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ABSTRACT

This paper examines the cubic form hypothesis and the flying geese pattern hypothesis of income distribution. We use time series data for the Gini coefficients of Korea for 1961-2006 and panel data calculated based on a household income survey for the period 1998-2003. We show; (1) The Korean economy has a cubic form inequality as shown in many advanced countries such as the U.S, U.K and Japan, and (2) Different relationships between income inequality and income level are observed among regions since less developed rural areas lagged behind more developed urban ones. Thus the pattern of the change of inequality by region in Korea has similarities to the flying geese pattern and the multiple catching up pattern that are processes of the industrialization of manufacturing.

Key Words: Income inequality, Cubic form, Flying geese pattern of development, Multiple catching-up
JEL Classification: D31; O15

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I. **Introduction**

Since Kuznets' (1955) classic analysis, a large amount of research has been compiled about the relationship of economic growth to inequality. The inverted U-shape hypothesis first developed by Kuznets (1955) is as follows: First, income inequality increases at the early stage of economic development and reaches a peak of inequality. Second, income inequality declines at the matured stage of economic development. The association between income and inequality in Korea has been examined in a number of reports (e.g., Ahn, 1997; Jung, 1992; Kang and Lee, 2001; Kim, 1977; Koo, 1984; Lee,2004; Mah, 2003; Yoon, 2000).

How does the income inequality change after the Kuznets curve is completed? An increasing tendency has been seen that inequality in various developed countries such as Japan, United Kingdom and United States increases after experiencing the sequential cycle of increase and then decline; that is, after a cycle of the inverted U (e.g., Amos, 1988; Fan and Casetti, 1994; Tachibanaki, 2005; Lopez, 2006). Following Tachibanaki (2005), we explain such phenomenon as the cubic hypothesis. The central idea of the cubic hypothesis is the increasing trend of income inequality found in a mature postindustrial society.

In this paper, we ascertain that the Korean economy has a cubic form of inequality as seen in advanced countries[2]. Prior to the 1997 currency crisis, Korea experienced unprecedented economic growth, and at the same time an amelioration of the inequality in the distribution of income (Fields and Yoo, 2000; Kim et al, 2003; Lee, 2002). This is consistent with the inverted U-shape hypothesis. Subsequently, out of line with the U-shape hypothesis, there is evidence of sharply increasing income inequality in the post currency crisis period (e.g., Cheong, 2001; Kim, D and Kim, S, 2003; Lee, 2002; Mah, 2006). In Figure 1, the results of analyses of this period by these above-mentioned researches show that it is easy to understand that the Korean economy has seen the cubic

2 As shown in the literature n the so-called "New Economies" many developed countries, such as U.S and U.K, have observed increasing income inequality during the past two decades. Therefore, it would not be surprising if a similar pattern were found in Korea given the growth of the IT-related sectors in Korea. This paper, we believe, is the first to explicitly show a cubic form of inequality in the Korean economy.

phenomenon[3]. Korea can not be considered an exceptional case. Sequential evidence highlights an additional phase that thus far is not taken into account in the inverted U-Shape hypothesis. That is, the Korean Economy has experienced three phases; the first and second ones schematized by the inverted U-Shape hypothesis, and the third one where further economic growth entails another increase in inequality, e as seen in developed countries. The cubic hypothesis asserting that inequality increases once again after experiencing a cycle of an inverted U-shape is a convincing argument that accounts for the phenomenon that occurred in Korea after the 1990s.

Figure 1: Previous reports and the Cubic Hypothesis in the Korean Economy

Earlier works have used time series (e.g., Jung, 1992; Mah, 2003; Kim et al., 2003) or cross section data (Fields and Yoo, 2000) to ascertain the determinants of inequality in Korea through regression analysis[4]. To investigate the overall flow of inequality in Korean economy, we need to control some elements that have not concerned previous works. It is generally understood that the socio-economic characteristics among the regions in Korea show distinct differences[5]. Furthermore, macro economic shock, in particular the currency crisis that occurred throughout Asian countries in 1997, has had tremendous effects on the Korean Economy (e.g., Cheong, 2001; Hyun and Lim, 2005; Hayami, 2001). Neither time-series nor cross-section data capture these effects, thus leading to an estimation bias. Therefore, we pay careful attention to capture these effects to alleviate this bias. Compared to earlier reports, the empirical contribution of this paper lies in

[3] However, the validity of the cubic hypothesis to explain inconsistencies among earlier works on inequality in Korea has not been empirically examined before. Many earlier works concerned inequality in Korea for different periods, presumably resulting in the inconsistencies.

[4] A multiregional Computable General Equilibrium (CGE) model is employed in Kim and Kim (2002).

[5] Half of the income inequality was attributed to the difference in income between the Seoul Metropolitan Area and rural Korea (Kim and Jeong, 2003). Williamson (1965) adapts the inverted U-shape hypothesis to regional inequality arguing that unequal natural resource endowments provided the stimulus for unbalanced development in the earlier stage. Such natural conditions, regarded as regional specific fixed effects, have a tremendous influence on inequality and should be controlled for to avoid an estimation bias.

controlling for regional specific and year specific effects by constructing original panel data of Gini based on a household survey. Moreover, we can measure the financial crisis effects and find the regional effect among regions located in different phases of economic development by showing the different relationships between income inequality and income level.

The key findings of our empirical analysis are summarized as follows. The Korean economy shows cubic form inequality as seen in advanced countries. Less developed rural areas lagged behind more developed urban ones, leading to regional differences in the phase as schematized by the cubic hypothesis in terms of the relationship between income inequality and income level. In other words, the pattern of the change of inequality by region in Korea is similar to the flying geese pattern[6] and the multiple catching up pattern that show the process of the industrialization of manufacturing (Akamatsu, 1962).

The remainder of this paper is organized as follows. Section II proposes two hypotheses; the cubic form and the flying geese pattern hypotheses of income inequality in Korea. Section III surveys the development process of the Korean economy as a whole, and the changes in income inequality. It advances the cubic form hypothesis. Section IV highlights the relationship between per capita income and inequality among regions after the mid-1990s, and shows the flying geese pattern of income inequality with regression results. The final section offers some concluding observations.

[6] The phase "flying geese pattern of development" was originally coined by Kaname Akamatsu in 1930s. The flying geese model explains the catching-up process of industrialization by latecomer economies.

II. Hypothesis

In this section we suggest two hypotheses concerning inequality changes to explain the Korean economy; the cubic form hypothesis and the flying geese pattern of regional development hypothesis.

II.1 Cubic Form Hypothesis

According to Kuznets (1955), the initial condition of a country begins with a fairly homogeneous population largely employed in traditional sectors. In the process of economic development, individual transfers into a modern sector cause differences among people's incomes and income inequality then starts to arise. Modern sectors appear to be initiated partly by the emergence of new technology. Assuming all else to be equal, as the emerging modern sector becomes a dominant one through the diffusion of new technology, it is expected that inequality declines to a critical point and then become stable. Even after reaching a stable stage, it is possible for there to be another disequilibrium shock similar to the emergence of new technology at the onset of the inverted U-shape in the early stage, again leading to an increase in income inequality. Therefore, there is a hypothesis that the simple increase-decrease inverted U-shape pattern is replaced by a pattern of increase-decrease-increase; this is called the cubic form (Amos, 1988; Tachibanaki, 2005).

Following the classical work of Schumpeter (1912), such a shock usually originates from innovations that entrepreneurs generate. It is known that the development of new technology in the early stage worsens income inequality (Galor and Tsiddon, 1997; Weil, 2005). Thus, we have to consider such an innovation shock in an economy from two opposite viewpoint, simultaneously. Taking economic development as the bright side and increasing income inequality as the dark side. In the case of the Korean economy, after it experienced rapid growth and the ensuing amelioration of income disparity, the IT industry emerged and became a dominant industry[7]. This emergence of the IT industry is considered an innovation shock leading to increased economic performance and growth (Jun, 2006; Kim and Shin, 2003; Kim, 2003). On the other hand, the shock and its diffusion

[7] IT capital has accumulated rapidly since 1995 and the difference in the accumulation rates for the IT capital among industries has been quite large (Ha and Pyo, 2004).

are also expected to have had an effect on the increase in income inequality after the financial crisis. We now postulate the following hypothesis and visually explain this hypothesis in section III.

Hypothesis 1: The Korean economy, as a whole, has the cubic form of the relationship between inequality and income level.

II.2 Flying Geese Pattern of Regional Development Hypothesis

We can set up another hypothesis related to the pattern of regional development, applying several international development concepts to the inter-national development case. First, the product cycle concept argues that the new technology, or a new product, is based on transfers from a developed country (Vernon, 1966). Second, the flying geese pattern of development concept explains how an undeveloped country can become developed relatively quickly when the undeveloped country adopts suitable labor-intensive industries from the more developed ones (Akamatsu, 1962). Based on the above concepts, we can derive the regional income disparity in the intra-national case: new technology diffuses from an urban area where most new technologies are generated to the suburban and subsequently to the rural areas, accompanied by changes of production location.

It is widely accepted that regional disparity and spatial polarization are distinct in Korea and originated from the Comprehensive National Physical Development Plan (Hereafter abbreviated as CNPDP) that placed priority on Seoul and its vicinity (Kim et al, 2003; Kim, E and Kim, K, 2003). As a consequence of CNPDP, Seoul became the core of Korea's development process. After Seoul, metropolitan cities including Pusan, Taegu, Inchon, Kwangju, Daejeon and Ulsan were fostered as a series of major centers in different regions. Seoul enjoys the benefit of agglomeration economics and thus induces multiple innovations, in part by introducing new technology. Subsequently new technology is expected to initially diffuse from Seoul to the metropolitan cities, and then out to other areas[8].

After the financial crisis, the IT industry became dominant and had a tremendous

[8] A similar diffusion process was also observed in Japan; between Tokyo and its surrounding area (Yamamura and Shin, 2007).

effect upon Seoul's economy, but the effect of the IT industry appeared to diffuse very slowly outside of Seoul and its vicinity. This was partly because the effect of IT industry is limited to IT using sectors, in particular the financial sector, which does not have a big presence outside Seoul (Jun, 2006; Ha and Pyo, 2004). As a result, the increase in inequality began, and though limited to Seoul until around 2005 it started to diffuse to the other regions after that. From the technology diffusing process as noted above, we derive the following hypothesis and explain this hypothesis in section IV.

Hypothesis 2: The less developed regions in Korea lagged behind developed ones in each stage of the cubic form hypothesis.

III. Cubic form inequality in the Korean economy (1961-2006)

In this section, we present the cubic form of growth and changes in inequality in the Korean economy from 1961 through 2006. From the development process of growth and inequality, the periods in Korean economy can be divided into three phrases; (i) a rapid growth period from 1961 to 1980, (ii) the first matured growth period from 1981 to 1997, and (iii) the second matured growth period from 1998 to 2006.

III.1. Rapid Growth Period: 1961-1980

The Korean economy, that of a divided country with only $80 GDP per capita in 1961, accomplished rapid growth between 1961 and 1980 under the export-leading policies of the Korean government. The Korean government suggested 'Growth before Distribution' as its main economic policy in this period and appealed to the people to endure distributional inequality in order to achieve higher incomes sooner in the future. It then had a remarkable average annual growth rate; 8.5% (1962~66), 9.7% (1967~71), 10.1% (1972~76), and 5.5% (1977~81)[9]. However, income inequality measured by Gini coefficients had a steadily increasing trend 0.272 (1965), 0.288 (1970), 0.346 (1976), and 0.389 (1980)[10]. Therefore, this period can be summarized that the inequality of income distribution worsened at the same time that higher rapid economic growth occurred.

III.2. First Matured Growth Period: 1981-1997

In this period, we can observe that Gini coefficients declined steadily, indicating an improvement in income distribution from 0.389 in 1981 to 0.311 (1985), 0.295 (1990), 0.284 (1995), 0.283 (1997). Compared with several other nations by the ratio of the share of the bottom 40% to that of the top 20%, the Korean economy achieved an improved income distribution of 0.558 that was only second to that of Denmark (0.710) in 1996. This was even higher than the United States (0.338) and the Netherlands (0.526), representing a welfare

[9] See Chon and Park (1986).
[10] See Lee and Hwang (1998).

state[11]. This indicates that the Korean economy experienced an amelioration of inequality in the first matured growth period. Considering joint Gini coefficient changes in both periods (1961~1997), we can apply the inverted U-shaped hypothesis to the Korean economy since it sequentially experienced economic growth and then an improvement of inequality.

III.3. Second Matured Growth Period: 1998-2006

III.3.1. Financial Crisis: 1998-2000

The Asian financial crisis began in Thailand in 1997 and even spread to Taiwan and Hong Kong, which had strong economic fundamentals. At the time, the Korean economy had some weak points such as a shortage of foreign currency holdings and was heavily in debt in the form of a trade deficit. As a result, the Korean financial market could not stand the pressure of the sudden and swift withdrawal of huge amounts of foreign capital and thus collapsed at the end of 1997. To make matters worse, with bankruptcies such as the Daewoo (the second largest conglomerate in Korea) and Kia (the eighth largest) groups, the national credit rating fell and many foreign investors hurriedly retreated from the Korean market. Apart from postponing the maturing dates of foreign bonds, the Korean government had no choice but to make a request to the IMF for financial aid. Thus, a series of crisis-management plans and policy reforms as conditions of the IMF aid were compulsorily applied to the Korean financial system, the corporate sector, the labor market, and to new government regulations. Consequently, the number of firms going into liquidation rose from 1,469 in November to 3,197 December 1997. The number surged to 9,499 in the first quarter of 1998. Moreover, the unemployment rate, about 2% before the crisis, increased to 2.6% in 1997, and jumped to 6.8% in 1998[12].

Fortunately, signs of economic recovery from the crisis came very fast and private consumption and fixed investment started to rebound in the middle of 1998, while the unemployment rate and the number of bankruptcies declined rapidly in 1999. Accordingly, the main economic indicators returned to the steady state seen prior to the financial crisis.

[11] See Lee (2006).

[12] See Cho and Suh (2004)

It is estimated that the Korean economy had overcame the financial crisis by the end of 2000.

III.3.2. After the Financial Crisis: 2001-2006

For the period 2001-2006, after the financial crisis, we can summarize the effect of the IMF shock treatment as being three structural changes in the Korean economy. Data for this comes from an examination of the Input-Output Tables reported by the Bank of Korea (Bank of Korea, 1998-2000).

First, since the financial crisis the Korean economy had become more heavily reliant on foreign trade. This crisis resulted in a contraction of domestic demand but an export boom because of Korea's devaluated currency. This had a primary role in the early recovery of the Korean economy. However, the higher dependence on foreign trade along with company restructurings made for severe instability that weakened the loop that exports usually increase investment and employment, which then increases consumption. The added value inducement coefficient of exports decreased from 0.70 in 1995, to 0.63 in 2000, and to 0.58 in 2003. The employment inducement coefficient of exports decreased even more dramatically from 46.3 in 1990, to 25.8 in 1995, and 15.7 in 2000[13]. This phenomenon was aggravated as Korean industries restructured to accommodate Information Technology (IT). This made them more dependent on imported components and materials.

Second, the relative importance of the IT related industry rose in the Korean economy as the number of computer, internet and mobile phone users increased. The weight of the IT industry on GNP steadily increased; 9.6% in 1995, 10.8% in 1998, 12.2% in 1999 and 15.3% in 2000. In terms of added value, the trend showed a 20.7% increase in 1998 compared to 1997, and 6.5% in 1999. Contrarily, non-IT industries increased only 8.1% and 5.0% in 1999 and 2000 respectively.

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[13] The added valued inducement coefficient of exports indicates how much added value is induced by the output of exports in units of one million U.S. dollars. This coefficient can be calculated by dividing total added value over the export output in units of one million dollars. The case in Korea was lower than before as the IT related industries developed with a high dependence on imports. The employment inducement coefficient of exports indicates how many employees are needed per one million U.S. dollars for the export output. Thus, it is calculated from the total number of employees divided by total export output in units of one million dollars. (Ministry of Finance and Economy, 2005).

Third, many companies in the knowledge based industries[14] crowded around Seoul. Min and Kim (2003) note that 75.3% of new companies and 74% of total employees related to the knowledge based manufacturing industry positioned themselves around Seoul. Moreover, with the venture capital boom in IT and BT (Bio-Technology) industries after the crisis, 87.8% of foreign direct invested companies and 70% of venture companies were located in or around Seoul.

These structural changes after the financial crisis resulted in raising the Gini coefficient again from 0.283 in 1997 to 0.312 in 2002, and 0.351 in 2006. As well, the ratio of the top 10% to the bottom 10% in Korea shows a constantly increasing trend from 4.49 times in 1997, 5.02 in 2003, and 5.43 in 2005[15].

Figure 2: Changes of the Gini Coefficient from 1965 through 2005

Merging the inverted U-shaped inequality in first two periods with the rebounding inequality in the second matured period, we conclude that the Korean economy, as a whole, showed the cubic form inequality in this period (1961-2006).

[14] All industries are to some extent dependent on knowledge inputs. However, some industries rely more on knowledge than others. The term "knowledge-based industries" usually refers to those industries that are relatively intensive in their inputs of technology and/or human capital. industries are included in this group are IT, communications, finance, insurance, real estate and business services, health and education services etc (OECD, 2000).

[15] KOSIS household data base, Korea Statistical Information System, is provided by the Korea National Statistical Office (http://www.kosis.kr).

IV. Flying Geese Pattern of Regional Inequality in the second matured growth period (1998~2003)

We focus on the changes in regional inequality in the second matured growth period, looking at three different regions of Korea; Seoul, metropolitan cities and rural regions.

IV.1. Data

The data used in this paper are from the Korean Labor and Income Panel Study (Hereafter abbreviated as KLIPS). The KLIPS is a longitudinal household survey conducted by the Korea Labor Institute to measure changes related to individuals and families over time. In the first panel from 1998, 5,000 households were included as samples; about 13,300 adults aged 15 years and over were included. Subjects have been interviewed once a year. We use household income data for 6 years (1998~2003). Total income of a household was measured by summation of earned income, financial income, income from immovables, social insurance, transfer income and other incomes. All incomes were deflated using the price level in 2005. Gini coefficients were calculated by the total income of a household divided by the total members aged 15 years and over in a household[16].

Figure 3: Changes in Per capita Income in Three Regions

To examine regional differences, the data can be spit into three categories by region; Seoul (the most developed area), metropolitan cities (developed areas), the rural regions (less developed areas)[17]. The differences in per capita income levels between these regions are set out in Figure 3. The income levels of all regions consistently rose over time,

[16] There was no weight on a household per capita income, regardless of the total numbers in a household. We regard household per capita income as the representative income of the household. It would have a negligible error because Gini coefficients were calculated by region, and the difference in the total number of household members in each region is not large enough to be considered separately.

[17] Metropolitan cities include Pusan, Taegu, Inchon, Kwangju, Daejeon and Ulsan. The rural regions are 9 provinces; Kyugi, Kangwon, Chngbuk, Chungnam, Jeonbuk, Jeonnam, Kyungbuk, Kyungnam, and Jeju.

even though this tendency was slight at the outset, presumably because of the financial crisis. The per capita income of Seoul was clearly the highest among all regions with the metropolitan areas slightly higher than the rural regions.

IV.2. Estimation

To derive the characteristics of the regional inequality changes, we estimate using the following form:

$$GINI_{it} = \alpha_1 INCOM_{it} + \alpha_2 INCOM^2_{it} + \alpha_3 INCOM^3_{it} + \varepsilon_t + \nu_i + u_{it},$$

The Gini coefficient, $GINI_{it}$, is calculated based on household survey data, and represents the dependent variable in regions i and in year t. α's represent the regression parameters. ε_t, ν_i, u_{it} represent the following unobservable effects: the t's year-specific effect and the i's prefecture-specific effect, and the error term, respectively. Here ν_i includes the time-invariant feature. Macroeconomic conditions are covered in ε_t, and each year's dummy variables are incorporated to restrain time-specific effects. The socio-economic differences among regions and the shocks at a macro-economic level, such as the financial crisis, are likely to have had a crucial effect on the outcomes of economic performance. Therefore, these unobserved regional and time specific effects must be controlled for to attenuate the omitted variable bias. We control the panel data set for such biases by using fixed effects estimation.

Table 1: Determinants of Income Inequality with Fixed Effects

The estimation results of the fixed-effect regression of Gini coefficients on the explanatory variables are set out in Table 1. *Y98, Y99, Y00, Y01, Y02* represent the year dummies for 1998, 1999, 2000, 2001, and 2002, respectively. These capture the year specific effects and suggest the difference of these effects on *GINI* compared to the default year, 2003. *Y98, Y99, Y00* and *Y01* take a positive sign while being statistically significant at the 1 % level, implying that inequalities are greater from 1998 to 2001 compared with 2003. However, *Y02* takes a positive sign, though is not statistically significant. The results of the year dummies are robust and stable in the alternative specifications set out in columns (3)

and (5). It follows from this that the financial crisis shock led to increased inequality; however, the effect faded out in 2002.

Looking at columns (1) and (2), it can be seen that the coefficient signs of *INCOM, INCOM* ^{2} *, and INCOM* ^{3} are positive, negative, and positive, respectively, and are statistically significant. Turning to columns (3) and (4), *INCOM* and *INCOM* ^{2} take signs that are consistent with the inverted U-shape hypothesis in column (3), but not that in column (4). What is more, *INCOM* ^{2} is not statistically significant in column (3). These results do not give the necessary support to the inverted U-shape hypothesis of regional inequality. Therefore, the results of these estimations indicate that the cubic form of regional inequality by incomes is more valid than the inverted U-shape form in Korea's post-currency crisis period. In other words, it shows that each of the three regions has the cubic form of inequality in respect to income levels.

IV.3. Concept vs. Data of Regional Inequality

IV.3.1. Concept of Regional Inequality

Using some results from the above data and estimations, we suggest a conceptual graph of regional inequality for three regions with time periods. The left graph in Figure 4, which details the inequality changes in a given year, is derived from two results; one in which the three regions have in common the cubic form of inequality changes in respect to income levels. The other is that the three regions have different levels of per capita income; in the order of Seoul, metropolitan cities and rural regions ("the rest" areas)[18]. In the right graph in Figure 4, the income level is replaced by the time period of the year since income level is highly correlated with time schedule, especially in the Korean economy with its ceaseless process of growth. Moreover, the cubic forms of the different regions should be shifted since the time period is in the right graph. Thus, the regional positions of the cubic form of inequality need adjusting; such as the cubic form for Seoul has to shift to the left, and the rural regions to the right, compared to that of the metropolitan cities. In this graph, we can see that the flying geese pattern of the regional cubic form of inequality is shown in the

[18] For the sake of simplicity, we disregarded the possibility that three regions could have a different shape of the cubic form of inequality with a different level of Gini coefficient in any given income level in Figure 4.

sequence for Seoul, metropolitan cities and rural regions. Taking out the period of the second matured growth in Figure 4, we need to confirm the coherence of the reduced outcomes in this imperfect concept to determine whether it might well explain the changes in regional inequality with the real data for this period.

Figure 4: Conceptual Graph of Regional Inequality for Three Regions

IV.3.2. Data on Regional Inequality

We now look at the changes in inequality in the three regions for the 6 years, as shown in Figure 5. Seoul shows a rapid drop of the Gini coefficients from 1998 to 2000 and subsequently a steep rise after 2000. This can be interpreted as follows; the demand for highly educated and technologically skilled workers is far higher in Seoul than in other regions. Thus, service and high technological sectors concentrated in Seoul. Many of these firms had investment from foreign investors (Kim, E and Kim, K, 2003). Consequently, workers in these sectors suffered during the financial crisis as companies laid them off. As a result, the disparity of per capita income rapidly increased in Seoul after the financial crisis (Kim, D and Kim, S, 2003), which shows a higher Gini coefficient than over 0.40 in 1998. Subsequently, as the financial shock receded at the end of 2000, laid-off workers gradually returned to work. The financial crisis is regarded as a shock at the macro-economic level; one that caused income disparity to temporarily widen.

Figure 5: Changes in Gini Coefficient in Three Regions

In the post-crisis period, the financial and corporate sector reforms undertaken by the Korean government contributed to the strengthening of these sectors (Mah, 2006). The emergence of the Information Technology industry also became the main driving force for the recovery from the financial crisis; resulting in the growth of labor productivity (Kim, 2003; Kim and Shin, 2003). However, the benefits from a significant increase in productivity have been restricted to just some IT-using sectors, such as the financial sector (Ha and Pyo, 2004; Jun, 2006). As well, these are mostly located in Seoul. As a consequence, the Gini

coefficient of Seoul in 1998 and 1999 showed unusual effects from the financial shock that occurred in 1997, which had expected to be the same level in2000. The rise of the IT industry worsened income disparity per capita even though it contributed to economic growth since 2000.

The Gini coefficient for the metropolitan cities consistently declined over time while that of the rural regions remained stable. The Gini level of the rural regions was much higher than that of the metropolitan cities. Neither the metropolitan cities nor the rural areas were much influenced by the financial crisis, presumably because the major industries in these areas were not so tightly linked to the international or the Asian regional economy[19]. Considering these facts and controlling for the financial shock, we can argue that in 2000 Seoul entered a stage of increasing inequality, the metropolitan cities were still in a stage of inequality improvement, while the rural regions began to enter an initial stage of inequality improvement.

Figure 6: Flying Geese Pattern of Income Inequality

In Figure 6, each figure connects the level of Gini coefficients for each of the regions from Figure 5, using real data showing that in 2000 Seoul is at an increasing inequality stage; Metropolitan cities at a decreasing inequality stage; and rural regions at the initial stage of inequality improvement. This indicates that the regional development pattern in Korea is similar to the flying geese and the multiple catching up patterns.

[19] The share of the primary sector in rural regions is considered to be larger than in urban areas. Such a sector is likely to be affected by a natural disaster but less likely to be so by a financial crisis.

IV. Concluding Remarks

It is widely acknowledged that economic inequality has increased in developed countries in a way that does not concord to the classical inverted U-shape hypothesis. Studies have attempted to investigate the mechanism involved; one empirical explanation concerning such a phenomenon is the cubic hypothesis proposed by Tachibanaki (2005). Inequality can be decomposed into inter-regional and intra-regional inequalities, and thus it is critical to consider them separately when we examine the relationship of inequality and growth. In terms of international economics, there is a lag in the development stage among countries undergoing the development process following the flying geese pattern of development, multiple catching-up and product cycles etc. Such a lag is also likely to be observed between urban and rural areas within a country and can lead to inequalities among areas. Hence, this research attempts to examine the cubic form hypothesis by considering gaps in inequality among regions caused by differences in their developmental stages.

However, it needs to be noted that Korea experienced a miraculous economic growth while still showing a pronounced income gap among its regions. This is why Korea is an interesting case to examine the inequality-growth relationship. Socio-economic features distinctly differ among regions, so that unobserved regional specific characteristics tend to be associated with the resultant inequality. What is more, the 1997 currency crisis had a tremendous detrimental influence on economic activity in Korea, such that it can be regarded as a shock at the macro economic level. These factors convincingly affected inequality and should be controlled for to attenuate the omitted variable bias. To this end, in constructing a panel data set consisting of 15 regions based upon a household survey, fixed effects estimation is employed to control for unobserved individual specific and year specific effects. The key findings of the investigation here are as follows. The Korean economy has the cubic form of inequality as seen in advanced countries. Less developed rural areas lagged behind the more developed urban ones, which resulted in regional differences in the relationship between income inequality and income level. In other words, the pattern of the changes in inequality by region in Korea is similar

to the flying geese and the multiple catching up patterns which illustrate the process of industrialization of manufacturing.

Various factors that have not been taken into account in this paper are also expected to affect inequality. For instance, human capital, the choice of household location, and the quality of governance are also likely to be important issues. The future direction of this study will seek to ascertain the determinants of inequality in more detail by utilizing micro level data. Although in this paper we presented some interesting empirical evidence, there is no theoretical framework to ascertain any mechanism in respect to the causality of inequality and growth. We hope to in the future construct a rigid economic model that will verify the findings we presented in this paper.

References

Ahn, K., 1997, Trends in and determinants of income distribution in Korea. *Journal of Economic Development*, **22**, pp.27-56.

Akamatsu, K., 1962, A historical pattern of economic growth in developing countries. *Journal of Developing Economies*, 1(1) pp.3-25, March-August.

Amos, O.M., 1988, Unbalanced regional growth and regional income inequality in the latter stages of development. *Regional Science and Urban Economics* **18**, pp.549-566.

Bank of Korea, 1998-2000, The Inter-industry Relation Table, Department of Economic Statistics in Bank of Korea.

Cheong, K.S., 2001, Economic crisis and income inequality in Korea. *Asian Economic Journal,* **15,** pp.39-60.

Cho, S.H. and Suh, B.D., 2004, An Empirical Study on the Usefulness of the Cash Flow Information as the Discriminant Index for Assessing Failing Firms after IMF Financial Crisis (in Korean), Accounting Information Research, Vol 22. No 2. pp 47-75.

Chon, C.H. and Park, K., 1986, "The Government Leading Economic Development", New Understanding of Korean Liberalization II, Dolbaegae.

Fan, C.C. and Casetti, E., 1994, The spatial and temporal dynamics of United States regional income inequality, 1950-1989. *Annals of Regional Science,* **28**, pp.177-196.

Fields, G.S., and Yoo, G., 2000, Falling labor income inequality in Korea's economic growth: Patterns and underlying causes. *Review of Income and Wealth,* **46**, pp.139-159.

Gaolr, O. and Tsiddon, D., 1997, Technological Progress, Mobility, and Economic Growth, *American Economic Review* 87 (3) 363-382

Ha, B.C., and Pyo, H., 2004, The measurement of IT contribution by decomposed dynamic input-output tables in Korea 1980-2002. *Seoul Journal of Economics,* **17**, pp. 511-546.

Hayami, Y., 2001, Development Economics: From the poverty to the wealth of nations. Second edition. The Oxford University Press.

Hyun, J.K., and Lim, B., 2005, The financial crisis and income distribution in Korea: The

role of income tax policy. *Journal of the Korean Economy,* **6**, pp.51-65.

Jun, S., 2006, The nexus between IT investment and banking performance in Korea. *Global Economic Review,* **35**, pp.67-96.

Jung, J.H., 1992, Personal income distribution in Korea 1963-1986: A human capital approach. *Journal of Asian Economics,* **3**, pp.57-72.

Kang, S.J., and Lee, M.W., 2001, Income distribution and public transfers as social safety nets in Korea. *Journal of Economic Development*, **26**, pp.61-75.

Kim, D., 1977, Structural change, employment, and income distribution: the case of Korea, 1960-1970. *Journal of Economic Development*, **2**, pp.215-250.

Kim, E. and Jeong, Y.H., 2003, Decomposition of regional income inequality in Korea. *Review of Regional Studies,* **33**, pp.313-327.

Kim, E. and Kim, K., 2002, Impacts of regional development strategies on growth and equity of Korea: A multiregional CGE Model. *Annals in Regional Science,* **36**, pp.165-180.

Kim, E. and Kim, K., 2003, Impacts of development of large cities on economic growth and income distribution in Korea: A multiregional CGE Model. *Papers in Regional Science,* **36**, pp.165-180.

Kim, E., Hong, S.W. and Ha, S.J., 2003, Impacts of national development and decentralization policies on regional income disparity in Korea. *Annals in Regional Science,* **37**, pp. 79-91.

Kim, H. and Shin, I., 2003, Effect of IT job training on employment and wage premium: Evidence from Korea panel data. *Developing Economies,* **41**, pp.461-483.

Kim, S., 2003, Information technology and its impact on economic growth and productivity in Korea. *International Economic Journal*, **17**, pp.55-75.

Kim, D. and Kim, S., 2003, Globalization, financial crisis, and industrial relations. *Industrial Relations,* **42**, pp.341-367.

Koo, H., 1984, The political economy of income distribution in South Korea: The impact of the state industrialization policy. *World Development,* **12**, pp.1029-1037.

Kuznets, S., 1955, Economic growth and income inequality. *American Economic Review,* **45**, pp.1-28.

Lee, C., 2002, Structural change in household income inequality in Korea: A new

decomposition including labor supply changes. *Seoul Journal of Economics,* **15**, pp.395-421.

Lee, J. and Hwang, S.H., 1998, The Problems of Income Distribution and Related Policy Issues (in Korean), KDI Policy Research Vol.20

Lee, S.S., 2004, Spatial dynamic variations of regional inequality in Korea and Japan. *Studies in Regional Science,* **34**. pp.97-116

Lee, Y.H., 2006, What is the Problem in the School Textbook?, Textbook Forum, Duraesidae.

Lopez, H., 2006, Growth and inequality: Are the 1990s different?. *Economics Letters,* 93, pp.18-25.

Mah, J.S., 2003, A note on globalization and income distribution: the case of Korea, 1975-1995. *Journal of Asian Economics*, **14**, pp.157-164.

Mah, J.S., 2006, Economic restructuring in post-crisis Korea. *Journal of Socio-economics,* **35**, pp.682-690.

Min, K.H. and Kim, Y.S., 2003, Industrial Agglomeration in Korea: Structural Patterns and Productivity Externalities, Research reports, KIET.

Ministry of Finance and Economy, 2005, Bipolarization phenomenon and Policy Implication, Finance and Economy Forum in Korea.

OECD, 2000, Knowledge based industries in Asia, OECD, Paris.

Schumpeter, J. A., 1912, The theory of economic development. Harvard University Press.

Tachibanaki, T., 2005, Confronting Income Inequality in Japan: A Comparative Analysis of Causes, Consequences, and Reform. The MIT Press.

Vernon, R., 1966, International investment and international trade in the product cycle. *Quarterly Journal of Economics*, **80**, pp.190-207.

Weil, D. N., 2005, *Economic Growth*, Addison-Wesley.

Williamson, J. G., 1965, Regional inequality and the process of national development: A description of patterns. *Economic Development and Cultural Change,* **13**, pp.3-45.

Yamamura, E., and Shin, I., 2007, Dynamics of agglomeration economies and regional industrial structure: The case of the assembly industry of the Greater Tokyo Region, 1960-2000. Forthcoming in *Structural Change and Economic Dynamics*, **18**, pp.483-499.

Yoon, S. B., 2000, Regional income distribution in South Korea, *Journal of the Asia Pacific Economy*, **5**, 57

Figure 1. Previous Reports and the Cubic Hypothesis in the Korean Economy

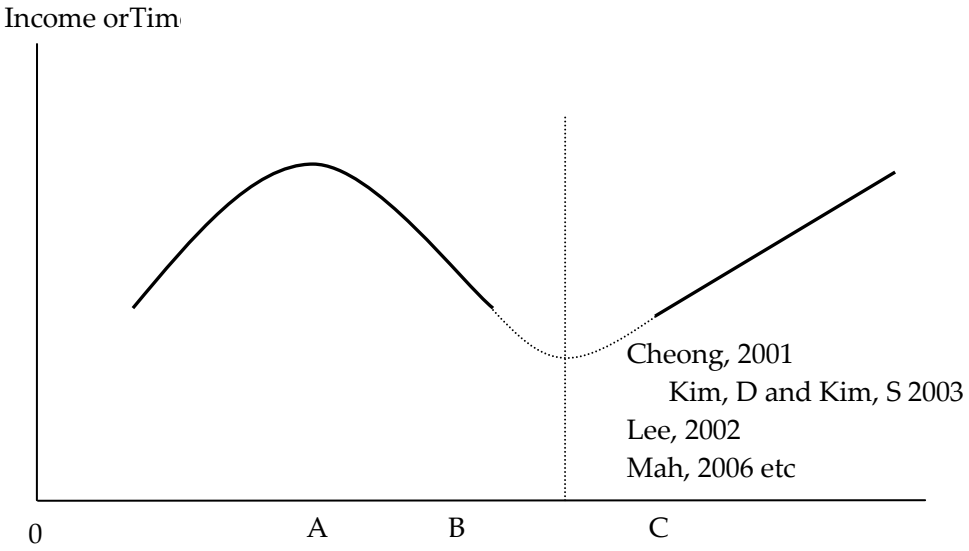
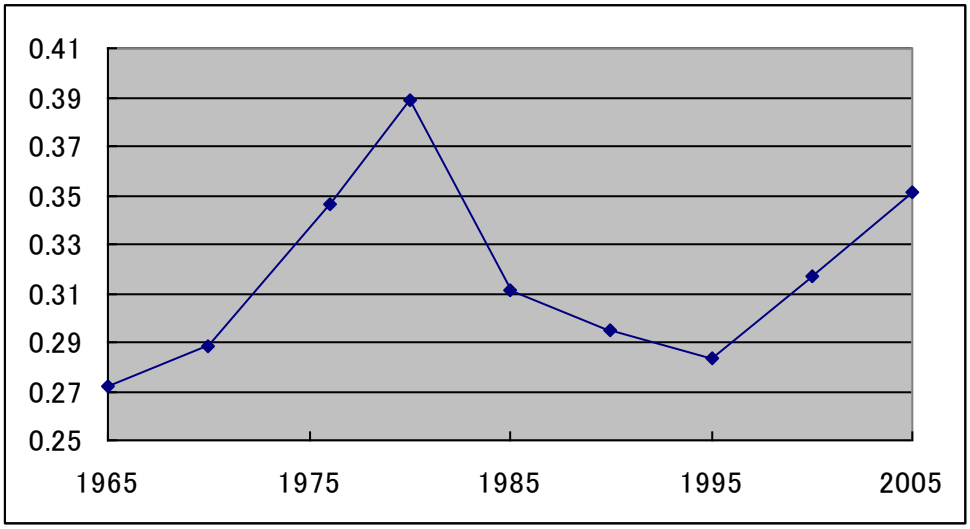


Figure 2. Changes of the Gini Coefficient from 1965 through 2005



Notes: The data of 1965, 1970 and 1980 are comes from Lee and Hwang (1998). The data after 1980 are obtained from KOSIS data base, Korea Statistical Information System, which is provided by the Korea National Statistical Office (http://www.kosis.kr). KOSIS data base does not include data before 1980 and thus Lee and Huang (1988) is used during this period.

Figure 3. Changes in Per capita Income in Three Regions

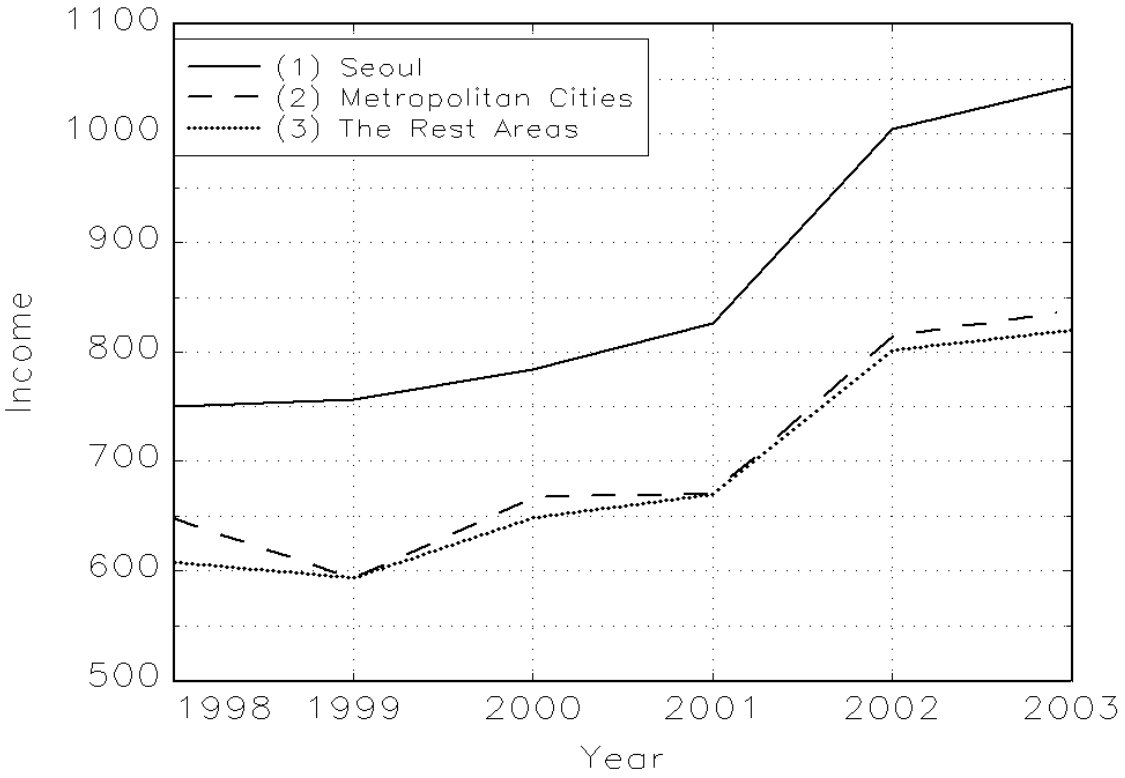


Figure 4. Conceptual Graph of Regional Inequality for Three Regions

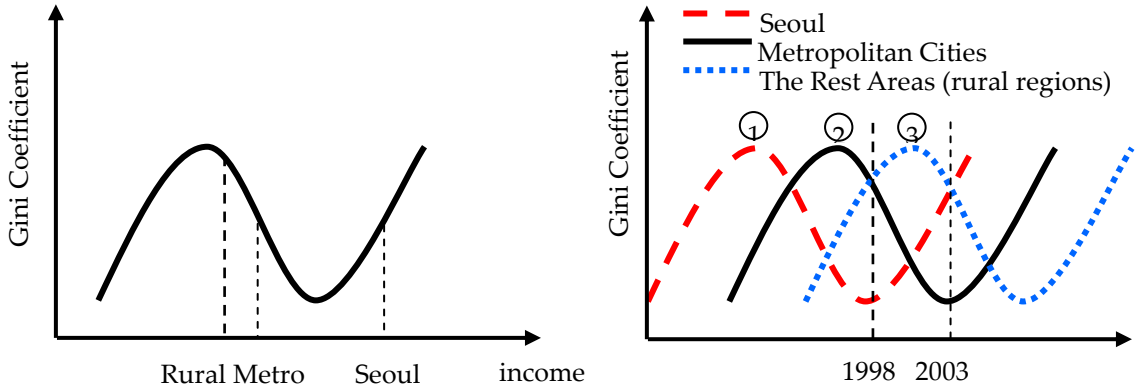


Figure 5. Changes in Gini Coefficient in Three Regions

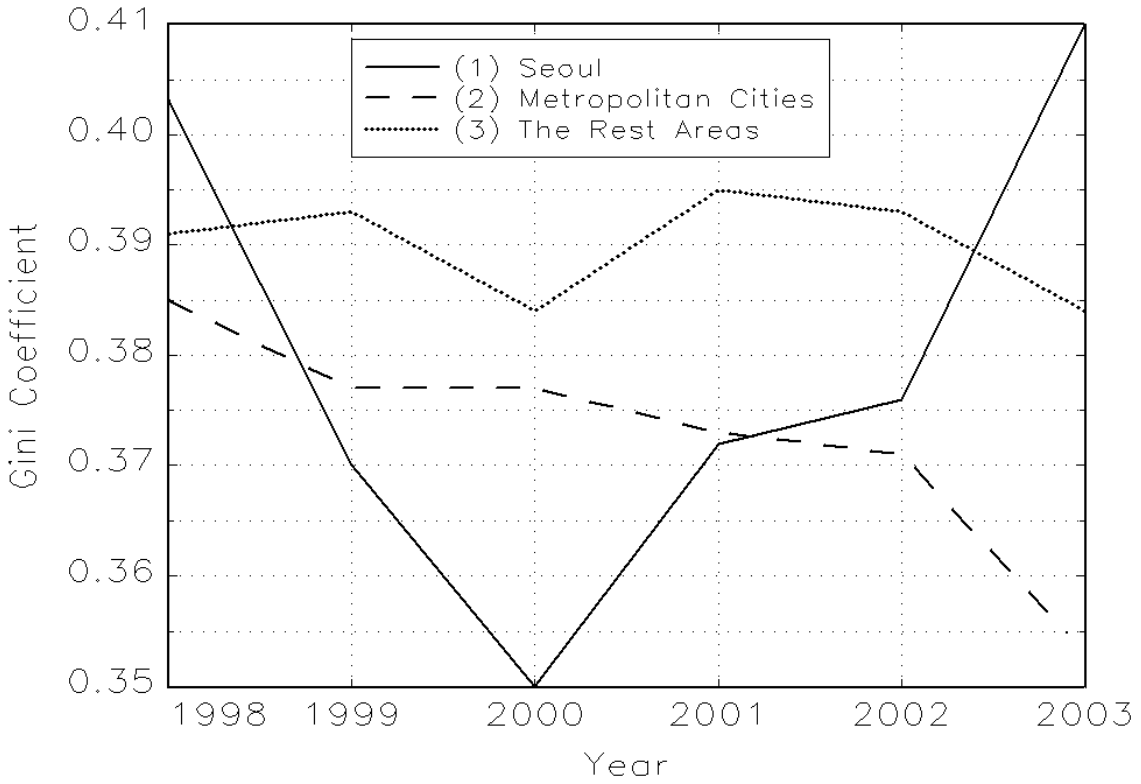


Figure 6. Flying Geese Pattern of Income Inequality

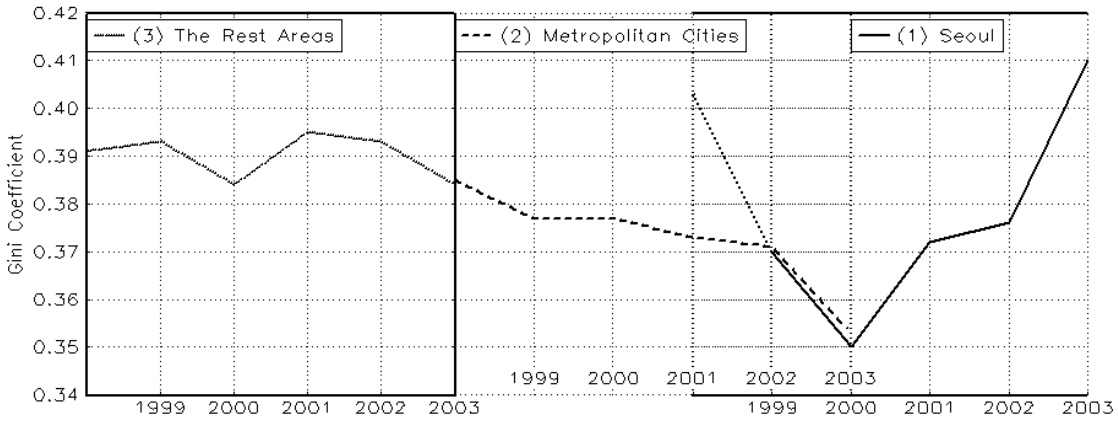


Table 1. Determinants of Income Inequality with Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
INCOM	1.83**	2.17**	0.55**	-0.001	0.31**	0.11**
	(2.51)	(2.76)	(2.99)	(-0.001)	(6.44)	(3.76)
$INCOM^2$	-1.79*	-2.68**	-1.39	0.07		
	(-1.94)	(-2.73)	(-1.36)	(0.72)		
$INCOM^3$	0.66	1.10**				
	(1.80)	(2.82)				
Y98	0.06**		0.07**		0.06**	
	(4.12)		(4.60)		(4.40)	
Y99	0.07**		0.08**		0.07**	
	(4.33)		(4.89)		(4.71)	
Y00	0.05**		0.06**		0.05**	
	(3.87)		(4.47)		(4.23)	
Y01	0.05**		0.05**		0.05**	
	(3.70)		(4.29)		(4.05)	
Y02	0.01		0.01*		0.01	
	(1.32)		(1.73)		(1.56)	
Sample	90	90	90	90	90	90
Group	15	15	15	15	15	15
Adjusted R^2	0.38	0.22	0.35	0.15	0.34	0.16

Notes: * and ** indicate statistical significance at the 5 and 1% levels, respectively.