to the missing values in NIAR, the total number of observations is 2191 instead of 2222

Table 4.9 Marginal Effects after the PA Estimation with TM Dummy Variable

Dependent Variable: (CRB)	*Population Averaged Logit (dy/dx)*	*Complementary Log-log Population Averaged (dy/dx)*
OWN	-.0002**	-.0002**
NIAR	.0002***	.0001***
AGE	.0020***	.0018***
TM	-.2543***	-.2492***
Y predicted at the mean	.497	.489

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

Table 4.10 PA Models with Industry and TM Dummy Variables

Dependent Variable: (CRB)	*Population Averaged Logit*		*Complementary Log-log Population Averaged*	
	Coef (S.E)	*Z*	*Coef (S.E)*	*Z*
OWN	-.0011 (.0005)	-2.11**	-.0008 (.0003)	-2.49***
NIAR	.0007 (.0003)	2.02**	.0004 (.0002)	2.06**
AGE	.0090 (.0025)	3.56***	.0054 (.0014)	3.87***
IND3	-2.9040 (1.0314)	-2.82***	-2.4538 (1.0437)	-2.35***
IND4	-.2765 (.5233)	-.53	-.1904 (.3698)	-.51
IND5	-.0370 (.4163)	-.09	-.1123 (.2911)	-.39
IND6	-.5500 (.7849)	-.70	-.6576 (.6146)	-1.07
IND7	-.1362 (.4210)	-.32	-.0566 (.2918)	-.19
IND8	-.5799 (.6479)	-.90	-.3676 (.4817)	-.76
IND9	-.5993 (.3841)	-1.56	-.6540 (.2930)	-2.23**
IND10	-.9670 (1.2375)	-.78	-1.0048 (1.0165)	-.99
IND11	.0855 (.3352)	.25	-.0546 (.2302)	.24
IND12	-2.8567 (1.1018)	-2.59***	-2.3049 (1.0524)	-2.19**
TM			-.7758 (.1991)	-3.90***
Constant	.1451 (.2043)	.71	-.0146 (.1523)	.10
	$\chi^2(13)=36.32$***		$\chi^2(14)=55.49$***	
No. of groups	321		321	
No. of obs	2178		2178	

Standard errors are in the parentheses.
,,*** Z-values significant at the 5%, 2.5%, and 1% levels respectively*
,,*** χ^2 -values significant at the 5%, 1%, and 0.1% levels respectively*

N.B.:

1) *Only the population averaged effects are estimated as industry dummies are time invariant.*
2) *As industries with only on firm observation (IND1 and IND13) are dropped, the total number of observation is 2178 instead of 2191.*
3) *For the inclusion of a firm creation dummy (TM),only the result of complementary log-log population average is presented due to a non-convergence in population average logit.*

Table 4.11 Marginal Effects after the PA Estimations with Industry and TM Dummy Variables

Dependent Variable: (CRB)	*Population Averaged Logit (dy/dx)*	*Complementary Log-log Population Averaged (dy/dx)*
OWN	-.0003**	-.0003***
NIAR	.0002**	.0002**
AGE	.0022***	.0018***
IND3	-.4566***	-.4403***
IND4	-.0727	-.0605
IND5	-.01414	-.0363
IND6	-.1362	-.1856
IND7	-.0387	-.0185
IND8	-.1429	-.1116
IND9	-.1489	-.1914****
IND10	-.2218	-.2554
IND11	.0162	.0181
IND12	-.4421***	-.4160***
TM	-	-.2372***
Y predicted at the mean	.467	.451

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

Table 4.12 PA Model with Group and TM Dummy Variables

Dependent Variable: (CRB)	*Population Averaged Logit*		*Marginal Effects at the mean $\overline{X}$ (Y=.5026)*
	Coef (S.E)	*Z*	*dy/dx*
OWN	-.0012	-1.84*	-.0003*
	(.0007)		(.0002)
NIAR	.0008	1.83*	.0002*
	(.0004)		(.0001)
AGE	.0101	3.16***	.0025***
	(.0032)		(.0008)
G1	-.5404	-.83	-.1324
	(.6484)		(.1527)
G2	-2.5671	-2.93***	-.4482***
	(.8753)		(.0770)
G3	-2.1848	-2.37***	-.4084***
	(.9201)		(.0968)
G4	-1.8748	-3.06***	-.3808***
	(.6122)		(.0852)
G5	.5292	.84	.1297
	(.6329)		(.1493)
G6	-.0484	-.07	-.0121
	(.6882)		(.1720)
G7	.0121	.02	.0030
	(.66648)		(.1662)
G8	-.6507	-.93	-.1580
	(.6961)		(.1594)
G9	-.8254	-1.49	-.1974
	(.5526)		(.1214)
G10	5.7981	.33	.0506
	(17.4377)		(.0642)
G11	-2.0480	-1.63	-.1390
	(1.2562)		(.1358)
G12	-2.4392	-3.34***	-.4402***
	(.7296)		(.0732)
G13	-1.5616	-3.67***	-.3500***
	(.4254)		(.0792)
G15	-1.8473	-4.26***	-.3979***
	(.4332)		(.0731)
G16	-.7218	-1.21	-.1744
	(.5965)		(.1347)
TM	-1.2102	-4.26***	-.2902***
	(.2841)		(.0630)
Constant	1.1732	3.75***	-
	(.3133)		
$\chi^2(19)$		71.10***	
No. of groups	323		
No. of obs	2191		

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** *χ^2 -values significant at the 5%, 1%, and 0.1% levels respectively*
N.B.: Samsung Group (G14) is used as a reference group.

Table 4.13 Dynamic Estimation

Dependent Variable: (CRB)	*Random Effects Logit*		*Population Averaged Logit*		*Complementary Log-log Population Averaged*	
	Coef (S.E)	*Z*	*Coef (S.E)*	*Z*	*Coef (S.E)*	*Z*
CRB_{t-1}	10.874 (.742)	14.66***	10.865 (.742)	14.63***	6.788 (.427)	15.90***
OWN	-.004 (.011)	-.38	-.004 (.011)	-.38	-.004 (.003)	-1.30
NIAR	-.006 (.012)	-.52	-.006 (.012)	-.52	-.001 (.006)	-.06
AGE	-.016 (.027)	-.60	-.016 (.027)	-.60	.004 (.009)	.46
Constant	-4.593 (.800)	-5.74***	-4.591 (.801)	-5.73***	-4.923 (.473)	-10.42***
$\chi^2(4)$	229.68**		228.81***		252.98***	
Log likelihood	-56.10					
No. of groups	316		316		316	
No. of obs	1879		1879		1879	

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

Table 4.14 Cross-sectional Logit Estimation for Each Year

Dependent Variable: (CRB)	1994 *Coef (S.E)*	1995 *Coef (S.E)*	1996 *Coef (S.E)*	1997 *Coef (S.E)*	1998 *Coef (S.E)*	1999 *Coef (S.E)*	2000 *Coef (S.E)*	2001 *Coef (S.E)*	2002 *Coef (S.E)*
OWN	-006 (.005)	-.008 (.005)	-.006 (.005)	-.004 (.005)	-.004 (.005)	-.010** (.005)	-.008* (.004)	-.010*** (.004)	-.009** (.004)
NIAR	-.021 (.028)	-.007 (.014)	-.023 (.022)	.018 (.022)	.008 (.008)	.019* (.011)	.021*** (.009)	.010* (.006)	-.001 (.003)
AGE	.011 (.013)	.004 (.012)	.004 (.012)	.014 (.011)	.016 (.011)	.012 (.011)	.016* (.009)	.010 (.009)	.010 (.009)
Constant	.157 (.344)	.357 (.327)	.323 (.338)	-.013 (.317)	-.074 (.335)	.146 (.313)	-.031 (.271)	.226 (.274)	.162 (.287)
$\chi^2(3)$	3.32	3.48	3.26	4.19	5.26	10.35*	15.45**	14.89**	9.34*
Log likelihood	-125.85	-133.11	-139.08	-152.78	-153.76	-165.48	-198.08	-208.08	-200.33
No. of obs	185	197	205	224	226	247	299	312	296

Standard errors are in the parentheses.
*,**,*** *Z-values significant at the 5%, 2.5%, and 1% levels respectively*
*,**,*** χ^2 *-values significant at the 5%, 1%, and 0.1% levels respectively*

Table 4.15 Summary of Switching in Banking Relationship

Co. ID	*NIAR prior to the switch*	*Average NIAR prior to the switch*	*Average OWN prior to the switch*	*Age as of 2002*	*Group (Industry)*
Switched from INDB → CRB					
ID78	3 consecutive years of decline	-1.87	88.3	12	Hanjin (Transportation)
ID95	2 consecutive years of decline	-11.74	60	5	Hyosung (Construction)
ID155	No particular pattern around 0 to 1	.92	2.58	33	LG (Manufacturing)
ID163	4 consecutive years of decline	2.59	40	6	LG Utilities (Energey)
ID168	Extremely bad start	-168.06	100	2	LG (Telecomm)
ID238	2 consecutive years of loss although improved	-4.20	65.43	4	Samsung (Financial services and Insurance)
Switched from CRB → INDB					
ID87	5 consecutive years of decline	-1.03	100	15	Hyosung (Manufacturing)
ID94	One year decline	3.62	33.50	13	Hyosung (Manufacturing)
ID223	One year decline	-14.31	54.45	2	Samsung (Retail and wholesale)

Chapter 5

Conclusion

5.1 Overall Conclusions and Observations

This thesis has challenged the existing research on banking structure by introducing some new angles of investigation. The scope of study in banking structure has been broadened by bringing in industrial policy, banking regulation and deregulation, banking technology, and relationship banking to the investigation. An evolutionary approach to the East Asian banking structure allowed the thesis to assess and to analyse the recent banking restructuring in relation to the industrial policy and the history of the banking regulation and deregulation in the region. The review of the East Asian banking structure and the analyses presented in chapter 2 indicated that the banking structure was influenced by the industrial policy and the changes in the regulation which were to maintain the financial stability and to favour economic growth.

Investigating consumer adoption of a new banking technology, the internet banking, allowed the thesis to link the behaviour of banks and customers and carefully assess the background technology policy in Korea which made the adoption

more successful than elsewhere. This investigation in chapter 3 adds a particularly important value to the banking studies as intermediation between customers and banks is one of the main functions of banks. The evolution of banking technology was reviewed and the results found the position of the customers in the social network as a significant factor which affected the speed of their internet banking adoption.

Finally, a new concept for relationship banking, namely 'collective relationship banking (*CRB*)' was introduced in chapter 4 in contrast to 'independent banking (*INDB*).' This thesis investigated the relationship between the real sector and the banking sector structures and found the cross-ownership structure amongst the borrowing companies as an important factor for the choice of banking relationship. In the same context, changes in the ownership structure of a firm appear to cause the switching in banking relationship.

This thesis has attempted to broaden the focus from the banking sector in isolation to other adjacent sectors such as the real sector and their policy changes when investigating the banking structure and its evolution. As the thesis has pointed out the importance of the Government policies in shaping the banking structure, the next section concludes each chapter by having some policy discussions related to the banking regulation, banking technology and the corporate governance of the borrowers in relation to relationship banking.

5.2 Policy Discussions

The recent financial crises around the world have raised concerns over banking structures as no country seems to be immune to the risk of experiencing such crises. Then, one may ask what policies and/or (*de*)regulations are available as precautionary measures to such undesirable outcomes. In order to answer this question, we need to first define what the desirable outcomes are and what we have in terms of current banking structure. Without assessing the current position of banking structure, it is not possible to identify a way from the current structure to a more desirable one. This is why the evolution of banking structure is an important subject for investigation especially when the sector gets into trouble. More importantly, given the dynamic policy implications, the study of banking structure also needs a dynamic consideration looking at both past and current positions, which has been implemented throughout the thesis.

As described in the previous chapters, another key implication of our analysis is to direct research on banking structure towards those with more inter-industry and inter-sector considerations. The banking system plays an important role as intermediaries linking lenders and borrowers. In this context, it is essential to investigate what individual banking customers do as depositors as well as borrowers. Similarly, we also need to identify the relationship between the real sector and the banking sector for corporate customers. Therefore any policy concerned with the banking structure would affect the adjacent individual and corporate customers via

financial transfers. In the same principle, policies affecting individuals and corporate customers would also have an impact on the banking structure.

As the literature on financial crises and regulation so far appears to focus only on the banking system in isolation, the following sections further discuss the policy implications associated with each chapter in the thesis and pose some further important policy questions.

5.2.1 Industrial Policy and Banking Restructuring

For the consideration of dynamic policies and the analysis of adjacent industries, especially between the banking and the industrial sectors, the evolution of banking structure in East Asia provides a useful area of investigation. As discussed in length in chapter 2, the history of industrialisation in Japan and Korea shows strong evidence of a Government-led and well-thought out industrial policy, consisting of several stages run over a few decades. Whilst these successful industrial policies have worked on the economic progress, it was crucial to have some policy coordination between the industrial and financial sectors in order to facilitate the necessary project funding.

Therefore, the recent efforts made on banking regulation in the aftermath of financial crises create some concerns in countries like Korea as they focus on the performance and efficiency improvement in the banking sector in isolation when the evolution of its banking sector has been driven by the industrial policy. As countries differ in their evolution of banking and the associated industrial policies, a very

important and related question to ask in the context is whether implementing a single international guideline and requirement for the entire global banking sector such as Basel Accord I and II is really an appropriate measure. It is doubtful that Korea would have achieved the same economic success under the current BIS ratio requirement set by the Basel Accords. It seems to be a difficult task for a single international financial authority to satisfy policy coordination in different countries and provide an effective unilateral regulation across when countries are in different stages of industrial developments and under the influence of different development policies. One should also note that the changes in banking structure and associated policy and regulation did not follow an identical and concurrent path in Japan and Korea that we believed to be the closest.[151]

Another important question to pose is whether the implementation of BIS ratio has made small and medium size enterprises (SMEs) face funding sources scarce as banks become more reluctant to provide loans to SMEs under the stricter guideline of risk assessment. If we recall the discussion regarding prevailing Keiretsu and Chaebol structures in East Asia, this lack of funding for SMEs can be potentially detrimental to the economy.

We acknowledge that some parts of the above policy discussion do not emerge from the work presented in the thesis. However, we feel that it is crucial to raise the above issues in relation to banking regulation and industrial policy and they certainly appear to be important issues for further in-depth research.

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[151] These questions can draw a parallel case from the current debate on the stability of Euro and the European constitution which involves rule-making exercises by a single authority for many countries.

5.2.2 Technology Policy and Banking

The study on internet banking adoption in chapter 3 has also taken into account of the adjacent sector namely the banking customers as well as the dynamics of the adoption. There are two main questions to pose when we introduce a new technology: 1/ whether to adopt the new technology, and 2/ if adopted, how fast it should be adopted. However, when we are concerned with a banking technology, the above two issues may need to be assessed for both banks and customers as society does not benefit from the new technology when it is not adopted by customers. Then, the policy implication in this case needs primary coordination between the banking policy in technology and the general technology policy in terms of public education for technology and the necessary foundation of technological infrastructure.

The successful adoption of internet banking in Korea strongly advocates the above policy coordination in banking technology. Although the empirical analysis presented in the thesis does not directly explain why Korea has experienced a successful adoption of internet banking, the public policy towards high-technology infrastructure seemed to have worked favourably for Koreans to adopt a new technology. For example, Korea had a government policy to wire the entire country with a high-speed cable network and has successfully achieved an extremely high level of home computer ownership and broadband internet connection. This e-culture naturally provided a good ground for internet banking adoption.

However, one must point out that risks associated with internet banking have not been fully addressed in the process of promoting internet banking in many

countries and appropriate regulations regarding internet banking still needs careful attention. This is related to the second question posed above regarding 'if adopted, how fast it should adopted' as there exist security threats of potential banking frauds in internet banking. The thesis does not elaborate to answer the above questions whilst focusing on the consumer adoption. However, the welfare effects of its premature adoption provide an important area of further investigation.

5.2.3 Corporate Governance and Relationship Banking

Another inter-sector consideration adopted in the thesis is in reference to the relationship between the changes in real sector and the banking sector. A valuable new concept of collective relationship banking is introduced in chapter 4 as a result of bridging the gap between the two sectors. Following the crises in Asia, authorities in the region have urged sound corporate governance and corporate restructuring as discussed in chaprter 2. Therefore, companies in the region were encouraged or rather forced to restructure via mergers and acquisitions (M&As) or divestiture. However, the results on collective relationship banking show a negative relationship between holding company's stake and collective relationship banking. The empirical results of chapter 4 do not directly deal with the causality between the real sector restructuring and the undesirable dominance and concentration in the banking sector. However, one could further question whether this implies, the real sector restructuring through divestiture would create more collective relationship banking and hence a more concentrated banking structure with only a few dominant banks. In

other words, a sound policy in one sector namely the real sector restructuring may have caused a sub-optimal outcome in the other, e.g. the dominance of a small number of large banks. Given the limitations of the analysis brought forward in chapter 4, considering adjacent sectors for policy implementation, of which the effects differ across sectors, is possible future work to make further elaborations especially for those industries with an intermediary nature across sectors.

5.3 Concluding Remarks

5.3.1 Summary of Contributions

In each of the main chapters of the thesis, we have investigated different ways of analysing banking structure and behaviour and their evolution. The thesis adopted largely empirical tools in investigating and assessing the different aspects of banking structure. Each chapter has benefited from different methodologies in investigating the respective issues of banking structure: whether they are theoretical or empirical; quantitative or qualitative; static or dynamic.

The novel idea of broadening the focus from banking sector in isolation to linking with other adjacent sectors such as the real sector and their policy changes improved our understanding of the banking structure. As discussed in the above section, there are many possible ways of policy implications in one sector influencing an adjacent sector substantially. In this thesis, we have only investigated issues related to industrial policy, technology policy, and corporate governance in relation to banking. However, we have an almost unlimited horizon for further

research extension into other adjacent industries given the nature of banking as an intermediary.

In chapter 2, the impact of industrial policy behind the banking structure was rightly pointed out and discussed with respect to relevant regulation and deregulation and also in reference to strategic choice of banking behaviour between revenue maximising and profit maximising. A simple banking competition model developed in the thesis indicated that the transition from a price-cap regulation (*interest rate control*) to a rate-of-return regulation (*ROA and/or BIS ratio*) induces a more concentrated banking structure as banks shift their behaviour from revenue maximising to profit maximising. The empirical analysis of commercial banks in Japan and Korea in the SCP paradigm framework supported the argument and explained the recent consolidation in relation to the changes in regulation and the banking competition environment. The changes in regulation were assessed using different types of deregulation measures of which the impacts on the banking structure vary. Furthermore, the differences between nationwide and regional banking structures were analysed and the results suggest that the consolidation in the nationwide banking is more noticeable than in the regional banking since the regional banks have a certain degree of market power within the region.

In chapter 3, the behaviour of banks and customers was examined when a new banking technology (*internet banking*) was introduced. The importance of consumer behaviour was addressed as consumers drive the final stage of a banking technology adoption. This thesis has emphasised the fact that a new technology can be wasted in the absence of consumer adoption. The investigation of the Korean case

of internet banking adoption has shown a favourable technology policy as essential as a macro-level technology policy provided the necessary infrastructure and the social environment in favour of a new banking technology. However, the individual differences in adoption regarding whether and when to adopt a new banking technology depended on personal characteristics. The fast diffusion of IB technology was motivated by the early adopters who are middle aged males positioned in the core of their social network. The behavioural economics were applied to this chapter in explaining how consumers imitate the social reference groups, i.e. norms set by middle-aged males in this case. Another important observation to make from the perspective of banks is that there was no evidence of first mover advantage in introducing internet banking whilst the largest bank in commercial banking remained dominant in internet banking as well.

In chapter 4, a new banking concept, 'collective relationship banking' was introduced in order to link the real sector and the banking sector structures. The implication of the results are mainly based on the banking behaviour driven by signalling and sharing of private information and monitoring it *ex post*. Although the notion of private information monitoring and sharing has been used in the previous literature, introducing a new concept of collective relationship banking allowed us to show a new approach of direct and indirect monitoring of information. The empirical results indicated that the choice between collective relationship banking was negatively associated with the holding company's ownership stake in the borrowing firms. These firms seemed to have outside options for borrowing as they are perceived as good quality and strategically important firms to the holding company's

network. Lastly, switching of banking relationship between collective relationship banking and independent banking was investigated and the case study results suggested that changes in corporate ownership structure influenced the switching. Although we observe a small number of switching cases in relationship banking, it opens up a new area of research where we could further investigate the relationship between the real sector and the banking sector structures as corporate restructuring further develops.

5.3.2 Comments and Future Research

Most investigation in the thesis is limited to the banking structure in East Asia and their experience in reference to the related sectors and industries. However, many of the results that we have found can be generalised and applied to other countries. Otherwise, cases of other countries would be another interesting field of investigation provided that the relevant and reliable data are available.

We need to note that the simple banking model presented in chapter 2 is a stylised model of banking competition extended from the Chiappori et al. (1995) model and we do not present extensive justifications for assumptions of the model, although the way that the model has been extended has been fully justified. One possible way to improve the model can be to take into account the dynamics. This will make the model rather complex but it should be a useful exercise given the dynamic results that we have found from the empirical analyses. This empirical research extension would also benefit from alternative econometric model

specifications when the dependent variables are transformed N-firm concentration ratios (CNC_t or $BCNC_t$) given the insignificant results in Korea.

Another significant extension can be made by investigating the relationship between the specific regulation and the industrial policy in depth, especially looking into the structural break around the Asian financial crisis. As discussed earlier in section 5.2.1, the impact of a single international banking guidance on different countries' industrial policies and their economic developments would be a valuable topic for further investigation.

With respect to chapter 3, the thesis can branch out to at least two more policy areas. First, a further in-depth analysis of the Korean technology policy would make an important contribution to the field given that we notice the well-thought out public policy seemed to have created a favourable environment to adopt a new technology such as internet banking and the pro-technology public. Second, as mentioned above in section 5.2.2, the welfare effect of premature adoption of a new technology would be a useful topic for further research as it is still ambiguous how much consumers gain from their early adoption or how much they lose in case of their premature adoption.

On the empirical side, the duration analysis on internet banking adoption used only 4-year of monthly data from 1998 to 2001. However, a larger survey with more time periods can be a useful extension to establish robustness of the results.

We can also extend the data set for collective relationship banking up to the top 35 chaebols according the list of chaebols monitored by the FSS, provided that the reliable firm level data for such extended panel become available. This extension

will increase our sample size from 323 companies to over 1500 companies. One advantage of the extension is to cover almost 80% of the Korean economy and it may allow us to test: 1/ the differences between top 10 chaebols and other smaller chaebols, and 2/ the industry specific effects can be tested at further detailed industry categories, e.g. 2-digit KSIC or higher. Once we have a more comprehensive data set, a shift in countervailing power between the real sector (*or industries*) and the banking sector can be also tested dynamically using the market concentration levels in both sides.

As set out in section 5.2.3, a further in-depth research on cross-effects of policies across different sectors and their coordination would make a valuable contribution to the field as it is still not clear how a sound policy in one sector would guarantee an optimal policy outcome or cause a sub-optimal outcome in the other sector.

Finally, the new concept of collective relationship banking explains monitoring of private information and the reduction in its cost via indirect monitoring. A theoretical model of costs of financial intermediation can be an interesting and useful extension.

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