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Has financial liberalization improved economic efficiency in the Republic of Korea? Evidence from firm-level and industry-level data

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ADB Working Paper Series

**Has Financial Liberalization Improved Economic
Efficiency in the Republic of Korea?
Evidence from Firm-Level and Industry-Level Data**

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Abstract

This study analyzes the effects of financial liberalization on the lending behavior of banks and non-bank financial institutions (NBFIs) before and after the 1997 Asian financial crisis, using panel regressions on Republic of Korea firm-level and industry-level data of the period 1991–2007. It also develops a financial liberalization index to incorporate the multifaceted nature of financial reform. Findings show that financial liberalization has led banks and NBFIs to allocate more of their loans to small and medium-sized firms with good performance histories, thereby helping these entities to improve their total factor productivity growth. This paper does not find similar effects of financial liberalization on efficiency at large firms or at the industry level. Heavier reliance on direct financing after the crisis has not improved the productivity of large firms.

JEL Classification: G20, O40

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1. INTRODUCTION

Through much of the postwar period, the Republic of Korea maintained a highly repressive financial regime where financial markets were heavily regulated, but in the early 1980s it embarked on a wide range of reforms for financial market opening and liberalization. Most of the reform initiatives, however, fell short of expectations—i.e., ended up being superficial or cosmetic—as the Republic of Korea’s policymakers found it difficult to extricate themselves from the industrial policy regime they had nurtured for so long. They continued to persist with their control over finance, until mounting pressure for reform finally forced them to launch a more substantial restructuring of the financial system in the early 1990s. This time they were more successful.

Market interest rates went through several phases of deregulation before being fully liberalized as part of the reform dictated by the International Monetary Fund (IMF) for the resolution of the 1997 Asian financial crisis. Since then, most of the regulatory restrictions on asset and liability management at banks and other non-bank financial intermediaries (NBFIs), and on capital account transactions have been phased out to create a market-oriented and open financial regime.

Theory predicts that transition from a repressive to a deregulated financial regime will bring about improvements in efficiency of financial markets and institutions through amelioration of information asymmetries, lowering of transactions costs, and better screening of creditworthy and productive borrowers. Indeed, it is almost a matter of faith that in emerging economies, a market-oriented financial system is more efficient at allocating capital than a state-controlled regime.

In his survey of the literature, Levine (2005) argues that finance has a positive causal effect on growth as it improves the allocation of capital by easing external financing constraints on firms, and that countries with more efficient financial systems grow faster. A large number of empirical studies on the finance–growth nexus confirm Levine’s view, although it should be noted that there are also other experiences of emerging economies which suggest that the positive effect is not universal

The purpose of this study is to analyze the Republic of Korea’s experience to examine the significance and extent of the positive effect of financial liberalization. To this end, this paper conducts empirical analyses of causal linkages and their significance for market-oriented financial reform on the one hand, and efficiency and economic growth on the other, through firm-level and industry-level panel data from before and after the 1997 Asian financial crisis. More specifically, this paper investigates whether financial liberalization has led to an increase in the total factor productivity (TFP) of firms and industries through the improvement in efficiency of allocation of loanable funds at banks and NBFIs.

Section 2 briefly surveys the literature on the effects of financial liberalization on financial development, efficiency improvements, and economic growth. Empirical studies attempting to analyze the finance–growth nexus need to begin with the construction and measurement of the degree of market orientation of the financial system. Section 3 develops and estimates an index of financial liberalization using the data, reflecting changes in the behavior of financial markets and institutions attributable to the market-oriented reform. Section 4 develops three models for empirical estimation at the firm and industry levels. Section 5 presents estimation results. Section 6 concludes.

2. A BRIEF SURVEY OF THE LITERATURE

Earlier studies on financial development and economic growth, such as the ones by Gurley and Shaw (1955), McKinnon (1973), and Shaw (1973), identified potential channels through which financial liberalization could bring about diversification and improvements in efficiency of the financial sector with the attendant positive effect on economic growth. According to the studies, government controls on market interest rates and asset and liability management at banks and NBFIs would cause stagnation in financial development and ultimately in economic growth. Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991) concur by showing that financial intermediation in a liberal financial regime enhances efficiency of the economy and growth through better information processing and investment screening.

King and Levine (1993) conduct a cross-country regression analysis, and Levine, Loayza, and Beck (2000) perform country-level panel regression estimations to show that financial development exerts positive effects on economic growth. Beck, Levine, and Loayza (2000) find that expansion and efficiency improvements of financial intermediation enhance TFP growth, but have little long-term effect on investment or the savings rate. In a study using cross-country panel data, Favara (2003) disputes these results by showing that financial development does not necessarily promote economic growth.

Rajan and Zingales (1998) present evidence that the degree of technological financial dependency on external financing differs from industry to industry. This difference means that financially dependent industries would be able to take advantage of the potential growth opportunities presented by financial growth and development more than those industries requiring less external financing. Given the differences in external financial dependency, therefore, financial market development would result in differential rates of growth in different industries. Fisman and Love (2003) challenge these findings by showing that growth opportunities, rather than external finance dependency, better explain growth of different industries, using the dataset of Rajan and Zingales (1998).

Analyzing firm-level data from 30 countries, Demirguc-Kunt and Maksimovic (1998) find that wider access to external finance tends to encourage long-run growth of firms. An empirical examination of the panel data on a large number of firms from 13 developing countries by Laeven (2003) finds that small firms are more financially constrained than large firms before the start of financial liberalization, but afterwards the larger ones are squeezed on credit allocation. This is because large firms no longer benefit from preferential credit they were accorded during financial repression. Beck et al. (2008) show that financial development through market-oriented reforms promotes growth of smaller firms and industries naturally composed of small firms as it eases obstacles that firms face in their external financing.

As for studies on the experience of the Republic of Korea, Kim (2003) conducts a principal component analysis to create a single index representing five aspects of financial liberalization: changes in regulations and government policy on interest rates, foreign exchange rates, the legal reserve requirement, capital account liberalization, and bank privatization. Using the index, Kim shows that financial liberalization exerted a significantly positive impact on economic growth during the period 1980–2002.

Shyn and Oh (2005) test the validity of the external finance dependency (Rajan and Zingales 1998) and growth opportunities (Fisman and Love 2003) hypotheses using industry-level panel data from 30 to 34 industries in the Republic of Korea between 1981 and 2001. Their results imply that industrial development in the Republic of Korea

was influenced by both external finance dependency and growth opportunities in the 1980s, but the growth opportunities emerged as the main factor contributing to industrial growth in the 1990s.

Ahn et al. (2008) examine Republic of Korea firm-level data of the period 1991–2003 to see whether there were differential effects of external financing on capital accumulation, research and development (R&D), and TFP growth before and after the financial crisis of 1997. Separate regressions on the subsamples of the 1991–1996 and 1999–2003 periods show that the availability of external finance was associated with faster capital accumulation before, but less so after the crisis. In contrast, the external finance effect on TFP growth was found to be relatively weak both before and after the crisis.

3. FINANCIAL LIBERALIZATION INDEX

Empirical examinations of the effects of financial liberalization on the economy need to begin with the identification and estimation of variables that gauge quantitative changes in the degree of deregulation and opening of financial markets. Since there is no generally accepted measure of financial liberalization, most studies develop graded indices over time in terms of a multifaceted measure of financial liberalization that covers a number of aspects of financial reform (Abiad et al. 2008). Following a similar approach, this study adopts the financial reform index of Abiad et al. (2008), but corrects some subcomponent indices to reflect changes in the financial system brought about by the reform for financial liberalization during the 1990–2007 period.

Abiad et al. (2008) provide seven measures for constructing the financial reform index: interest rate controls, entry barriers, banking supervision, privatization, international capital flow, and security markets.¹ However, in their estimation, the interest rate control index (*intratecontrols*) for the Republic of Korea exhibits an unrealistic downward movement after 2000, which is at odds with the country's history of financial deregulation. Taking into account the three phases of interest rate liberalization undertaken by the Government of the Republic of Korea, this study produces an alternative interest rate control index.

Throughout the 1980s, deposit and lending rates in the banking sector were strictly under the control of the government. The relaxation of control over these interest rates went through three different phases of liberalization in the 1990s. As a result, the interest rates fluctuated more widely and frequently throughout the 1990s, which may indicate growing competitiveness of the bank loan and deposit markets. This interest rate index takes a value of 0 until 1990, then increases to 2 for the next 3 years (1991–1993), and then to 3 for the 1994–1997 period. Except those on bank deposits, most of the market interest rates were fully liberalized in 1997, which is shown as the raw measure rises to the highest level, 4, in Table 1.²

¹ See Abiad et al. (2008). Originally, the IMF financial reform index was created by summing the following seven indices: credit controls (*creditcontrols*), interest rate controls (*intratecontrols*), entry barriers (*entrybarriers*), banking supervision (*bankingsuperv*), privatization (*privatization*), international capital flows (*intlcapital*), and security markets (*securitymarkets*).

² The first phase started in November 1991, when interest rates on short-term bank loans and deposits with maturities of 3 years or longer were deregulated. The second phase, which began in July 1994, targeted liberalization of interest rates on all loans except those subject to rediscounts by the Bank of Korea, and on deposits except demand and short-term savings deposits with maturities of less than 3 months. In July 1997, the third phase went on to liberalize all demand deposits except savings deposits with maturities of less than 7.

Table 1: Original (Abiad et al. 2008) and Modified Indices of Financial Liberalization by Component

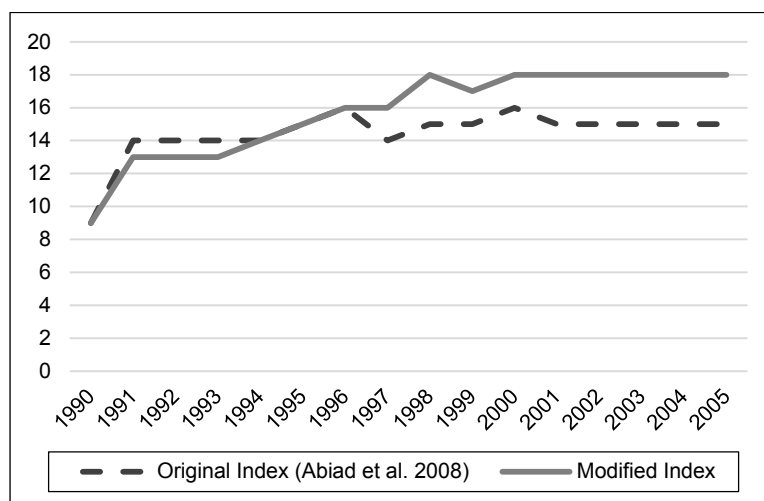
Year	Credit Controls	Interest Rate Controls	Entry Barriers	Banking Supervision	Privatization	International Capital	Security Markets	Modified Index
1990	3	0	2	0	2	1	1	9
1991	3	3 (2)	2	0	2	2	2	14 (13)
1992	3	3 (2)	2	0	2	2	2	14 (13)
1993	3	3 (2)	2	0	2	2	2	14 (13)
1994	3	3	2	0	2	2	2	14
1995	3	3	2	1	2	2	2	15
1996	3	3	2	1	2	3	2	16
1997	3	3	2	1	0 (2)	3	2	14 (16)
1998	3	3 (4)	3	1	0 (2)	3	2	15 (18)
1999	3	3 (4)	3	1	0 (1)	3	2	15 (17)
2000	3	3 (4)	3	1	0 (1)	3	3	16 (18)
2001	3	2 (4)	3	1	0 (1)	3	3	15 (18)
2002	3	2 (4)	3	1	0 (1)	3	3	15 (18)
2003	3	2 (4)	3	1	0 (1)	3	3	15 (18)
2004	3	2 (4)	3	1	0 (1)	3	3	15 (18)
2005	3	2 (4)	3	1	0 (1)	3	3	15 (18)

Notes: The interest rate controls and privatization indices are modified from the originals by Abiad et al. (2008). The modified numbers are in parentheses.

Source: Abiad et al. (2008) and authors' calculations.

The index *privatization* in Abiad et al. (2008) is designed to reflect the asset share of government-owned financial institutions. However, the index for the Republic of Korea seems to overstate government ownership for the post-1997 period as it takes the value of 2 before the crisis and 0 after the crisis. Calculating the government ownership using data from *Bank Management Statistics*, published by the Republic of Korea's Financial Supervisory Service, this study produces an alternative privatization index, which takes the value of 2 before and 1 after the 1997 crisis, as shown in Table 1. Figure 1 compares this study's index with that of Abiad et al.

Figure 1: Original Financial Reform Index (Abiad et al. 2008) and Modified Financial Liberalization Index



Notes: The values for the financial reform index of Abiad are derived from the summation of the seven sub-indices in the study by Abiad et al. (2008). The values for the modified financial liberalization index of this study are derived from the summation of the seven sub-indices in Table 1.

Source: Abiad et al. (2008) and authors' calculations.

Throughout the sample period, firms, in particular large ones, continued to borrow relatively less than before from banks as they were required to lower their debt–equity ratios and had greater opportunities to raise funds on the capital market after the crisis. The ratio of direct financing (bond and equity) to total financing is a proxy measuring the effect of the relative increase in capital market financing on firm efficiency. Appendix, Figure A.1 shows changes in the ratio.

4. EMPIRICAL IMPLEMENTATION AND DATA DESCRIPTION

4.1 Main Questions and Empirical Models

This study constructs three linear regression models, which are estimated using firm-level and industry-level panel data for the 1991–2007 period to assess the impact of financial liberalization on the lending behavior of banks and NBFIs, and the growth performance of individual firms and industries before and after the 1997 crisis.

More specifically, this study poses the following three questions:

1. Has the market-oriented financial reform made banks and NBFIs more efficient in allocating loanable resources by taking into greater account fundamental firm and industry characteristics, such as the return on assets (ROA) or value-added history in searching for creditworthy borrowers? Put differently, in the process of financial liberalization, have individual firms and industries with better ROAs or value-added records gained greater access to bank loans at financial intermediaries than before the crisis?
2. Have firms and industries with greater access to indirect bank financing—or through easing of external financing constraints—done better in improving their TFP?
3. Has the increase in capital market financing relative to bank financing of firms and industries—i.e., a change in the funding structure—boosted their productivity growth? Here, the hypothesis is that capital markets, as opposed to banks and NBFIs, are more efficient in screening out viable and potentially successful firms.

Carlin and Mayer (2003) examine whether there is a significant link between financial development and the growth of industries that are relatively more dependent on capital market financing. As the economy develops, monitoring becomes more expensive relative to capital costs in financial intermediation. They argue that the costs of monitoring are relatively lower in equity markets. This cost advantage induces a large increase in the supply of and demand for equity relative to debt, which in turn leads to higher growth of equity markets. This means that equity dependent industries are likely to find it easier to secure external funding and hence grow faster.

This paper examines whether financial liberalization, which has induced the shift to more market-oriented financing, has been more beneficial for industries that are inherently more equity dependent, as Carlin and Mayer (2000, 2003) argue.³ Using 2-digit industry level data of TFP from the Republic of Korea and measures of equity

³ For the growth regression analysis, they find that greater disclosure tends to increase the growth rates of industries with high equity dependence and high skill intensity, but not the growth rates of industries with high dependence on banks. They also find a higher level of bank concentration is associated with lower growth for industries that depend more on equity financing

dependence for each industry, this section examines whether performance of equity-dependent industries improved more than that of less-equity-dependent industries. We examine how TFP at the industry level is related to the equity finance dependence of the industries. The key question is how the relationship changed before and after the financial reform.

In order to answer the three main questions at both the firm and industry levels, this study applies firm-specific as well as industry-specific fixed effects panel regression estimations.

Model 1

The first model, which addresses the firm-specific (industry-specific) question on the efficiency of bank and NBF lending, is specified as follows:

$$\begin{aligned} dln(loans)_{it} = & \alpha_0 + \alpha_1 * X_{i,t-1} + \alpha_2 * finlib_t + \alpha_3 * X_{i,t-1} * finlib_t \\ & + \gamma'Z_{it} + u_i + v_t + \varepsilon_{it} \end{aligned} \quad (1)$$

The dependent variable, $dln(loans_{i,t})$, is the rate of growth of total loans extended by both banks and NBFs.⁴ The variable $finlib_t$ is the financial liberalization index at time t . $X_{i,t-1}$ is the ROA of firm i in year $t-1$, or the growth of value added in the case of industry i , which represents firm (industry) i 's main performance characteristic of the past. In this specification, the regressor, $X_{i,t-1}$, measures the independent effect of the past performance of the firm and industry on loan acquisition.

The interaction term ($X_{i,t-1} * finlib_t$) captures the extent to which financial liberalization has changed the effect of past performance on securing loans. If this term is significant and positive, then it would suggest that financial liberalization has made banks and NBFs consider the past performance of firms (industries) more than before when allocating their loans. Z represents a vector of control variables.⁵ Variables u_i and v_t stand for firm-fixed (industry-fixed) and year-fixed effects, respectively.

Model 2

The model for analyzing the second question, the degree of contribution of loans by banks and NBFs to firm (industry) TFP growth, takes the following form:

$$\begin{aligned} dln(TFP)_{it} = & \beta_0 + \beta_1 * dln(loans_{i,t-1}) + \beta_2 * finlib_t \\ & + \beta_3 * dln(loans_{i,t-1}) * finlib_t + \delta'Z_{it} + u_i + v_t + \varepsilon_{it} \end{aligned} \quad (2)$$

The dependent variable is the firm (industry) TFP growth ($dln(TFP)_{it}$). The regressor, $dln(loans_{i,t-1})$, weighs up an independent effect of the past loan growth on TFP growth. The interaction term ($dln(loans_{i,t-1}) * finlib_t$) assesses the extent to which financial liberalization has been responsible for the contribution of bank loans to the firm's (industry's) productivity improvements. If this term is significant and positive, it could be understood as reinforcing the significance of the effect of the past loan growth on TFP growth because of financial liberalization.

⁴ In the subsequent discussion, loans or bank loans refer to the total volume of loans extended by both banks and NBFs, which are described as financial institutions for brevity.

⁵ The control variables for each model are explained in the next section.

Model 3

The third model for analyzing the effect of a change in the funding structure on a firm's efficiency is as follows:

$$\begin{aligned} dln(TFP)_{it} = & \rho_0 + \rho_1 * dln(loans_{i,t-1}) \\ & + \rho_2 * finlib_t + \rho_3 * dln(loans_{i,t-1}) * finlib_t + \rho_4 * shdirect_{it-1} \\ & + \rho_5 * shdirect_{it-1} * finlib_t + \varphi'Z_{it} + u_i + v_t + \varepsilon_{it}, \end{aligned} \quad (3)$$

where *shdirect* is the share of direct financing in total financing of an individual firm. In this specification, *shdirect*_{*it*-1} picks up the effect of a change in a firm's financing method toward the use of capital markets on its productivity (TFP) growth, while the interaction term, *shdirect*_{*it*-1} * *finlib*_{*t*}, estimates how much financial liberalization has changed the effectiveness of direct financing on improving a firm's productivity.

In addition to the full sample regressions of the three models presented above, the sample of the firm-level data is divided into two subgroups: Republic of Korea Exchange (KRX)-listed large firms (KRX subsample) and other small and medium-sized enterprises (SMEs) (non-KRX or the SME subsample).⁶ This study also conducts subsample regressions to ascertain whether SMEs have gained greater access to banks and NBFIs for loans than larger and more established firms in the process of financial liberalization, and whether this expanded financing opportunity has been a factor contributing to improvements in their productivity.

4.2 Data Description for Firm-Level Data

For the firm-level analysis, this study uses 36,948 annual observations of 6,882 firms from the Korean Information Service Value database (KIS-VALUE) for the 1990–2005 period, due to unavailability of TFP data for later years. The KIS-VALUE database compiled by the NICE Information Service provides financial and non-financial data for the listed and external audited firms. The sample excludes financial companies. It also leaves out the financial crisis period from 1997 to 1999 to remove distortions in the data.

The bank financing variable, *loans*, is the sum of short- and long-term loans from banks and NBFIs.⁷ ROA (*roa*) is the return on assets of each firm. Firm-level TFP growth rates, *dlnTFP*, are obtained from Baek et al. (2009), who estimate them using the approach proposed by Bailey, Hulten, and Campbell (1992).

The index of change in the funding structure, *shdirect*, is the share of capital market financing—bond and equity funding—in total financing of each firm. An alternative measure, *dlnindirectf*, is the change in the amount of bond and equity financing of each firm. The variable *shequity* is the share of equity financing in total financing of each firm, and the variable *dlnequityf* is the change in the amount of equity financing of each firm.⁸ The variables *dlnindirectf* and *dlnequityf* are measured in real terms deflated by the consumer price index.

⁶ The KRX-listed firms are relatively more established and larger due to demanding requirements for the listing. The remaining small and medium-sized firms include KOSDAQ-listed firms, external audited firms, and firms under government supervision.

⁷ Short-term loans are the sum of bank overdraft, other short-term borrowings in both domestic and foreign currencies, and long-term loans in both currencies maturing within a year. Long-term loans include long-term borrowings in foreign currencies.

⁸ Average shares of equity and direct financing of each firm in KRX and non-KRX subsamples are provided in Appendix Table A.1.

In order to hold constant some of the variables that could affect the determinants of bank and NBF lending, model 1 includes a set of control variables. They are the ratio of R&D expenditure to gross sales (*rnd_sales*) to account for innovative activity of the firm; the log of total assets (*lnassets*), to proxy the size of the firm; the ratio of debt to equity (*liab_eq*), to measure the degree of capital adequacy; and a post-1997 crisis dummy (*dum_after97*), which takes a value of one after 1997.⁹ All these variables (except for the dummy) are lagged in the regression. As for models 2 and 3, the set of control variables include *rnd_sales*, *lnassets*, and *dum_after97*. Financial reform indices are from the Bank for International Settlements and Abiad et al. (2008). Appendix, Table A.2 presents summary statistics and definitions of the variables.

4.3 Data Description for Industry-Level Data

The industry data are from the annual industry-level panel dataset at the two-digit level of Republic of Korea industries from 1990 to 2007. As before, the sample excludes the financial crisis period from 1997 to 1999.

The bank financing variable, *loansi*, is the sum of total short-term and long-term loans to each industry by banks and NBFs. The definitions of the funding structure variables, *shdirecti*, *dlndirectfi*, *shequityi*, and *dlnequityfi*, are the same as those for the firm-level analysis. As before, *dlndirectfi* and *dlnequityfi* are measured in real terms. The data are from the Bank of Korea's *Statistical Yearbook*.

Industry-level value added (*vai*) and TFP growth rates are from the Republic of Korea Productivity Center, which provides input and output data on the Republic of Korea for the EU KLEMS database. The EU KLEMS database is an industry-level panel database for European Union member states and a selected number of non-member countries compiled by the European Commission under the EU KLEMS project.¹⁰

The R&D intensity, *rnd_vai*, defined as the ratio of current R&D expenditure to current value added in each industry is the only control variable that enters into all models. R&D expenditure data are from the KISTEP R&D Activity Survey database. The sample comprises 246 annual observations of 24 different manufacturing and non-manufacturing industries from 1993 to 2007.¹¹ Summary statistics and definitions of the variables are in Appendix, Table A.3.

5. FIRM-LEVEL ANALYSIS RESULTS

5.1 Rationalization of Bank Lending Operations

Table 2 presents the results of the firm-level estimation of equation (1). Columns (1)–(3) include a post-1997 crisis and columns (4) and (5) include year dummies to control

⁹ Extreme values of the TFP growth rate over 0.5 or less than -0.5, percentage changes in loans in excess of 100% or less than -100%, the ratio of external financing greater than 1, and the R&D ratio greater than 1 are all excluded from the sample. In the regressions on the structural changes in financing, outliers such as percentage changes in bond and equity financing in excess of 200% or less than -200% are also excluded.

¹⁰ The EU KLEMS database lists data on economic growth, employment, capital formation, and technological change at the industry level for 72 different industries in each country.

¹¹ The industries covered in this estimation include 19 in manufacturing, electricity, gas and water, construction and transport, and storage and communication. Extreme values of the TFP growth rate over 0.2 or less than -0.2, percentage changes in loans in excess of 50% or less than -50%, or R&D ratios greater than 0.2 are all excluded from the sample.

for unobserved year-specific shocks.¹² The coefficient estimates for *roa* (lagged ROA) are significant and positive in columns (1)–(4), suggesting that the ROA history has become an important factor for screening borrowers at financial institutions. The coefficient estimates for *finlib* are also significant and positive in columns (2) and (3), implying that financial liberalization has broadened the scope as well as capacity of intermediation at banks and NBFIs during the sample period.

The coefficient signs of the interaction terms between firm ROA and the liberalization index are positive and significant as shown in columns (3) and (4). This finding implies that in a liberalized financial market environment, financial institutions place greater importance on firm's ROA history in evaluating their loan applicants.

Banks and NBFIs are likely to rely on different sets of lending criteria to assess credit qualities of different borrowers. This difference in lending practices is captured in column (5), which shows the differences in the effects of the ROA and ROA**finlib* on loan growth for both KRX-listed firms and other SMEs. The coefficient signs of the interaction terms for both the KRX-listed and SMEs (*roa_finlib_krx* and *roa_finlib_nonkrx*) are positive and significant.

¹² The variable *finlib* in column (4) is not identified when year dummies are included since *finlib* is year specific.

Table 2: Determinants of Bank and Non-Bank Financial Institution Financing: Firm-Level Regressions for the Full Sample(dependent variable = $dln(loans)$)

Variable	(1)	(2)	(3)	(4)	(5)
<i>roa</i>	0.334*** (10.478)	0.342*** (10.763)	0.335*** (10.472)	0.333*** (10.441)	
<i>roa*krx</i>					0.326*** (3.450)
<i>roa*nonkrx</i>					0.336*** (9.917)
<i>finlib</i>		0.027*** (9.524)	0.027*** (9.522)		
<i>roa*finlib</i>			0.036** (2.398)	0.050*** (3.277)	
<i>roa*finlib*krx</i>					0.075* (1.959)
<i>roa*finlib*nonkrx</i>					0.045*** (2.708)
<i>rnd_sales</i>	-0.051 (-0.833)	-0.041 (-0.675)	-0.036 (-0.583)	-0.042 (-0.693)	-0.043 (-0.705)
<i>lnassets</i>	-0.033*** (-6.954)	-0.049*** (-9.691)	-0.050*** (-9.892)	-0.055*** (-10.297)	-0.055*** (-10.313)
<i>liab_eq</i>	0.000 (0.635)	0.000 (0.574)	0.000 (0.598)	0.000 (0.619)	0.000 (0.615)
<i>dum_after97</i>	-0.043*** (-7.353)	-0.134*** (-11.970)	-0.133*** (-11.837)		
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes
Observations	36,948	36,948	36,948	36,948	36,948
R-squared	0.014	0.017	0.018	0.025	0.025
Number of firms	6,882	6,882	6,882	6,882	6,882

Notes: All estimates are based on firm fixed effects panel regressions. The dependent variable is loan growth, $dlnloans$. Explanatory variables *roa*, *rnd_sales*, *lnassets*, *liab_eq*, and *dum_after97* are ROA, R&D-sales ratio, log of assets, leverage ratio, and a post-1997 dummy, respectively. They are all 1-year lagged. The variable *finlib* is the financial liberalization index and the variable *roa*finlib* is an interaction term between *roa* and *finlib*. Values in parentheses are t-statistics. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

In order to investigate further the consistency of these results, this study conducts subsample regression estimations for each of the KRX-listed and SME groups. Table 2 presents the results, where columns (1)–(4) show that the interaction terms are significant for the SME group, but not for the KRX-listed firm sample.

Table 3: Determinants of Bank and NBFI Financing: Firm-Level Regressions for KRX and Non-KRX Subsamples(dependent variable = $dln(loans)$)

Variable	(1) KRX	(2) KRX	(3) Non-KRX	(4) Non-KRX
<i>roa</i>	0.224** (2.236)	0.201** (2.016)	0.346*** (10.272)	0.348*** (10.351)
<i>finlib</i>	0.023*** (3.750)		0.028*** (8.797)	
<i>roa*finlib</i>	0.043 (1.091)	0.050 (1.279)	0.034** (2.053)	0.047*** (2.843)
<i>rnd_sales</i>	0.004 (0.009)	-0.077 (-0.191)	-0.035 (-0.570)	-0.042 (-0.684)
<i>lnassets</i>	-0.038*** (-2.838)	-0.018 (-1.288)	-0.051*** (-9.400)	-0.063*** (-10.597)
<i>liab_eq</i>	0.000 (0.400)	0.000 (0.603)	0.000 (0.530)	0.000 (0.505)
<i>dum_after97</i>	-0.167*** (-6.955)		-0.125*** (-9.834)	
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	No	Yes
Observations	5,420	5,420	31,528	31,528
R-squared	0.034	0.052	0.015	0.021
Number of firms	564	564	6,318	6,318

KRX = Republic of Korea Exchange, NBFI = non-bank financial institution.

Notes: All estimates are based on firm fixed effects panel regressions. The dependent variable is loan growth, $dlnloans$. Explanatory variables *roa*, *rnd_sales*, *lnassets*, *liab_eq*, and *dum_after97* are ROA, R&D–sales ratio, log of assets, leverage ratio, and a post-1997 dummy, respectively. They are all 1-year lagged. The variable *finlib* is the financial liberalization index and the variable *roa*finlib* is an interaction term between *roa* and *finlib*. Values in parentheses are t-statistics. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

These results suggest that the Republic of Korea's financial liberalization has induced banks and NBFIs to throw a larger net to bring more potentially successful SMEs into their fold of loan customers. This is because they have been left with room for lending as large firms which migrated to capital markets and international financial markets for funding after the 1997 financial crisis. Financial liberalization has generated incentives for financial institutions to search for and lend relatively more to creditworthy SMEs with profitable projects as they have been losing some of their traditional customers, large and more established firms.

It should be noted that the overall positive effect of the interaction term in the full sample analysis at the firm level presented in Table 2 is in part caused by the dominance of SMEs, of which the number is far greater than that of the KRX-listed firms in the full sample.¹³ Although the number of firms in the KRX-listed group is small,

¹³ The number of KRX-listed firms remained stable over time in our sample. There were 453 firms in 1991, 414 in 2000, and 454 in 2005. On the other hand, there was a large increase in the number of SME firms in our database from 1,318 in 1991 to 3,132 in 2000, and finally to 5,459 in 2005. Therefore, the number of KRX-listed enterprises as a share of the total number of firms in the database continued to decline to 12% in 2000 and further to 8% in 2005, from 22% in 1995.

in terms of its share in total sales or output of the entire sample, the KRX-listed group far outweighs the SME group. For instance, the KRX-listed group accounted for 71% of total sales of the full sample in 1995, 72% in 2000, and 60% in 2005. This means that borrowings of the KRX-listed group would dominate the overall impact of total bank and NBF1 lending on the economy.¹⁴

To verify this dominance, the next section conducts an industry-level analysis. Since industry-level data are the aggregates of bank and NBF1 lending to all firms belonging to each industry—which are not affected by the number of firms—the industry-level analysis will reveal the impact of financial liberalization at the industry level, which may be different from that of the firm-level analysis.¹⁵

5.2 Bank Loans and Productivity

Table 4 displays regression results for equation (2). As in the specification of equation (1), columns (1)–(3) include a post-1997 crisis dummy to isolate the effect of financial liberalization, and columns (4)–(7) include year dummies. Estimation of equation (2) is expected to show whether increases in loans extended by banks and NBF1s (a measure of access to indirect financing) helped to boost firm TFP growth with financial liberalization during the sample period.

¹⁴ The median size of SME firms was 21% in 1995, 11% in 2000, and 12% in 2005 of a similar size of KRX-listed firms. The distribution of firms in terms of sales is shown in Appendix, Figure A.2.

¹⁵ A number of empirical studies show that technical efficiency of Republic of Korea banks improved during the post-crisis period (see Park et al. [2010]). This result does not contradict the finding of this paper that financial liberalization has not contributed to augmenting the allocative efficiency of bank lending. Technical efficiency of banks arises from both lowering of operating costs and better allocation of loans in financing high-return, low-risk projects. The findings of this study suggest that financial liberalization has succeeded in strengthening the former, but not necessarily the latter.

Table 4: The Effect of Alternative Methods Financing on Total Factor Productivity Growth: Firm-Level Regressions for the Full Sample(dependent variable = $dln(TFP)$)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>dlnloans</i>	0.009*** (4.989)	0.010*** (5.239)	0.010*** (5.298)	0.010*** (5.069)	0.010*** (5.337)	0.010*** (5.068)	
<i>finlib</i>		0.005*** (5.229)	0.005*** (5.121)				
<i>dlnloans*finlib</i>			0.002** (2.182)	0.002** (2.349)	0.002** (2.212)	0.002** (2.353)	
<i>shdirect</i>					0.004 (0.196)		
<i>shdirect*finlib</i>					-0.000 (-0.057)		
<i>dlnindirectf</i>						0.000 (0.095)	
<i>dlnindirectf*finlib</i>						0.000 (0.193)	
<i>dlnloans *krx</i>							0.005 (1.053)
<i>dlnloans *nonkrx</i>							0.010*** (4.871)
<i>dlnloans *finlib*krx</i>							-0.001 (-0.477)
<i>dlnloans *finlib*nonkrx</i>							0.003*** (2.782)
<i>rnd_sales</i>	0.183*** (7.211)	0.185*** (7.280)	0.184*** (7.254)	0.188*** (7.413)	0.188*** (7.433)	0.188*** (7.414)	0.188*** (7.399)
<i>lnassets</i>	-	0.014*** (-8.453)	-0.017*** (-9.760)	-0.018*** (-9.827)	-0.013*** (-7.082)	-0.014*** (-7.184)	-0.013*** (-7.085)
<i>dum_after97</i>	0.012*** (5.985)	-0.004 (-1.129)	-0.004 (-0.986)				
Constant	0.333*** (8.443)	0.343*** (8.688)	0.348*** (8.789)	0.263*** (6.397)	0.271*** (6.147)	0.263*** (6.401)	0.264*** (6.424)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes	Yes	Yes	Yes
Observations	32,651	32,651	32,651	32,651	31,146	32,649	32,651
R-squared	0.005	0.006	0.006	0.011	0.011	0.011	0.011
Number of firms	6,009	6,009	6,009	6,009	5,742	6,009	6,009

Notes: All estimates are based on firm fixed effects panel regressions. The dependent variable is TFP growth, $dlnTFP$. Explanatory variables $dlnloans$, rnd_sales , $lnassets$, $dum_after97$, $shdirect$, and $dlnindirectf$ are growth of indirect financing, R&D-sales ratio, log of assets, a post-1997 dummy, direct financing ratio, and growth of direct financing, respectively. They are all 1-year lagged. The variable $finlib$ is the financial liberalization index, and the variable $dlnloans*finlib$ is an interaction term between $dlnloans$ and $finlib$. krx takes a value of 1 if the respective firm is KRX-listed (not listed in KRX, for $nonkrx$). $X*Y$ is an interaction term between variables X and Y . Values in parentheses are t-statistics. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

The coefficient estimates of the interaction terms between lagged loan growth and the financial liberalization index ($dlnloans*finlib$) are all positive and significant in columns (3)–(6). Again, the inclusion of this interaction term does not change either the magnitudes or signs of the coefficients of other regressors. This finding renders support to the chain of events observed during the sample period, in which financial liberalization first leads to improvements in efficiency of lending operations at financial intermediaries, which in turn augment the subsequent TFP growth of firms.

In order to delineate the different effects of financial liberalization and bank loan expansion on TFP growth of KRX-listed firms and SMEs, column (7) allows for the loan growth variables ($dlnloans$ and $dlnloans*finlib$) to interact with the KRX- and SME-group dummy variables, respectively. The interaction term for the KRX-listed firms ($dlnloans_finlib_krx$) is insignificant, whereas a similar term for the SME group ($dlnloans_finlib_nonkrx$) is significant. This indicates that financial liberalization strengthens the effect of loan expansion on TFP growth of the SME group, but not that of the KRX-listed group.

This difference in significance stems from the following two developments. One is the intensification of competition in the banking industry following financial liberalization, which has prevailed on banks and NBFIs to improve their credit and market analyses so that a larger share of their lendable resources have been extended to more creditworthy and efficient borrowers than before.

Another factor has been the result of the restructuring of firms—in particular larger ones—many of which were closed down or merged with others. The surviving or restructured ones were required to deleverage—to lower their debt–equity ratios below 250%. As a result, the corporate demand for bank loans plummeted, allowing banks and NBFIs to lend more to SMEs than before. Many of these SMEs were efficient and profitable, but credit-constrained before the financial reform in the wake of the 1997 financial crisis. As more of these SMEs gained greater access to bank and NBF loans, they were able to grow faster than before. This growth performance explains much of the improvements in efficiency of lending operations at banks and NBFIs.

Table 5 presents the subsample regression results for the KRX-listed firms and SMEs. As in the estimation of equation (1), the results suggest that firms belonging to the SME group benefit more from financial deregulation than those in the KRX-listed group of large firms.

Columns (1)–(6) show that the interaction terms ($dlnloans*finlib$) for the SME sample are significant, whereas they are not for the KRX-listed group. This finding, which is consistent with the result in Table 4, suggests that SMEs are able to enhance their TFP growth by gaining access to indirect financing in the process of financial liberalization. Again, these results indicate that financial liberalization played a positive role in supporting TFP growth of typical small-sized firms in the Republic of Korea during the sample period.¹⁶

5.3 Endogeneity Bias and Instrumental Variables Estimation

Estimation results in Tables 4 and 5 indicate that financial liberalization reinforces the effect of loan expansion on TFP growth. One interpretation of these results is the gain

¹⁶ To examine whether different aspects of financial liberalization have influenced change in efficiency of the firm through the expansion of bank loans, equation (2) is estimated in terms of individual sub-components of the financial liberalization index. The results show that in all estimations, the interaction terms ($ROA*finlib$ and $dlnloan*finlib$) are insignificant for the KRX-listed firm subsample. The results can be provided upon request.

of greater access of small and medium-sized firms to bank loans following financial liberalization. This study shows that the newly gained access was instrumental in boosting their TFP growth. Another interpretation is that financial liberalization has improved the lending efficiency of financial institutions as they have become more proficient in identifying creditworthy borrowers with future potential TFP growth. This interpretation suggests the possibility of reverse causality—that is, causality between financial liberalization and TFP growth could run either way.

This ambiguity creates an estimation bias. In order to address this potential endogeneity bias, this study re-estimates equation (2) using the instrumental variables (IV) method using two alternative instruments: the median and mean loan growth of other firms within the same industry (KSIC 4-digit level). The IV estimation results for the full sample and the two subsamples of KRX-listed firms and SMEs are presented in Table 6. Columns (1)–(3) use only the median loan growth and columns (4)–(6) use the mean growth of other firms within the same industry as the instrumental variables. Mitigation of the endogeneity bias does not change the main findings of Table 4 and Table 5.

Table 5: Effect of Alternative Methods of Financing on TFP Growth: Firm-Level Regressions for KRX and Non-KRX SubSamples

(dependent variable = $dln(TFP)$)

Variable	(1) KRX	(2) KRX	(3) KRX	(4) Non-KRX	(5) Non-KRX	(6) Non-KRX
<i>dlnloans</i>	0.007** (2.279)	0.007** (2.013)	0.007** (2.261)	0.011*** (4.835)	0.011*** (5.161)	0.011*** (4.837)
<i>dlnloans*finlib</i>	-0.002 (-1.226)	-0.002 (-1.074)	-0.002 (-1.241)	0.003*** (2.861)	0.003*** (2.681)	0.003*** (2.867)
<i>shdirect</i>		-0.004 (-0.621)			0.005 (1.032)	
<i>shdirect*finlib</i>		0.002 (0.787)			-0.001 (-0.452)	
<i>dlnindirectf</i>			-0.000 (-0.422)			0.000 (0.239)
<i>dlnindirectf*finlib</i>			-0.000 (-0.398)			0.000 (0.230)
<i>rnd_sales</i>	0.211** (2.298)	0.210** (2.279)	0.210** (2.290)	0.186*** (6.837)	0.185*** (6.838)	0.186*** (6.839)
<i>lnassets</i>	-0.010*** (-3.068)	-0.008*** (-2.614)	-0.010*** (-3.055)	-0.015*** (-6.824)	-0.017*** (-7.059)	-0.015*** (-6.833)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,326	5,308	5,326	27,325	25,838	27,323
R-squared	0.030	0.030	0.031	0.011	0.011	0.011
Number of firms	554	552	554	5,455	5,190	5,455

KRX = Republic of Korea Exchange, TFP = total factor productivity.

Notes: All estimates are firm fixed effects panel regression estimates. The dependent variable is TFP growth, $dlnTFP$. Explanatory variables *dlnloans*, *rnd_sales*, *lnassets*, *shdirect*, and *dlnindirectf* are growth of indirect financing, R&D–sales ratio, log of assets, direct financing ratio, and growth of direct financing, respectively. They are all 1-year lagged. The variable *finlib* is the financial liberalization index and the variable $X*finlib$ is an interaction term between variable X and *finlib*. t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

Table 6: The Effect of Bank and NBFi Financing on TFP Growth: Firm-Level Regressions Using the Instrumental Variables Method(dependent variable = $dln(TFP)$)

Variable	(1) IV1 Full Sample	(2) IV1 KRX Subsample	(3) IV1 Non-KRX Subsample	(4) IV2 Full Sample	(5) IV2 KRX Subsample	(6) IV2 Non-KRX Subsample
<i>dlnloans</i>	0.006 (0.299)	-0.006 (-0.338)	0.027 (0.782)	0.009 (0.506)	-0.006 (-0.379)	0.035 (1.030)
<i>dlnloans*finlib</i>	0.015** (2.044)	-0.000 (-0.033)	0.027** (2.267)	0.019*** (2.660)	-0.001 (-0.150)	0.036*** (2.995)
<i>rnd_sales</i>	0.184*** (7.201)	0.201** (2.168)	0.178*** (6.342)	0.183*** (7.124)	0.201** (2.171)	0.174*** (6.160)
<i>lnassets</i>	-0.014*** (-4.412)	-0.008** (-2.458)	-0.019*** (-3.500)	-0.014*** (-4.682)	-0.008** (-2.470)	-0.021*** (-3.825)
First F-test	86.63	36.05	54.22	80.09	31.91	45.35
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,722	5,312	26,410	31,722	5,312	26,410
Number of firms	5,080	540	4,540	5,080	540	4,540

IV = instrumental variable, KRX = Republic of Korea Exchange, NBFi = non-bank financial institution, TFP = total factor productivity.

Notes: All estimates are based on firm fixed effects panel regression estimates. The dependent variable is TFP growth, $dlnTFP$. The explanatory variables $dlnloans$, rnd_sales , and $lnassets$, are growth of indirect financing, R&D–sales ratio, and log of assets, respectively. They are all 1-year lagged. The variable $finlib$ is financial liberalization index and the variable $dlnloans*finlib$ is an interaction term between $dlnloans$ and $finlib$. IV1 and IV2 use median and mean loan growth of the other firms in the same KSIC 3-digit industry as the instrumental variable, respectively. t-statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

5.4 Capital Market Financing and Productivity

Estimation of equation (3) for the full sample, of which results are presented in columns (5) and (6) in Table 4, shows that change in the financing structure ($shdirect$, a lagged share of direct financing) and the interaction terms between lagged growth of direct financing and the financing structure ($shdirect*finlib$) do not have any significant effect on TFP growth ($dlnTFP$). The subsample results in columns (2) and (5) in Table 5 are qualitatively the same.

Furthermore, growth of direct financing ($dlnindirectf$) and its interaction term with financial liberalization index ($dlnindirectf*finlib$) are insignificant in both subsamples of firms as shown in columns (3) and (6). The results are qualitatively the same when the variable, $shdirect$, is replaced by either the share of equity financing or the growth of equity financing, $dlnindirectf$. Thus, the effect of the relative increase in capital market financing on firm TFP growth is negligible, and this insignificance has little to do with financial liberalization itself. It also implies that capital market financing is a good substitute for bank financing for larger firms in the Republic of Korea.

6. INDUSTRY-LEVEL ANALYSIS RESULTS

This section estimates all three models with industry-level data to examine the effects of financial liberalization on industries, except for a couple of model modifications. First, in model 1, value added (VA) is chosen in place of ROA as the potential factor influencing the lending behavior of banks and NBFIs. This choice is made because of the unavailability of industry ROA data. Second, the industry-level analyses use a different set of control variables. Since it is very difficult to find variables identifying industry-specific characteristics, estimations of the three models include only a limited set of control variables. All estimates are obtained from industry fixed effects panel regressions.

6.1 Rationalization of Bank Lending Operations

The results of estimation of equation (1) at the industry level (Table 7) show that *dlnvai* (lagged value-added growth) and the financial liberalization index are statistically insignificant. The coefficient signs of the interaction term between industry value-added growth and the financial liberalization index, *dlnvai*finlib*, are also insignificant as presented in columns (3) and (4).¹⁷

Table 7: Determinants of Bank and NBF Financing: Industry-Level Regressions
(dependent variable = *dln(loansi)*)

Variable	(1)	(2)	(3)	(4)
<i>dlnvai</i>	0.023 (0.293)	0.020 (0.253)	0.020 (0.254)	0.128* (1.862)
<i>finlib</i>		0.010 (0.721)	0.010 (0.723)	
<i>dlnvai*finlib</i>			-0.004 (-0.082)	0.031 (0.697)
<i>rnd_vai</i>	0.188 (0.348)	0.179 (0.332)	0.176 (0.325)	-0.189 (-0.408)
<i>dum_after97</i>	-0.106*** (-6.049)	-0.138*** (-2.894)	-0.138*** (-2.882)	
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes
Observations	269	269	269	269
R-squared	0.152	0.154	0.154	0.424
Number of industries	24	24	24	24

NBFI = non-bank financial institution.

Notes: All estimates are industry fixed effects panel regression estimates. Variables *dlnvai* and *rnd_vai* are growth of value added and ratio of R&D to value added, respectively. They are both 1-year lagged. The variable *finlib* is the financial liberalization index. The variable *dlnvai*finlib* is an interaction term between *dlnvai* and *finlib*. t-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

Overall, the results suggest that financial liberalization had little bearing on the lending behavior of banks and NBFIs at the industry level, contradicting the results of the firm

¹⁷ The results are qualitatively the same as for the manufacturing-only subsample.

level analyses. One possible explanation for this disparity is that the magnitude of the positive effect of financial liberalization on the SME group may not have been large enough at the industry level to produce results similar to those of the firm-level analysis.

6.2 Bank Loans and Productivity

Table 8 displays the regression results of equation (2). The dependent variable is TFP growth ($dlnTFP$). As before, columns (1)–(3) insert a post-1997 crisis dummy to isolate the effect of financial liberalization. Column (4) includes year dummies. The coefficient estimates of the financial liberalization index ($finlib$) and the interaction terms between lagged loan growth and the financial liberalization index ($dlnloans*finlib$) are not significant, as shown in columns (3) and (4).

Table 8. The Effect of Bank and NBFI Financing on Total Factor Productivity Growth: Industry-Level Regressions

(dependent variable = $dln(tfpi)$)

Variable	(1)	(2)	(3)	(4)
<i>dlnloansi</i>	-0.001 (-0.086)	-0.002 (-0.105)	-0.002 (-0.110)	-0.014 (-0.727)
<i>finlib</i>		-0.005 (-1.096)	-0.006 (-1.077)	
<i>dlnloansi*finlib</i>			0.001 (0.033)	0.014 (0.833)
<i>rnd_vai</i>	0.275* (1.901)	0.277* (1.917)	0.276* (1.905)	0.275* (1.929)
<i>dum_after97</i>	-0.005 (-0.998)	0.010 (0.712)	0.010 (0.708)	
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	Yes
Observations	246	246	246	246
R-squared	0.023	0.029	0.029	0.123
Number of industries	24	24	24	24

NBFI = non-bank financial institution.

Notes: All estimates are industry fixed effects panel regression estimates. Variables *dlnloansi*, *shdirecti*, *dlnirectfi*, and *rnd_vai* are growth in indirect financing, direct financing ratio, growth of direct financing, and ratio of R&D to value added, respectively. They are all 1-year lagged. The variable *finlib* is the financial liberalization index and the variable $X*finlib$ is an interaction term between variable X and *finlib*. t-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

Although the firm-level analyses in the earlier subsection show that financial liberalization had a significant impact only on the group of firms not listed on the KRX, the relative importance of this impact at the industry level may not have been large enough to produce results similar to those of the firm-level analysis. These results may be interpreted as implying that financial liberalization has not improved the efficiency of lending by banks and NBFIs to foster subsequent industry TFP growth.

6.3 Capital Market Financing and Productivity

Data on the amount of direct financing and its share in total financing at the industry level were collected from internal sources of the Bank of Korea and used in the estimation of equation (3). Table 9 presents the estimation results of equation (3) for the industry-level data. Column (1) shows that change in the financing structure (*shdirecti*, a lagged share of direct financing) and the interaction term between lagged growth of direct financing and the financing structure (*shdirecti*finlib*) do not have any significant effect on TFP growth (*dlnTFP*). However, the interaction term between growth of direct financing and the financial liberalization index (*dlnirectfi*finlib*) is significant, as shown in column (2).

Table 9: The Effect of Alternative Methods of Financing on Total Factor Productivity Growth: Industry-Level Regressions

(dependent variable = <i>dln(tfpi)</i>)				
Variable	(1)	(2)	(3)	(4)
<i>dlnloansi</i>	-0.015 (-0.752)	-0.018 (-0.937)	-0.010 (-0.520)	-0.015 (-0.803)
<i>dlnloansi*finlib</i>	0.016 (0.911)	0.024 (1.401)	0.009 (0.537)	0.025 (1.536)
<i>shdirecti</i>	-0.007 (-0.200)			
<i>shdirecti*finlib</i>	0.009 (0.537)			
<i>dlnirectfi</i>		-0.012 (-1.465)		
<i>dlnirectfi*finlib</i>		0.020** (2.133)		
<i>shequityi</i>			0.009 (0.253)	
<i>shequityi*finlib</i>			0.033 (1.314)	
<i>dlnequityfi</i>				-0.021** (-2.370)
<i>dlnequityfi*finlib</i>				0.034*** (3.021)
<i>rnd_vai</i>	0.284** (1.972)	0.273* (1.929)	0.180 (1.033)	0.210 (1.230)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	246	246	236	236
R-squared	0.124	0.144	0.123	0.157
Number of industries	24	24	23	23

Notes: All estimates are industry fixed effects panel regression estimates. Variables *dlnloansi*, *shdirecti*, *dlnirectfi*, and *rnd_vai* are growth in indirect financing, direct financing ratio, growth of direct financing, and ratio of R&D to value added, respectively. They are all 1-year lagged. The variable *finlib* is the financial liberalization index and the variable *X*finlib* is an interaction term between variable *X* and *finlib*. t-statistics are shown in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Authors' calculations.

When the variable *shdirecti* is replaced by the share of equity financing, *shequityi*, and the variable *dIndirectfi* by the growth of equity financing, *dlnequityfi*, the interaction term between the growth of equity financing and the financial liberalization index, *dlnequityfi*finlib*, becomes significant as seen in column (4).

This contrast in results may be understood as follows. The share of direct financing is very slow to change and may not be fit to capture the effects of capital market financing, whereas the growth of direct financing has enough variation to appropriately match the changes in TFP. Thus, these results may imply that the effect of an increase in capital market financing on industry TFP growth is enhanced by financial liberalization. It is notable that this finding at the industry level is in contrast with the findings based on the firm-level data. One possible explanation is that the enhanced effect of direct financing during liberalization was not present for most of the firms within an industry, but was strongly present for a few very influential firms within the same industry.

These estimation results do not necessarily prove the hypothesis that equity-dependent industries benefitted relatively more than others from an expansion of the equity market for two reasons. The share of lagged equity financing is not significant, and the estimation does not define or identify inherently equity-dependent industries. Instead, it examines whether the industries with larger shares of equity financing have been able to increase their TFPs relative to those industries with smaller shares.

7. CONCLUDING REMARKS

The purpose of this paper has been twofold. First, it investigates whether financial reform for liberalization launched in the aftermath of the 1997 financial crisis has led to improvements in allocative efficiency of lending at banks and NBFIs. In a liberalized financial environment, intensification of competition through market deregulation is likely to drive these institutions to increase efficacy in identifying and lending to potentially more creditworthy and successful borrowers than before. If this positive effect is realized, then it can be expected that firms and industries that have gained greater access to indirect bank financing would have done better in improving their TFPs.

Second, it examines (i) whether the growing reliance of firms—in particular large ones—on capital market relative to bank financing has enhanced their productivity growth; and (ii) whether inherently equity-dependent industries have benefited more from the relative expansion of the equity market since the 1997 financial crisis, which set in motion a sweeping reform of the financial system in the Republic of Korea.

One of the findings of this study is that banks and NBFIs have taken a more rational approach to screening their borrowing customers by taking into account factors such as TFP and ROA history as lending criteria. Financial liberalization has also broadened the scope as well as capacity of intermediation at these institutions.

Despite these advances in banking, this study finds that overall effects of financial liberalization on efficiency improvements at the firm and industry levels, measured by changes in TFP and ROA history, have been relatively small or insignificant—although this does not necessarily mean that financial liberalization has not delivered what theory envisages in terms of efficiency gains.

When the sample is divided into large firms and SMEs for analysis of efficiency gains, this study finds that SMEs have benefited more from financial liberalization than large

firms, as the funding constraints they were subjected to during the repressive financial regime of the pre-crisis period have been relaxed.

In the process of restructuring the corporate sector after the crisis, large firms were required to improve their financial soundness by reducing their debt–equity ratios below 200% from more than 500% on average before the crisis. This meant that they had to rely more on internal and equity market financing than before.

With the growth of capital markets and deregulation of external funding, many of these large firms have been able to shift out of indirect financing, allowing banks and NBFIs to extend their lending to SMEs. In contrast, however, as for large firms—which were not bound by borrowing constraints even in the heavily controlled financial regime—substitution of bank financing for capital market financing has done little to improve their TFPs, suggesting that bank financing and direct funding through capital markets are good substitutes.

Although the number of SMEs is far greater than that of large firms, their share in the value added of the economy is very small. For this reason, when they are lumped together with large firms, efficiency gains of the whole sample of firms decline or become insignificant. It should also be added, although this is beyond the scope of this study, that changes in TFP at both the firm and industry levels are likely to be affected by a host of real factors, which could have more than offset the positive effects of financial liberalization during the period under discussion.

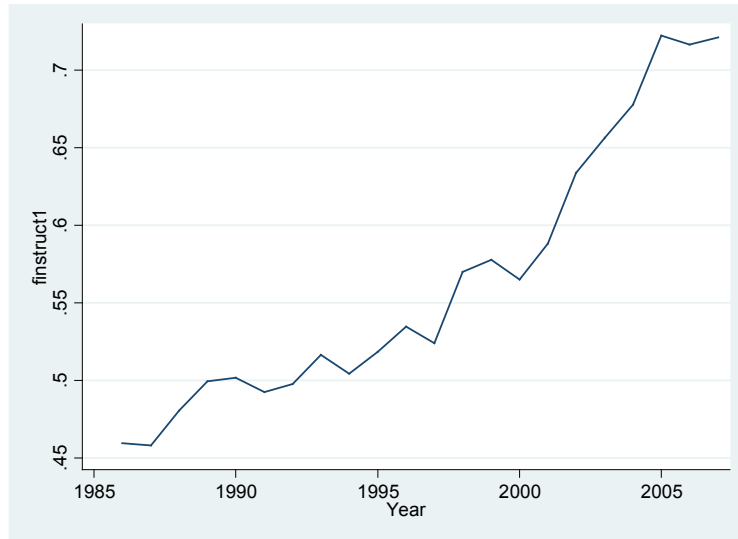
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APPENDIX

Figure A.1: Ratio of Direct Financing to Total Financing, 1990–2007
(%)

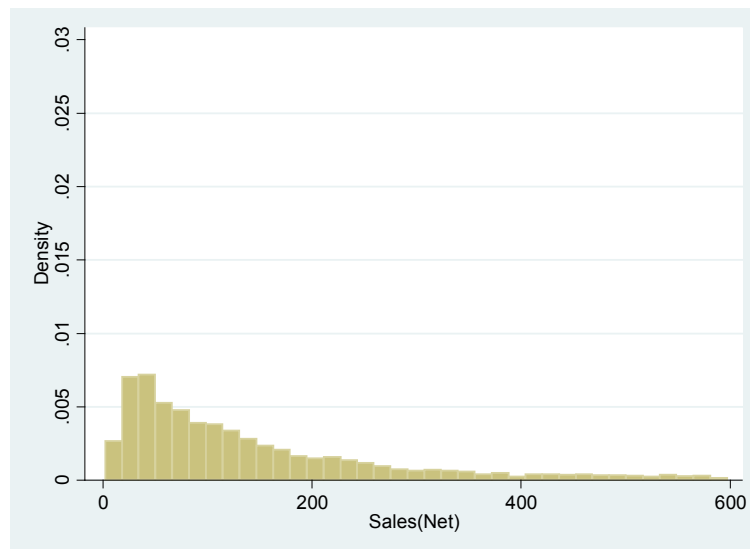


Note: The index is the ratio of direct financing (bond and equity) to total financing

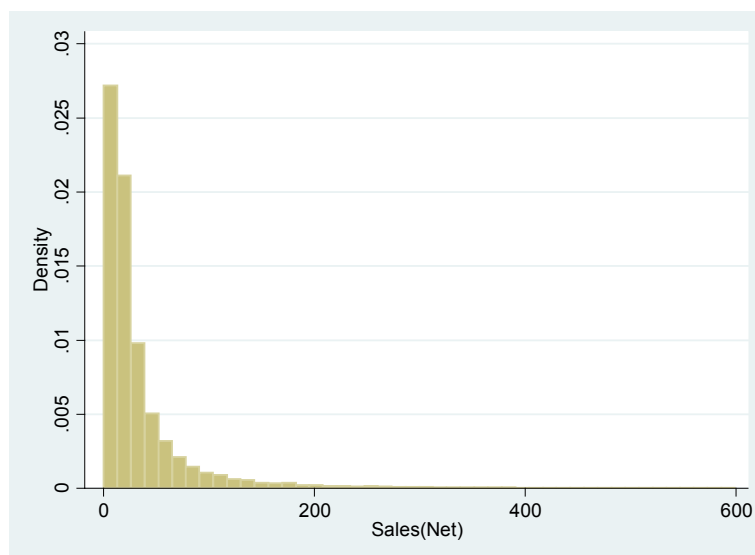
Source: *Flow of Funds Tables*, Bank of Korea.

Figure A.2: Distribution of Firms in Terms of Sales, 1991–2005
(W billion)

(a) KRX-Listed Firm Subsample



(b) Non-KRX Firm Subsample (SME)



Source: KIS-VALUE database, NICE Information Service.

Table A.1: Average Shares of Equity and Direct Financing of Firms in KRX and Non-KRX Subsamples

	KRX		Non-KRX	
	Equity Financing	Direct Financing	Equity Financing	Direct Financing
1991	0.335	0.501	0.147	0.230
1992	0.324	0.496	0.137	0.223
1993	0.335	0.524	0.144	0.238
1994	0.340	0.526	0.145	0.234
1995	0.336	0.527	0.137	0.217
1996	0.357	0.547	0.140	0.209
1997	0.335	0.507	0.114	0.162
1998	0.404	0.575	0.160	0.194
1999	0.471	0.630	0.202	0.223
2000	0.509	0.650	0.251	0.267
2001	0.528	0.664	0.255	0.279
2002	0.558	0.666	0.269	0.293
2003	0.583	0.684	0.257	0.283
2004	0.593	0.690	0.244	0.267
2005	0.621	0.727	0.250	0.277

KRX = Republic of Korea Exchange.

Source: Authors' calculation based on KIS-VALUE database, NICE Information Service.

Table A.2. Summary Statistics and Definitions of Variables: Firm-Level Data

Variable	Description	Obs.	Mean	Std.	Minimum	Maximum
<i>dln(tfp)</i>	Growth rate of TFP	41395	0.007	0.114	-0.498	0.498
<i>dlnloans</i>	Growth rate of indirect financing	36952	-0.005	0.342	-1.611	0.990
<i>ROA</i>	Return over asset	41384	0.070	0.085	-0.738	0.971
<i>finlib</i>	Financial liberalization index	41395	16.793	1.917	13.000	18.000
<i>rnd_sales</i>	Ratio of R&D to sales	41395	0.015	0.068	-0.035	4.235
<i>lnassets</i>	log of total assets	41395	23.963	1.368	18.613	31.798
<i>liab_eq</i>	ratio of liability to equity	41395	5.715	234	-2305	39200
<i>shdirect</i>	share of direct financing	38950	0.309	0.335	0.000	1.000
<i>dlnDirectf</i>	Growth rate of direct financing	36950	0.354	4.292	-27.190	26.930
<i>shequity</i>	share of equity financing	38950	0.253	0.312	0.000	1.000
<i>dlnEquityf</i>	Growth rate of equity financing	36950	0.356	4.026	-28.463	28.593

Obs. = observations, R&D = research and development, Std. = standard deviation, TFP = total factor productivity.

Notes: All variables except for *finlib* are firm-level annual frequency data. *finlib* is a year-specific variable.

Source: Authors' calculation based on KIS-VALUE Database, NICE Information Service.

Table A.3: Summary Statistics and the Definition of Variables: Industry-Level Data

Variable	Description	Obs.	Mean	Std.	Minimum	Maximum
<i>dln(tfpi)</i>	Growth rate of TFP	269	0.005	0.029	-0.126	0.177
<i>dlnloansi</i>	Growth rate of indirect financing	269	0.072	0.134	-0.393	0.456
<i>dlnvai</i>	Growth rate of value-added	269	0.076	0.097	-0.342	0.421
<i>finlib</i>	Financial liberalization index	269	17.037	1.597	13.000	18.000
<i>rnd_vai</i>	Ratio of R&D to value added	269	0.030	0.039	0.000	0.182
<i>shdirecti</i>	share of direct financing	269	0.456	0.103	0.219	0.758
<i>dlnDirectfi</i>	Growth rate of direct financing	269	0.021	0.203	-0.748	1.442
<i>shequityi</i>	share of equity financing	258	0.298	0.087	0.134	0.591
<i>dlnEquityfi</i>	Growth rate of equity financing	258	0.023	0.167	-0.457	0.988

Obs. = observations, R&D = research and development, Std. = standard deviation, TFP = total factor productivity.

Notes: All variables except for *finlib* are industry-level annual frequency data. *finlib* is a year-specific variable.

Source: Authors' calculation based on data from EU KLEMS database and KISTEP R&D Activity Survey database.