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UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

# THE EFFECTS OF FINANCIAL DEVELOPMENT ON THE INCOME INEQUALITY, ECONOMIC GROWTH, AND FINANCIAL SYSTEM IN TAIWAN

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

CHENGTE HSIAO
Norman, Oklahoma
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**THE EFFECTS OF FINANCIAL DEVELOPMENT ON THE INCOME INEQUALITY, ECONOMIC GROWTH, AND FINANCIAL SYSTEM IN TAIWAN**

**A Dissertation APPROVED FOR THE**

**DEPARTMENT OF ECONOMICS**

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# Abstract

In the past several decades, there has been a resurging interest in the study of the interactions between economic growth, income inequality, and financial development. Since the introduction of Kuznets's (1955) hypothesis, a great deal of literature has been devoted to the investigation of the causal relationship of economic growth and income distribution. Another major strand of thought, often associated with the work of Goldsmith (1969), Mckinnon (1973), and Shaw (1973), stresses the connection between economic growth and financial development. However, the link between financial development and income inequality has rarely been explored by the scholastic world both theoretically and empirically. It is not only unusual but surprising to see that so little attention has been paid to the study of this area considering a large portion of families in developed countries (DCs) and newly industrialized countries (NICs) engage in the activities of financial market on a daily basis.

The purpose of this study is to outline a tentative theoretical model to study the relationship between financial development and income inequality in general and to present an empirical analysis of Taiwan's case to examine what result can be derived from the available data. The choice of Taiwan for our study has several folds. The first

is that for the past 30 years, Taiwan, along with its counterparts of Hong Kong, Singapore, and South Korea has been considered as the most successful economic story for the developing countries. Not only does Taiwan sustain high economic growth but also maintains a fairly low degree of income inequality. However, just like most of the developed countries, in the turn of 1980s, Taiwan encountered the reverse trend of income distribution: rising income inequality. The main difference between Taiwan's experience and that of most developed countries is that Taiwan retained a high rate of economic growth while most of the developed countries endured reduced growth even though income equality was experienced by both during the 1980s. It is also the first time in Taiwan's short economic development history--fifty years--that the improvement in income equality was no longer in tandem with the economic growth. The second reason is that during that period of time, Taiwan's government initiated a series of financial reform and liberalization measures gradually throughout the decade in order to further facilitate the transactions and deal with the new challenges brought about by the integration of the international financial market. It is of great interest to probe if these two phenomena are correlated as it is alluded indirectly in some economic theories.

# Chapter 1

# Introduction

Two strands of research have been pervasive in the study of economic growth and development. The first theme largely revolves around the traditional Kuznets (1955) hypothesis: over the transition course from rural to industrial economy, the income inequality rises during the early stage of the development, tapers off in the intermediate phase, and finally starts to decline by the stage of maturity. In contrast to the conventional approach, which focuses on the interaction of level and distribution of income, recent studies emphatically address the effect of international trade, technological progress and organizational change on income inequality due to the ambiguous and mixed results of empirical investigation derived from the Kuznets hypothesis.

The principal argument about the effect of international trade on the distribution of income primarily stems from the neoclassical Hechscher-Ohlin-Samuelson (HOS) theory. It states that countries will specialize in the production of commodities that intensively use domestically abundant factors of production. Upon the opening to international trade, the price of the affluent factors will rise and that of the scarce ones will fall. Consequently, the income gap between the abundant and scarce factors will

be reduced and a more equalitarian state of distribution will be realized. However, the emphasis and nature of this classical model are quite different from the latest studies. While the former stresses the effect of trade on the dispersion of income among land, capital, and labor, the latter focuses on the effect toward the distribution of income between individuals.

Another hypothesis in the literature of income inequality speculates that technological progress is the single most dominant determinant of rising inequality in most of the OECD countries and certain newly industrialized countries (NICs) for the past two decades. It argues that, in essence, the progress of technology is skill-biased and in favor of the skilled labor; therefore, it magnifies the existing wage gap between workers of various skill levels. Of the recent advancement in technology, the advancement in computers and their application has been considered as the major culprit attributing to the worsening of income inequality. A great number of empirical analyses for the cases of the United States and some other OECD countries[1] show that both computers and other technical changes have a positive and significant impact on the increase of income share of skilled workers.

Yet another school of economists believes that along with the other causes, the

[1] See Danziger and Gottschalk (1995), Aghion and Caroli (1999), and Haskel and Slaughter (2001) for details.

organizational change also plays a substantial role in the increase of inequality. It can be further divided into two types: between-industry and within-industry. According to the between-industry hypothesis, the shift of employment out of manufacturing and into the service sector, which is characterized by both lower wages and greater disparities in wages, would directly cause increases in inequality. While the between-industry theory stresses the changes across industries, the within-industry model examines the changes within the industry. The recent tide in the study of the effect of organizational change on income inequality has turned in favor of the latter after the emerging evidence documented in the work of Murphy and Welch (1993), Sheldon Danziger and Peter Gottschalk (1995), etc., shows that the impact of within-industry change is much more significant than that of between-industry change.

The second major strand of thought prevalent in the development and growth literature, often associated with the work of Goldsmith (1969), McKinnon (1973), and Shaw (1973), stresses the correlation between economic growth and financial development. Their theoretical framework is further extended by the studies of Greenwood and Jovanovic (1990), Bencivenga and Smith (1992), and King and Levine (1993). However, in contrast to their forerunners' work that focuses on the mechanisms channeling savings to investments in probing the possible connection between financial policy and economic growth, the more recent studies focus on the

importance of an alternative role of financial intermediation and endogenous growth process.

Even though the links between economic growth and income inequality and between financial development and economic growth have been extensively examined by the scholastic world, it is puzzling to see that very little attention has been paid to the nexus between financial development and income inequality both theoretically and empirically, considering the fact that a large portion of the population in the OECD countries and NICs is involved either directly or indirectly in the activities of the financial sector. Furthermore, this affiliation is only either indirectly or vaguely implied in the limited amount of studies on this subject. So far, there have been two main types of research on the link between financial development and income distribution. The first emphasizes the effect of credit rationing on the attainment of education and training, which in turn will affect the distribution of income. The other stresses the indirect influence of financial liberalization on the equality of earnings. Since the earnings from various financial investments; such as securities, bonds, mutual funds, etc., have become important sources of income for more than half of the families in most of the OECD countries and NICs, it is necessary to identify the direct interaction between them in order to better and more comprehensively understand the vicissitudes of income inequality in the past several decades.

The purpose of this study is to investigate the effect of financial development on income inequality in Taiwan. The choice of Taiwan for our study has three folds. First, even less attention has been called upon the studies of less developed countries (LDCs) and NICs in the literature. Secondly, the high participation rates--100% for households and 43.6% for the population over 18 years old[2]--in securities market present the best setting for the study of the correlation between financial development and income inequality. Thirdly, since Taiwan has been considered as one of the most successful stories of economic development for developing countries (DCs) in modern history, a deeper and more complete understanding of Taiwan's situation will shed light not only on the issues of how to balance economic growth and income distribution in Taiwan but also on the policy implication for those DCs closely following the developmental footsteps of the so-called four Asian dragons.

The remainder of this discussion will be organized as follows. In chapter 2, a series of essential and related theoretical and empirical studies in the links between economic growth and income distribution and between economic growth and financial development are reviewed to pave the way for our investigation of the correlation of income inequality and financial development. In chapter 3, a brief overview of the vicissitudes of income distribution and the development of a financial system in

[2] Source: Taiwan Stock Exchange.

Taiwan will be presented with the stress on the periods before and after the reform and liberalization of capital market. Both the quantitative and qualitative evidence that suggests the causal relationship between them will also be discussed. In chapter 4, a theoretical model based on endogenous growth frameworks will be developed to analyze the link between financial development and income inequality. A distinctive concept toward the invention and innovation in the financial system will be introduced and incorporated into the model to reflect the reality that those advancements in the financial world are just as complicated as those in the engineering field. Accordingly, these advancements require an equal amount of ability and knowledge to utilize them. In chapter 5, several tests on the hypotheses suggested in the previous chapter will be provided. Conclusions will be offered in chapter 6.

# Chapter 2

# Survey of Literature

## 2.1. Introduction

This chapter will present a brief review of the literature in the two most pervasive strands of economic research--the links between economic growth and income inequality and between financial development and economic growth, and the relatively neglected link between financial development and income inequality.

## 2.2. Economic Growth and Income Inequality

Since the presentation of Kuznets hypothesis in 1955, the studies on the relationship between economic growth and income inequality have been expanded enormously. The early literature on income distribution and economic development, however, is dominated by Kuznets hypothesis. Based on his studies and analyses on the development of three developed countries--United States, United Kingdom, and Germany--for the period from 1880 to 1950, Kuznets proposed an inverted-U shaped curve to delineate the relation between income inequality and economic growth in his theoretical model. He found that the income inequality rises during the early stage of development, then tapers off during the intermediate stage, and eventually declines by

the stage of maturity. While this hypothesis is far from being incontrovertible, other researchers have found evidence in support of it. For example, Adelman and Morris (1973) confirm the increase in income inequality at the early stages of development for 44 developing countries as postulated in Kuznets inverted-U curve. Paukert (1973) found evidence that intracountry income inequality rises and falls with economic development by using cross-country data. Similarly, Danziger and Gottschalk (1995) verify the argument in their study of the equity in U.S. for 1950 through 1980. However, this downward trend in inequality experienced by most OECD countries before 1980 has reversed sharply since 1980.[1] In light of the recent evidence, new theories are needed to understand the impact of growth upon inequality. So far, three major types of studies have emerged on the scene in an effort to solve the mystical causes of the increasing income inequality across countries: international trade, technological progress, and organizational change.

### 2.2.1. International Trade

Recent studies in the effect of international trade on the distribution of income are mostly derived from and based on the HOS hypothesis propounded by Heckscher (1919) and Ohlin (1924). The correlation of international trade and income distribution

[1] See Deininger and Squire (1996), and Aghion (1998) for the details.

was first established by Heckscher in his revolutionary article "The Effect of Foreign Trade on the Distribution of Income". He attributed disparities in comparative costs, and hence in the pattern of trade, to dissimilarities in factor endowments rather than to differences in productivity as in the classical theory. Ohlin further expanded and elaborated Heckscher's framework by incorporating Walrasian equilibrium, neoclassical theory, and monetary factors into the model to form the well-known HOS theorem. According to the theory, a country will export goods that are intensive in production in its abundant factors, and it will import goods intensive in its scarce factors. Hence, a trade boom will drive up the demand for its abundant factors and drive down the demand for the scarce ones, and lead to the narrowing of the income gap between abundant and scarce factors. Even though recent studies in the correlation of international trade and income distribution still closely follow the principles of the HOS model, the focus of the distribution has been shifted from among land, capital and labor to between individuals.

Krugman (1981) examined the effect of international trade on income inequality from the aspects of distribution effect and market size effect in a general equilibrium framework. Since both of the components are positively correlated with the income of abundant factors, he suggests that the opening to trade will be in favor of them. As for the income of scarce factors, the result is indecisive inasmuch as the sign of the

difference between the negative effect of distribution and the positive effect of market size is uncertain. By and large, his argument is in concert with the HOS theorem, i.e., the opening to trade will reduce the income inequality.

By adding two distinguishing features--overlapping generations and heterogeneous agents--to the HOS hypothesis, Fischer (1992) developed a dynamic two-sector trade model to investigate the effect of trade on the intra- and inter-generational distribution of income. He asserts that if the consumption good is labor-intensive, trade liberalization reduces personal income inequality in labor-abundant countries. This reduction in inequality continues over time until a new steady state is reached. Conversely, inequality increases in the long and short run in capital-abundant countries. If the consumption good is capital-intensive, the short run effect of trade liberalization is the same as in the previous case, but the long run effect is ambiguous.

Fischer and Serra (1996) further divided the types of bilateral trades into three categories: trade between developed countries, trade between developed and middle-income countries, and trade between developed and poor counties. They investigated how each type of trades will affect the distribution of income in the developed countries. In their general equilibrium model, they conclude that due to the

substitution effect of intermediate goods imported, the trade between developed countries and middle-income countries will worsen the income equality of the former. Notwithstanding, the trade between developed countries and between developed and developing countries will at least impose no negative impact on the equality.

An ever-growing literature examines empirically the impact of international trade on the increasing income inequality and draws mixed results. Fieleke (1994) states that there is no convincing evidence to support the hypothesis that increased globalization has contributed substantially to greater inequality in income. Richardson (1995), and Feenstra and Hanson (1996) procured similar outcomes from their studies of the United States. They found that trade only accounts for a very small share of the increasing income inequality and its influence has slightly declined in the past decade. On the other hand, Savvides (1998), and Harrison and Hanson (1999) demonstrate that among less developed countries, especially Latin America countries, more open economies experienced greater increase in income inequality. However, Chakrabarti (2000) suggests in a cross-country study that greater participation in trade significantly reduces income inequality. His view is echoed in part by the literature of Das (2001) that shows that free trade decreases income inequality in less developed countries.

### 2.2.2. Technological Progress

A growing amount of literature argues that the demand shift in the relative labor has been caused by technological changes. These studies suggest that technological progress in nature is skill-biased in the sense that it enhances the differences in abilities across workers, and it leads inevitably to the increase of income inequality. Betts (1994) developed a human capital model to analyze the interaction between different levels of technical changes and heterogeneous workers. According to his theory, there are three types of technological changes, namely, skill-using, skill-neutral, and skill-saving, given a non-degenerate, continuous uniform distribution of abilities. Skill-using inventions, reflecting the fact of recent technological progress, lead to increased training requirements. Skill-neutral inventions increase productivity without changing human capital needs, and skill-saving ones reduce the training needs. The time needed to learn a new invention is a decreasing function of abilities. A worker will decide whether to adopt a new invention based on the net effect of loss of income caused by reduced working time and gain of income derived from the new technology on his production function. In a two-sector framework of a technologically dynamic sector and a backward static one, skill-using inventions will only be adopted by those workers whose abilities are above a certain threshold; hence, they will increase the inequality of income and induce shifts of labor out of the technologically dynamic sector. In contrast, skill-saving inventions are adopted only by lower-range workers;

therefore, they reduce the inequality in income, causing shifts of labor toward the innovation sector. Skill-neutral inventions cause no change in equality nor in the sectoral allocation of labor.

Galor and Tsiddon (1997) contrived a theoretical model to examine the relationships between technological progress, wage inequality, intergenerational mobility, and economic growth. Their analysis is based on a model of a small, open, overlapping generations economy that operates in a perfectly competitive world in which economic activity extends over an infinite discrete time. In every period, the economy produces a single homogeneous good, using physical capital and efficient units of labor in the production process. The good is produced in several sectors, which differ in production technologies, and can be used for consumption or saving. Furthermore, they assume that individuals are identical in their preferences and in their production technology of human capital but different in ability and in parental type of human capital. The analysis demonstrates that the interplay between technological progress and two components that determine an individual's earnings: parental specific human capital and the individual's ability, governs the evolution of income inequality, intergenerational earnings mobility, the pace of technological progress, and economic growth. In periods of major technological inventions, the ability effect is the dominating factor, and mobility as well as inequality rises. In periods of technological

innovations, when existing technologies become more accessible, the parental human capital effect dominates, mobility diminishes and inequality decreases.

Galor and Moav (2000) developed a growth model featured with ability-biased technological transition that is responsible for the evolution of technology, education, and wage inequality in the United States and other advanced countries over the past several decades. Their study argues that an increase in the rate of technological progress raises the return to ability and simultaneously generates a rise in the wage inequality between and within groups of skilled and unskilled workers, an increase in the average wage of skilled workers, and a temporary decline in the average wage of unskilled workers. Their paper also sheds light on the international technological spillovers of wage inequality. It suggests that in the presence of imperfect technological diffusion, wage inequality among technological leaders is likely to be greater than that among followers. In addition, institutional changes in a technological leader, which curtail the wage gap between skilled and unskilled labor and raise the rate of technological progress in the leader, would have an increasing impact on wage inequality among follower countries.

### 2.2.3. Organizational Change

In recent years, a great deal of literature has emphasized the impact of

organizational change on rising wage inequality. The general conception is that organizational change is in large part an offshoot brought about by technical progress but has its own unique influence on the distribution of income. The effect of organizational change on income inequality is generally divided into between- and within-industry two types. Inasmuch as recent evidence demonstrates that the significance of the within-industry change far outweighs that of the between-industry change, the former has become the emphasis of recent literature.[2]

Murphy and Welch (1993) documented that the labor force with a college degree has grown by 13.9 percent between 1970 and 1984, and the within-industry growth alone accounts for 11.9 percent of the increase. After analyzing manufacturing industries in detail, Berman, Bound, and Griliches (1994) conclude that most of the 15 percent drop in manufacturing employment came from shifts away from production workers toward other types of workers within the industries. Bresnahan, Brynjolfsson and Hitt (1998) show that the decentralization within firms has a positive impact on firms' investments in human capital, and as a result, induces the increasing inequality. Similarly, Caroli and Van Reenen (1999) demonstrate that both technological and organizational changes reduce the income share of unskilled labor within British and French enterprises.

[2] Also see Danziger and Gottschalk (1995), and Aghion (1998).

## 2.3. Economic Growth and Financial Development

Based on two assumptions: (1) members of an economy are different in ability to combine factors of production and to utilize assets, and (2) economies of scale and indivisibility of investments exist, Goldsmith (1969) hypothesizes that a financial superstructure accelerates economic growth and improves economic performance through channels of the function of intermediation between savings and investments, which is made possible by the introduction of financial instruments, as well as the enlargement of the range of financial assets, which follows from the creation of financial institutions. As he notes, though, it is difficult to establish with confidence the direction of the causal mechanism between them, i.e., whether financial development leads economic growth or financial development reflects economic growth.

Acknowledging the connection between financial development and economic growth and the deleterious effect of financial repression on economic growth, Shaw (1973) and McKinnon (1973) developed a debt intermediation hypothesis concerning the effect of financial repression. The debt intermediation states that a perfect and competitive financial market operates according to Walrasian equilibrium. Under this assumption, the supply of credit is positively related to interest rates while the demand for credit is negatively related to them. Equilibrium is characterized by market

clearance as flexible interest rates equalize the supply of and demand for credit. Financial repression reduces not only the real size of the financial sector relative to non-financial ones but also the real rate of growth.

Greenwood and Jovanovic (1990) developed a formal theoretical model to investigate the role of financial development in economic growth in the framework of an endogenous growth model. Both the extent of financial intermediaries and the rate of economic growth are endogenously determined. Their study focuses on the role of financial intermediation in providing investment information and in channeling savings to investments. According to their hypothesis, financial intermediation promotes growth because it allocates the fund supplied to the investments with the best possible returns through profit and risk analysis.

Bencivenga and Smith (1992) emphasize the role of financial intermediaries in providing liquidity to alter the composition of savings. By means of risk diversification, financial agents are conducive to savers, who face random future liquidity needs and retain unproductive assets when allocating their resources to investments more efficiently.

### 2.4. Financial Development and Income Inequality

The links between economic growth and income inequality and between financial development and economic growth are well-defined and have been examined in detail. On the other hand, the relationship between financial development and income inequality has received little attention from income inequality theory in general, and from empirical tests in particular. The existing literature tends to analyze the role of financial development in income through the effect of credit rationing on the attainment of education and on the accumulation of capital. Again, Greenwood and Jovanovic mentioned in their article that it is costly to join the trade syndicate, so only individuals with the required amount of initial capital are able to enjoy the higher returns for their investment. They correspond these findings to the initial stage of development in Kuznets hypothesis. However, the relationship between them in the later stages of development is not clear. The theory presented by Piketty (1997) emphasizes the effect of interest rates on overall economic performance and the mobility of wealth in a modified Solow model. With higher interest rates, it results in a lower rate of capital accumulation, slower economic growth and less mobility of wealth. On the contrary, a lower interest rate is instrumental to the formation of capital and leads to high economic growth and better wealth mobility. Gregorio and Kim (2000) presented an endogenous growth model in which credit markets affect time allocation of individuals with different educational abilities. They hypothesize that the

introduction of a perfect credit market can allow individuals to optimize their utility by choosing between specializing in education for the more able and specializing in working for the less able. As a result, it promotes economic growth. With the assumption of heterogeneity of agents, they further infer that the opening of a perfect credit market results in a more disperse income distribution.

## 2.5. Conclusion

Compared with the two dominant strands of research, relatively little attention has been paid to the link between financial development and income inequality. Even if there is any literature at all, most of it is aimed at the conditions of developed and OECD countries in an implicit fashion. Since countries in different development stages vary a great deal in terms of economic superstructure, investment tendency, education system and etc., it is very difficult, without adjustment, to apply the experience of developed and OECD countries to newly industrialized countries.

# Chapter 3

# Financial Development and Income Inequality in Taiwan

## 3.1. Introduction

For the past several decades, Taiwan has experienced rapid economic growth with stable price and full employment, and it has emerged as one of the most successful newly industrialized economies in the world. Its real per capita income has grown at an average annual rate of 8.6% from 1952 to 1996 and exceeded US $11,662 in 1996 as compared to US $200 in 1952. Even more impressive is that it posts a positive real growth rate in every single year except 1974, the year immediately after the first oil crisis in 1973. For the period of 1970~1979, it boasts the highest average annual growth rate at 10.2% among all LDCs and NICs of that time. With 8.1% growth rate for the interval of 1980 to 1989, it is only second to China's 9.3%. Recently, because of political instability and the stock market crash during the early 1990s, Taiwan's growth rate has dropped down to 6.3% and is only better than that of Hong Kong among all Asian Pacific countries.

This rapid economic growth in Taiwan is accompanied by yet another two remarkable macroeconomic performances: low inflation and unemployment rates. For

## Table 3.1 Principal Economic Indicators

| Year | Growth Rate of GNP (%) | Per Capital GNP (US$) | Inflation Rate (%) | Unemployment Rate(%) | Interest Rate* |
|---|---|---|---|---|---|
| 1961 | 6.83 | 142 | 4.12 | | 14.40 |
| 1962 | 7.89 | 151 | 2.90 | | 12.96 |
| 1963 | 9.36 | 166 | 0.56 | | 11.52 |
| 1964 | 12.30 | 189 | 0.61 | | 11.52 |
| 1965 | 11.00 | 203 | 0.65 | | 11.52 |
| 1966 | 8.98 | 221 | 1.61 | | 11.52 |
| 1967 | 10.60 | 249 | 4.45 | | 11.52 |
| 1968 | 9.12 | 283 | 6.08 | | 10.80 |
| 1969 | 9.05 | 320 | 5.69 | | 10.80 |
| 1970 | 11.32 | 360 | 3.76 | | 10.80 |
| 1971 | 13.00 | 410 | 2.73 | | 9.25 |
| 1972 | 13.40 | 482 | 2.62 | | 8.50 |
| 1973 | 12.80 | 642 | 24.02 | | 10.75 |
| 1974 | 1.20 | 853 | 33.99 | | 12.00 |
| 1975 | 4.40 | 890 | 0.23 | | 10.75 |
| 1976 | 13.70 | 1041 | 3.62 | | 9.50 |
| 1977 | 10.30 | 1193 | 8.46 | | 8.25 |
| 1978 | 14.00 | 1443 | 7.65 | 1.67 | 8.25 |
| 1979 | 8.50 | 1758 | 12.50 | 1.27 | 11.00 |
| 1980 | 7.10 | 2155 | 22.21 | 1.23 | 11.00 |
| 1981 | 5.80 | 2443 | 9.07 | 1.36 | 11.75 |
| 1982 | 4.10 | 2419 | 2.45 | 2.14 | 7.75 |
| 1983 | 8.70 | 2573 | -1.22 | 2.71 | 7.25 |
| 1984 | 11.60 | 2890 | 1.66 | 2.45 | 6.75 |
| 1985 | 5.60 | 2992 | -1.32 | 2.91 | 5.25 |
| 1986 | 12.60 | 3646 | 2.64 | 2.66 | 4.50 |
| 1987 | 12.60 | 4839 | 1.93 | 1.97 | 4.50 |
| 1988 | 8.30 | 5829 | 1.11 | 1.69 | 4.50 |
| 1989 | 8.00 | 6977 | 3.14 | 1.57 | 7.75 |
| 1990 | 5.50 | 7413 | 4.56 | 1.67 | 7.75 |
| 1991 | 7.60 | 8189 | 3.88 | 1.51 | 6.25 |
| 1992 | 6.20 | 9536 | 3.42 | 1.51 | 5.63 |
| 1993 | 6.00 | 9872 | 4.62 | 1.45 | 5.50 |
| 1994 | 6.10 | 10566 | 2.64 | 1.56 | 5.50 |
| 1995 | 5.90 | 10934 | 4.58 | 1.79 | 5.50 |
| 1996 | 5.93 | 11662 | 2.53 | 2.60 | 5.00 |
| 1997 | 6.32 | 12457 | 0.26 | 2.72 | 5.25 |
| 1998 | 4.28 | 11333 | 2.12 | 2.69 | 4.75 |
| 1999 | 5.87 | 12100 | 0.14 | 2.92 | 4.50 |
| 2000 | 6.36 | 12916 | 1.66 | 2.99 | 4.63 |

* bank discount rate

** sources: Directorate-General of Budget, Accounting and Statistics (DGBAS), Central Bank of China (CBC), R.O.C.

over 35 years, Taiwan has not only posted an average annual inflation rate at 5.3%, but it has also consistently managed to confine its inflation to a single-digit rate. The only periods during which Taiwan experienced double-digit inflation rates were those years during and immediately after oil crises. Another characteristic of Taiwan's economic experience is its low unemployment rate. Except for the post World War II years, the unemployment rate never rose above 3% even in the years around the oil crises.

Even though the economy in Taiwan as a whole has been thriving under the regime of free market, the formal financial sector has been heavily regulated and repressed. As a result, the informal sector or the curb market has become an important source of financial loans for a great deal of private investment projects. Facing mounting pressure from US multinational financial institutions and increasing international competition, Taiwan's government initiated a series of financial reform and liberalization measures beginning in the late 1970s in order to both sustain its economic growth and cope with the US pressures.

Another issue that has concerned and disturbed Taiwan's economic development the most in the past two decades is the increasing income inequality. Since the late 1970s, Taiwan has first seen its decreasing trend in income inequality come to an end and then gradually reverse. Since the ratios were first officially reported in 1964, the

ratio of the income share of the top quintile to that of the bottom quintile reached a record high of 5.51 in Taiwan in 1998. As a result, the equality of income distribution as well as the progress of financial reform has become the foremost priority and challenge for the future development of Taiwan's economy.

The remainder of the chapter is organized as follows. Section 2 briefly examines the background, progress and effect of the financial development and reform. Section 3 provides a succinct review of the vicissitude of the income inequality in Taiwan for the past forty years.

### 3.2. Financial Development

Like most LDCs, Taiwan's financial system consists of a repressed formal sector and a free informal sector. The formal financial sector was tightly regulated by the government by means of interest rate control, select credit, entry barrier, and operation restrictions. Before 1960, there were only 6 nationwide banks, 8 regional small- and medium-sized enterprises (SMEs) banks, and a number of credit cooperative associations to provide banking services to millions of households and businesses. The security market was not even established until 1962. All of the 6 nationwide banks were solely or jointly owned by the state and accounted for 80.2%

**Table 3.2 Development of Financial Institutions**

| Year | 1960 | 1970 | 1980 | 1990 | 2000 |
|---|---|---|---|---|---|
| Central Bank of China | 1 | 1 | 1 | 1 | 1 |
| Depository Financial Intermediaries | | | | | |
| Domestic Banks | | | | | |
| Nationwide | 6 | 11 | 16 | 24 | 53 |
| Regional | 8 | 8 | 8 | 8 | 8 |
| Foreign Banks | 1 | 6 | 8 | 35 | 39 |
| Credit Cooperative Associations | 36 | 39 | 39 | 74 | 48 |
| Credit Department of Farmers' Associations | 244 | 251 | 260 | 285 | 287 |
| Credit Department of Fishermen's Associations | 4 | 4 | 4 | 24 | 27 |
| Postal Savings System | 1 | 1 | 1 | 1 | 1 |
| Investment and Trust Companies | 0 | 1 | 3 | 8 | 3 |
| Non-depository Financial Intermediaries | | | | | |
| Life Insurances | 2 | 8 | 8 | 13 | 32 |
| Property and Casualty Insurances | 4 | 14 | 14 | 19 | 26 |
| Financial Non-intermediaries | | | | | |
| Bill Finance Companies | 0 | 0 | 0 | 3 | 16 |
| Security Finance Companies | 0 | 0 | 0 | 1 | 4 |
| Brokers | - | - | 28 | 371 | 158 |
| Dealers | - | - | 10 | 37 | 105 |
| Underwriters | - | - | 22 | 60 | 75 |
| Foreign Securities Firms | 0 | 0 | 0 | 2 | 13 |

* sources: CBC, Securities and Exchange Commission (SEC)

of the total financial assets of the formal sector in 1960. However, the primary function of these formal financial institutions was to serve the financial needs of public enterprises and selected large private firms. The responsibilities of serving the financial needs of consumers as well as small and medium firms are shared by regional

private financial institutions and the informal sector. According to a survey conducted by the Bank of Taiwan, the informal sector alone provided more than 40% of the borrowings by private enterprises in the 1950s. This phenomenon indicated the inefficiency of the formal financial sector in tapping the large pool of savings and channeling them into the private enterprises. The risk of the informal market is high, and as a result, the interest rates are also higher than the official interest rates. However, the curb market lenders adopted more flexible standards to provide short-term loans to small and medium businesses on an unsecured basis as well as the use of postdated checks as collateral. It was this combination and complementarity of the repressed formal sector and the active informal sector that resolved the allocation dilemma between supply of and demand for capital and induced the rapid economic development through the 1970s.

### 3.2.1. Reform of the Banking System

The changes in the formal financial system were slow and reserved before the 1970s. During that time, the most predominant progress was for the government to ease the entry barriers for farmers and fishermen's associations to form credit unions and branches in rural areas for political reasons. Facing mounting external and internal pressure to open the market and recognizing the necessity to sustain the growth, the

government of Taiwan has initiated a series of measures to reform its banking system since the late 1970s. The major addresses of the reform included the interest rate decontrol, market entry deregulation, and privatization of major banks.

The Central Bank of China (CBC), the authority of the banking system, adopted a more flexible and practical policy and allowed interest rates to adjust to market equilibrium rates in the 1970s. Nonetheless, the CBC was still the ultimate setter of interest rates. In 1981, the CBC started to relegate the control of interest rates to the Bank Association, an organization designed to coordinate the business of the banks, under the Law of the Essential Points of the Interest Rate Adjustment for Banks. Even though the range of the interest rates was subject to the approval of the CBC, the CBC continued to support the interest rates that were proposed by the Bank Association.

The pace of the reform intensified in the late 1980s. In 1989, the Banking Law of Adjustment (BLA), which affects one-quarter of the provisions in Banking Law, was enacted and promulgated to pursue further and broader overhauls of the banking system with the policy thrusts in competitive and prudential deregulation. Under the competitive deregulation, the BLA enhances the competition in three major areas. First, the intervention of the CBC over the interest rates was totally eliminated. Second, the entry barrier was removed and some of the state-owned banks were privatized to

strengthen the efficiency of the banking system. Third, foreign banks have been given greater entry and business opportunities to enable them to be more competitive in the domestic market.

Under prudential deregulation, the BLA seeks to enhance the safety and stability of the banking industry with a number of measures. First, in order to overcome the problems of lack of authority and means to regulate the informal financial sector, the BLA attempts to restrict the underground financial industry with a better definition of deposit taking so that the financial regulatory authorities would have a more adequate legal basis to prosecute the underground financial industry. Secondly, the BLA has introduced provisions on ownership concentration to ensure that the new commercial banks will be widely held. Thirdly, the BLA has mostly adopted the risk-based capital framework of the Balse Committee on Banking Regulations and Supervisory practices, requiring that a bank have a ratio of its capital to its risk-weighted assets of not less than 8 percent unless otherwise approved by the Ministry of Finance (MoF).

In 1992 the BLA was further revised with the addition of five new articles and the amendment of twelve existing ones. The stress of those articles is to regulate both secured and unsecured credit extensions to companies in which the directors, officers, employees, and major shareholders of a bank own a part of interest.

### 3.2.2. Effects of the Reform on the Banking System

By 1960, there were only six state-owned nationwide banks, 8 SMEs and a number of credit cooperative associations to serve the banking needs of households and businesses in Taiwan. From 1960 to 1988, ten new state-owned or state-controlled banks were chartered to facilitate the implementation of government economic policies as well as to serve the needs of specific and selected industries and objectives. After the lift of the entry ban by the BLA in 1989, fifteen new privately owned commercial banks were licensed between 1991 and 1992. Since 1992, the number of banks in Taiwan has grown steadily throughout the rest of the 1990s, and it reached 53 by the end of 2000. While the number of foreign banks that operate in Taiwan has grown at a much slower pace than domestic ones--increasing from 32 to 39--the figures of their branches have more than doubled, rising from 33 to 70 for the same period. However, the number of locally operated credit cooperative associations declined after the promulgation of the BLA, from its peak at 74 during 1987~1995, to 48 in 2000, due to the tighter supervision by the government after the 1985 scandal[1] as well as the mergers and conversions of several of the credit cooperative associations.

In terms of the shares of assets, deposits, and loans, the state-owned banks still

[1] It involved a grand scale of illegal lending, mismanagement of funds, and embezzlement.

dominated the industry in the years immediately following 1989. Nevertheless, their shares continued to fall to 53.5%, 46.3%, and 62.6% in 1990 from 70.5%, 77.3%, and 76.8% in 1970, respectively. After the privatization of several major state-owned commercial banks from 1993 on, these ratios further fell to 43.1%, 35.6%, and 25.3% in 2000. The total deposits and loans grew from NT$4881 billion and NT$3395 billion in 1988 to NT$19309 billion and NT$16311 billion in 2000, correspondingly. Despite the shares of assets, deposits, and loans of foreign banks that were maintained at about the same level before and after the BLA, their absolute values multiplied by more than four times. It is noteworthy that the role of the informal sector in the loan market has dropped to less than 25% in the 1990s from more than 40% before the 1970s. Another conspicuous progress is the ratio of loan to deposit, rising from 69.6% in 1988 to 84.5% in 2000. Both of these statistics indicate the significant improvement on the efficiency of the formal banking system after a series of banking reform measures.

### 3.2.3. Reform of the Security Market

Taiwan's security market was officially commenced in 1961 and was governed by a number of regulations enacted through the 1950s. The Security Exchange Law (SEL), a comprehensive regulatory framework to replace much of the fragmented regulations, was promulgated in 1968. There was no new addition or revision to the law until 1982

when the security market of Taiwan saw its capitalization fall for three consecutive years. In order to bolster the market, a number of short-term measures were taken, which included increasing the rates on margin financing, opening the over the counter (OTC) market, and tightening the screening of the listed companies.

In 1983, the government undertook the first stage of a three-stage plan to allow the entry of foreign capital into the security market by permitting securities investment trust enterprises (SITEs) to offer mutual funds of domestic equities to overseas investors. In 1988, the government promulgated the Securities and Exchange Law Amendments (SELA) to further deepen and liberalize Taiwan's security market. The SELA aims to improve several major areas of the SEL, such as the scope of operation, the criteria of issuing, and the requirements of entry, which affects over one-third of the SEL's provisions. The SELA continues to carry out the second stage of financial liberalization toward the entry of overseas investors. It opens the door for foreign security firms and financial institutions to enter the domestic security business, acquire the ownership of domestic security companies, and operate in the areas of underwriting, dealing, and brokering. The SELA also permits the new entry of domestic security firms into the security industry by enacting the criteria for new entrants. In addition, the SELA equips security firms with broader and greater powers by allowing them to engage separately or concurrently in any combination of the

underwriting, dealing, and brokering functions. Prior to the SELA, security firms were licensed to engage in only one of those operations.

Another major revision is to liberalize the system of margin transactions; security firms are permitted to engage in these transactions directly or act as an agent for such transactions. Before the SELA, these activities had been the legal monopoly of Fuh Hwa Securities Corporation since its inception in 1980. The third stage of the internationalization of the security market was realized by allowing foreign security firms to establish representative offices and branches in 1991.

Capital market integrity is another important objective of capital market reform. Capital market integrity is crucial to the efficiency and growth of the security market because without it, investors may shun away from the capital market for other financial segments, causing among other things, the trading on the secondary market to be less liquid, and the issuing of securities in the primary market to be more expensive for issuers as investors would want a discount to compensate for the higher liquidity risk in the secondary market. In order to encourage public participation and enlarge the scale of the security market, the SELA contains provisions emphasizing the areas of shareholder diversification, capital structure of issuers, and disclosure requirements. The SELA requires the issuing companies to offer at least a certain percentage of the

shares to the public in order to broaden the holding bases. Those provisions apply to all shares issued regardless of whether or not they are listed and traded on Taiwan Stock Exchange (TSE) or OTC. The SELA also enables the Securities and Exchange Commission (SEC) to limit the percentage of the net capital increases a company otherwise would obtain to prevent the illusory increases in the capitalization of a company. Most important of all, the SELA requires more extensive and continuous disclosure in the areas of financial and operational conditions of a company, the holding positions of its major shareholders, directors, supervisors, and managers, and its major acquiring and transferring transactions. These measures were enacted in order to deter the occurrence of such events as insider trades and manipulative practices.

### 3.2.4. Outcomes of the Reform on the Security Market

Prior to the 1988 SELA, there were twenty-eight brokers, ten dealers, and twenty-two underwriters. However, pursuant to the SELA, the entry restrictions were liberalized, and there was considerable entry into the various segments of the securities business.

**Table 3.3 Development of Stock Market**

| | 1965 | 1975 | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|---|---|
| No. of Listed Companies | 37 | 68 | 127 | 199 | 347 | 531 |
| No. of Shares Listed* | 529 | 3,458 | 21,345 | 50,643 | 132,642 | 363,018 |
| Total Par Value** | 8,950 | 29,069 | 213,449 | 506,425 | 1,342,619 | 3,630,183 |
| Total Market Value** | 27,070 | 73,959 | 415,706 | 2,681,911 | 5,108,437 | 8,191,474 |
| Trading Volume* | 477 | 6,645 | 14,533 | 232,306 | 267,297 | 630,868 |
| Trading Value** | 10,960 | 130,336 | 195,227 | 19,031,288 | 10,151,535 | 30,526,566 |
| Weighted Index | | 317.48 | 745.62 | 6775.32 | 5543.75 | 7847.21 |
| Stock Population*** | | | | | 3.337 | 6.829 |
| (As % of Total Households) | | | | | 51.49 | 100 |

* million shares ** NT$million *** million

Note: source: Securities and Exchange Commission (SEC)

Pursuant to the permissive SELA, the number of brokers who buy and sell securities on behalf of clients increased dramatically. In 1990, two years after the SELA, the number of licensed brokers quickly reached its peak at 373. This number was more than the 199 companies listed on TSE, the shares of which they broker for clients. Inasmuch as the conditions in the security industry has not been conducive for brokers to earn substantial brokerage commissions from large volumes of transactions, most brokerage firms have lost money. As a result, the number of firms has steadily declined to 158 at the end of 2000 as the industry has undergone significant reconstruction.

The security firms licensed to deal with their own accounts were tallied at 37 at the end of 1990. Even encountering the same detrimental aggregate conditions as the brokers, the number of dealers continued to grow in a steady fashion and arrived at 105 as of 2000. However, many of these licensed dealers were affiliated with one or more listed companies, and holding but not trading the shares of their affiliates became their main function. In order to improve the market stagnation, the SEC decreed in 1992 that the licenses of security dealers will be revoked in the event that they fail to trade securities in a fifteen-day period.

The development for the underwriters is similar to that of the dealers. The security firms with underwriting licenses gradually climbed to 75 at the end of 2000. Underwriting by these firms is generally done on a best-effort rather than a firm-commitment basis. The former entails prospective investors to submit their offers to purchase shares by conventional mail. In the event of oversubscription, a computer-assisted lottery system allocates the shares in order to ensure that all subscribers enjoy fair and equal opportunities.

Prior to the SELA, there were 163 listed companies on TSE. That number increased rapidly through the 1990s and approached 531 at the end of 2000. The market value of the security market accumulated to NT$8.2 trillion in 2000 from

NT$3.4 trillion in 1988. The trading value fluctuated dramatically from year to year. From 1988 to 1989, the trading value in Taiwan had more than tripled from US$298 billion to US$970 billion, and was ranked third in the world, only trailing the United States (US$2431 billion) and Japan (US$1542 billion) in 1989. However, the trading value took a freefall after the crash of the stock market in 1991. It hit the bottom with only US$211 billion in 1992, but gradually recovered and surpassed its previous peak with US$1330 billion in 1997.[2]

Taiwan also boasts one of the most active security markets in the world in terms of trading volume from 1987 onwards. On average, there are more than 2 billion shares changing hands each day in recent years. This unique and special characteristic of Taiwan's security market is in large part caused by the composition of the investors. In terms of the shares of capital, individual investors account for more than 50% of the market value, while the government and private institutions account for around 10% and 20%, respectively. According to the report released by the SEC, there were more than 12 million accounts and 7 million investors registered on TSE. The number of investors not only accounted for over 43% of the adult (18 years old and above) population, but also was larger than the number of households (6.7 millions) in 2000.

[2] Sources: Taiwan Securities and Exchange Commission.

### 3.2.5. Reform of the Insurance Industry

Before 1961, all insurance companies in Taiwan were run by the state. Between 1961 and 1963, the government temporarily lifted the ban on the formation of privately owned insurance companies. From 1986 through 1987, three American insurance companies were allowed to operate a full-range program due to the pressure stemming from the US and the lack of competition in the domestic market. In 1992, the government enunciated the Insurance Law Amendments (ILA) to lift the ban on the entry of new insurance firms, to expand the business power of the companies, and to promote more competition in the market. Additional provisions were added in 1993 to further allow domestic insurance firms to invest overseas and for non-US foreign insurance companies to enter Taiwan's market.

### 3.2.6. Development of the Insurance Industry

Since the passing of the ILA in 1992, the government has granted 12 licenses to life insurance companies and 5 to property and casualty companies, respectively. Even though the market shares of the insurance industry in the overall financial system are still insignificant after the reform, they did grow from 2.1% to 5.2% in deposits, and from 1.9% to 4.9% in loans and investments from the 1980s to 1990s, correspondingly. However, Taiwan's insurance industry is still underdeveloped with only 32% of its

population insured, compared to 160% in the US and 360% in Japan.

### 3.3. Income Distribution

According to the hypothesis proposed by Kuznets (1955), the income inequality of a country would rise during the stage of take-off, then stabilize around the middle stage, and finally start to fall by the stage of maturity. Contrary to his theory, Taiwan's income inequality, based on two most commonly accepted measures: Gini coefficients and ratios of the top quintile's income share to the bottom quintile's income share, improved drastically from 55.8 to 29.02 and from 8.37 to 4.49, respectively, during 1953~1972, while the economy grew at a rate of 8.6% per year. During the 1970s, despite facing two oil crises, Taiwan's economy continued to shine in both the growth and the income equality categories. While it led all LDCs and developed countries (DCs) with an average annual growth rate of 10.2%, its income inequality consistently declined to 27.76 in Gini coefficient and to 4.14 in ratio of income shares. For this very reason, Taiwan's economic development has been considered by many economists as a miracle and role model for other developing countries to follow. However, just when Taiwan's economy crossed the border of middle and mature stages, Taiwan saw its income inequality take a reverse trend, rising gradually ever since 1980. In 1993, its Gini coefficient climbed to 30.78 and its ratio of income

## Table 3.4 Income Inequality Index of Taiwan

| Year | Gini Coefficients* | Ratios of Income of Highest 20% to that of Lowest 20%** | Ratios of Income of Highest 10% to that of Lowest 10%** |
|---|---|---|---|
| 1953 | 55.80 | | |
| 1960 | 44.00 | | |
| 1964 | 32.24 | 5.33 | |
| 1966 | 32.43 | | |
| 1968 | 28.90 | 5.28 | |
| 1970 | 29.42 | 4.58 | |
| 1972 | 29.02 | 4.49 | |
| 1974 | 28.09 | 4.37 | |
| 1976 | 28.40 | 4.18 | 16.09 |
| 1977 | 28.00 | 4.21 | 14.43 |
| 1978 | 28.43 | 4.18 | 14.21 |
| 1979 | 27.70 | 4.34 | 15.74 |
| 1980 | 27.96 | 4.17 | 15.77 |
| 1981 | 28.15 | 4.21 | 15.82 |
| 1982 | 28.51 | 4.29 | 15.44 |
| 1983 | 28.45 | 4.36 | 17.14 |
| 1984 | 28.81 | 4.40 | 15.16 |
| 1985 | 29.20 | 4.50 | 15.14 |
| 1986 | 29.29 | 4.60 | 16.96 |
| 1987 | 29.65 | 4.69 | 15.99 |
| 1988 | 30.02 | 4.85 | 16.26 |
| 1989 | 30.41 | 4.94 | 15.98 |
| 1990 | 30.11 | 5.18 | 19.28 |
| 1991 | 30.49 | 4.97 | 18.04 |
| 1992 | 31.20 | 5.24 | 19.41 |
| 1993 | 31.60 | 5.42 | 19.35 |
| 1994 | 31.80 | 5.38 | 21.06 |
| 1995 | 31.70 | 5.34 | 23.93 |
| 1996 | 31.70 | 5.38 | 24.38 |
| 1997 | 32.00 | 5.41 | 23.72 |
| 1998 | 32.40 | 5.51 | 33.07 |
| 1999 | 32.50 | 5.50 | 42.17 |

* source: Deininger (1996) ** source: DGBAS

shares reached a thirty-year high at 5.34, which is worse than the previous record of 5.33 posted in 1964.

Since the increasing income inequality has become a ubiquitous economic and political concern globally, a great deal of literature has been devoted to exploring the possible causes. However, most of those studies are focusing on the development of income inequality in the OECD countries. Due to the differences in economic fundamentals, demographic conditions, and education systems between NICs and OECD countries, those studies could hardly apply to NICs without significant adjustment. For example, unlike in the US, the immigration and demographic aspects have never been an issue for the income inequality in Taiwan. Except for less than 2% of aborigines who mostly live in mountain areas, Taiwan's population is unanimously composed of Chinese descents. As for immigration, there is no major immigration influx that is big enough to affect the labor market and the composition of the population since the introduction of foreign labors. Taiwan's education system is an amalgamation of those of the US and western Europe. On one hand, like most of western European countries, education is free in Taiwan through $12^{th}$ grade and for post-graduate study. On the other hand, like the US, Taiwan supports the universal education system in which college education is available to all those who desire to attend. Even though college education in Taiwan is not free, the cost to attend college

is relatively affordable compared with its per capita income. For example, the cost to attend a private university and the cost to attend a public university for one year were US$850 and US$300, respectively, while per capita income was US$7413 in 1990. Therefore, the credit restriction in education pursuit is not a significant cause of income inequality in Taiwan's case.

Another distinguished difference between NICs and OECD countries is the macroeconomic settings of the occurrence of the rising income inequality. A great deal of economists in OECD countries blame the rising income inequality on the slow economic growth, but their argument could not explain why the equality of income is falling in Taiwan while its economy grows at a rate of over 8% per annum.

Due to the aforementioned conditions that vary from country to country, and from development stage to development stage, it is imperative to approach the problems of income inequality on a country-specific basis in order to resolve them more effectively and properly.

### 3.4. Conclusion

When immersing in the glory of its rapid economic growth, Taiwan also has to confront several formidable challenges stemming from rising income inequality and

urgency for financial reform. Since both theoretical and empirical studies agree that financial development and income equality have a positive effect on economic growth, it is vital for the financial reform and the endeavor in abating income inequality to succeed in order to lift Taiwan from its current economic slump as well as lay down a solid foundation for its future development. Therefore, it becomes an important and crucial task for policy makers and economists to identify the specific causes and come up with adequate solutions to ensure the success of their efforts in reducing income inequality and liberalizing the financial system for Taiwan's economy.

# Chapter 4

# Theoretical Model

## 4.1. Introduction

This chapter will develop a general equilibrium model, which examines how the changes in the financial system caused by the liberalization measures have affected the distribution of income through the channels of investment. Since the financial development, income distribution and other principle economic behaviors are based on the characteristics specific to NICs in general, and to Taiwan in particular, the theoretical model reflects these attributes concurrently. They include a near full employment, a uniform distribution of human capital, a rapid growth in savings and deposits, an increase in the share of non banking system compared to that of banking system, an increasing influence of the fast growing security market on income, and the propensity of people to leave a large percentage of their wealth to their progenies, in spite of the underdevelopment of the financial system. In addition, these characteristics are expected to further the interrelations among financial behaviors as well as other economic areas.

The general framework of this paper is derived from the theory of incomplete financial markets and the neoclassical theory of growth under altruism. However, it is

further modified to address the specific economic characteristics of the macroeconomic environment, the financial system, the investment behavior, and the intergenerational altruism in Taiwan, without conflict with the essential attributes of the model. In our model, we consider a small open economy comprised of a stationary population. Each agent has one progeny and generations succeed each other ad infinitum. Agents live for one period during which they invest or work. In addition, individuals are assumed to be risk neutral and have identical preferences and labor endowments, deriving utility from consumption and bequest. The only source of heterogeneity among individuals is assumed to be their initial wealth endowments from their parents. In this economy, a single composite good, which can be used for either consumption or investment, is produced. There are two channels how an agent can participate in the process of production. He can choose to work in the backward sector and earn a deterministic wage. Alternatively, he can launch his own entrepreneurial venture in the modern sector that requires a fixed initial capital investment and gives a higher expected return. Other than investing in entrepreneurial activity, an agent can also invest his capital in secured financial assets and earn a lower, but fixed return. This model shows that in the face of credit market imperfections, the distribution of wealth affects not only aggregate economic growth but also individual's future income. Furthermore, it demonstrates that in the presence of indivisibilities in

the capital requirement of entrepreneurial activity, these effects are carried to the long run as well.

The remainder of this chapter is organized as follows. In section 2, the basic analytic model is outlined to pave the way for our examination of the relationships of the principal economic variables--financial development, economic growth, and income distribution--we focus on. In section 3, we investigate how the development of the financial market affects the income distribution and the economic growth under the regime of a perfect credit market. Section 4 characterizes the interactions among those three economic behaviors under the regime of an imperfect credit market. Concluding observations are presented in section 5.

## 4.2. The Basic Model

### 4.2.1. Demographics and Preferences

The economy is assumed to consist of a large number of agents L with identical preferences and labor endowments who are active for one period. Each agent has exact one offspring so that there is no population growth. For each generation, the only source of heterogeneity among individuals is their initial wealth endowments from their parents. The distribution of wealth endowments at the beginning of time t is

defined by:

(1) $$\Phi(w_t) = \int_0^{w_t} d\Phi(x_t)$$

where $\Phi$: $R_+ \rightarrow [0,1]$ and $w_t$ is the wealth level. Agents derive utility from both consumption and bequests. We assume that parents are altruistically concerned about the well being of their offspring so that they gain utility from the bequests per se, not from the offspring's utility drawn from the bequests. Formally, the utility function of a representative individual of generation t is given as follows:

(2) $$U = U(c_t, b_t) = \alpha \log c_t + (1-\alpha) \log b_t \quad \text{with } 0<\alpha<1$$

subject to

(3) $$y_t = c_t + b_t$$

where $c_t$ is the consumption of an agent who lives in period t, $b_t$ is the bequest he leaves to his progeny, $(1-\alpha)$ is the saving rate, and $y_t$ is the income. An individual can employ his endowed indivisible one unit of labor inelastically in one of the following two production activities at no disutility cost. First, he can use it to serve as a wage-earning worker in the backward sector and receive a prevailing market equilibrium wage $\lambda_n$. Secondly, he can invest it in the entrepreneurial activity $\tau$ that requires a fixed initial

capital outlay I, and earn an opulent but risky return $R_{\tau,t}$, which is randomly distributed with density function of $p(R_{\tau,t})$. Its range is supposed to be subset of $[-1,\infty]$, which means that there is no marginal transaction. Except for the risky asset for the entrepreneurial activity, agents can invest his capital in a secured asset and earn a lower but steady return $r_{s,t}$. Agents are assumed to be risk neutral toward investment choices.

### 4.2.2. Aggregate Production

Consider that a single composite good is produced in this economy. The good can be used for either consumption or investment. The good can be produced by two technologies, one modern which requires entrepreneurial endeavor and capital and the other outdated using labor only. Production in the modern sector as a whole is denoted by:

$$(4) \qquad Y_t = F(K_t, L_{e,t})$$

where $Y_t$ is the output in this sector at time t, $k_t$ is the amount of capital and $L_{e,t}$ is labor input. $F(k_t,L_{e,t})$ is a concave production function with constant return to scale with respect to aggregate capital and labor inputs $k_t$ and $L_{e,t}$. It is presumed that both the capital investment and the entrepreneurial endeavor are committed in the beginning of the period. For the sake of tractability, we postulate that there are no adjustment costs to investment and no depreciation of capital. By assuming that $k_t=I>>0$ and $L_{e,t}=1$,

furthermore, we obtain the Leontief production function for a representative entrepreneurial activity at the individual level:

(5) $y_e = \eta f(I, 1) = R_\tau \qquad \tau \in A$

where $y_e$ is the expected return, $\eta$ is a project specific shock, and A is the set of risky projects. Because the production shock for an individual project is not exactly known and its expected value is assumed to be one, the shock does not affect the demand of input factors when they are employed. Thus, the typical production function for an entrepreneurial project is described by:

(6) $R_\tau = f(I, 1)$

We assume that the expected return for any given venture at time t is presented as follows:

(7) $R_{r,t} = \int R_{r,t} * p(R_{r,t}) d R_{r,t}$

Production in the backward sector is denoted by:

(8) $Y_{n,t} = \lambda_n * L_{n,t}$

where $Y_{n,t}$ and $L_{n,t}$ are the output and labor input in this sector, respectively, and $\lambda_n > 0$ is

the marginal productivity.

## 4.3. Wealth Distribution In The Presence Of A Perfect Capital Market

### 4.3.1. Short Run Equilibrium

In this section, we extend the basic set-up developed in the previous section to analyze both the short and long term effects of the financial system on income distribution and economic growth in the presence of a perfect credit market. It is assumed that there is no transaction friction and information asymmetry in the capital market and that the equilibrium interest rate is determined by the equalization of supply of and demand for credit. Since the main objective of our study is to explore the income and growth effect of wealth distribution through the channel of investment, we will limit our discussion to the financial market without consumption loans while no qualitative result is compromised.

We now turn to describe individual optimal decisions under the assumption of a perfect capital market. Consider an individual who inherits an amount of $w_t$ from his/her parent in the beginning of time t. If he/she decides to work in the backward sector and not engage in entrepreneurial activity, he/she becomes a lender with lifetime income:

(9) $$y_n(w_t) = \lambda_n + w_t(1 + r_{s,t})$$

and lifetime utility:

(10) $$U_n(w_t) = \log[\lambda_n + w_t(1 + r_{s,t})] + \varepsilon$$

where $\varepsilon = \alpha\log\alpha + (1-\alpha)\log(1-\alpha)$.[1] This labor provider leaves his (her) progeny a bequest of size:

(11) $$b_n(w_t) = (1-\alpha)\, y_n = (1-\alpha)[\lambda_n + w_t(1 + r_{s,t})]$$

By choosing to launch his/her own entrepreneurial venture, an individual earns expected lifetime income:

(12) $$y_e(w_t) = R_{r,t} + (w_t - I)(1 + r_{s,t})$$

and expected lifetime utility:

(13) $$U_e(w_t) = \log[R_{r,t} + (w_t - I)(1 + r_{s,t})] + \varepsilon$$

This entrepreneur bestows his/her offspring with a bequest of size:

(14) $$b_e(w_t) = (1-\alpha)\, y_e = (1-\alpha)[R_{r,t} + (w_t - I)(1 + r_{s,t})]$$

[1] The Cobb-Douglas preference is adopted for the utility function in the analysis. For the detailed explanation, see appendix 1.

Since the very incentive that a rational individual is willing to undertake an entrepreneurial activity is its expected return exceeds its opportunity cost--wage plus interest income, it is logical to assume that:

(15) $$R_{r,t} - I(1 + r_{s,t}) \geq \lambda_n$$

Combine Equations (9), (12), and (15) to obtain:

(16) $$y_r(w_t) \geq y_n(w_t) \qquad \text{for all } w_t \in R$$

In other words, an individual is better off financially if he/she chooses to launch his (her) entrepreneurial venture under the regime of a perfect capital market in the short run, regardless of his (her) initial wealth. Since all rational agents will try to devote their endowed labor and capital to the more productive modern sector, all the investment opportunities will be exploited and the aggregate economic growth will reach Pareto equilibrium.

### 4.3.2. Long Run Equilibrium

In this section, the long run effects of wealth endowment and financial development on income distribution and economic growth are examined in a similar fashion. An individual who decides to work in the backward sector and deposit his/her

capital in secured assets leaves his/her progeny a bequest of size:

$$(17) \qquad w_{t+1}=b_n(w_t)=(1-\alpha)\,y_n(w_t)=(1-\alpha)[\,\lambda_n+w_t(1+r_{s,t})\,]$$

If this lineage stays in the backward sector generation after generation, the long run wealth endowment converges to $\overline{w_n}$:[2]

$$(18) \qquad \overline{w_n}=\lim_{j\to\infty} w_{t+j}=(1-\alpha)\,\lambda_n/[1-(1-\alpha)(1+r_s)]$$

Agents who determine to invest in the modern sector leave their progenies a bequest of size:

$$(19) \qquad w_{t+1}=b_e(w_t)=(1-\alpha)\,y_e(w_t)=(1-\alpha)[\,R_{e,t}+(w_t-I)(1+r_{s,t})\,]$$

If all their descendants remain in this sector, the long run wealth endowment converges to $\overline{w_e}$:[3]

$$(20) \qquad \overline{w_e}=\lim_{j\to\infty} w_{t+j}=(1-\alpha)[\,R_e-I(1+r_s)\,]/\,[1-(1-\alpha)(1+r_s)]$$

From Equation (16), it is straightforward to show that $\overline{w_e}$ is greater than or equal to $\overline{w_n}$. Hence lineages remaining in the modern sector are better off than those remaining in the backward sector in the long run as well. Assuming that individuals are rational, they certainly will prefer investing in the more profitable entrepreneurial

[2] For the derivation, see appendix 2.
[3] It is derived in the same manner as equation (18).

venture to working in the backward sector. As a result, all investment opportunities will be exploited and the growth potential of aggregate output will be fully realized.

### 4.4. Wealth Distribution In The Presence Of An Imperfect Capital Market

In this section, we continue to investigate how wealth endowment and financial development affect the behaviors of income distribution and economic growth under the regime of an imperfect capital market. It is assumed that there exist transaction friction and information asymmetry in the credit market so that borrowers have to pay a higher than market equilibrium interest rate to cover monitoring cost and default risk. As a result, an individual who borrows an amount of m pays lenders an interest rate $i_m$, which covers the market clearance interest rate $r_s$, and the monitoring cost and risk premium z, is denoted by:

(21) $$m \times i_m = m \times r_s + z$$

Lenders choose z to be high enough to deter any possible evasion:

(22) $$m(1+i_m)=\beta z$$

This is an incentive compatibility constraint. Equations (21) and (22) determine $i_m$:

(23) $$i_m = i = (1+\beta \times r_s)/(\beta-1) > r_s$$

The borrowing interest rate i is, therefore, independent of the amount m borrowed, as monitoring cost and risk premium rise with the amount m borrowed. This result is quite intuitive: as the amount m borrowed increases, the incentive to default rises and hence monitoring cost and risk premium rise.

### 4.4.1. Short Run Equilibrium

We now turn our attention to describe individual optimal decisions under the regime of an imperfect capital market. Consider an individual who inherits an amount of $w_t$ in the beginning of time t. If this person decides to work in the backward sector and not launch an entrepreneurial venture, he/she procures lifetime income:

(24) $$y_n(w_t) = \lambda_n + w_t(1 + r_{s,t})$$

and lifetime utility:

(25) $$U_n(w_t) = \log[\lambda_n + w_t(1 + r_{s,t})] + \varepsilon$$

This agent is a lender who leaves a bequest of size:

(26) $$b_n(w_t) = (1-\alpha)[\lambda_n + w_t(1 + r_{s,t})]$$

An individual with wealth endowment more than I, who invests in an

entrepreneurial venture in the modern sector, is a lender with lifetime income:

(27) $$y_e(w_t) = R_{r,t} + (w_t - I)(1 + r_{s,t})$$

and lifetime utility:

(28) $$U_e(w_t) = \log[\, R_{r,t} + (w_t - I)(1 + r_{s,t}) \,] + \varepsilon$$

This entrepreneur bestows his/her offspring with a bequest of size:

(29) $$b_e(w_t) = (1-\alpha)\, y_e(w_t) = (1-\alpha)[\, R_{r,t} + (w_t - I)(1 + r_{s,t}) \,]$$

As for those who succeed less than I and decide to undertake the entrepreneurial activity, they become borrowers and their lifetime income and utility are:

(30) $$y_e(w_t) = R_{r,t} + (w_t - I)(1 + i)$$

(31) $$U_e(w_t) = \log[\, R_{r,t} + (w_t - I)(1 + i) \,]$$

They leave their offspring with a bequest of size:

(32) $$b_e(w_t) = (1-\alpha)\, y_e(w_t) = (1-\alpha)[\, R_{r,t} + (w_t - I)(1 + i) \,]$$

A rational agent with inheritance less than I will only choose to undertake an entrepreneurial project as long as the expected gain of the venture outweighs the

opportunity cost--wage and interest income, i.e., $U_e(w_t) \square U_n(w_t)$. Let $w_t^*$ denote the initial wealth endowment of an individual in time t who is indifferent between borrowing and lending, we have:

(33) $$R_{r,t} + (w_t^* - I)(1+i) = \lambda_n + w_t^*(1+r_{s,t})$$

The L.H.S. is the expected income from being a borrower, the R.H.S. is the expected income from being a lender. Rearranging Equation (33), we obtain:

(34) $$w_t^* = [\lambda_n + I(1+i) - R_{r,t}] / (i - r_{s,t})$$

Individuals who succeed an amount smaller than $w_t^*$ would prefer not to participate in the entrepreneurial activity but serve as a labor provider and lender. Investment opportunities, therefore, is only enjoyed by those who are endowed with high initial wealth, due to a higher interest rate for borrowers.

The amount of wealth an individual inherits in the beginning of the lifecycle, fully determines his/her decisions in regard to whether to undertake an entrepreneurial venture or simply work in the backward sector and how much to consume and bequest. The distribution of inherited wealth $\Phi(w_t)$ for individuals living in period t satisfies:

(35) $$\int_0^\infty d\Phi(w_t) = L$$

where L represents the total labor available. The distribution of $\Phi(w_t)$, hence, fully influences economic performance in period t. It determines the amount of labor devoted to the entrepreneurial activity:

$$(36) \qquad L_{e,t}=\int_{w_t}^{\infty} . \, d\Phi(w_t)$$

and to the backward sector:

$$(37) \qquad L_{n,t}=\int_{0}^{w_t^*} d\Phi(w_t)$$

Thus, the distribution of wealth determines aggregate output as well as the macroeconomic equilibrium. This result is induced by the credit market imperfection. In the next subsection, we show that the indivisibilities in investment requirements for entrepreneurial ventures in conjunction with the imperfection of the capital market, leads to non-ergodic[4] dynamics and to multiple long run wealth distributions. Therefore, it is essential to investigate the effect of wealth distribution in the short run as well.

### 4.4.2. Long Run Equilibrium

The distribution of wealth not only determines equilibrium in period t, but also

[4] Ergodicity characterizes the property that the process governing the wealth distribution of a lineage converges to the process governing the wealth distribution of the population in the long run. Details see Banerjee (1991) and Hamilton (1994).

determines the distribution of inheritance in the next period $\Phi(w_{t+1})$:

$$b_n(w_t) = (1-\alpha)[\lambda_n + w_t(1+r_{s,t})] \qquad \text{if } w_t < \dot{w}_t$$

(38) $$b_e(w_t) = (1-\alpha)[R_{r,t} + (w_t - I)(1+i)] \qquad \text{if } \dot{w}_t \leq w_t \leq I$$

$$b_e(w_t) = (1-\alpha)[R_{r,t} + (w_t - I)(1+r_{s,t})] \qquad \text{if } w_t \geq I$$

Agents succeeding less than $\dot{w}_t$ work in the backward sector and so do their descendants in all future generations. Their wealth endowment converges to a long run level $\overline{w_n}$ as in the regime of a perfect capital market.

Figure 1 illustrates the dynamic evolution of intergenerational wealth distribution. The curves $b_n$ and $b_e$ describe the relationships between wealth endowments for labor workers and entrepreneurs, respectively. Note that $\dot{w}_t$ is decided by the intersection of $b_n$ and $b_e$.

Individuals succeeding an amount greater than $\dot{w}_t$ but less than I invest in entrepreneurial venture, however, not all of their descendants will remain in the modern sector in future generations. Suppose the critical point is $\overline{w_h}$:[5]

[5] Also see the derivation of equation (18) in appendix 2.

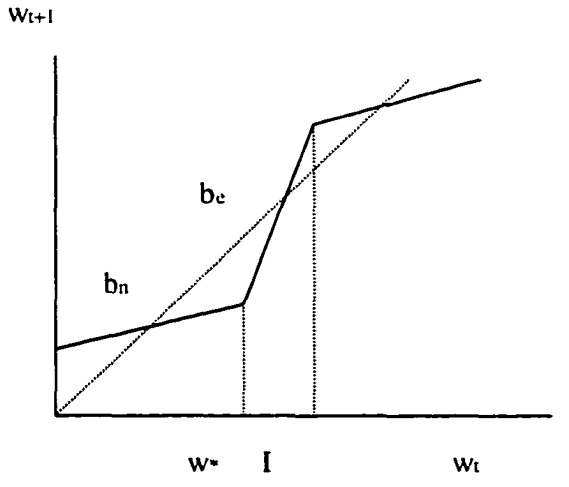


Figure 4.1

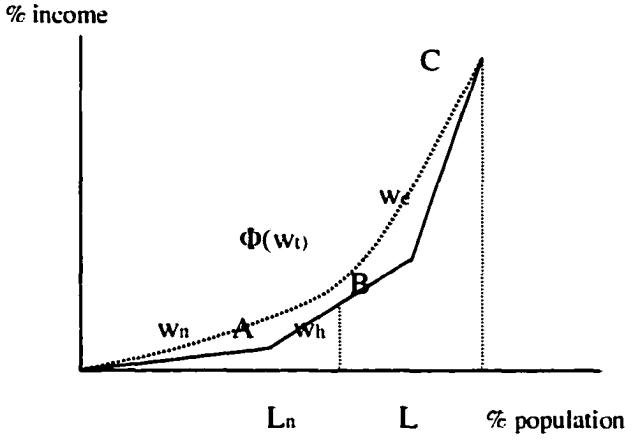


Figure 4.2

(39) $\overline{w_h}=(1-\alpha)[\ R_r - I(1+i)\ ]/[\ 1-(1-\alpha)(1+i)\ ]$

where $\overline{w_h}$ is assumed to lie between $\overline{w_n}$ and $\overline{w_e}$. Individuals succeeding an amount between $\dot{w_t}$ and $\overline{w_h}$ may engage in entrepreneurial activity, but after some generations, their descendants end up working in the backward sector and their inheritances converge to $\overline{w_n}$. Individuals with greater than $\overline{w_h}$ inheritance undertake entrepreneurial activity and so do their descendants, generation after generation. Their wealth converges to $\overline{w_e}$.[6] Therefore, lineages in this economy are concentrated in two groups in the long run: rich lineages, where all their descendants will be entrepreneurs who enjoy high profit modern technology, and poor ones, where generation after generation, work in the backward sector. The dynamics of the income distribution in the long run is illustrated by the Lorenz curve in Figure 2. The values of $\overline{w_n}$, $\overline{w_h}$, and $\overline{w_e}$ are represented by the slopes of curves OA, AB, and BC, respectively. The downward shift of the Lorenz cure from $\Phi(w_t)$ to OABC indicates the increases in income inequality.

In this financial regime, therefore, an individual with initial wealth less than $\dot{w_t}$ is financially repressed in the long run as well as in the short run. He/She is deprived of the opportunity to enjoy the monetary prosperity of investing in an entrepreneurial

[6] For the proof. see appendix 3.

venture that he otherwise would have had under the regime of a perfect credit market in the short run. In the long run, his/her lineage will inevitably fall into poverty trap due to the denial of opportunity to participate in the entrepreneurial activity generation after generation caused by capital market imperfection. Individuals with bequests between $\dot{w}_t$ and $\overline{w_h}$, are financially repressed in the long run due to the diminishing return to their investment induced by the high borrowing interest rate.

Note that the slopes in Figure 1 are less than one at $\overline{w_n}$ and $\overline{w_e}$ indicates that $\alpha$ and $r_s$ satisfy:

(40) $(1-\alpha)(1+r_s)<1$

This additional assumption warrants that the process of bequest from generation to generation is stable and does not explode. Another additional assumption which is implicit in Figure 1 is that enforcement costs are rather high so that the spread between the lending and borrowing interest rates is high too:

(41) $(1-\alpha)(1+i)=\beta(1-\alpha)(1+r_s)/(\beta-1)>(1-\alpha)(1+r_s)$

The long run effects of wealth distribution and financial infrastructure on the aggregate output and income inequality can be derived from individual dynamics accordingly. In the long run, the economy becomes dichotomous financially and is

divided into two groups: rich agents with wealth level of $\overline{w_e}$ and poor agents with wealth level of $\overline{w_n}$. The relative size of these two strata is decided by the initial wealth distribution under the regime of the imperfect capital market. From Equation (39), the portion of population work in the backward sector in the long run is described by:

(42) $$\overline{L_n} = \lim_{j \to \infty} \int_0^{w_h} d\Phi(x_{t-j})$$

The average wealth is:

(43) $$\overline{w} = \overline{w_e} - \text{Ln}(\overline{w_e} - \overline{w_n})/\text{L}$$

Since not all investment opportunities are exploited in this economy, this results in a lower economic growth rate. Hence, it is clear that the portion of the population with initial wealth endowment greater than or equal to $\overline{w_h}$ is positively related to the long run output and wealth levels in both individual and aggregate settings.

### 4.5. Dynamics of the Imperfect Credit Market

In this section, we will further investigate various dynamics of the model under the regime of an imperfect credit market. First, we will release the assumptions of fixed return and wage for investment and backward sector jobs, respectively, and

proceed to explore how the changes of investment return and wage will affect the results of the previous analysis. Assume that the return $R_r$ for an entrepreneurial investment grows at a rate of $g_r$ and the wage for a job in the backward sector grows at a rate of $g_n$. If $g_r > g_n$, then from Equations (34) and (39), we obtain:

(44) $\delta \dot{w}_t / \delta R_r < 0$ and $\delta \overline{w_h} / \delta R_r > 0$.

In other words, the relatively faster growth of $R_r$ not only lowers the wealth threshold for investment in the short run but also reduces the portion of population falling into poverty trap. This theoretical implication concurs with the economic development of industrialized and newly industrialized countries for the past fifteen years. Due to the high expected returns for certain computer-related industries in the past fifteen years, a great deal of entrepreneurs with very limited initial wealth were able to access to those investment opportunities and successfully established their own enterprises. However, the increase in the investment requirement I, will lead to, ceteris paribus, the increases of both $\dot{w}_t$ and $\overline{w_h}$, and accordingly lower income equality. This observation reflects the fact that the absolute majority of the high tech investment opportunities in recent years is capital-intensive and requires a large amount of start-up cost. The net effect of the interaction of the aforementioned two factors depends on their relative magnitudes. In our model, it is straightforward that the factor growing

faster will dominate the outcome. If they both vary at the same rate, they will have no effect on the values of $\dot{w}_t$ and $\overline{w_h}$, and in turn, the income distribution and economic growth remain unchanged.

As for the variation of the borrowing interest rate, the observations derived from our model are: $\delta \dot{w}_t / \delta i > 0$ and $\delta \overline{w_h} / \delta i < 0$, which are concert with the general conception that higher interest rates for loans discourage investments and consequently deter economic development and worsen income inequality.

Another specific assumption in the basic model is that the motivation of intergenerational altruistic bequest is modeled as utility from the size of bequest. The alternative way to construct this motivation, as mentioned in the previous sections, is to assume that parent's utility depends on the utility that his or her progeny derived from the bequest instead of the size of it. As long as the borrowing interest rate is higher than the lending interest rate and investment is non-convex, the basic results of this study hold; there are lineages remaining poor if their initial wealth is relatively small.

The outcome of this paper also holds subject to the assumption that wages and returns are variable to the skill level and the investment characteristics, respectively. Assume that $\lambda_n$ and $R_r$ are random but bounded, then the qualitative results are verified

as follows: lineages with low initial wealth will never invest in entrepreneurial venture and remain poor, and rich lineages will invest in entrepreneurial venture and remain rich. There is some intermediate range in which lineages fluctuate between those two sectors. Therefore, initial wealth distribution does affect the economy both in the short run and in the long run, even as labor skills and expected investment returns are heterogeneous.

### 4.6. Conclusion

The theoretical model developed in this chapter is designed to analyze the effects of financial development and socioeconomic status on income distribution and economic growth through the channels of investments. Even though the model is premised on earlier studies on the relationships among economic growth, financial development, and income inequality, it is distinctive from those traditional studies on two fronts. The most salient one is that it is based particularly on the various macroeconomic and microeconomic characteristics of the NICs and Taiwan. Another distinctive feature is that this study introduces uncertainty into the model by assuming that there are two primary assets, one safe with fixed and stable income, and one risky with higher expected return. The model shows that the financial development in conjunction with the initial socioeconomic status determines both the short- and

long-run income distribution and aggregate output. In the presence of an imperfect capital market, agents with less than the threshold initial wealth are financially repressed both in the short- and long-run. Since not all the available investment opportunities are exploited under the regime of an imperfect capital market, this leads to lower economic growth than under the regime of a perfect capital market in the short term. In the long term, the economy not only experiences a slower average growth rate but also becomes financially dichotomous.

The policy implication derived from our model is that without government intervention, a country with a large middle class or more equality would experience a higher economic growth and lower income inequality as the financial liberalization progresses. For a less equalitarian country, the government has to delicately and carefully balance between the necessity of financial liberalization and the prevention of its side effect on income inequality in order to achieve a steady and sustainable growth in the long run. Since it has proven by the incidences occurring in U.S. and other nations that there isn't a perfect capital market in the world at all, proper regulation and monitoring is needed to maintain the principal function of the financial market--facilitating investments--instead of encouraging speculation and manipulation.

Even though this model may have limitations to explain the entire complexity of the real world due to many strict assumptions and simplifications, it is expected to provide good intuitive understanding of the interactions of the financial behaviors, income distribution, and economic growth in Taiwan as well as in other NICs.

# Chapter Five

# Empirical Test

## 5.1. Introduction

The development of the financial system and the dynamics of the income distribution in Taiwan were analyzed descriptively in Chapter Three. Several predominant aspects characterizing Taiwan's financial system and income inequality were presented in the analysis: dualism of the financial system, high saving rate, rapid expansion of the security market, and increasing income inequality. In Chapter Four, theoretical models were developed according to those characteristics to investigate the relationships among financial behaviors, income distribution and economic growth. The theoretical models emphasize how the development of financial system in conjunction with the initial wealth distribution affects the future income equality and economic growth. These models also show how the interactions of investment requirement, return rate and borrowing interest rate influence the overall output level and the distribution of output to different sectors.

In this chapter, based on the descriptive and theoretical analyses, empirical tests are carried out on the hypotheses of financial development, income inequality,

investment and economic growth. Important implications to be tested are: (i) how the financial system influences the per capita output before and after the financial reform, (ii) how the dynamics of the security market and the banking system affect the income inequality and economic development, (iii) whether the increasing income inequality is caused by the increasing shares of top income quintiles or by the decreasing shares of low income quintiles.

The formulation and development of the empirical tests on those three implications are discussed in the next section. The analysis of the data employed in the tests is presented in section three. The test results are evaluated in section four and conclusion marks are given in section five.

### 5.2. Econometric Models

In this section, econometric models are developed to estimate the relationships among financial advancement, income inequality, and economic development, and to test the relevant hypotheses suggested in the previous chapters. For the purpose of estimation, it is necessary to convert the theoretical implications based on micro foundation into the econometric specifications delineated by macroeconomic relationships. In other words, statistical estimations on income, investment, savings, and production will be computed on a macroeconomic level, which is the entire

Taiwan's economy.

Two systems of equations are presented in this section to examine the various economic implications derived in the theoretical models. The first system of the equations is devoted to the study of the relationships between average income level and several yearly financial indices such as the capitalization of the stock market, the increase of capital invested in the stock market, and the amount of loan advanced. The specification of the empirical equations in this group is based on the variables and relationships suggested in our theoretical models as well as those in the studies of Wu (1996), and Li and Zou (2000). Since the theoretical models contain strict assumptions and are simplified to facilitate the investigation of the relationships among the variables, the equations may miss some factors from a practical point of view.

The basic form of the equations that estimate the relationships between income level and various financial variables is defined as follows:

(1) $PCI_t = a_1 + a_2 \times SMVR_t + a_3 \times SCINR_t + a_4 \times LONAR_t + \upsilon_t$

where $PCI_t$: Per capita real income for time t.

$SMVR_t$: Ratio of nominal stock market capitalization to nominal GNP.

$SCINR_t$: Ratio of nominal capital increase in security market to nominal GNP.

$LOANR_t$: Ratio of nominal loan to nominal GNP.

The second set of equations is derived from the theoretical models in Chapter 4 and the studies of Berggren (1999), and Li and Zou (2000), and aims at testing the effects of financial behaviors on income inequality and economic development. In addition, the concept of inverted-U shape relationship between development level and income inequality suggested by the Kuznets' hypothesis is incorporated in the equations through the quadratic form as well. They are expressed as follows:

$$(2)\quad GINI_t = b_{1,1} + b_{1,2}\times SMVR_t + b_{1,3}\times SCINR_t + b_{1,4}\times LOANR_t + b_{1,5}\times PCI_t + b_{1,6}\times PCI_t^2 + \varepsilon_{1,t}$$

$$(3)\quad INS20_t = b_{2,1} + b_{2,2}\times SMVR_t + b_{2,3}\times SCINR_t + b_{2,4}\times LOANR_t + b_{2,5}\times PCI_t + b_{2,6}\times PCI_t^2 + \varepsilon_{2,t}$$

$$(4)\quad HI20_t = b_{3,1} + b_{3,2}\times SMVR_t + b_{3,3}\times SCINR_t + b_{3,4}\times LOANR_t + b_{3,5}\times PCI_t + b_{3,6}\times PCI_t^2 + \varepsilon_{3,t}$$

$$(5)\quad LO20_t = b_{4,1} + b_{4,2}\times SMVR_t + b_{4,3}\times SCINR_t + b_{4,4}\times LOANR_t + b_{4,5}\times PCI_t + b_{4,6}\times PCI_t^2 + \varepsilon_{4,t}$$

where $GINI_t$: Gini coefficient for year t.

$INS20_t$: Ratio of the income share of top quintile to that of bottom quintile.

$HI20_t$: Income share of the top quintile.

$LO20_t$: Income share of the bottom quintile.

## 5.3. Data

Except the Gini Coefficient data, which are obtained from the publication of Deininger and Squire (1996), the remainders of the data employed in this study are collected from the database of Directorate General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, Taiwan, R.O.C., in 2001. Even though the related statistics for the stock market can be traced back as far as the inception year of 1963, only data after 1971 are considered in the empirical analysis due to the following two factors. First, there were very few private investments involved in the trading activities of the security market in the preliminary years, hence, those indices could hardly reflect either the true mechanism of the market or the other related economic behaviors. Secondly, the stock market experienced drastic fluctuations from time to time in the early years due to its small scale. In addition, some auxiliary variables such as schooling information, etc., are not available before 1970. Taking into account all the aforementioned factors, we determine that 1972 is an adequate year to start with for our tests.

Gini Coefficient: A summary measure of the extent to which the actual distribution of income diverges from a hypothetical uniform distribution in which each agent receives an identical share. The best available data for Gini Coefficient so far are

published by Deininger and Squire. Those data along with the other income distribution statistics will be employed in the empirical study as dependent variables.

Income Distribution: The percentage shares of disposable income by quintiles of households published by DGBAS for the period of 1972-1999 are adopted as the other dependent variables in this study as well. It is noteworthy that this statistics were published every two to four years by DGBAS before 1976, thus, we choose 1972 as the starting year in the regressions to accommodate the availability of both income distribution and security market data. The data missing for 1973 and 1975 are obtained by calculating the average of the values of the previous and following years. The observations for the top and bottom income quintiles range from 36.80 (1980) to 39.26 (1998) and from 7.12 (1998) to 8.96 (1977), respectively. This distribution pattern reveals a U-shape relationship between income inequality and development level, which is contrary to the hypothesis propounded by Kuznets. This phenomenon will be examined in detail in the following discussion.

The Level of Development: In the model, the per capita disposable income is selected as the measure of the degree of economic development. These data are computed in real term with the price index of 1991 as the base year. From the data, we can observe that the per capita disposable income in Taiwan shows a rapid but steady

growth until recent years. The variable representing per capita disposable income will appear in quadratic form in the regression in accordance with the Kuznets' hypothesis.

The Level of Financial Development: Three indicators of the financial market are adopted as the measures of the level of financial development and the independent variables in the empirical analysis. The first statistics is the ratio of the nominal total stock market capitalization to the nominal GNP (SMVR). The range of this ratio spans from 1.5332 (1989) to 0.0916 (1974). The mean values for the two sample periods, 1972-1982 and 1983-1999, are 0.1341 and 0.7399, respectively. It clearly shows that the security market plays a more influential role in the macroeconomic development in the latter period. Except the transitional years, these ratios are relatively stable within the respective horizons observed. The second information taken into account in the analysis is the ratio of the nominal capital increase in stock market to the nominal GNP (SCINR). This ratio fluctuates less than its counterpart SMVR and ranges from 0.00151 (1972) to 0.06285 (1986). The mean values for the two time frames are 0.01117 and 0.02433, respectively. Compared with the corresponding values of SMVR, it is not hard to reveal the speculation nature of the market; the capitalization value grows much faster than the actual capital increase in the market. Due to the imperfection of the market, the signs of these two ratios in the regressions are expected to be negative. Another indicator adopted as the measure of the financial development

is the ratio of total nominal loan to nominal GNP (LOANR). As expected, this value grows as the level of economic development progresses and varies from 0.4519 (1972) to 1.8502 (1998). Throughout the entire horizon, it increases gradually and reaches the peak at 1998. The respective mean values for the two periods observed are 0.6332 and 1.30114. The sign of the loan-GNP ratio is expected to be positive since it will ease the access restriction to capital for those individuals endowed with less fortunate. Note that while the first two variables are the measurements of the development of the stock market sector, the last one is the gauge of the expansion of the banking sector.

Average Skills: In the empirical analysis, the general education level is employed as the measure of average skills. It is the weighted average shares of the education levels: primary school, middle school, high school, college, and graduate school for the population over the age of fifteen years old. The mean value and range of the average education years are 9.063 and from 7.15 to 10.59, respectively. The average years of education is not expected to have any significant influence on the income distribution due to three specific features of Taiwan's education system. The first is that the expenses for various education levels are either free or low, so the credit

TABLE 5.1 SUMMARY STATISTICS FOR 1972-1982

| | *Number of observations* | *Mean* | *SD* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| SMVR[a] | 11 | 0.12946 | 0.07827 | 0.061983 | 0.26316 |
| SCINR[b] | 11 | 0.00646 | 0.00637 | 0.0015117 | 0.02821 |
| GROWTH | 11 | 10.252 | 3.4096 | 1.20000 | 13.400 |
| PCI[c] | 11 | 382.91 | 206.70 | 189 | 853 |
| LOANR[d] | 11 | 0.43621 | 0.05059 | 0.35368 | 0.53477 |

TABLE 5.2 CORRELATIOM MATRIX FOR 1972-1982

| | *SMVR* | *SCINR* | *GROWTH* | *PCI* | *LOANR* |
|---|---|---|---|---|---|
| SMVR | 1.0000 | | | | |
| SCINR | 0.5461 | 1.0000 | | | |
| GROWTH | 0.2635 | 0.0539 | 1.0000 | | |
| PCI | -0.2177 | -0.0342 | -0.4848 | 1.0000 | |
| LOANR | -0.3967 | -0.1584 | -0.4398 | 0.9529 | 1.0000 |

[a]. SMVR: the ratio of stock market capitalization to GNP
[b]. SCINR: the ratio of capital increase to GNP
[c]. PCI: nominal per capita income
[d]. LOANR: the ratio of total loan to GNP

TABLE 5.3 SUMMARY STATISTICS FOR 1983-1999

| | *Number of observations* | *Mean* | *SD* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| SMVR | 17 | 0.34620 | 0.38806 | 0.10690 | 1.5322 |
| SCINR | 17 | 0.01495 | 0.01293 | 0.00625 | 0.06285 |
| GROWTH | 17 | 8.7294 | 3.2291 | 4.10000 | 14.000 |
| PCI | 17 | 3452.4 | 2340.1 | 890 | 8189 |
| LOANR | 17 | 0.8089 | 0.18728 | 0.63280 | 1.2561 |

TABLE 5.4 CORRELATION MATRIX FOR 1983-1999

| | *SMVR* | *SCINR* | *GROWTH* | *PCI* | *LOANR* |
|---|---|---|---|---|---|
| SMVR | 1.0000 | | | | |
| SCINR | 0.0029 | 1.0000 | | | |
| GROWTH | -0.0919 | 0.3096 | 1.0000 | | |
| PCI | 0.7884 | 0.1013 | -0.1698 | 1.0000 | |
| LOANR | 0.7448 | -0.0278 | -0.2816 | 0.9435 | 1.0000 |

restriction on education pursuit is not a substantial cause of income inequality.

Another feature is that here is no entrance requirement through $12^{th}$ grade and the admissions to college and graduate school are solely based on the scores of the entrance examination, thus there is no human subjective preference or corruption involved. Lastly, Chinese people overwhelmingly emphasize the importance of education and parents will do everything they could to encourage and facilitate their children in education pursuit regardless of their income levels and occupations.

### 5.4. Results

In order to investigate the impact of financial development and reform on income distribution and economic growth, we divide the period of 1972-1999 in the study into two time frames, 1972-1982 and 1983-1999, according to the progression of Taiwan's financial development and the dividing criteria proposed by Wu (1996). The former time frame of 1972-1982 represents the pre-reform era and the latter one of 1983-1999 represents the period of reform, which continues as of 1999. All of the regression equations are estimated by ordinary least squares (OLS) method for the two sample data.

Table 5.5 reports the regression results for the first set of equations. Columns

(i)-(v) in the table are based on the data for 1972-1982, and columns (vi)-(x) are based on the data for 1983-1999. The most noticeable result is the effects of the stock market variables on per capita GNP. In the first period, the loan-GNP ratio is the only independent variable with significant coefficient at 1% level in all equations it involves. The investment-GNP ratio is only significant at 5% level when the control variable loan-GNP ratio is included in the regression. However, all three variables show significant impact on per capita income except SMVR in column 6 for the second period. When the coefficient of SCINR is estimated without any controlling variable, it is significant at 2.5% level; while LOANR is included in the regression, SCINR becomes insignificant. However, the absolute value of SCINR in column 10 is still much larger than the corresponding coefficient in column 5. It shows the closer relationship between income level and stock market development. As for the coefficient of SMVR, it is not significant in both columns (i) and (vi). Like the coefficient of SCINR, the absolute value of SMVR in the second period is larger than the corresponding ones for the first period. All of the coefficients but one display the expected sign in the direction they affect income level. Another feature is that the $R^2$ values in the second sample are, in general, higher than those for the earlier sample. This findings in the regression are consistent with those published by Wu (1996), etc.

Verifying the increasing influence of financial system, both stock market and

## TABLE 5.5 FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH

Independent Variable: Per Capita Income

| | *1972-1982* | | | | | *1983-1999* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *1* | *2* | *3* | *4* | *5* |
| CONST. | 457.34 | 375.76 | -1315.4 | -1515.1 | -1408.6 | 668.47 | 312.77 | -1590.6 | -1692.5 | -1549.6 |
| $a_0$ | (128.4)[a] | (95.8) | (181.1) | (186.1) | (156.8) | (361.9) | (219.3) | (240.7) | (273.7) | (244.7) |
| SMVR | -574.91 | | | 502.80** | | 581.72 | | | 734.03* | |
| $a_1$ | (859.2) | | | (251.9) | | (2456) | | | (901.5) | |
| SCINR | | 11.06 | | | 61.47** | | 480.77** | | | 94.63* |
| $a_2$ | | (10.39) | | | (27.56) | | (198.5) | | | (97.02) |
| LOANR | | | 3893.2** | 4201.9** | 4015.8** | | | 4502.6** | 4509.0** | 4259.1 |
| $a_3$ | | | (412.7) | (389.6) | (348.6) | | | (451.8) | (457.1) | (516.8) |
| $R^2$ | 4.7% | 0.1% | 8.08% | 92.34% | 92.9% | 3.7% | 28.11% | 86.0% | 85.68% | 85.96% |

a. Numbers in parentheses are standard errors

* Significance at 10% level

** Significance at 5% level

banking sectors, on the income level, we will next examine how they affect the income inequality and the income shares of various quintiles. The regression results are reported in Tables 5.6 and 5.7. From Tables 5.6 and 5.7, we can observe that the results derived from 1983-1999 are more consistent with the prediction of the theoretical model than those derived from 1972-1982 due to the fact that the data quality of and the number of observations for the second period is better and larger than those for the first period. Another conspicuous characteristics is that the explanatory variables of the security market show a strong influence on the income inequality in the second period while the explanatory variable of the banking sector plays a larger role in the distribution in the first period. For the 1972-1982 data in Table 5.6, the regression on Gini coefficient shows that the variable of the market capitalization-GNP ratio is significantly different from zero and of the expected positive sign. The other two regressions, the capital increase-GNP ratio and the loan-GNP ratio, are of the expected sign but statistically insignificant. In the regressions for the ratio of top quintile income share to bottom quintile income share, all of the three regressions are insignificant and the signs of two of them are inconsistent with the implication of the theoretical model except the loan-GNP ratio. These results are not totally unexpected since the quality of this ratio data is inferior to that of Gini coefficient. As for the regressions on the income shares of top quintile and bottom quintile, the only regressor, which is

significant and consistent, is the loan-GNP ratio. The causes of the aberration are also possibly related to the data quality and the anomaly of the stock market. Even though the coefficients of the stock market variables are neither significant nor consistent for the three distribution statistics published by DGBAS, the sign of the banking coefficients are concurrent to the theoretical prediction.

In the regressions for the 1983-1999 data, the effects of both the market capitalization-GNP ratio and the capital increase-GNP ratio are significantly different from zero at 5% and 10% levels, respectively, and are of the expected positive sign, i.e., they do contribute to the worsening of income inequality. Even though the loan-GNP ratio is of the expected sign, it is not significantly different from zero in the regressions for the ratio of top quintile income share to bottom quintile income share, all three variables show expected sign, but none of them is significant. Similarly, the effects of the stock market variables on the income share of top quintile are positive but not significant. The effect of the loan-GNP ratio is also insignificant but positively related to the income share of top quintile. As expected, all of the three variables have negative impact on the income share of the bottom quintile, however, they are not significantly different from zero.

TABLE 5.6 FINANCIAL DEVELOPMENT AND INCOME INEQUALITY FOR 1972-1982

| | *Constant* | *PCI* | *Squared PCI* | *SMVR* | *SCINR* | *LOANR* | *Adjusted* $R^2$ | *DW* |
|---|---|---|---|---|---|---|---|---|
| GINI | 34.21 | -0.0188** | 1.3E-05* | 5.9024* | | | 0.6642 | 1.7940 |
| | | (0.0089)[d] | (8.6E-06) | (4.563) | | | | |
| | 35.93 | -0.0021** | 1.5E-05* | | 0.3587 | | 0.6047 | 1.4597 |
| | | (0.0094) | (9.3E-06) | | (0.5928) | | | |
| | 33.413 | -0.0276** | 1.9E-05** | | | 8.5832 | 0.5902 | 1.4611 |
| | | (0.0143) | (1.0E-05) | | | (26.47) | | |
| INS20[a] | 6.46 | -0.0061** | 4.3E-06** | -0.5614 | | | 0.7947 | 1.9583 |
| | | (0.0017) | (1.7E-06) | (0.8831) | | | | |
| | 6.45 | -0.0058** | 4.1E-06** | | -0.0308 | | 0.7854 | 1.7416 |
| | | (0.0017) | (1.7E-06) | | (0.1081) | | | |
| | 4.86 | -0.0077** | 4.8E-06** | | | 4.9568 | 0.8164 | 1.918 |
| | | (0.0024) | (1.66E-06) | | | (4.384) | | |
| HI20[b] | 46.07 | -0.0225** | 1.7E-05** | -3.7695 | | | 0.6928 | 1.8673 |
| | | (0.0069) | (6.65E-07) | (3.533) | | | | |
| | 45.34 | -0.0208** | 1.6E-05** | | -0.2411 | | 0.6571 | 1.5613 |
| | | (0.0071) | (7.02E-06) | | (0.4464) | | | |
| | 37.46 | -0.0295** | 1.9E-05** | | | 24.105* | 0.7164 | 1.8385 |
| | | (0.0096) | (6.7E-06) | | | (17.82) | | |
| LO20[c] | 6.61 | 0.0056** | -3.7E-06** | 0.3181 | | | 0.8607 | 2.0842 |
| | | (0.0015) | (1.4E-06) | (0.7599) | | | | |
| | 6.69 | 0.0054** | -3.5E-06** | | 0.0123 | | 0.8576 | 1.9173 |
| | | (0.0015) | (1.4E-06) | | (0.092) | | | |
| | 8.18 | 0.0074** | -4.3E-06** | | | -4.7546 | 0.8855 | 2.0952 |
| | | (0.0019) | (1.36E-06) | | | (3.617) | | |

a. The ratio of the income share of top quintile to the income share of bottom quintile

b. The income share of top quintile

c. The income share of bottom quintile

d. Numbers in the parentheses are standard errors.

* Significance level at 10%

** Significance level at 5%

TABLE 5.7 FINANCIAL DEVELOPMENT AND INCOME INEQUALITY FOR 1983-1999

| | *Constant* | *PCI* | *Squared PCI* | *SMVR* | *SCINR* | *LOANR* | *Adjusted* $R^2$ | *DW* |
|---|---|---|---|---|---|---|---|---|
| GINI | 31.07 | -0.0062** | 2E-06** | 9.3412** | | | 0.7321 | 1.5747 |
| | | (0.00146) | (6.8E-07) | (3.618) | | | | |
| | 32.10 | -0.0071** | 2.2E-06** | | 0.7133* | | 0.6601 | 1.0505 |
| | | (0.00164) | (7.5E-07) | | (0.4512) | | | |
| | 30.27 | -0.0099** | 3.1E-06** | | | 7.3227 | 0.6067 | 0.9466 |
| | | (0.00512) | (1.5E-06) | | | (11.22) | | |
| INS20 | 5.57 | -0.0021** | 6.8E-07** | 0.5036 | | | 0.8058 | 1.1417 |
| | | (0.00035) | (1.6E-07) | (0.8725) | | | | |
| | 5.63 | -0.0021** | 7.0E-07** | | 0.0288 | | 0.8021 | 1.1712 |
| | | (0.00035) | (1.6E-07) | | (0.0975) | | | |
| | 5.03 | -0.0029** | 9.3E-07** | | | 2.0457 | 0.8133 | 1.3219 |
| | | (0.00099) | (2.9E-07) | | | (2.191) | | |
| HI20 | 42.19 | -0.0062** | 1.8E-06** | 0.1377 | | | 0.7715 | 1.1970 |
| | | (0.00135) | (6.3E-07) | (3.352) | | | | |
| | 42.21 | -0.0062** | 1.8E-06** | | 0.0208 | | 0.7715 | 1.2044 |
| | | (0.00135) | (6.2E-07) | | (0.3710) | | | |
| | 39.65 | -0.0099** | 2.8E-06** | | | 8.5597 | 0.7890 | 1.4014 |
| | | (0.00376) | (1.1E-06) | | | (8.252) | | |
| LO20 | 7.45 | 0.0024** | -8.3E-07** | -0.6244 | | | 0.8371 | 1.2518 |
| | | (0.00033) | (1.5E-07) | (0.8231) | | | | |
| | | 0.0024** | 8.0E-07** | | -0.0213 | | 0.8306 | 1.2719 |
| | | (0.00033) | (1.6E-07) | | (0.0929) | | | |
| | 7.87 | 0.0031** | 1.0E-06** | | | -1.7286 | 0.8383 | 1.4227 |
| | | (0.00096) | (2.8E-07) | | | (2.101) | | |

* Significance level at 10%

**Significance level at 5%

It is noteworthy that in all of the regressions, the results express a U-shape relationship between income inequality and development level, which is contradictory to the inverted U-shape correlation suggested by Kuznets (1955), et al. All of the coefficients for per capita GNP and squared per capita GNP are significantly different from zero at 5% level. Another notable phenomenon is the discrepancy of significance and consistence between Gini coefficient and other inequality indices in the regressions. This could be caused by the inefficiency of the taxation mechanism so that a lot of households underreported their income during the census in order to match their falsely filed tax information, especially in the first period.

### 5.5. Sensitivity Analysis

In this subsection, we proceed to discuss the quality of the regression results obtained above. The first possible econometric problem associated with the regressions is the autocorrelation. To investigate this problem, we examine whether the residuals show a particular pattern across time. From visual inspection and Durbin-Watson d test, we cannot reject the hypothesis that there is no positive or negative autocorrelation among the residuals. The second possible problem that could distort the results is multi-linearity. From the correlation matrices in Tables 5.2 and 5.4, it reveals that the links among the explanatory variables are very limited that they will

not cause any aberration to the regression results. Third, as for heteroscedasticity, this problem is alleviated by a great deal as the original data set is divided into two groups according to the particular development stages of financial system.

As mentioned before, the fourth possible econometric problem is measurement error, given that the data collected by DGBAS in the early times are not as reliable and accurate as those in the latest two decades. However, we found that the results are robust to measurement error in INS2020, HI20, and LO20. Hence, if anything, measurement error would seem to bias the coefficients of interest against our hypothesis to a minor degree at most. Finally, the fifth possible problem involves the omission and endogeneity of variables, i.e., how sensitive the specified regression models are to changes in the set of independent variables. In order to investigate the sensitivity of the regression models, three other explanatory variables, which are economic growth, unemployment rate, and average years of schooling for population over 15 years old, are used in various combinations, in addition to those used in the regression models in Table 5.6 and Table 5.7. These three are all considered to be possible influence on the degree of income inequality by a great deal of studies. Due to the unavailability of the data for those variables for most of the 1972-1982 period, the sensitivity test portion of the investigation is carried out only for the 1983-1999 period. The results of 48 new regressions are summarized in Table 5.8.

TABLE 5.8 SENSITIVITY TEST FOR 1983-1999

| | | Model 1[a] | Model 2[b] | Model 3[c] | Model 4[d] |
|---|---|---|---|---|---|
| GINI | SMVR | (+)** | (+)** | (+)** | (+)** |
| | SCINR | (+) | (+) | (+) | (+) |
| | LOANR | (+) | (+) | (+) | (+) |
| INS2020 | SMVR | (+) | (+) | (+) | (+) |
| | SCINR | (+) | (+) | (+) | (+) |
| | LOANR | (+) | (+) | (+) | (+) |
| HI20 | SMVR | (+) | (+) | (+) | (+) |
| | SCINR | (+) | (+) | (+) | (+) |
| | LOANR | (+) | (+) | (+) | (+) |
| LO20 | SMVR | (-) | (-) | (-) | (-) |
| | SCINR | (-) | (-) | (-) | (-) |
| | LOANR | (-) | (-) | (-) | (-) |

a. Model 1: Inequality index=$a_0+a_1 \cdot FB^f+a_2 \cdot PCI+a_3 \cdot PCI^2++a_4 \cdot AYE^g+\varepsilon$.

b. Model 2: Inequality index= $a_0+a_1 \cdot FB+a_2 \cdot PCI+a_3 \cdot PCI^2+a_4 \cdot$growth $+\varepsilon$.

c. Model 3: Inequality index= $a_0+a_1 \cdot FB+a_2 \cdot PCI+a_3 \cdot PCI^2+a_4 \cdot UNEM^h+\varepsilon$.

d. Model 4: Inequality index= $a_0+a_1 \cdot FB+a_2 \cdot PCI+a_3 \cdot PCI^2+a_4 \cdot$growth$+a_5 \cdot UNEM+\varepsilon$.

e. Signs in the parentheses are the directions of the correlations.

f. FB represents one of the three financial behaviors.

g. AYE indicates average years of education.

h. UNEM represents unemployment rate.

** Significance at 5% level.

A few things are clear from Table 5.8. In the first place, the changes of the regression models alter neither the directions of the effects of the three principal explanatory variables nor the magnitude of the coefficients of them on the dependent variables. It appears that the significant effects of the market capitalization-GNP ratio and the capital increase-GNP ratio on Gini coefficient are quite stable to theoretical changes in the regression models. Even though it is still insignificant, the sign of the effects of the loan-GNP ratio on Gini coefficient does not change. For the other three dependent variables, the results of the sensitivity tests are similar to those in the basic regression models, i.e., the effects of the three principal explanatory variables are not significantly different from zero while the signs of them in the extended regression models remain the same. However, the effects of the new explanatory variables on the dependent variables vary even though they are not specified in Table 5.8. Among them, the unemployment rate has the most significant and consistent impact on all dependent variables but Gini coefficient. As expected, the unemployment rate exerts negative effect on the income share of bottom quintile in models 3 and 4, and positive effect on the INS2020 variable in model 4. Coherent with the studies of Persson and Tabellini (1994), and Alesina and Rodrik (1994), economic growth is negatively correlated to income inequality, however, except for the effects on the income share of top quintile, the estimates of economic growth on the other three dependent variables are

statistically insignificant. Average years of schooling for the population over 15 years old, as predicted in the previous section, shows no significant effect on any of those four dependent variables. This outcome reflects the distinctive education environment and cultural background in Taiwan.

In all, the results of the estimations are acceptable and very consistent across the various specifications of the independent variables. The adjusted coefficients of determination ($R^2$) are robust to changes in the regression models and assert the goodness of fit of the equations. The DW values either reject the autocorrelation hypothesis or fall into the indecisive areas to further solidify the fitness of the regression models. Another distinctive feature of the regressions is that the effects of the principal explanatory variables on the dependent variables are robust throughout the scope of the entire estimations. The effects of the market capitalization-GNP ratio on the Gini coefficient are significant at 5% level in all the regressions regardless of the variations in the time horizon or in the specification. However, its effects on the INS2020, HI20, and LO20 are of the right sign but are not significant in all regressions except the basic ones for the 1972-1982 period. Similar to the market capitalization-GNP ratio, the effects of the capital increase-GNP ratio on the Gini coefficient are significant at 10% level for all the tests in the 1983-1999. For all the other dependent variables, the effects of the capital increase-GNP ratio are of the right

sign but not significant. The loan-GNP ratio expresses the similar effects as the capital increase-GNP ratio except that its effect on the Gini coefficient is not significant. It is apparent that both the per capita GNP and its square are significant at 5% level. Another noticeable evidence is that the unemployment rate has significant negative impact on the income share of the bottom quintile. Growth is negatively related to the ratio of the top to bottom income shares with significance at 10% level. Even though its effects on the individual quintile are of the right sign, negative to the top quintile, and positive to the bottom quintile, neither is significant. In a nutshell, those results are more or less compromised by the discrepancy of the regressions between two data sources, and by the deficiency of the data quality.

### 5.6. Conclusion

The aim of this chapter is to provide an empirical examination of the hypotheses implied in the theoretical models: the correlations among the financial behaviors, the income inequality, and the level of economic development. Some important hypotheses and arguments developed throughout this study are validated by the results of the empirical tests.

The relationship between the income level and the development of the financial system proves to grow closer and tighter as the financial reform and economic growth

proceed. Two of the three financial behaviors, the capital increase-GNP and loan-GNP ratios, show significant effect on the income level in both periods. These results are in accordance with the findings of the majority of the studies in the field of economic development. As for the stock market capitalization-GNP ratio, its effect on the income level is positive but not significant. The only nuance between the effects of these financial behaviors in the sampled two periods is that magnitudes in the second period are evidently larger than those in the first one in general.

Even though those reform measures of the financial system as a whole do contribute positively to the development of the financial system per se and to the growth of the income level, they are the likely culprits deteriorating the income equality in Taiwan for the past two decades. Among them, the two stock market indices especially display significant negative effect on the aggravation of the income equality while the banking behavior shows little influence. Between the stock market capitalization and capital increase, the negative effect of the former on the income equality is larger in magnitude and more significant than the latter. In conjunction with the fact that the market capitalization shows insignificant effect on the economic growth, these two findings reveal the speculation nature of the activities of the stock market. This outcome is concurrent with the studies of Aghion (1999), and Arnold and Walz (2000), which imply that the stock market-dominated economies, such as the

United States and Britain, are usually less equalitarian in income distribution than the bank-dominated ones, such as France and Germany. This negative correlation between financial freedom and income equality is further verified by the financial turmoil experienced by Central and South American countries during the financial liberalization of the 1980s. Even though some theoretical and empirical studies still argue that the liberalization of the financial institution is instrumental to the reduction of income inequality in the longer term, recent evidences occurring across both the developed and newly industrialized countries prove otherwise. Among them, the most pronounced scenario is the crash of the stock market and the drastic aggravation of the income inequality of the United States in the past several years. This fact demonstrates that even a financial market as open and efficient as the one in the United States still operates far from the level of a theoretically perfect market and is susceptible to the frauds of deceptive financial statements, insider trades, manipulative practices, and corruption, let alone the other economies with the similar financial system. Due to the effect of economies of scale, financial system, especially the market-dominated one, is inherently asymmetrical in terms of the accessibility to information and resources. Therefore, a liberalization measure without matching discipline and supervision is doomed to cause financial and economic catastrophe and to exacerbate income inequality. In turn, the aggravation of income inequality, as being proven, is

detrimental to economic growth in the long run. As a result, it is imperative to develop and implement corresponding regulatory and monitoring measures to come along with any additional liberalization policy in order to achieve long term and stable growth; otherwise the prosperity, if there is any, brought about by the liberalization policy is only specious and temporary, and the economy will suffer eventually. The financial turmoil of the United States in recent years, of Japan in the early 1990s, and of Central and South America in the 1980s and 1990s, provide the best proof. Hence, how to balance the progression of the financial liberalization and the related regulation and supervision in order to achieve the goals of both economic growth and income equality has become an essential economic and political issue for the government when considering further opening its market, especially for those who intent to adopting a market-dominated financial system.

# Chapter 6

## Conclusions and Summaries

The purpose of this study is to analyze the effects of the financial development on the income inequality as well as on the economic growth in Taiwan since the early 1970s. For this purpose, this study consists of six chapters. Chapter 1, the introduction, presents the necessity, goals, direction, and composition of this study.

Chapter 2 examines earlier studies on the relationships among economic growth, financial development, and income inequality. It covers the pioneering studies of trade theory and Kuznets hypothesis from the 1920s to 1950s, the publications of the financial liberalization school in the 1960s and 1970s, and the endogenous growth models of various emphases in the 1980s and 1990s. This chapter also discusses how those studies and theories are associated with the conditions of the LDCs and what adjustments are needed in order to apply them to interpret the economic behaviors of the LDCs.

Chapter 3 examines in detail the background and development of the financial system and the dynamics of the income inequality in Taiwan. In the first part, it discusses the financial reform, which started in the late 1970s, and its effects on the

development of the financial system. The correlations among the financial development, income inequality, and economic growth are analyzed in the second part of this discussion.

In chapter 4, theoretical models are presented in order to analyze the systematic relationships among financial development, income inequality, and economic growth. Theoretically, these models are based on the endogenous financial growth models, which provide a microeconomic foundation for the analysis of financial behaviors, income distribution, and economic growth of the macroeconomic level. Two basic models are developed to represent two financial regimes: a perfect and an imperfect financial market. The short- and long-term effects of the asymmetry of information, the initial wealth distribution, and investment restriction on the income inequality and economic growth are investigated and compared between these two regimes.

Chapter 5 provides the results of empirical tests on the hypothetical implications implied in the previous chapter. Two econometric models are presented to carry out the task of the tests. The first model is presented to explore the relationship between income level and financial behaviors. Second model is developed to investigate the effects of three principal financial indicators on income distribution. In order to study in particular the effects of the financial reform and progression on the dependent

variables, these two models are applied to data that are divided into two samples chronologically. Due to the reliability of the data, the results of the more recent data are not only more consistent but also more significant throughout various specifications of the basic model.

Along with the analysis made in the previous chapters, the empirical tests provide the following conclusions. First, the influence of the financial behavior on the income level and distribution does enhance dramatically during the post-reform period. This evidence implies that the increase in the access to and choices of financial instruments lead to higher participation rate of the public in investment activities. However, even through the financial reform is implemented on both the banking and market sectors simultaneously, only the market sector expresses increasing influence on the income inequality and the income level. It is probably that the high return of the security market in the late 1980s and early 1990s made it more attractive to the investors than the banking sector.

Secondly, even though the behavior of the stock market contributes to the economic growth positively in Taiwan, it is negatively correlated to the income inequality. As for the behavior of the banking sector, neither the direction nor the significance of its effects is clearly established in the tests. These findings are

reinforced by the fact that the economies of the market-dominated system tend to experience higher income inequality than those of the bank-dominated one. The policy implication of this evidence is that in order to sustain steady and long-term economic growth, the implementation of financial reform must come with adequate discipline and regulation so that the induced detriment to income inequality can be minimized.

Third, among the auxiliary variables, the effect of the unemployment on the income share of the less endowed population is significant and negative. It indicates how closely the income inequality, economic growth and financial freedom are intertwined in the modern economy. Education, as indicated, bears no effect on the income distribution due to the specific cultural and educational background in Taiwan. Finally, the relative high value of the market capitalization compared to the value of the capital increase displays the speculative and immature aspects of the security market in Taiwan, which is supported by the empirical tests as well. In spite of its negative impact on the income inequality this phenomenon shows no ill effect on the economic growth.

In summary, the experience of Taiwan's financial reform provides several lessons to other LDCs, which attempt to undergo financial liberalization in the future. In order to stimulate economic growth, it is necessary to propel financial reform to increase the

circulation and efficiency of the market. However, it is crucial to ascertain that the financial reform serves the objective of facilitating the transactions and investments exclusively and avoids the speculative and manipulative components of the liberalization so that the harm to income equality can be minimized and the growth can be sustained. Another lesson drawn from the study is that even though Taiwan implemented its financial reform at a modest and incremental pace, Taiwan experienced high growth in a wide range of financial instruments and in its economy. This experience is clearly distinctive from the cases of some LDCs that propelled abrupt and comprehensive financial liberalization during the 1980s, resulting in instability, reduced investments and savings, and disappointing growth. Therefore, each economy should choose its own pace of progression according to its economic necessity, stage of development, and culture characteristics so that the reform measures can be integrated into the existing macroeconomic surroundings in a stable and harmonious fashion.

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# Appendices

Appendix 1: The derivation of equation (10). The Cobb-Douglas preferences defined directly over consumption and bequest is adopted as the utility function in our models. In other words, each agent tries to maximize his (her) utility as follows:

$$U(c,b) = \log c^{\alpha} b^{(1-\alpha)} = \log(\alpha y)^{\alpha}[(1-\alpha)y]^{(1-\alpha)}$$

$$= \log[\alpha^{\alpha} \square (1-\alpha)^{(1-\alpha)} \square y] = \log y + \alpha \log \alpha + (1-\alpha)\log(1-\alpha)$$

Appendix 2: The derivation of equation (18). Let $w_t$, $w_{t+1}$, ..., $w_{t+j}$ represent the wealth functions of generation t, t+1, ..., t+j for a lineage working in the backward sector over time, we attain:

$$w_{t+1} = (1-\alpha)[\lambda_n + w_t(1+r_{s,t})]$$

$$w_{t+2} = (1-\alpha)[\lambda_n + w_{t+1}(1+r_{s,t})] = (1-\alpha)\lambda_n + (1-\alpha)^2(1+r_{s,t})\lambda_n + (1-\alpha)^2(1+r_{s,t})^2 w_t$$

$$w_{t+3} = (1-\alpha)\lambda_n + (1-\alpha)^2(1+r_{s,t})\lambda_n + (1-\alpha)^3(1+r_{s,t})^2\lambda_n + (1-\alpha)^3(1+r_{s,t})^3 w_t$$

.....

$$w_{t+j} = (1-\alpha)\lambda_n + (1-\alpha)^2(1+r_{s,t})\lambda_n$$

$$+(1-\alpha)^3(1+r_{s,t})^2\lambda_n+\ldots+(1-\alpha)^j(1+r_{s,t})^{j-1}\lambda_{n+}(1-\alpha)^j(1+r_{s,t})^j w_t$$

$$w_{t+j} = (1-\alpha)\lambda_n[1-(1-\alpha)^j(1+r_{s,t})^j]/[1-(1-\alpha)(1+r_{s,t})]$$

Let j approach $\infty$, we obtain the long run wealth function as follows:

$$\overline{w_n} = \lim_{j\to\infty} w_{t+j} = (1-\alpha)\lambda_n/[1-(1-\alpha)(1+r_{s,t})]$$

Appendix 3: The proof of the critical point. Let $w_t = \overline{w_h}$ and substitute into equation (32): $w_{t+1} = (1-\alpha)[R_r + (w_t - I)(1+i)]$, it follows:

$$w_{t+1} = (1-\alpha)[R_r + (\overline{w_h} - I)(1+i)]$$

$$= (1-\alpha)[R_r - I(1+i)] + (1-\alpha)(1+i)\overline{w_h}$$

$$= (1-\alpha)[R_r - I(1+i)] + (1-\alpha)(1+i)\times\{(1-\alpha)[R_r - I(1+i)]/[1-(1-\alpha)(1+i)]\}$$

$$= (1-\alpha)[R_r - I(1+i)]/[1-(1-\alpha)(1+i)] = \overline{w_h}$$

Since $\delta w_{t+1}/\delta w_t > 0$, it is straightforward to show that $w_{t+1} < \overline{w_h}$ for $w_t < \overline{w_h}$, and $w_{t+1} > \overline{w_h}$ for $w_t > \overline{w_h}$.