The Role of Financial Development in Economic Growth: The Experiences of Taiwan, Korea, and Japan

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Abstract

Since the financial crisis broke out in East Asia, the importance of financial development and stability had been noted. This paper tries to examine the relationship between financial development and the source of growth for three Asian economies, namely, Taiwan, Korea, and Japan. Particularly, we wish to emphasize the role of financial development and structure (including banking and stock markets), monetary and financial policies, as well as the degree of international capital mobility in the economic growth processes. Using the generalized method of moments (GMM) and principal component analysis, we find that (1) high investment had accelerated economic growth in Japan, while high investment to GDP ratio did not necessarily lead to better growth performance if investment did not have been allocated efficiently e.g. in Taiwan and Korea cases; (2) real export growth rate had contributed to all three economies; (3) capital flows had negative effects on Taiwanese and Korea's economic growth, while the capital inflow had positive effect on Japan's economy only; (4) the finance-aggregate had positive effects on Taiwan's economy, but had negative effect on other countries; (5) the stock market development had positive effects on Taiwan's economic growth.

Keywords: financial development; economic growth; international capital mobility; GMM (generalized method of moments).

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I. Introduction

In the last two decades, Taiwan and Korea had experienced remarkable growth with an annual average growth rate over 6%, while the average growth rate of Japan was only 2.67%. It is interesting to examine the sources of economic growth in these economies. Until the Asian Crisis came out, the importance of financial development and stability had been ignored. The reason to focus on these three economies is that recently they have been undergoing remarkable financial reform and therefore offer a superb sample to assess the role of the financial sector development in these country's economic growth processes.

The general idea that economic growth is related to financial development and structure can go back at least to Schumpeter(1911). Schumpeter emphasized the importance of the banking system in economic growth and highlighted circumstances when financial institutions can actively spur innovation and future growth by identifying and funding productive investments. Earlier literature including Goldsmith(1969), McKinnon(1973) and Shaw(1973) had suggested that financial system should have played an important role in economic growth. McKinnon(1973) and Shaw(1973) showed that financial development would raise saving, capital accumulation, and hence economic growth. Greenwood and Jovanoic(1990), Bencivenga and Smith(1991), Levine(1991), Saint-Paul(1992) and King and Levine(1993a) have developed various theoretical frameworks that link financial activities or services with steady state growth.

At the empirical studies, King and Levine(1993a,b) used cross-countries data to analyze the relationship between economic growth and the financial development. Their results had shown that a range of financial indicators are robustly positively correlated with economic growth. But, they also found that government intervention in the financial system has a negative effect on the growth rate. Demirgüc-Kunt and Levine(1996b) used 44

cross-countries data from 1986 through 1993 had found that a positive relationship between stock market and financial institutions development. Demetriades and Hussein(1996) employed time series data for each of 16 countries showed that finance is a leading sector in the process of economic development. Also, Odedokun(1996) employed time series data for 71 developing countries and showed that financial intermediation had promoted economic growth, in some 85% of the countries. While the empirical works above focus on only banking sector development, they ignored the effect of stock market development.

Levine(1991), Saint-Paul(1992) and Bencivenga et al.(1995) showed that stock markets accelerate growth by allowing agents to diversify portfolios and facilitating the ability to trade ownership of firms without disrupting the productive processes occurring within firms. However, Bencivenga et al.(1995) also showed that financial development can hurt economic growth. Specifically, financial development by enhancing resource allocation and hence the returns to saving may lower saving rates.

Levine and Zervos(1998) investigated whether measures of stock market liquidity, size, volatility, and integration with world capital markets are correlated with economic growth. Their study provided empirical evidence on the theoretical debates regarding the linkages between stock markets and long-run economic growth. However, their study did not utilize time series model to test the growth relation in a particular country. Instead, they used 47 countries data from 1976 though 1993 by taking the standard cross-country growth regression framework like Barro(1991) to test the economic growth hypothesis. Also, Leahy et al.(2001) used OECD countries data and showed that stock market and financial institutions development are correlated with economic growth. Levine et al.(2000) and Beck et al.(2000) used both cross-country data and dynamic panel data techniques to assess the role of the financial development in stimulating economic growth. Their results found that

financial development had been robustly linked with economic growth and total factor productivity growth.

Arestis et al.(2001) used quarterly data and applied time series model to five developed economies and showed that while both banking sector and stock market development could explain subsequent growth, the effect of banking sector development had been substantially larger than that of stock market development. Hsu and Lin (2000) had investigated the relationship between long-run economic growth and financial development to see whether stock market and financial institutions promote economic growth using Taiwan's data from 1964 through 1996. The empirical method utilized is the vector autoregressive error-correction model proposed by Johansen and Juselius(1992). They found that both banking and stock market development are positively related with short-run and long-term economic growth. In particular, the financial depth measured by the ratio of the broad monetary aggregate (M_2) and GDP had strong effect on the output growth. In addition, they also found that Granger causality exists between financial development measures and economic development in both directions occurred during the study period (i.e. from 1964 through 1996).

However, most of the empirical studies on economic growth had neglected the effect of international capital mobility on economic growth. High degree of capital mobility not only affects independence of domestic monetary and fiscal policies, but also adds to complexity of managing saving and investment problems in a country.

Hanson(1994) suggested that a stable macroeconomy and domestic financial liberalization to a significant degree are preconditions to international financial liberalization. Johnston et al.(1997) examined issues in sequencing and pacing capital account liberalization and draws lessons from experience in Chile, Indonesia, Korea, and Thailand. Their results suggested that capital account liberalization should be approached

as an integrated part of comprehensive reform strategies and should be paced with the implementation of appropriate macroeconomic and exchange rage policies. However, Kim and Suh(1998) suggested that capital account liberalization will enhance the competitiveness and efficiency of financial transactions for Korean corporations. Hence, It cannot further delay the opening of domestic capital market to foreigners as well as the foreign capital markets to domestic residents.

The purpose of this paper is to review the evolution of financial policies in Taiwan, Korea, and Japan and to examine the relationship between financial development and the source of growth in each country. This paper will emphasize the role of financial development and structure (including banking and stock markets), monetary and financial policies, as well as the degree of international capital mobility in the economic growth processes. The remainder of this paper is organized as follows. Section II briefly reviews the evolution of each country's financial system. Section III describes an econometric model and the data used in this study. Section IV presents the main results. Section V is the concluding remarks.

II. Evolution of the Financial System

This section describes the three countries' experience of financial liberalization. World Bank (1993) showed that Taiwan, Korea, and Japan have achieved high economic growth since the post-World War II is due to the guide of government policies. However, the government policies of financial liberalization process implemented by these countries were different during the last two decades. We describe each country's financial liberalization process below.

2.1 Taiwan

The Taiwan government controlled the financial liberalization process very tightly.

Liberalization in the financial sector changes gradually. Financial liberalization took place in three stages since 1980. Slow financial liberalization allows Taiwan to be free from the serious attack of the Asian financial crisis. In particular, the incomplete deregulation of the capital account, i.e. the control of the portfolio investment inflows, as well as the low reliance on hard-currency-denominated foreign loans in the private sector were two key factors to allow the Taiwan economy to fight against the hard-type financial investment of foreign funds.

The financial liberalization process in Taiwan could be divided in three stages. Firstly, interest rate liberalization started in the early 1980s. Deregulation of the interest rate ceiling on the money market was effective in November 1980. And from March 1985 banks were allowed to price their own interest rates.

Secondly, the foreign exchange system was converted from a fixed rate system to a managed flexible rate system in February 1979. Although the exchange rate of the NT dollar against the US dollar has been allowed to fluctuate since then, it is controlled occasionally by the Central Bank. Until now, the foreign exchange market is still only partially liberalized. Also, the Central Bank had controlled the capital movement quite closely until July 1987, when it deregulated capital outflow in the non-bank private sector. However, the bank's borrowing of foreign exchange was frozen.

Thirdly, the liberalization of the securities market started in January 1988, when the Securities and Exchange Law was revised to lift the restriction of the establishment of new securities companies. However, the participation of foreign investors in the Taiwan securities market is allowed to increase gradually. This slow increase in the foreign investment in the domestic stock market did not completely separate the Taiwan capital market from the global financial markets. However, this conservative liberalization policy together with the partial deregulation of capital movement allowed the Taiwan economy to be secure from the speculative attack of the foreign hedge and mutual funds. In sum, the

financial liberalization process in Taiwan during the last two decades followed the order suggested by McKinnon (1991) to transform the economy from a financial control economy to a market-oriented one. The Taiwan government had designed a series of financial account or capital account control to stave off the speculative attack on currency and the financial market. The main regulations on capital flows could be summarized as follows.

1. Taiwanese banks are not allowed to borrow abroad freely. Usually they should report in advance at the beginning of each year to the Central Bank to explain their yearly schedule of foreign borrowing and debt balances.
2. The Central Bank banned the use of non-delivery forward contracts（NDFs）for Taiwanese corporations to hedge against the foreign exchange risks.
3. In the equity and securities market, the maximum investment quota for each qualified foreign institutional investor is ＄600 million US dollar before November 1999. In December of 2002, it was raised to ＄3 billion US dollars and was released in July of 2003.
4. Each offshore natural person is limited to invest a maximum of ＄5 million US dollars, while each offshore juridical person or each non-incorporated fund is limited to invest a maximum of ＄50 million. However, in September of 2003, this restriction had been released conditionally.

In addition, before 1991, all banks were either owned or partly owned by the government. Even banks have played a critical role in promoting Taiwanese development process. However, since sixteen new private commercial banks had been permitted and established in 1991, the average rate of return on the net worth for the banks dropped tremendously from above 20.79% in 1990 to about 3.61% and –7.35% in 2001 and 2002. The non-performing loans rose from 0.93% of total loans in 1990 to 7.48% and 6.12% in 2001 and 2002 respectively. Over banking phenomenon exists.

Therefore, in order to solve the problem, the government had undergone significant

changes in financial reforms. Firstly, in order to raise the competitiveness of financial institutions, the Financial Institutions Merger Law was promulgated in December 2000. Secondly, in order to effectively handle unhealthy financial institutions, the financial restructuring fund was set up in July 2001. Thirdly, in order to raise the overall operational efficiency of financial system and promote the soundly development of the financial market, the Financial Holding Company Act was enacted and formally implemented in November 2001. The Act provides banks, securities firms and insurance companies with a mechanism for cross-industry operations. As of August 2003, the government has approved the application of 14 financial institutions to set up financial holding companies.

2.2 Korea

The financial liberalization policies in Korea were to give financial institutions greater freedom to set their own prices and to attract and allocate funds, during the 1980s. Major policies implemented during the first half of 1980s include the privatization of commercial banks started in 1982 and was completed by 1983; the reduction of entry barriers to nonbank financial intermediaries; more diversification of financial services provided by different financial intermediaries in 1982-1983; various interest rate deregulations (1982-1984) including the abolition of preferential interest rates (1982); and the internationalization of capital markets (1981-85). Extensive deregulation of interest rates of banks and nonblank financial intermediaries in 1988 resulted in the liberalization of most of the lending rates, interest rates on money and capital markets, and partial liberalization of the interest rates on deposits (see Kim and Suh (1998)). Three new commercial banks were established in 1989, five securities investment companies were set up in that year, and 18 life insurance companies were opened during 1987-1990.

However continued government control of interest rates at all banks, along with high proportion of nonperforming bank loans and heavy dependence on the Bank of Korea for

low-cost funds to support their outstanding loans, had left the privately owned commercial banks very vulnerable. A substantial of their outstanding loans had been still policy-related. The banks cannot afford to ignore the government's suggestions, despite their shift to private ownership (see Smith(2000)). State allocation of credit remained little changed after financial liberalization in 1980s.

The nonbank financial institutions, in contrast, had always been privately owned and had been both less controlled and less protected by the government. They had to mobilize their own funds in competitive markets and to earn enough on their loans and investments to cover the cost of their funds. A combination of lax government supervision, unreliable accounting statements, and high growth had avoided and postponed serious problems before the Asian Financial Crises in 1997. This is especially true for finance companies and merchant banks.

The financial liberalization in Korea during the 1990s was due to its effort to join the OECD. The global integration of the economy accelerated in 1993, in an effort to meet the requirements to join the OECD. The capital account liberalization in Korea since 1990 had induced capital inflows, as the fall in world real interest rates in 1989 pushed capital to flow to Asia. The portfolio net inflows to Korea between 1990 and mid-1997 totaled US$ 59 billion. In the previous seven years, net inflows had totaled roughly zero (see Hanna(2000)). It should be noted that while there is conflicting debate surrounding the distribution of blame for the Asian Financial Crises in Korea during 1997-1998, there is a general consensus that its root cause lay in the country's high-debt model of economic development, as well as poor sequencing of financial market liberalization. In 1991, foreign exchange controls phased out. In 1992, partial opening of the stock market to foreigners. In 1994, Korean authorities liberalized restrictions on short-term foreign borrowing by financial institutions and corporates, but retained controls on long-term borrowing. Subsequently, the time profile of Korea's foreign debt shortened significantly. However, foreign firms can list

on the Korea stock exchange in 1996.

2.3 Japan

Since the late 1970s, the Japanese financial system has been gradually but steadily liberalized. Japan entered the "era of financial liberalization" in the 1980s. The liberalization of bank deposit interest rates was the introduction of large-denomination CDs (certificates of deposit) with unregulated rates in 1979. After several years of no further deregulation measures, the government started to decontrol interest rates step by step from 1985. The interest rate deregulation proceeded slowly and full deregulation occurred much later than other major industrialized economies and even some of East Asian developing economies such as Taiwan and Singapore. By 1993 almost all bank deposit rates except for small –denominated and demand deposits had been liberalized. The deregulation of deposit interest rate was completed in 1994. Foreign exchange transactions were liberalized in December 1980, although some restrictions still remained.

New Banking Law and Securities and Exchange Law implemented in 1982. The participation of foreign institutions in government bond syndicates was allowed in 1984. Nine foreign banks were allowed to participate domestic trust business in 1985. In 1986, foreign brokers become Tokyo Stock Exchange members. And from August 1987 U.S. banks were allowed to do securities business.

However, it is noteworthy that the financial system in Japan was deregulated slowly and gradually in the 1980s. It has been market development associated with globalization that asserted the strongest influence in shaping the evolution of the financial system in the 1990s. With the bubble's collapse, the Japanese economy slumped into the long stagnation of the 1990s. To counter this stagnation, the government began to encourage financial reform.

In 1992, the Financial Reform Law was approved and financial institutions were allowed to enter into other kinds of financial business by establishing subsidiaries. For

example, banks were allowed to engage in securities business through their subsidiaries (see Honda(2003)). The government allowed securities companies to set up trust-bank subsidiaries from 1993. The pension fund market was opened in 1995. However, the Japanese financial reform was still slowly, the non-performing loans(NPLs) rose quickly, led to the problem of Japan's banking crisis burst in late 1997 and early 1998.

In late 1996, the government revealed a plan to reform its financial markets and institutions, creating a free, fair and global system. The financial system reform is so-called Japanese Big Bang. The Big Bang reforms allow competition through financial holding companies and also allow foreign firms liberalized access. The "Big Bang" is comprehensive, including:

1. The Foreign Exchange Act was revised in 1997, and the reform abolished most the international capital controls that had remained after an extensive liberalization in 1980.
2. Non-life insurance premiums were deregulated in 1998.
3. Securities companies entered the insurance industry was started in 1998.
4. Remaining regulations on cross-border or cross-currency financial transactions were abolished with exceptions of the emergency in 1998.
5. Brokerage commissions were completely deregulated in 1999.
6. In 2000, insurance companies can enter the banking, trust and securities sectors through subsidiaries. Bank also can enter the insurance industry.

III. An Empirical Model and Data Sources

3.1 An Empirical Model

The specific model setup here is to follow Odedokun(1996). Odedokun's model is based on the standard neoclassical one-sector aggregate production in which financial development constitutes an input. The specification is the following:

$$Y_t = \mathrm{F}(L_t, K_t, F_t, Z_t), \qquad (1)$$

where the subscript t refers to time, Y is real output or real GDP, L is labor, K is physical capital, F represents the level of financial development, Z represents other factors associated with economic growth.

By taking differentiation of equation (1), after appropriately manipulating and rearranging, equation (1) could be expressed as:

$$\dot{Y}_t = \beta_0 + \beta_1 \dot{L}_t + \beta_2 \frac{I_t}{Y_t} + \beta_3 \dot{F}_t + \beta_4 \dot{Z}_t + u_t, \qquad (2)$$

where $\dot{Y}_t$, $\dot{L}_t$, $\frac{I_t}{Y_t}$, $\dot{F}_t$ and $\dot{Z}_t$ represents the economic growth rate, the rate of labor force growth, the investment rate, financial development indicators and other factors, respectively. u_t is the error term. Equation (2) is our estimating equation, where the investment rate is the proxy of capital growth.

In fact, more specifically, we may reinterpret equation (2) by rewriting equation (1) with a Cobb-Douglas form, i.e.,

$$Y=AK^{\alpha}L^{\beta}, \qquad (3)$$

where A is the total factor productivity. And expressing in log form, we have

$$\log(Y/L) - \alpha \log(K/L) = \log A + (\alpha + \beta - 1) \log(L)$$

By assuming that A is positively related to financial deepening and development measured by F, then we have estimated equation (2) (see Park (1992)).

3.2 Data Description and the Econometric Method

We use time-series data to test the relationship between financial development and economic growth. Our variables are measured as follows. The growth rate of real GDP is the measure of economic growth. The investment rate is the ratio of fixed-capital investment

and GDP. The labor force growth is proxied by employment growth. The variable is calculated as the annual growth rate of employment.

To assess the effect of financial intermediary development on economic growth, three indicators of financial intermediary development are constructed.[1] Firstly, we use a broad money stock (M2) to GDP ratio to capture the overall size of the formal financial intermediary sector. This is a typical indicator of financial depth (see King and Levine(1993a)). The second indicator used is private credit, which equals bank claims on the private sector divided by GDP. The measure excludes loans issued to governments and public enterprises. It also excludes credits issued by the central bank. It indicates the share of credit funneled through the private sector (see Levine et al. (2000) and Beck et al.(2000)). The third one used to measure the financial intermediary development is commercial-central bank, which equals the ratio of bank domestic assets to total assets of bank and the central bank. It measures the degree to which commercial banks or the central bank allocate the society's savings (see Beck et al. (2000)).

Likewise, to evaluate the effect of stock market development on economic growth, three indicators are constructed. The first indicator is the stock market capitalization ratio, which equals the ratio of the market value of listed shares to GDP. This is a typical measure of stock market size. The second indicator is turnover ratio, which equals the value of the trades of shares on domestic exchanges divided by total value of listed shares. The turnover ratio measures the value of stock transactions relative to the size of the market, and it is frequently used as a measure of market liquidity (Demirgüc-Kunt and Levine (1996a, b, c)). The third indicator is the percentage change of stock price index which is the measure of stock market volatility. The deviation of stock price index is measured by the first differences of the average-of-quarter stock market price index.

In addition, to assess the effect of international capital mobility on economic growth,

[1] See King and Levine(1993a,b), Demetriades and Hussein(1996), Levine(1997) and Beck et al.(2000).

two variables are considered. One variable is capital outflow and GDP ratio, which is defined as the ratio of the sum of outward foreign direct investment and portfolio investment assets to GDP. Another variable is capital inflow and GDP ratio, which equals the sum of inward direct investment and portfolio investment liabilities to GDP. Also, we use the inflation rate and the ratio of government consumption to GDP as indicators to measure the macroeconomic stability (Beck et al.(2000)). The inflation rate is defined as the change of CPI.[2] Real export growth was calculated as the annual growth rate of real exports of goods and services. And the growth rate of real export is to capture the degree of openness of an economy. The data for Taiwan and Korea are quarterly data over the period from 1981:1 to 2001:3. To explain the financial development in Japan, the interval of the data in Japan is longer, from 1970:1 to 2001:3. The data of capital outflow and inflow are still from 1980:1 to 2001:3 since the short of quarterly data before 1980. The sources of our data are reported in the Appendix A.

Since most of the variables under study are likely to be endogenous, the OLS estimators are inconsistent. To overcome the difficulty, we use the generalized method of moments (GMM) to estimate the coefficients of the model. One and four-period-lagged dependent and independent variables are used as instruments. All standard errors of estimates are asymptotically autocorrelation and heteroschedascity consistent. We examine the appropriateness of the instruments with Hansen's(1982) test of the overidentifying restrictions. The instruments are appropriate if we cannot reject the null hypothesis.

IV. Empirical Results

4.1 Descriptive statistics and correlations

[2] Fischer(1991,1993) suggested that macroeconomic instability was negatively associated with economic growth.

Table 1 summarizes some of the macroeconomic trends. Taiwan and Korea have higher average growth rates with 6.87% and 7.34% respectively. Korea and Japan have higher average fixed-capital investment to GDP ratio, which were 30.29% and 30.07% respectively. It is usually suggested that investment share of GDP is the engine of economic development. Although Taiwan has achieved higher economic growth than Japan, Taiwanese average investment ratio was only three-fourth of Korea and Japan. Hence, high growth rates were not necessarily associated with high investment ratios. However, Taiwan and Korea have achieved higher export growth than Japan. It seems that high rate of economic growth have accompanied by even higher rates of export growth. As for the inflation rate, Taiwan and Japan have maintained a stable price level. Furthermore, average ratio of M2 to GDP was 2-3 times greater in Taiwan and Japan than it was in Korea. The measures of commercial-central bank, private credit, stock market capitalization ratio, turnover ratio, and the change of stock price index in Taiwan and Japan are also higher than those in Korea. However, the capital outflow to GDP ratio in Korea is lower than those in Taiwan and Japan.

Tables 2-1, 2-2, 2-3 and 2-4 show the correlations between different measures of financial development and real GDP growth rate in these three countries. In Taiwan, the correlations between the economic growth rate and commercial-central bank is only 0.08, while the correlations between the economic growth rate and other financial development indicators are in within the range –0.05 ~ –0.42. In Korea, the correlations between the economic growth rate and stock market capitalization ratio is only 0.12, while the correlations between the economic growth rate and other financial development indicators are within the range –0.04 ~ –0.37. Finally, the correlation between economic growth rate and all financial development indicators in Japan are within the range -0.37 ~ 0.51 by the data from1981/1 to 2001/3.

In addition, the correlation between M2 to GDP ratio and both commercial-central bank and private credit in Taiwan and Korea are within the range 0.70 ~ 0.97 and 0.82 ~ 0.80 respectively. The correlation between M2 to GDP ratio and private credit is 0.88 in Japan but only 0.80 during the period from 1981/1 to 2003/1. It should be noted that M2 to GDP ratio can be regarded as liquidity of banks as well as finance-size. Due to these variables are highly correlated over the sample period, multicollinearity might be serious in these countries. To solve the problem, we will follow Beck et al.(2001) and utilize the multivariate analysis to find out the principal components of the highly correlated financial indicators in the particular category. Finance-aggregate, an alternative measure of financial intermediary, is a conglomerate indicator of the overall size, activity, and efficiency of financial intermediaries. Specifically, it is the first principal component of M2 to GDP ratio, private credit, and commercial-central bank. The principal component analysis has just followed that of Jollitte(1986).

Furthermore, the correlation between the change rate of stock price index and both stock market capitalization ratio and turnover ratio are 0.10 and –0.04 in Taiwan and 0.0002 and 0.33 in Korea respectively.

4.2 Regression Results

Table 3 reports the GMM estimation results for these countries. The last row in each table reports p values for the Hansen test which cannot reject the null of overidentifying restrictions. That is, the null hypothesis that the instruments are appropriate cannot be rejected.

In Table 3, Column (1) considers the economic growth effect of those variables such as the fixed-capital investment to GDP ratio, the employment growth rate, real government

consumption as share of real GDP, the growth rate of real export, inflation rate, finance-aggregate, stock market capitalization ratio, turnover ratio, and the change of stock price index.[3] Column (2) further includes capital outflow and inflow to GDP ratios.

Table 3 shows that, as expected, all coefficients of growth rates of employment and real export are statistically significant. This implies that both employment and real export have contributed to economic growth. As for the fixed-capital investment to GDP ratio, in each country it behaves differently. The estimated coefficient of fixed-capital investment to GDP ratio is significantly positive in Japan, while it becomes significantly negative in Taiwan and has little or even negative effects in Korea. The fixed-capital investment to GDP ratio is not a significant factor in accounting for economic growth over the past two decades in Taiwan and Korea. One possible reason for these different effects may be due to that investment did not exhibit dynamic efficiency among these countries. The other reason may be that investment had level effect on GDP, but it did not reveal growth effect. The finding is consistent with what Lin et al.(1996) had got using Taiwan's and Korea's data. In other words, there may exist overinvestment during the study period. It should be noted that the national investment includes private and public investment.

In addition, the finance-aggregate variable has a positive and significant effect on economic growth in Taiwan and Japan cases, while it becomes insignificant or the sign of the coefficient even negative in Korea case.[4] This may be due to the relative stability of financial system in Taiwan from 1980 and in Japan from 1970. However, after 1980, the effect of Finance-aggregate variable in Japan becomes negative as shown in column (2). This may be in line with the situation of the Japanese banking system in these periods, dominated by large banks, has been suffering from serious problems with non-performing

[3] Stock market capitalization ratio and turnover ratio are not available for Japan.
[4] In Appendix B, we compare the difference between principal components estimates and original lease square estimates.

loans since the bursting of the stock market and urban real estate bubbles at the beginning of the 1990s. At the same time, the Japanese economy slumped into the long stagnation. To solve the problem, the Japanese government started to encourage financial reforms. However, it was clear that the financial reform was not sufficient to end the stagnation in the early 1990s. Delay by regulatory authorities and the fact that the Japanese banks had an intertwined relationship with the government led to a banking crisis burst in the late 1990. Similarly, Korea's banks have an intertwined relationship with the government. Many reforms just followed Japan's steps. Moreover, to join the OECD and to meet the OECD's requirements, without taking account of financial structural imperfections, the process of financial deregulation not only continued but accelerated. The Korea's government even further abolished capital account controls. The bank's crisis eventually burst in 1997-1998.

With regard to stock market capitalization ratio, it had played a positive role in Taiwan and Korea. However, the estimated coefficient of turnover ratio is insignificantly positive or even negative in Taiwan and Korea cases. This result is inconsistent with the findings of Levine and Zervos (1998). They found that the liquidity of the stock market was a robust predictor of economic growth. Moreover, all coefficients of the percentage change of stock price index were significantly positive except Korea. It seems that the stock market development had contributed to Taiwan's economic growth comparing with those in Korea and Japan.

Finally, in Taiwan and Korea, both estimated coefficients of capital outflow and capital inflow to GDP ratio are negative, although the effect of capital outflow to GDP ratio on economic growth is insignificant in Taiwan. These results reveal that capital inflows could hurt Taiwanese and Korea's economic growth. One possible reason for this is that the portfolio investment was larger than the foreign direct investment in Taiwan and Korea (see Figures 1-1 through 1-2). The coefficient of capital outflow to GDP ratio is significantly

negative and capital inflow to GDP ratio is significantly positive in Japan case. This indicates that the capital inflow play a positive role in Japan's economic growth, while the capital outflow has negative effect on economic growth.

V. Conclusions

In the past two decades, Taiwan and Korea had experienced rapid economic growth, while Japan did not. This paper tries to investigate the sources of economic growth in these countries. Particularly, we focus on the role of financial development and structure (including banking and stock markets), monetary and financial policies, as well as the degree of international capital mobility in the economic growth processes.

The major findings could be summarized as follows. (1) High investment had accelerated economic growth in Japan, while high investment to GDP ratio does not necessarily lead to better growth performance if investment did not have been allocated efficiently or overinvestment exist e.g. in Taiwan and Korea cases. (2) Real export growth rate had contributed to all three economies. (3) Capital flows had negative effects on Taiwanese and Korea's economic growth, while only the capital inflow had positive effect on Japan's economy. (4) The finance-aggregate had positive effects on the economy of Taiwan and Japan, but had negative effect on Korea and that Japan after 1980. One possible reason may be due to the relatively sound financial system and prudentially financial regulation and supervision in Taiwan comparing with those in Korea and Japan. (5) The stock market development had positive effects on economic growth in Taiwan.

The results from this study are fruitful, we had combined the principal component analysis with time series analysis to investigate the relation of financial growth and structure with economic growth. In order to do so, we categorize the banking financial indicators into financial aggregate, instead of putting all financial variables separately in the regression

model.

Appendix A: Data Sources

The data included in this study have contained consist of real GDP, real fixed-capital investment, employment, real government consumption, real export of goods and services, consumer price index (CPI), money, quasi-money, bank claims on the private sector by deposit money banks, deposit money bank domestic assets, central bank domestic assets, the total value of listed shares, the value of the trades of shares on domestic exchanges, the stock price index, direct investment abroad, direct investment in domestic, portfolio investment assets, and portfolio investment liabilities. First, about the data for real GDP, real fixed-capital investment, employment, real government consumption, real export of goods and services, Taiwan data are from *Quarterly National Economic Trends Taiwan Area, the Republic of China*, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, ROC. The Korea data are from http://www.nso.go.kr/eng. The Japan data are from *IMF International Financial Statistics.* Second, about employment, Taiwan data are from *Monthly Bulletin of Manpower Statistics Taiwan Area, Republic of China*, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, ROC. The data of Korea and Japan are, respectively, from http://www.nso.go.kr/eng and *IMF International Financial Statistics*.

The data for money, quasi-money, bank claims on the private sector by deposit money banks, the deposit money bank domestic assets, central bank domestic assets, direct investment abroad, direct investment in domestic, portfolio investment assets, and portfolio investment liabilities of Korea and Japan are all from *IMF International Financial Statistics*, while those of Taiwan are from *Financial Statistics, Taiwan District Republic of China* (compiled in accordance with IFS format), Central Bank of China. The CPI data of Korea and Japan are from *IMF International Financial Statistics*, while that of Taiwan is from

Commodity-Price Statistics Monthly in Taiwan Area of the Republic of China, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, ROC. The data for total value of listed shares, the value of the trades of shares on domestic exchanges, the stock price index of Taiwan and Korea are from *TEJ Data Bank*, Taiwan Economic Journal Co. Ltd., and http://www.nso.gov.kr/eng respectively. The data of the stock price index of Japan is from *IMF International Financial Statistics.*

Appendix B: Principal Components

Since the three variables for financial intermediary development indicator are highly correlated, we use principal components regression to solve this multicollinearity problem. We select one principal component to capture the main elements of three variables and name it "finance-aggregate". The new estimated coefficient of finance-aggregate is a simple function of original least squares estimators of these three variables. Though the principal components estimator is a biased estimator, it may be more precise than its least squares counterpart.

1. Principal Components Regression Analysis

Let the model under consideration be

$$\mathbf{y} = \mathbf{X\beta} + \boldsymbol{\varepsilon},$$

where $\mathbf{y}$ is (T□1), $\mathbf{X}$ is (T□K) and nonstochastic, $\boldsymbol{\beta}$ is (K□1), and $\boldsymbol{\varepsilon}$ is (T□1) and distributed as $N(\mathbf{0},\sigma^2\mathbf{I})$. Consider the transformation

$$\mathbf{y} = \mathbf{XPP'\beta} + \boldsymbol{\varepsilon} = \mathbf{XP\theta} + \boldsymbol{\varepsilon} = \mathbf{Z\theta} + \boldsymbol{\varepsilon}, \qquad \text{(B1)}$$

where $\mathbf{P}$ is a (K□K) matrix whose columns ($\mathbf{p}_i$) are orthogonal characteristic vectors of $\mathbf{X'X}$ ordered to be correspond to the relative magnitudes of the characteristic roots of the positive definite matrix $\mathbf{X'X}$ and $\mathbf{Z}$ is the (T□T) matrix of principal components. Accordingly, $\mathbf{z_i} = \mathbf{Xp}_i$ is called the *i*th principal component, where $\mathbf{z}_i'\mathbf{z}_i = \lambda_i$ and λ_i is the *i*th largest characteristic root of $\mathbf{X'X}$.

The principal components estimator of $\boldsymbol{\beta}$ is obtained by deleting one or more of the variables $\mathbf{z}_i$, applying ordinary least square to the resulting model and making a transformation back to the original parameter space. Assume for the moment that $\mathbf{Z}$ has been partitioned into two parts $\mathbf{Z}_1$, the $\mathbf{z}_i$ to be retained, and $\mathbf{Z}_2$, the $\mathbf{z}_i$ to be deleted. This partitioning imposes an identical partitioning on $\mathbf{P}$. Thus (B1) becomes

$$\mathbf{y} = \mathbf{XP}_1\theta_1 + \mathbf{XP}_2\theta_2 + \boldsymbol{\varepsilon} = Z_1\boldsymbol{\theta}_1 + Z_2\boldsymbol{\theta}_2 + \boldsymbol{\varepsilon},$$

where $\mathbf{X}\{\mathbf{P_1} : \mathbf{P_2}\} = \{\mathbf{Z_1} : \mathbf{Z_2}\}$. The principal components estimator is obtained by an inverse linear transformation. Since $\boldsymbol{\beta} = \mathbf{P}\boldsymbol{\theta} = \mathbf{P_1}\boldsymbol{\theta_1} + \mathbf{P_2}\boldsymbol{\theta_2}$, omitting the components in $\mathbf{Z}_2$ means that $\boldsymbol{\theta}_2$ has implicitly been set equal to zero. Hence $\mathbf{P}_2\boldsymbol{\theta}_2=\mathbf{0}$ and the principal components estimator of $\boldsymbol{\beta}$ is

$$\hat{\boldsymbol{\beta}} = \mathbf{P_1}\hat{\boldsymbol{\theta}}_1 = \mathbf{P}\hat{\boldsymbol{\theta}}^*$$

where $\hat{\boldsymbol{\theta}}_1 = (\mathbf{Z}_1'\,\mathbf{Z}_1)^{-1}\mathbf{Z}_1'\mathbf{y}$ and $\hat{\boldsymbol{\theta}}^* = (\hat{\boldsymbol{\theta}}_1', \mathbf{0}')'$ with $\mathbf{0}$ a null vector of conformable dimension.

2. Comparison of the Results

The following table shows the difference between least square estimators and principal components ones. In Taiwan case, the principal components estimate is positive and this shows that the effect of Commercial-Central Bank and Private Credit dominates M2 to GDP ratio. In Korea case, the principal components estimate is also positive, so the effect of Commercial-Central Bank dominates that of Private Credit and M2 to GDP ratio in the regression including capital outflow and inflow to GDP ratios. In Japan case, since the principal components estimate is positive in column (1) but negative in column (2), the effect of principal components has different size in different interval. These results also indicate that the financial development in 1970s has positive contribution to growth, but that after 1980 may not be so sure.

Country	Taiwan		Korea		Japan	
Variable	(1)	(2)	(1)	(2)	(1)	(2)
M2 to GDP ratio	-0.018**	-0.015**	-0.010**	-0.013**	0.061**	0.057**
	(0.003)	(0.003)	(0.004)	(0.003)	(0.008)	(0.004)
Commercial-Central Bank	0.463**	0.405**	0.349**	0.396**	0.396	0.281**
	(0.029)	(0.035)	(0.046)	(0.058)	(0.093)	(0.057)
Private Credit	0.010**	0.006**	-0.031**	-0.026**	-0.115**	-0.089**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.008)	(0.005)
Finance-aggregate	0.507**	0.364**	-0.172	0.341**	0.378**	-1.337**
	(0.134)	(0.087)	(0.203)	(0.190)	(0.163)	(0.104)

Note: see Table 3.

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Table 1 Statistics Summary

Unit:%

Variables \ Country, Period	Taiwan	Korea	Japan
	1981:1~2001:3	1981:1~2001:3	1970:1~2001:3
The growth rate of real GDP	6.87	7.34	3.48
	(3.05)	(4.25)	(3.15)
Fixed-capital investment to GDP ratio	20.81	30.29	30.07
	(3.44)	(5.01)	(2.90)
Employment growth rate	1.79	2.20	-0.44
	(1.45)	(2.96)	(2.04)
Real government consumption as share of real GDP	15.99	11.27	12.81
	(2.30)	(2.19)	(2.82)
The growth rate of real export	9.40	13.20	4.02
	(9.02)	(9.15)	(11.14)
Inflation	2.79	5.73	3.89
	(3.74)	(4.45)	(4.97)
M2 to GDP ratio	548.65	164.22	379.07
	(173.99)	(53.51)	(66.59)
Commercial-Central Bank	95.13	83.18	93.99
	(4.59)	(5.61)	(1.74)
Private Credit	435.39	400.07	96.83
	(158.97)	(133.64)	(14.19)
Stock market capitalization ratio	265.01	112.43	-
	(170.77)	(68.73)	
Turnover Ratio	58.78	32.89	-
	(34.04)	(19.71)	
The percentage change rate of stock price index	5.65	3.30	8.48
	(29.27)	(18.04)	(22.71)
Capital outflow to GDP ratio	2.24	0.77	2.98*
	(2.08)	(0.80)	(1.91)
Capital inflow to GDP ratio	1.45	1.88	1.72*
	(1.99)	(2.04)	(2.00)

Note: Numbers in parentheses are standard error. * indicates the interval of data is from 1980/1 to 2001/3.

Table 2-1 Correlations between the Growth Rate of Real GDP and Financial Market Development (Taiwan)

Unit:%

		Financial intermediary development indicators			Stock market development indicators			Financial account	
	The growth rate of real GDP	M2 to GDP ratio	Commercial-central bank	Private credit	Stock market capitalization ratio	Turnover ratio	The percentage change of stock price index	Capital outflow to GDP ratio	Capital inflow to GDP ratio
The growth rate of real GDP	1.00								
M2 to GDP ratio	-0.36	1.00							
Commercial-central bank	0.08	0.70	1.00						
Private credit	-0.42	0.97	0.55	1.00					
Stock market capitalization ratio	-0.17	0.74	0.60	0.68	1.00				
Turnover ratio	-0.05	0.50	0.46	0.45	0.72	1.00			
The percentage change of stock price index	0.34	-0.12	0.10	-0.17	0.10	-0.04	1.00		
Capital outflow to GDP ratio	-0.33	0.65	0.52	0.56	0.83	0.62	-0.07	1.00	
Capital inflow to GDP ratio	-0.32	0.53	0.23	0.49	0.39	0.14	0.01	0.44	1.00

Table 2-2 Correlations between the Growth Rate of Real GDP and Financial Market Development (Korea)

Unit:%

		Financial intermediary development indicators			Stock market development indicators			Financial account	
	The growth rate of real GDP	M2 to GDP ratio	Commercial-central bank	Private credit	Stock market capitalization ratio	Turnover ratio	The percentage change of stock price index	Capital outflow to GDP ratio	Capital inflow to GDP ratio
The growth rate of real GDP	1.00								
M2 to GDP ratio	-0.22	1.00							
Commercial-central bank	-0.12	0.82	1.00						
Private credit	-0.37	0.80	0.79	1.00					
Stock market capitalization ratio	0.12	0.45	0.50	0.58	1.00				
Turnover ratio	-0.13	0.67	0.56	0.73	0.53	1.00			
The percentage change of stock price index	-0.04	-0.10	-0.18	-0.07	0.0002	0.33	1.00		
Capital outflow to GDP ratio	-0.29	0.35	0.45	0.49	0.29	0.23	0.11	1.00	
Capital inflow to GDP ratio	-0.06	0.42	0.64	0.57	0.43	0.44	-0.03	0.43	1.00

Table 2-3 Correlations between the Growth Rate of Real GDP and Financial Market Development (Japan)

Unit:%

		Financial intermediary development indicators			Stock market development indicators			Financial account	
	The growth rate of real GDP	M2 to GDP ratio	Commercial-central bank	Private credit	Stock market capitalization ratio	Turnover ratio	The percentage change of stock price index	Capital outflow to GDP ratio	Capital inflow to GDP ratio
The growth rate of real GDP	1.00								
M2 to GDP ratio	-0.46	1.00							
Commercial-central bank	0.39	-0.33	1.00						
Private credit	-0.41	0.88	0.01	1.00					
Stock market capitalization ratio	-	-	-	-	-	-			
Turnover ratio	-	-	-	-	-	-			
The percentage change of stock price index	0.43	-0.30	0.41	-0.25			1.00		
Capital outflow to GDP ratio	-0.08	-0.32	-0.22	-0.33	-	-	-0.29	1.00	
Capital inflow to GDP ratio	0.00	0.17	0.11	0.18	-	-	-0.06	-0.31	1.00

Note: The data interval is from 1970/1 to 2001/3

Table 2-4 Correlations between the Growth Rate of Real GDP and Financial Market Development (Japan)

Unit:%

		Financial intermediary development indicators			Stock market development indicators			Financial account	
	The growth rate of real GDP	M2 to GDP ratio	Commercial-central bank	Private credit	Stock market capitalization ratio	Turnover ratio	The percentage change of stock price index	Capital outflow to GDP ratio	Capital inflow to GDP ratio
The growth rate of real GDP	1.00								
M2 to GDP ratio	-0.37	1.00							
Commercial-central bank	0.51	-0.50	1.00						
Private credit	-0.20	0.80	-0.03	1.00					
Stock market capitalization ratio	-	-	-	-	-	-			
Turnover ratio	-	-	-	-	-	-			
The percentage change of stock price index	0.33	-0.34	0.24	-0.36			1.00		
Capital outflow to GDP ratio	0.29	0.08	0.19	0.08	-	-	0.35	1.00	
Capital inflow to GDP ratio	0.01	0.20	-0.01	0.18	-	-	-0.08	0.16	1.00

Note: The data interval is from 1980/1 to 2001/3.

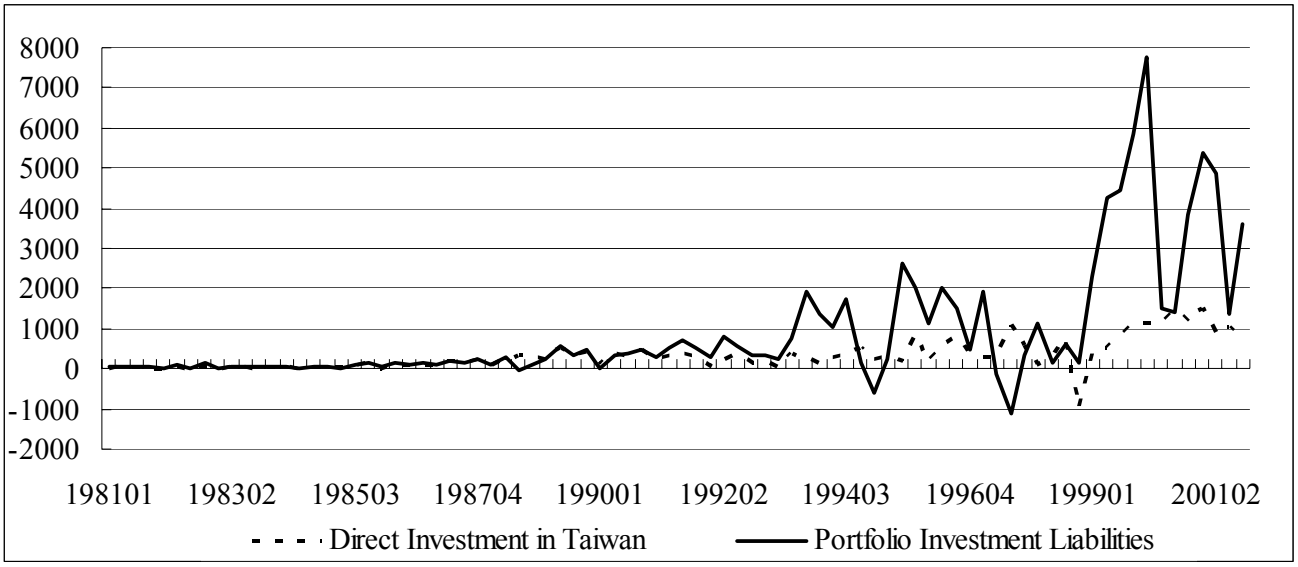
Table 3 Regressions on Economic Growth Rate

Country	Taiwan		Korea		Japan	
Variable	(1)	(2)	(1)	(2)	(1)	(2)
Constant	-4.267**	-0.170	-7.806**	-7.992**	2.852	-59.754**
	(1.715)	(0.987)	(2.255)	(1.678)	(3.702)	(5.189)
Fixed-capital investment to GDP ratio	-0.048**	-0.062**	-0.014	0.050	0.498**	1.295**
	(0.015)	(0.014)	(0.038)	(0.036)	(0.091)	(0.079)
The employment growth rate	0.990**	0.927**	0.700**	0.565**	0.303**	0.589**
	(0.110)	(0.086)	(0.111)	(0.101)	(0.080)	(0.067)
Real government consumption as share of real GDP	0.467**	0.258**	1.143**	1.167**	-0.928**	1.759**
	(0.098)	(0.058)	(0.164)	(0.133)	(0.102)	(0.210)
The growth rate of real export	0.177**	0.177**	0.163**	0.179**	0.024*	0.056**
	(0.015)	(0.011)	(0.015)	(0.015)	(0.013)	(0.013)
Inflation	0.009	0.005	-0.554**	-0.650**	-0.428**	-0.897**
	(0.063)	(0.048)	(0.113)	(0.103)	(0.060)	(0.108)
Finance-aggregate	0.507**	0.364**	-0.172	0.341**	0.378**	-1.337**
	(0.134)	(0.087)	(0.203)	(0.190)	(0.163)	(0.104)
Stock market capitalization ratio	0.003**	0.004**	0.028**	0.035**		
	(0.001)	(0.001)	(0.005)	(0.006)		
Turnover Ratio	0.006	0.003	-0.033**	-0.071**		
	(0.004)	(0.002)	(0.012)	(0.012)		
The percentage change of stock price index	0.012**	0.012**	-0.051**	-0.0004	0.004	0.018**
	(0.002)	(0.002)	(0.013)	(0.013)	(0.007)	(0.004)
Capital outflow to GDP ratio		-0.020		-0.894**		-0.159**
		(0.077)		(0.213)		(0.065)
Capital inflow to GDP ratio		-0.275**		-0.183*		0.081**
		(0.045)		(0.097)		(0.040)
$\overline{R}^2$	0.78	0.79	0.55	0.59	0.25	0.65
P value of Hansen Test	0.993	0.999	0.998	0.999	0.911	0.990

Note: The data interval in Column (2) is from 1980:1 to 2001:3 while the data for Japan which is form 1970:1 to 2001:3, in column (1). Numbers in parentheses are standard errors. **Significant at the 5% level. All regressions have an intercept which is not reported.

Table 1-1 Direct Investment and Portfolio Investment Liabilities in Taiwan

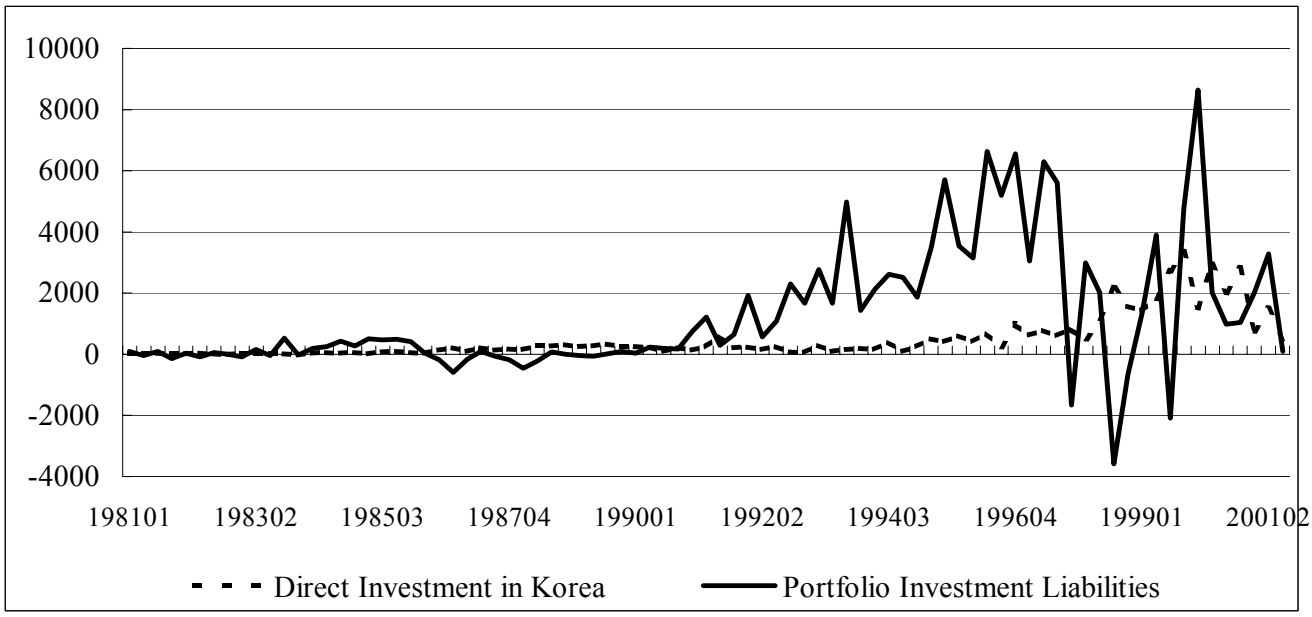
Unit: Millions of US Dollars



Source: *Financial Statistics Monthly Taiwan District Republic of China*.

Table 1-2 Direct Investment and Portfolio Investment Liabilities in Korea

Unit: Millions of US Dollars



Source: IMF, *International Financial Statistics.*