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What Contributed to China’s Rapid Rural Industrial Growth During the Reform Period?

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Thesis submitted for the degree of Doctor of Philosophy
at the Australian National University

November 1997
To the memory of my parents
The work contained in this thesis is my own,
except where otherwise indicated

WANG Xiaolu
November 1997
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Abstract

This thesis examines the reasons for the dramatic growth of China’s non-agricultural rural industrial sector, or Township and Village Enterprises (TVE) sector, during the period of economic reform. TVE growth largely explained China’s rapid economic growth during this period. The study focuses on the remarkable phenomenon of rapid transfer of rural labor from the agricultural sector to the TVE sector, and on the effect of institutional changes on this transfer.

A two-sector model is established to analyse the effect of institutional change on China’s rural industrial growth. This model explains the reallocation of labor between the two sectors as a result of removing institutional restrictions on labor allocation and on rural non-agricultural activities. Using provincial level data, the estimation result suggests that institutional restrictions in the pre-reform period resulted in a large gap in the values of the marginal product of labor between the two rural sectors. The MPLs were gradually converging, indicating a reduction of institutional cost. From the estimation, institutional change is found to have contributed six percentage points to the average 21.7 percent TVE growth rate, during the period 1980-92. TFP growth rate was 4.7 on average. These two effects together contributed half of the TVE growth rate. Therefore, they were the most important contributors. Resulting from the improvement in factor allocation, rural economic growth at the aggregate level is also found to have accelerated.

Although institutional change made a remarkable contribution to rural industrial growth, the tendency of MPL convergence is found to be slow, and the MPL gap was still high in 1992. In investigating the reason, the collective-owned rural enterprises, which were the major components of the TVE sector, are found to be more conservative than private enterprises in admitting new workers from outside the local community. Although the collective enterprises played an important role, and achieved a remarkable performance in rural industrialization, this behavior led to low
labor mobility and a sub-optimum allocation of labor in the short-run, given that the markets for other factors were imperfect. It reduced employment opportunities, and was partially responsible for the MPL gap. The econometric analysis in this thesis shows a significant relationship between the concentration ratio of collective enterprises in the TVE sector and the MPL gap. This implies that the recent TVE ownership structural reform in some regions has the potential to further improve factor allocation in the rural economy, and sustain rapid rural industrial growth for a longer period.

Although various market distortions still exist, in general, the market-oriented TVE sector has achieved great success. Using a two-sector analytical framework, improved from the literature, it is found that the TVE sector not only directly contributed to China’s economic growth, but also made indirect contribution, through its externality on the growth of the state owned enterprise sector. This externality can be explained as the pressure of market competition, which forced the partially market-oriented SOEs to increase their efficiency. Although SOEs have experienced difficulties due to some institutional weaknesses, and loss of monopolistic status, this positive externality at least partially offset these negative effects on their growth. As additional evidence, the above finding is supported by SOEs’ technical indicators, by classifying industrial branches according to the extent of competition.

The above findings suggest that institutional change in the reform period played very important role in China’s rural industrial growth, and economic growth. They also imply great potential for rapid economic growth in the future as a result of further improvements in the institutional framework. In the long run, when the institutional effects diminishes, sustainable growth will rely more on technical progress and human capital accumulation.
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CHAPTER 1. INTRODUCTION

1.1 THE QUESTIONS TO BE ANSWERED

This dissertation is mainly an empirical study focused on the phenomenon of the rapid growth of China's rural industry during the period of economic reform. China's rapid economic growth in the 1980s and 90s has attracted great attention from economists. During this period, growth of the rural non-agricultural industrial sector, or Township and Village Enterprises (TVE) sector, played an extremely important role in economic growth.

TVEs are basically non-agricultural enterprises in rural areas, owned either by rural collectives or by individuals, but not by the state. However, their predecessors in the pre-reform period were all owned collectively by People's Communes or their sub-organizations.¹

Annual average growth rate of the TVE sector during the period of economic reform was 23% (1979-94, measured by gross output), twice as high as the growth rate of the whole economy². According to the World Bank's estimate, the share of the TVE sector in China's GDP rose from 13 percent in 1985 to 31 percent in 1994 (World Bank 1996, 51). In industry, TVEs have surpassed the state owned enterprises sector (SOEs), and shared 44% of China's industrial output in 1994 (SSB 1995). This study mainly aims to answer the question: why has there been such a dramatic growth

¹ Official data for the TVE sector include almost the entire rural non-agricultural sector. Industry accounted for about 3/4 of TVE output in 1994. Agricultural production is included in the TVE sector only if it is organized in the form of an enterprise. This part is negligible, accounting for only 1.4% of TVE output in 1994 (SSB 1995, 365). Therefore in this study, the whole TVE sector will be approximately treated as the rural non-agricultural industrial sector.

² According to the constant price output data provided by the Ministry of Agriculture, annual growth rate in this period was more than 30% (BTV 1990-92). This figure is found to be overvalued, due to insufficient deflating. The 23% growth rate was derived by the author from a recalculation of constant price output, using the Producer Price Index of Industrial Products as the deflator (see Appendix A for detailed calculation). The overall gross output growth rate in China was 11.2% in 1979-92 annual average (measured by Total Output Value of Society, or TOVS). Data are not available for 1993 and 94. It can be roughly estimated as 11.5% in 1979-94. GDP Growth rate was 9.8% in 1979-94 (SSB 1993, 95).
in the rural industry during the period of economic reform? Or, what factors have contributed to the rapid growth in the rural industry?

Neoclassical economic growth theory states that, in the long run, the growth rate of an economy is determined by the growth rate of labor, if there is no technological progress (Solow 1956, Swan 1956). Changes of saving rate and other exogenous shocks have no long-run effect on growth rate. Endogenous growth theory shows that human capital accumulation has a long-run effect on growth, therefore the steady-state growth rate is determined not only by the labor growth rate, but also by the growth of human capital (Lucas 1988; Romer 1986, 1990). The “dual economy” theory suggests that for a developing economy with an abundant labor supply in the traditional sector, economic growth is determined by saving and capital accumulation, or productivity change, in the modern sector, as this determines the speed of labor transfer from the traditional sector to the modern sector (Lewis 1954; Ranis and Fei 1961).

These theories provided a basic analytical framework for studies on economic growth. However, to explain the rapid growth of China’s rural industry, additional contributing factors need to be identified.

First, much of the evidence shows that the Chinese economy is in a transitional dynamic instead of the long-run steady state. The economic growth rate in the reform period has been significantly higher than in the thirty years pre-reform period; there are also large differences among growth rates for different sectors, especially high in the rural industrial sector. Output growth has significantly exceeded input growth. In particular, different from the theoretical implication of the neoclassical growth model for long run growth, the low labor growth rate can only explain a small part of economic growth.

Second, although technological progress and human capital accumulation could partly explain the growth residual, it would be beyond empirical experience on

---

3 The growth rate of the rural industrial sector is not available for the pre-reform period. Roughly assuming that rural non-agricultural output in 1952 was 4.6 billion yuan (1952 price), only 10% of the agricultural output, then its growth rate after deflation would be 8% in 1953-78 average, far lower than the 23% in the reform period (calculated from SSB 1988: 25, 29, 777; 1995: 365).
economic history if they were solely or mainly responsible for the dramatic high
growth. In addition, such abnormal technical growth or human capital accumulation
was not observed.

Third, the high economic growth rate may not be simply explained as a result of
higher saving and investment. For instance, the national saving rate in 1971-80
(basically the pre-reform period) was 33.1% on average, even higher than the 31.3%
in 1981-85 (the early stage of the reform period) (SSB 1988: 60). FDI increased
significantly only in the late 1980s and 1990s. In the rural economy, similar to what
was described by the Lewis theory, a massive transfer of labor from agriculture to the
rural industry was observed. However, the labor transfer was much faster in the latter
period than in the former, whereas the national saving rate was higher in the former
period.

The major hypothesis raised in this dissertation is that, institutional change during
the economic reform made a major contribution to accelerating rural industrial
growth. In the pre-reform period, institutional barriers on labor allocation between the
rural agricultural and non-agricultural sectors were the major problem hindering the
rural industrial sector from faster development. The barriers were set by the
government to protect the centrally planned industrial sector from market competition,
and to control the price of food and the supply of food to urban residents in order to
support the "heavy industry priority" development strategy. This certainly caused
inefficient use of resources, particularly over-allocation of labor to agriculture, as well
as much lower income and labor productivity in agriculture than in other sectors.

These restrictions were gradually removed during the period of economic reform.
This started from the introduction of the Household Responsibility System and the
abolition of the People's Commune System, and further resulted from liberalization of
input-output control in the industrial sector, relaxing control on migration and control
on private business, and softening state quotas on agricultural production. These
induced a massive transfer of rural labor from agriculture to the rural industry that led
to the rapid growth of the rural industry.
In this study, a two sector model is established to examine the above hypothesis. Using the model, an empirical analysis is carried out to test this hypothesis and to derive the actual contribution of institutional change to rural industrial growth and economic growth. The contributions of factor growth and total factor productivity change to growth are also estimated. The empirical establishment of this model finally provides an answer to the question: what are the major factors that contributed to the rapid growth of China's rural industry during the reform period, and how much did each factor contribute?

In this study, two other important institutional issues concerning rural industrial growth and economic growth are investigated. One is the effect of the behavior of the collectively owned rural enterprises (Township and Village Owned Enterprises, or TVOEs) on labor allocation. Although a clear tendency of reducing government restrictions on factor allocation was observed, the empirical estimation in this study finds only a slow convergence of marginal labor productivity between the agricultural and rural industrial sectors (and even divergence in one region). To solve this puzzle, further investigation is needed to identify if any other institutional factor was responsible for reducing the capacity of the rural industry to absorb agricultural labor. A hypothesis tested in this study is that a collective owned rural enterprise (TVOEs) absorbs less labor than a competitive private enterprise, other conditions being equal, due to its objective of income-per-capita maximization.

The other institutional issue investigated is the interaction between growth of the two major non-agricultural sectors, i.e., the state owned enterprise (SOE) sector, which was previously under complete central planning control and is currently subject to partial government control, and the market-oriented rural industrial (TVE) sector. TVEs have been the major components of the non-state sector in the non-agricultural industries. They have expanded their activities far beyond their traditional rural markets, and compete with the SOEs in urban, or even international, markets. In Chapter 7, the possible existence of externalities between the two sectors is examined.
Although there are still market imperfections in rural sectors, the market-oriented rural industrial enterprises, including TVEs, have proved to be much more vigorous than SOEs in competition. However, concerning the competition between the TVE and state sectors and its impact on economic growth, there has been a lot of debates. One argument is that, because the intensity of technology in the TVE sector is low, TVE sector growth and its competition with SOEs for inputs reduced the capacity of state sector growth, and therefore reduced the technological level of the national economy. Although this suggestion has been rejected by many economists, further evidence is required. On the other hand, there are contradictory results from cross country studies in the literature, suggesting either positive or negative externalities from the government sector on economic growth (e.g., Landau 1983, Ram 1986, and Rao 1989). In this study, both possible externalities from one sector to another are tested. The result indicates that, during the period under investigation, the TVE sector had an unambiguously positive effect on the state sector growth, through market competition, but the state sector externality to the non-state sector is not identified.

After investigation of the above issues, a general picture of the role of rural industrial growth in China’s economic growth can be sketched.

1.2 THE IMPORTANCE OF THE STUDY

As a developing country with the largest population in the world and a very low level of income per capita compared with other countries, China has experienced dramatic economic growth since the beginning of its economic reform. After 17 years of rapid growth, China’s GDP in 1995 was 4.9 times that in 1978, measured by constant price. Income per capita jumped from 101st in the world in 1978 (Benin, Pakistan and Tanzania ranked the same), out of 125 economies, to 82nd in 1994, out of 118 economies\(^4\). In 1994, China’s GDP level had been close to the sum of the former

\(^4\) The 15 former Soviet Union countries were summed into one in 1994 for comparison with 1978. Without this sum, China ranked 95th, out of 133 economies. According to the PPP estimates of GNP per capita, made by the World Bank, China ranked 71st out of 114 economies (including the former USSR countries) in 1994.
Soviet Union countries (92% of the latter, in 1994 US$)\textsuperscript{5}, and was 64% of the sum of the four "Asian Tigers": Singapore, Hong Kong, Taiwan, and Korea. According to the World Bank's PPP estimates, China's GNP was second only to that of the US, and exceeded that of all the other major industrial countries, including Japan and Germany (calculated from the World Bank 1980: 110-111, 1996: 188-211; SSB 1996: 770).

This has attracted great world attention. Journalists has started to talk about China as the world's first superpower in the 21\textsuperscript{st} century, or about the next century as "China's century". Some economists, however, believe that China's rapid growth is just a short-run effect or even a bubble. Krugman (1994) compared the rapid growth in Asian economies (in some sense including China) with earlier rapid growth in the USSR in the 1950s, and argued that they both resulted from input-driven growth, caused by only high saving and intensive investment without increasing total factor productivity. Therefore he believes that rapid growth in those Asian economies is not sustainable growth and will soon diminish to a much lower rate. About China, he agreed that there has been a dramatic improvement in efficiency since 1978, although, it seems more like a recovery from the disaster of the Cultural Revolution. He thus suggests only part of the efficiency increases possibly represent a "sustainable trend."

It is thus imperative to analyze the mechanism behind China's rapid growth, as it will heavily influence the sustainability of China's economic growth, as well as the world economic-political structure, in the future. Since the rural industrial sector has made a major contribution to the acceleration of China's economic growth, analyzing the mechanism of rural industrial growth will provide an important key to solving the puzzle:

What determined such rapid economic growth in China? And how long can the rapid growth continue?

Adding to conventional production analysis, this dissertation focuses on the mechanism of how institutional change affect rural industrial growth. It aims to

\textsuperscript{5} As a comparison, China's GNP level in 1978 was only 23% of the USSR, in 1978 US$. 

6
demonstrate that as a major driving force in China's economic growth during the reform period, the rapid rural industrial growth cannot be simply explained by increasing saving and investment, or, by a recovery from the Cultural Revolution (see Krugman 1994). Instead, it mainly resulted from the institutional change induced factor reallocation. This explains the mystery as to why technical progress in each sector was moderate, but the overall economic growth and productivity increase was dramatic.

The study also intends to show that since the institutional change is a “short-run” dynamic, the current very high growth rate of the rural industry will finally diminish to a lower rate. Despite this, there is still great growth potential in the intermediate term future, which can be induced by further institutional reform towards market improvement. There is still a long way to go towards the end of the market-oriented institutional change. Some research outcomes in the literature suggest that, in the real world, a “short run” dynamic could last for a considerably long period, possibly one hundred years (see e.g., Sato 1963, Sato 1966, King and Rebelo 1993). In fact, just twenty years of “short run” rapid growth could greatly change the situation in an economy (see, e.g., Lucas 1988); this is especially meaningful for a developing country.

In addition, the market-oriented institutional change in China or any other developing country would not only result in an once-over factor reallocation, but also in changes in the incentive mechanism for technical innovation and human capital accumulation. This is an important feature distinguishing the market mechanism from the centrally planed one. It is a necessary, even though not sufficient, condition for sustainable economic growth. Further examining changes in the incentive mechanism in China would be beyond the scope of this study. However, as long as the contribution of the market-oriented institutional change to economic growth is identified, one may expect an increasing trend in technological progress towards long run sustainable economic growth. Therefore, it is too early to predict that the rapid growth in China will be only a short-run effect, particularly when considering the
changing incentive mechanism resulting from the institutional reform, for technical innovation and productivity growth.

Important implications can be derived from this study are:

The institutional change in the rural economy has been an important source for the increasing productivity, and therefore for the rapid economic growth of the Chinese economy. There is still a great potential for rapid economic growth in the intermediate term in future since the institutional reform has been far from complete. The long run situation after the transitional period is yet uncertain. However, due to the changing incentive mechanism, the institutional change has made the long run sustainable economic growth possible.

1.3 OUTLINE OF THE STUDY

This dissertation consists of eight chapters. Chapter 2 provides background information about China's rural industrial sector, or the TVE sector. It describes the origin of the TVE sector in the People's Commune period, its development in the past years, the institutional arrangements and central policies relating to TVEs, the recent achievement of the TVE sector in terms of output and employment, its branch structure and regional allocation, and its ownership structure.

Chapter 3 is a literature review towards establishing a theoretical framework for analyzing rural industrial growth. Different theories and models concerning economic growth and development are briefly summarized. In the first section of chapter 3, literature on rapid growth of East Asian economies and China is reviewed. There are various explanations and empirical findings for reasons leading to rapid growth and productivity changes in both East Asia and China. Some are common features shared by these, or some of these, economies: market-orientation and export orientation, high savings and investment in both physical capital and human capital, etc. In addition, some distinctive features for China have been found: increases in innovation and firms' efficiency that resulted from economic reform, and the dramatic growth of the rural industry and the massive transfer of labor from the agricultural to the industrial
sector. Obviously, the latter is also an effect of economic reform. In this thesis, the latter effect is analyzed as a key issue.

Other relevant literature is discussed in each chapter.

In Chapter 4, a two-sector model is constructed to derive the effect of institutional changes on China's rural industrial growth through factor reallocation. The marginal product of labor (MPL) differential between the rural industrial sector and the agricultural sectors is used to indicate institutional barriers on labor allocation. The outcome of the model suggests that removing institutional restrictions on labor allocation can result in a flow of labor from agriculture to rural industry, when labor productivity in the latter is higher than in the former. This will lead to faster growth of the rural industry in the transitional dynamic, and generate a net gain to the economy. With an assumption of sectoral capital stock being endogenously determined, the institutional change will not only result in a reallocation of labor, but also in a reallocation of capital in the same direction. Therefore the effect of institutional change will be stronger, and industrial growth will be further accelerated.

In Chapter 5, an empirical analysis is carried out to estimate the contributions of institutional changes to China's rural industrial growth during the economic reform period. The model established in Chapter 4 is used to estimate factor contribution, total factor productivity growth, and the MPL differential. Provincial data from 1980-1992 for both the rural industry and agriculture are used. The effect of institutional change on growth is then derived from changes of the MPL ratio.

The empirical analysis found an initial gap of MPLs between the rural industry and agriculture, much higher in industry than in agriculture. This indicates the existence of institutional barriers on the reallocation of labor from agriculture to the rural industry. The MPL differential that was induced by institutional restriction has been found gradually to have reduced during the period of economic reform, except in 1989-90 when a policy change occurred attempting to reinstall central control.6

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6 The direct estimation result suggests that the MPLs converged in the whole period of 1980s but diverged in the early 90s. The divergence has been found partly to have resulted from the anti-market policy change in 1989-90, but mainly from statistical error (the rural-urban migration was not deducted.
Based on the result mentioned above, and the output elasticities with respect to the MPL ratio, derived from the model, the contribution of institutional change to rural industrial growth and economic growth was derived. The results suggest that, besides the contribution of natural growth of labor and capital, the institutional effect played a most important role in the rapid growth of rural industry in the reform period (6 percentage points out of the 21.7% annual growth rate). Total factor productivity changes also made a significant contribution (4.7 percentage points). Factor reallocation only decreased the agricultural growth rate to a minor extent (-2.3 percentage point). At the aggregated level, rural economic growth was found accelerated by the institutional effect (1.1 percentage points). This suggests a net gain to the economy from the institutional changes.

The empirical analysis also found a misallocation of capital between the two rural sectors, due to different factor prices for each. This explained the growth residuals of rural industry. However, it causes inefficient use of capital.

Although the estimation and calculation results show a reduction in institutional barriers during economic reform, it appears slower than what one would expect. In one region the MPL ratio was non-decreasing. An answer to this mystery is derived in Chapter 6.

Chapter 6 analyzes the impact of the behavior of collective enterprises (Township and Village Owned Enterprises, or TVOEs) on labor allocation between the two sectors. Similarities and differences between TVOE s and Labor Managed Firms are discussed.

The theoretical outcome states that, with the objective of maximizing income-per-capita in a local community, TVOE s can maximize the income per local community member through internal employment, but can not achieve an economy-wide optimal from agricultural labor, and the TVE output was possibly over-reported in the 90s) and non-institutional factors (human capital accumulation in the TVE sector appears faster than in the agricultural sector). To correct these errors, the estimated MPL ratio in the initial year (1980) and the actual change of TVE employment is used to calculate the MPL gap that was induced purely by institutional changes. The calculation result shows a continued trend of MPL convergence, indicating a gradual reduction in institutional restrictions.
allocation of labor. After achieving internal full-employment, TVOEs will be more conservative than private enterprises in admitting new workers from outside the community. Therefore, TVOEs employ fewer workers and tend to be more capital intensive than profit-maximizing firms. This results in a MPL gap and a sub-optimum allocation of labor and capital in the rural economy.

The above hypothesis is empirically tested through the regression analysis. The result shows a significant and positive relation between the TVOE ratio (i.e., the proportion of TVOEs in the TVE sector) and MPL gaps. A similar result is obtained by analyzing the data of TVOE proportion and sectoral wage differentials. These results are also supported by the actual data for capital and labor intensity of TVOEs and other TVEs. The empirical result implies that, if the objective of these enterprises is redirected from income-per-capita maximization to profit maximization, higher employment would be achieved, and economic growth would be further accelerated.

Chapter 7 assesses the direct and indirect contribution of the TVE sector growth and marketization to China's economic growth during economic reform. The direct contribution is calculated from the different growth rates of the TVE, and other sectors, and their share in total output. The result shows that, in comparison with the state sector, which had the absolute dominating position in the Chinese economy before reform, the TVE sector made the major contribution to growth of the non-agricultural economy during the period of economic reform.

Some cross-country studies in the literature suggest that the government sector either positively or negatively contributes to economic growth through its externality to the non-government sector. In this chapter, a typical model in the literature (Feder 1983, Ram 1986) is modified to test possible externalities between the two major non-agricultural sectors: the state owned enterprises sector (SOEs) and the TVE sector. There is no clear evidence for the externality from SOEs on TVEs, but a positive and significant externality is found from the market-oriented TVE sector to the SOE sector. This implies that market competition from TVEs positively contributed to growth of the state sector, by exerting pressure on SOEs to increase their efficiency.
The estimation result also shows significant positive productivity growth in the TVE sectors. The result of the TFP growth is insignificant in the SOE sector.

According to this result, the market-oriented rural industrial sector does not only directly contribute to economic growth, via its own fast growth, but also indirectly contributes to economic growth through its externality on SOEs, generated from market competition.

Chapter 8 is the conclusion to this thesis.

Finally, Appendix A1 and A2 provide calculations for TVE output, and for capital stock in the TVE and agricultural sectors. These calculated data are used for the empirical studies in this thesis.
CHAPTER 2. A REVIEW ON DEVELOPMENT OF CHINA'S RURAL INDUSTRY

For a better understanding of the following chapters, this chapter provides a review, together with some background information, of China's rural industrialization, before and within the period of economic reform. Section 2.1 explains some concepts; section 2.2 gives a historical background of rural industrialization before reform; section 2.3 deals with the development of rural industry during the reform period; section 2.4 discusses factor intensity and industrial structure in the rural industrial sector; section 2.5 addresses the regional distribution of rural industry; and section 2.6 provides a summary.

2.1 SOME CONCEPTS

In the following, explanations are provided for some concepts in the Chinese economy that will be frequently mentioned throughout this thesis.

TVE: Township and Village Enterprise. Official data for the TVE sector covers almost the entire rural non-agricultural activities, except state owned and urban collective owned enterprises located in the rural areas. The structure of the TVE sector, in terms of Gross Output in 1994, was as follows: industry 76%, construction 10%, transportation 5%, commerce and food service 8%. Agriculture activities are included in the TVE sector only if they are registered as enterprises. This part is negligible, only accounted for 1% in 1994 (SSB 1995, 365). Other services are either included in the relevant category above, or are statistically unavailable. Statistical data

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1 For more information on China's rural industrialization, or on the development of Township and Village Enterprises, the following references may be useful: Byrd and Lin (ed.), 1990; Economic Institute, CASS (ed.), 1987 (in Chinese); Watanabe (ed.), 1991 (in Japanese). All information used in this chapter without referencing is from the author's personal experience obtained from previous surveys and researches.

2 The major part of the agricultural sector is constituted by communes, production brigades and teams in the pre-reform period and individual farmers in post reform period, both were not registered as enterprises.
for construction and services might be under-stated due to statistical difficulties.

Before 1984, TVE statistics only included rural collective-owned enterprises, i.e., Township and Village Owned Enterprises. Rural private enterprises (the official statistics refer to them as jointly owned and individually owned enterprises) were not allowed before 1980s; they started to develop in the early 80s and have been officially included in the TVE statistics since 1984.

**TVIE:** Township and Village industrial Enterprise, i.e., TVE in the industrial sector.

**TVOE:** Township and village owned enterprise, i.e., rural enterprise run by the township (or Town\(^3\)) government, or the village administrative authority (Villagers’ Committee). They originally came from Commune and Brigade enterprises (as described later in section 2.3). TVOE accounted for 67\% of total TVE output and 48\% of TVE employment in 1994 (the rests were private TVEs). TVOEs are classified as collective enterprises that legally belong to local residents of the communities at the township or administrative village level. Historically, they stem from the Commune and Brigades Enterprises of the pre-reform period.

**CBE:** Commune and Brigades Enterprises, i.e., rural enterprise owned by Peoples’ Commune or by Production Brigade (1958-83). They were predecessors of TVOEs. There was also a small proportion of CBEs owned by Production Teams, usually smaller in firm size. After the abolition of the commune system, most Team Enterprises were privatized by selling or renting to individuals.

**SOE:** State owned enterprise, legally belong to all the people in China. They are run either by the central, provincial, municipal, or county governments. Before economic reform, SOEs constituted the main part of China’s non-agricultural economy.

**Peoples’ Commune System:** A comprehensive system for rural agricultural and non-agricultural production and administration in the period 1958–82/83. A Peoples’

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\(^3\) The Townships and Towns are administratively at the same level, but towns are larger in population or higher in level of urbanization.
Commune was a collective productive organization, but its administration was also a lowest level of local government (under a county). It played the role of implementing the central economic plan for agricultural production, resource allocation, output purchasing, and administrating all the other local affairs. China had 52,781 communes in 1978. Each of these usually had 15,000 residents and consisted of 10–20 Production Brigades on average. In 1982-83, the Commune System was abolished. Basically each commune was converted into a township, or town, administratively, and each brigade was converted into an administrative village.

Production Brigade: The sub-organization of Peoples’ Communes. It consisted of several Production Teams and with normally 500-2000 rural residents. A Brigade could be constituted by one, or more, natural villages, depending on the size of the village.

Production Team: The lowest level of the organization, and the basic accounting unit in a Commune4, consisting normally of 20–50 households, or 100-200 residents. A team could consist of one natural village, or only a fraction of a natural village.

HRS: Household Responsibility System, introduced in the early 1980s and effective until now. Under this system, cultivated land was distributed to each farmer’s household, according to a renewable long term contract (usually 15 years) between the household and the collective (Production Brigade earlier, and administrative village later). Agricultural land is legally owned by rural collectives, but is under the administration of the state, even after abolition of the commune system. According to these contracts, households have the responsibility to produce agricultural products and sell a prefixed amount of the products to the state at state purchasing prices. It also has the right to own its surplus products and sell them in the free market. The strong incentive of this system, in increasing efficiency in agricultural production, is that the marginal products are fully owned by individual farmers’ households.

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4 Originally Communes were the basic counting units. After the agricultural disaster of 1960-62, created by the commune system and the “big leap forward”, this was changed to the team level, meaning that income was distributed basically within each team, no longer in each commune.
The State Monopoly for Grain Purchasing and Marketing: effective in the pre-
reform period and the early stage of the reform period (1950s - 80s). According to this
system, each Commune and Brigade (or, later, each township and village) had to
fulfill the state purchasing quota on grain and other major agricultural products. Their
excess quota output, after deduction of a certain amount of ration food for the farmers’
households, also needed to be sold to the state. Only farmers’ surplus food grain, if
any, or that produced from their family plots, was allowed to sell in the local market.
After the introduction of HRS, this system was changed to the state purchasing
contract system, but the state contract is still compulsory.

TOVS and GOV: Total Output Value of the Society, and Gross Output Value,
respectively. Until 1992, TOVS was the basic statistical indicator for national output
and economic growth. It is constituted by the Gross Output Value (GOV) of five
sectors: agriculture (including farming, forestry, animal husbandry and fishery),
industry (including manufacture, mining and power generation), construction,
transportation, and commerce and food services. Other services were excluded as
being treated as non-productive activities. Values of all inputs, including materials
and energy, were not deducted from the Gross Output Value. As the indicators for the
total products of an economy or a sector, TOVS and GOV have a double counting
problem, due to the inclusion of material inputs, as well as a problem of understating
economic output, due to the exclusion of the service sectors. An economic growth rate
measured by TOVS is higher than that of GDP or GNP. During the period 1978-92,
China’s GNP growth rate was 9.4% on average, whereas the TOVS growth rate was
11.2% (SSB 1993). Nevertheless, both TOVS and GDP show the same trend of
variation. In this study, TOVS and GOV are used, due to lack of GDP and Value
Added data.

For a clearer understanding of the Chinese economic structure and its changes,
Table 2.1 shows the ownership structure of the economy, divided by rural and urban
sectors, in both the pre-reform and reform periods. A detailed description of the
changing structure and institutional framework in the reform period will be given in
Section 2.3.

TABLE 2.1 CHINA’S RURAL AND URBAN SECTORS

<table>
<thead>
<tr>
<th>Sector</th>
<th>Pre-reform period (1958-78)</th>
<th>Reform period (1978-95)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban industrial and service</td>
<td>State Enterprises (SOE)(^a) (58%)</td>
<td>SOE (28%)</td>
</tr>
<tr>
<td>Sector</td>
<td>Urban collective enterprises (8%)</td>
<td>Urban collective enterprises (7%)</td>
</tr>
<tr>
<td></td>
<td>Urban private enterprises (^b) (13%)</td>
<td></td>
</tr>
<tr>
<td>Rural agricultural sector</td>
<td>Commune agriculture (29%)</td>
<td>Household agriculture (HRS) (20%)</td>
</tr>
<tr>
<td></td>
<td>State agriculture (1%)</td>
<td></td>
</tr>
<tr>
<td>Rural industry and service</td>
<td>Commune and Brigade Owned enterprises (CBE) (4%)</td>
<td>Township and Village Owned Enterprises (TVOE) (18%)</td>
</tr>
<tr>
<td>sector</td>
<td>Township and Village Owned Enterprises (TVOE) (18%)</td>
<td>Private enterprise (^b) (14%) (32%)</td>
</tr>
</tbody>
</table>

Note:
Percentages in parentheses are shares in GDP, in year 1978 and 1995, respectively. They are roughly estimated by the author according to some incomplete data of GDP, National Income and Gross Output by sector and by year (SSB 1988, 1996; The World Bank 1996).

a. Including the SOEs located in rural areas.
b. Including foreign funded enterprises.
c. CBEs were renamed as TVEs in 1982-83 when communes were abolished. Rural private enterprises were included in TVEs since 1984.
- Negligible.

2.2 A HISTORICAL BACKGROUND OF RURAL INDUSTRIALIZATION BEFORE REFORM

China established its state owned industrial sector by transforming underdeveloped private industries into public ownership in the 1950s. At the same time, technology and capital was transferred from the former Soviet Union for construction of 156 heavy industrial projects. After finishing its First Five-Year Plan in 1957, China had basically established a self-sufficient industrial sector under the central planning system, which could meet basic domestic needs, from iron, steel, machines and equipment, to clothing, food, and daily used products. Following the implementation of this industrialization development strategy, the industry share in Total Output Value of Society (TOVS) increased rapidly from 34% in 1952 to 44% in 1957, whereas the share of the agricultural sector in TOVS dropped from 45% to 33% (SSB 1988: 37).

However, China was still an agricultural country at that time, in the sense that 85%
of its population lived in the traditional agricultural sector (547 million in 1957). With limited land area and the traditional production technology, labor productivity in agriculture was extremely low.

In the early 1950s, the government successfully transformed its household based traditional agricultural sector into a collective (Agricultural Producers’ Cooperatives) based sector. During the first few years, production increased rapidly. Grain outputs increased from 112 million tones in 1949 to 195 million tones in 1957, with an average growth rate of 7% annually (SSB 1988). The cooperative system was successful, mainly due to its function in helping poor farmers recover from the damage of long term war5. After all these wars, even though they all got land from the 1940s-50s land reform, many rural farming families were in great difficulty. Some were suffering from shortage of money and inputs (e.g., draft animals, farm tools or even seeds) and some lacked labor. The cooperative system provided a way for them to combine their factors to enable farming. Therefore, the rapid agricultural growth during this stage appeared to be mainly a recovery.

In 1958, the farmers’ cooperative system was further “upgraded” into the Peoples’ Commune System – a collective system with much larger units than before, that dominated Chinese agriculture for 20 years.

To support its industrialization development strategy, and to be consistent with the centrally planned non-agricultural economy, the central government controlled pricing, purchasing, and distribution of major agricultural products through the State Monopolistic Grain Purchasing and Marketing System. The state price of agricultural products was much lower than the free-market price, so that the urban wage rate of the non-agricultural sectors could be kept at a low level. Thus, agricultural surplus was transferred to the urban industrial sector (see Dong 1988, Watanabe 1991, and Lin et. al. 1994). Because the government control on agricultural products reduced farmers’ income, labor mobility towards non-agricultural activities had to be strictly restricted,

5 That is, the war against Japanese invasion in 1937-45; the civil war in 1945-49; and the Korea War in 1950-53. The first two affected most areas of China.
in order to ensure the supply of agricultural products. Therefore, while the government was accelerating its (capital intensive) urban industrialization process under the central plan, it had to stop market-oriented spontaneous industrialization in the rural economy as well as rural-urban migration.

Thus, in the central planning period, the Chinese economy basically consisted of two major sectors: a state owned industrial and service sector in the urban areas, and a collective owned agricultural sector in the broad countryside. In 1978, out of a total 402 million labor force, the state sector employed 75 million (19%), the urban collective sector employed 20 million (5%), and the majority of the remaining 306 million (76%) was employed in the collective agricultural sector. The state industrial sector had a limited capacity for job creation, since it was a heavy industry based capital-intensive sector, whereas the non-state industrial sector was restricted.

Under these institutional arrangements, in addition to the pressures of a huge and growing rural population and land limitations, China suffered for a long time from an abundance of agricultural labor, low labor productivity and rural poverty. In 1978, the total cultivated land area was 99.4 million hectares, and each farmer’s share was only 0.34 hectare, on average6, and annual grain output per farmer was only 1.07 tones (SSB 1995: 330-347). Low output prices, restrictions on labor mobility, and the income distribution system of the Peoples’ Communes, heavily reduced incentive to farmers, thereby further reducing labor productivity.

From 1957 to 78, agricultural inputs increased rapidly. Total agricultural machine power increased from 1,210 KKW to 117,500 KKW, an annual growth rate of 24.3%. The application of chemical fertilizer increased from 373 thousand tons to 8840 thousand tons, an annual growth of 16.3%. The irrigation ratio (the irrigated land area to the total cultivated land area) also increased significantly, from 26% to 45% (SSB 1988: 153, 225, 233, 248). Despite these rapid increases in inputs, agricultural growth only achieved an annual rate of 2%, the same as the rural labor growth rate for the

6 It has been suggested that the cultivated land area was under-reported by around 20%. Therefore the actual share could be a little higher than this figure.
same period. Productivity was obviously decreasing.

These problems created heavy pressure on the government to find a way of absorbing surplus agricultural labor without breaking the existing central planning system. In the pre-reform period, the Commune and Brigade Enterprise (CBE) was the solution.

China's collective owned rural industry (the CBE sector) was established in 1958, after the elimination of the private non-agricultural sector. At that time, the rural People's Communes and their subordinate organizations, i.e., Production Brigades and Production Teams, were encouraged by the government to establish their own small industrial enterprises in the rural area. These small enterprises operated as subordinate parts of People's Communes or Brigades. Their members were selected from farmers. Managers and workers of these enterprises were either equally paid as farmers under the "Working Point" system, or by cash. In the latter case, they could earn more than farmers. The profits of these firms had to be submitted to the Communes or Brigades, and partially redistributed to farmers. As an exception from the Stalin type of central planning economies, production of these rural industrial enterprises was rarely subjected to the central plan, even in the pre-reform period. As observed by some foreign researchers, this was a clear industrial decentralization (J. Sigurdson, 1977, 13-22).

However, the purpose of encouraging CBEs was not to establish a second industry to compete with the state industrial sector in the market. Private enterprises were prohibited, and CBEs were restricted to operate in a few industrial fields under the following principles of the government (Sun 1991: 63, and Kondo 1978: 142):

1. Agricultural production, grain production in particular, was the first priority. CBEs should not compete with grain production for labor force;
2. CBEs should be engaged in production fields directly relating to agricultural needs and farmers' daily needs, or
3. be engaged in exploiting resources and local raw materials, provided that these resources were not be exploited by the (state owned) central industry. For instance,
communes in cotton producing areas should not develop their own textile industry since cotton had to be provided to the state textile industry.

The first principle restricted the CBE sector to a limited scale, since, as long as agricultural labor had a non-negative marginal productivity, the absorption of this by CBEs might be described as “competing with agriculture for labor”7. The second two principles indicated that all production fields other than those mentioned were prohibited. Under these policy restrictions, CBEs were mainly engaged in repairing and manufacturing agricultural machinery and farm tools, producing local building materials, processing local agricultural products, and small scale mining (see ARID 1977: 3; and Sigurdson 1977: 24-34). In 1978, two industrial branches: machinery (mainly farm machines and farm tools) and building materials (bricks, stones, and lime etc.), accounted for 55% of the total commune industry’s employment and 53% of its output (BTVE, 1978: 11).

In 1977, the first principle of the above was removed, whereas the others were restated by the government as “three serving” principles (LBSC 1987: 6), i.e., operation of rural industrial enterprises should be under the principle of:

1. serving the agricultural production, or
2. serving the living needs of local residents, or
3. serving the state industry and export industry.

Under the above principles, the restrictions on demand for labor were more or less relaxed, however, CBEs were still treated as supplements only to the state industry, and as complements to agriculture.

The state quotas and price control on inputs were other problems. Metals and many other industrial materials, power, petroleum products, and most of the industrial machines and equipment were under central planning control and could rarely be distributed to CBEs8. Therefore most of the CBEs had to carefully choose their

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7 In practice, if a commune or a brigade set up a CBE but could not fulfill the state quota for their agricultural production, or their agricultural output decreased, this might be considered as a result of CBE’s competition for agricultural resources.
8 In some cases lower level governments, e.g., provincial or municipal governments, could make some
production field to avoid the necessity for these inputs. In some cases they might attach themselves to the planning system by providing processing services to the state owned enterprises (SOEs). Little competition existed between CBEs and SOEs. Rather, the rural industry could only fill some market vacancies ignored by the central plan.

Thus, throughout the pre-reform period, the function of the market mechanism was significantly impeded by various government interventions, e.g. barriers of entry, restrictions on factor allocation, quotas and price control, etc.

Growth rates for rural industry during the pre-reform period are not available. However, it can be assumed that in most years, it was much lower than for that of the reform period. There were, however, two short phases of rapid CBE growth between 1958 and 1978. The first of these was in 1958-59, the initial period of setting up rural industry (but many of these soon failed in the “iron-steel smelting movement”); the second was in 1977-78, following the relaxation of controls on the movement of labor between agriculture and rural industry⁹. CBE employment increased from 17.9 million in 1976 to 28.3 million in 1978, and their share in total rural labor increased from 6% to 9%.

In 1978, CBEs (the predecessor of TVE) output accounted for 7% of China’s total output (TOVS) and 24% of the output (TOVS) of the rural economy (BTVE 1978: 1, 1991: 2; SSB 1988: 153, 294). Compared with the inefficient and slower growing agricultural sector in the Commune period, the performance of CBEs was relatively good, but it still had not significantly reduced the pressure of the disguised unemployment in the agricultural sector. From 1957 to 1978, the rural labor force increased by 101 million without any increase in the cultivated land area, whereas CBEs only absorbed 28 million (SSB 1988: 153, 1995: 364). As a result, the population and employment problems became even more serious.

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⁹ This was actually an early reform measure, although China’s economic reform is commonly regarded as having started in 1978.
2.3 DEVELOPMENT OF RURAL INDUSTRY DURING THE REFORM PERIOD

Changes in policy and institutional framework

China's rural economic reform began in 1978. In December, the 3rd Plenary Session of the 11th Central Committee of the Chinese Communist Party decided to implement economic reform. The changes that occurred immediately were as follows:

First, the state purchasing price for major agricultural products increased by 20-50%.

Second, some new system for agricultural production, e.g., working group responsibility system (WGRS), were introduced, before the introduction of the Household Responsibility System. The WGRS divided farmers in a Production Team into small groups, each responsible to a proportion of the production quotas of the teams. Their income was directly related to the production performance of their group.

Third, restrictions on CBEs were significantly relaxed. Instead of the "three serving" principles that is mentioned above, new principles were announced by the government (see Sun 1991):

1. Development of rural industry should follow the economic rationality principle. Those agricultural products that were suitable to be processed in the rural areas should be gradually transferred (from SOEs) to Commune and Brigade Enterprises.

2. Urban industrial enterprises (mainly SOEs) should transfer some of their products or parts, that were suitable to be produced in the rural areas, to CBEs. The former should also support the latter by providing equipment and technical guidance.

3. CBEs can link their production, purchasing and marketing with the state plans at different government levels to ensure the success of their purchasing and marketing (meaning governments can provide them with the inputs they needed and purchase their outputs; although, this was rarely realized, due to the later shrinking of the state plan and the expansion of the market).
4. Favored policies, i.e., tax reductions or exemptions, would be provided to CBEs according to different situations.

As a consequence of 4, newly established CBEs were exempted from income tax for 2-3 years, and CBEs having less than 3000 yuan returns were exempted from income tax. The tax exemption for underdeveloped border areas and minority ethnic regions was 5 years.

Although policy changes and institutional reforms were gradually implemented towards liberalization of rural industry, the old restrictive policies relapsed on several occasions. In 1979, the State Council reaffirmed the “three serving” principles for CBEs, and regulated that TVEs should not compete with the state industry for inputs like materials and energy. Although, barriers on entering some industries, i.e., material and energy production, construction, transportation, and services, were removed at the same time (The State Council 1979). In 1981, a new regulation required “rectification” of CBEs, in accordance with the above principle. As a result, about 87,000 CBEs, which were considered to be competing for inputs with the state industry, were forced to close down, and CBE employment was reduced by 301,000 workers (The State Council 1981; BTVE 1988: 292-93).

In 1983, restrictions on rural private enterprises were relaxed. These enterprises were allowed to employ up to five workers (this limitation was actually much exceeded later). Urban cooperatives in small cities or towns were allowed to employ rural laborers, under the condition that these employees could not transfer their status to urban residents.

There were more significant policy changes on rural industrialization in 1984. The two major changes were:

1. Rural cooperatives, joint owned, and individual owned enterprises were officially encouraged. These enterprises were classified, together with former CBEs, as Township and Village Enterprises (TVEs).

2. The “three serving” principle and restriction on competition of TVEs with SOEs was removed. The new policy gave equal rights to TVEs competing with SOEs in

In 1985, further policy changes allowed science and technical personnel, as well as technology, transfer from the urban state sector to the TVE sector (The Central Committee of CCP, 1985).

Thus, since 1984/85, TVEs have had the same rights as SOEs, and can compete with them in markets for inputs, outputs and factors.

In the agricultural sector, the HRS was introduced in 1979-82. It changed the collective based agricultural production to a household based one. Although land was still owned collectively by communes and brigades, it was distributed to farmers through contracts, the communes and brigades now no longer played an important role in agricultural production. In 1982-83, the Commune system was abolished; the administration system of communes were converted into township governments, and were no longer directly in charge of agricultural production. The remaining functions of communes and brigades, e.g., as the owners of land and CBEs, and, as one party of the HRS contracts, were also transferred to township governments and administrative villages. These reforms achieved great success (Garnaut, Guo and Ma 1996). In 1979-84, the annual growth rate of grain was 5%, cotton 19%, oil-bearing crops 15% and fruits 7%. The annual gross output growth rate in constant prices was 7.8% (SSB 1988: 216, 248-249). This was the fastest growing period of agriculture since the 1950s, and was due mainly to the changing incentive mechanism.

The increasing agricultural productivity, induced by agricultural reform, released more surplus labor that was previously disguisedly unemployed under the inefficient commune system. Agricultural labor transferred continuously to the TVE sector. After the agricultural reform and the changes made to the industrial policies, the TVE sector experienced a very fast growing period in 1984-88 (a 15-20 million workers increase per year in 1984\textsuperscript{10} and 1985, and 7-10 million per year in 1986-88). Not only did the

\textsuperscript{10} Official data of TVE employment increased by 22 million in 1984. This included pre-existing employment in private enterprises that appeared in statistics since 1984, due to changing statistical definition.
growth of TVOEs accelerate, but also rural private enterprises (officially, Jointly and Individually Owned Enterprises) mushroomed throughout the whole country, growing at an even faster rate than the former. However, the latter enterprises were far smaller in average size and lower in capital intensity than the TVOEs.

In late 1988 and 1989, the old restrictive policies were partially restored once again. The government announced policies to protect the state owned large and middle size enterprises, to restore the state monopoly supply of important industrial materials, to cut bank loans and cancel the preferential financial treatment for TVEs. These policy changes resulted in a very serious decline in both TVE employment and output growth rate (even though the growth rates were still positive) in 1989-90.

TVE growth recovered in 1991, when these restrictions were again relaxed. The situation further changed in 1992, when the government announced a decision to continue and accelerate the market oriented reforms. High growth rates in TVE employment and output have been maintained ever since.

Performance of rural industrialization

From 1978 to 1995, TVE employment increased dramatically, from 28.3 million to 128.6 million, which shared 28% of total rural labor by 1995. Its annual employment growth rate of 9.3% far exceeded the total rural labor growth rate of 2.4% in the same period.

Output growth was even faster. Gross output (GOV) of the TVE sector increased from 50 billion yuan in 1978 to 1447 billion yuan in 1994 (1980 constant price). The growth rate was 23%\(^{11}\), twice as high as the overall economic growth rate during the same period. According to the World Bank's estimate, the share of the TVE sector in China's GDP rose from 13 percent in 1985 to 31 percent in 1994 (World Bank 1996, 51).

Table 2.2 provides comparisons of the state and non-state sector growth rates in both the pre-reform and the reform period.

\(^{11}\) See footnote 2 in Chapter 1.
<table>
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<tbody>
<tr>
<td><strong>Economic growth</strong> a)</td>
<td></td>
<td></td>
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<tr>
<td>1953-78 (pre-reform)</td>
<td>7.9</td>
<td></td>
<td></td>
<td>-</td>
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<tr>
<td>1979-94 (reform)</td>
<td>11.5</td>
<td></td>
<td></td>
<td>23.4</td>
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<tr>
<td><strong>Industrial growth</strong> b)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>1953-78 (pre-reform)</td>
<td>11.4</td>
<td>14.2</td>
<td>7.4</td>
<td>-</td>
</tr>
<tr>
<td>1979-94 (reform)</td>
<td>14.8</td>
<td>7.8</td>
<td>21.9</td>
<td>23.1</td>
</tr>
</tbody>
</table>

Notes: a) measured by TOVS in constant price; b) GOV in constant prices.
Sources: Calculated from SSB(a) 1993: 52, 412-4; 1995: 32, 249, 365-79. The deflator is Industrial Products Producer Price Indices.

It shows that:

1. The economic growth rate was significantly accelerated in the reform period, while the state sector growth rate decreased. Therefore, acceleration of economic growth was fully induced by growth of the non-state sector.

2. In the non-state sector, the TVE growth rate was faster than the other components. Considering its share in the economy, it is evident that TVE has made the major contribution to acceleration of economic growth in the reform period.

Figure 2.1 shows the dramatic change in TVEs' output, compared with that of SOEs, and other non-state enterprises, in the industrial sector (from 1978 to 94). They are measured by GOV in 1980 constant price. It clearly indicates that market-oriented TVEs replaced the dominating position of SOEs in the industrial sector, and became the major component of industry.
Table 2.3 indicates the relative position of the TVE sector in the industrial sector and in the national economy. Comparisons with the agricultural sector are also made.

<table>
<thead>
<tr>
<th>TABLE 2.3 DEVELOPMENT OF TVES</th>
<th>1978</th>
<th>1994</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVE employment in rural labor</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>TVEs' share in industrial output</td>
<td>9</td>
<td>44</td>
</tr>
<tr>
<td>TVEs' share in total GDP</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>TVE output / agricultural output</td>
<td>35</td>
<td>270</td>
</tr>
</tbody>
</table>

Note: a) gross output of industrial TVEs as a percentage of total gross industrial output; b) a rough estimate by the author; c) gross output. The ratio of net output would not be such high (see section 2.1 the explanation of TOVS and GOV).
Sources: See sources of Table 2.1; and the World Bank 1996: 51.

The rapid growth of rural industries changed the rural income structure. Whereas most rural labor is still working in the agricultural sector, the major source of income
in the rural economy has shifted from agriculture to rural industries\textsuperscript{12}. Although the level of income per rural resident is still very low, rural income per capita increased by 2.5 times between 1978 and 1994, mainly as a result of rural industrialization. This is shown in the last row in Table 2.4.

<table>
<thead>
<tr>
<th>TABLE 2.4</th>
<th>LAND, RURAL POPULATION, AND RURAL INCOME IN CHINA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1978</td>
</tr>
<tr>
<td>Total employment (mil. Persons)\textsuperscript{a)}</td>
<td>401.5</td>
</tr>
<tr>
<td>Rural labor (mil. Persons)</td>
<td>306.4</td>
</tr>
<tr>
<td>TVE employment\textsuperscript{b)}</td>
<td>22.1</td>
</tr>
<tr>
<td>Agricultural labor</td>
<td>284.5</td>
</tr>
<tr>
<td>Cultivated land (mil. hectares)</td>
<td>99.4</td>
</tr>
<tr>
<td>Hectare per farmer</td>
<td>0.35</td>
</tr>
<tr>
<td>Income (yuan) per rural resident\textsuperscript{c)}</td>
<td>134</td>
</tr>
</tbody>
</table>

*Note: a) All rural labor is included regardless people's actual employment status. b) Agricultural component has been deducted. These figures are slightly inconsistent with the rural labor and agricultural labor figures. c) Annual income in constant price of 1978.*

Sources: Calculated from SSB 1995: 257, 329-365.

Table 2.4 also indicates that, although the rural industrial sector employment expanded by 100 million, at the same time the rural labor force increased by 140 million according to the statistics.

The increased agricultural labor was actually absorbed by the unrecorded rural-urban labor flow. Rural-urban migration was strictly restricted in both the pre-reform and early stage of the reform periods. However, the control was gradually relaxed, or became less effective, followed by a large scale rural-urban labor flow in the late 80s and early 90s, even though most migrants could only have temporary jobs. Statistical data is still unavailable. According to various estimations, the accumulated rural-urban migration in the reform period was between 50-100 million till 1994. Without this migration, the rural unemployment problem would have been far more serious.

\textsuperscript{12} The gap between income from TVEs and from agriculture is not that large as appeared by the output ratio in Table 2.2. This is because the industrial value-added-ratio (value added / gross output) is lower than agriculture. Still, we can be quite confident that TVE income has exceeded agricultural income.
If it is assumed that rural-urban migration absorbed roughly 80 million rural laborers in 1978-94, in addition to the 120 million TVE employment, the total absorption of agricultural labor by non-agricultural sectors in the reform period was 200 out of 447 million. Agricultural labor in 1994 should actually be 247 million instead of the official figure of 327 million.

Some estimations suggest 30%-50% of total rural labor in the late 1980s was agricultural surplus labor (Du 1989: 7; Chen 1989: 212; Cao and Tisdell 1992: 160), in the sense that, without further technical change, transfer of these rural laborers to non-agricultural sectors would not significantly reduce agricultural output\textsuperscript{13}. This means that agricultural labor exceeding 200-280 million (let us take the mean of 240) is non-productive.

Accepting this definition and estimation, by 1994 the surplus rural labor had basically been absorbed. However, since agricultural labor productivity is still very low, if surplus labor is defined as their marginal value product being significantly lower than that of other sectors, then the surplus labor in agriculture would still be huge. This is particularly true in the central and west areas. Elimination of disguised rural unemployment would still be a long-term process.

*Other important contributing factors in rural industrialization*

In the context of TVE growth in the period of economic reform, an important factor is the changing role of the state owned Agricultural Bank of China (ABC) and the Rural Credit Cooperative (RCC, nominally owned by collectives but practically acts as local branches of ABC) in TVE finance. In the pre-reform period, development of TVEs basically relied on internal financing. The initial investment of TVEs was mainly financed from the agricultural surplus within the communes and brigades. The

\textsuperscript{13} This is actually the Lewis (1956) assumption, i.e., the marginal product of labor in the agricultural sector is close, or equal, to zero. Although the zero MPL assumption was not proven, studies found that the MPL level in the Chinese agriculture was very low, in some areas below the survival level. Take 1994, for example, assuming that agricultural income in poor areas accounted for 70% of total rural income, a labor-population ratio of 0.5, and marginal product of labor in agriculture of 40% of average product of labor, then it can be derived, from the net rural income per capita, that the marginal product of labor was below the official poverty line for annual income (530 yuan per capita, or equal to 1060 yuan per labor) in nine provinces, out of the total 30.
major tasks of the ABC and RCC were absorbing rural savings to provide financial support to the state purchasing of agricultural products and to agricultural investment of communes. However, they have become far more involved in TVE finance since reform. Table 2.5 shows that, the proportion of bank credit (including that from both ABC and RCC) in the total capital stock\textsuperscript{14} of the Township and Village Owned Industrial Enterprises was only 8% in 1978. It increased to 29% in 1987 and was generally kept at that level ever since. In fact, in many areas, ABC and RCC loans are the most important sources for new investment in TVEs. This has been the major channel to collect rural savings for industrial investment.

**TABLE 2.5 BANK CREDIT AS SHARES OF TVES' TOTAL CAPITAL**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1).Total capital</td>
<td>277</td>
<td>443</td>
<td>668</td>
<td>1732</td>
<td>3405</td>
<td>6702</td>
</tr>
<tr>
<td>(2).Bank credit</td>
<td>22</td>
<td>56</td>
<td>164</td>
<td>511</td>
<td>957</td>
<td>1849</td>
</tr>
<tr>
<td>(2)/(1) (%)</td>
<td>7.9</td>
<td>12.6</td>
<td>24.5</td>
<td>29.5</td>
<td>28.1</td>
<td>27.6</td>
</tr>
</tbody>
</table>

Note: total capital = net value of fixed assets + year-end balance of circulating funds. Data for 1992 are of total TVOE, and for other years are of the Township and Village Owned Industrial Enterprises only. Sources: BTVE(a) 1989: 642-643; 1992: 199-201; BTVE(b) 1993: 498.

These banking systems played an important role in the process of rural industrialization. In comparison, in many developing countries, the small industrial sector financing is a difficult issue, due to the uncertainty of risk. Obviously, if TVEs could not borrow money from banks, they would lose a lot of opportunities for development.

Another important issue is the role of local governments and local communities in rural industrial development. Surveys have found that, besides capital and labor, supply of both human capital (including entrepreneurship) and technologies are extremely important in the development of TVEs. Given the factor market

\textsuperscript{14} Calculated as the aggregate of the net value of fixed assets and the year-end balance of circulating funds.
imperfection, local (particularly township) governments and village communities played an important role in organizing the supply of technology and human capital.

In those successful regions of TVE growth, such as Jiangsu, Guangdong and Shandong, many of the TVE engineers and technicians, and even skilled workers, came from urban areas, and were often those who had retired from SOEs. This is also an important channel for the transfer of technology from urban sectors, particularly the SOE sector, to the TVE sector. New product designs were also provided by, or learnt from, urban sectors, although often through personal connections rather than formal business relations. These were often found to be organized by local governments or village authorities. In these areas, TVE management and administration is the most important job of the township governments and village authorities.

With the assistance from the local governments, TVEs were able to overcome the financing, technical and information constraints they faced in the initial stage of their establishment. This may partially explain the fast development of TVEs in those regions. Unlike the relationship between the central government and state owned enterprises, local governments do not have the capacity to monopolize market, subsidize firms and intervene in TVEs’ pricing. Their roles are basically enhancing the market.

In addition, many TVE managers were found to be former local government officers and village leaders, who were usually more experienced in management and had more business relations than ordinary farmers.15

Although the role of the banking system and local governments are important issues, which are worth further investigating, yet the major focus of this thesis is the effect of market oriented institutional changes on rural industrial growth, which appears to be a most important contributing factor in the acceleration of TVE growth during the reform period..

15 Information obtained from 1982 rural survey in Zhejiang, 1986 TVE survey in Shanxi, 1986-87 TVE survey in Jiangsu, Guangdong, Jiangxi and Anhui, and 1995 TVE survey in Shandong. These surveys were organized by the Chinese Academic of Social Sciences and The World Bank, Chinese Institute of Economic System Reform, and the author himself, respectively.
2.4 FACTOR INTENSITY AND INDUSTRIAL STRUCTURE

*Industrial structure*

Compared with the state owned enterprises (SOEs), the TVE sector is far more labor intensive and less capital intensive. Table 2.6 shows that, the capital-labor ratio for the industrial SOEs was 7-9 times of that of the TVEs, in 1980-92. They both increased during this period, but there was no significant convergence.

Similar to the state sector, industry (manufacture and mining) has been the major component of the TVE sector. This resulted from policy encouragement and restrictions in the pre-reform period, and also from constraints in the supply of technology and human resources. The production fields chosen by TVEs heavily depended on what kind of technology and human resources they could get, whereas the state sector was the major, or only, source for the supply of technology and human resources\(^{16}\).

<table>
<thead>
<tr>
<th>Year</th>
<th>(1) TVE</th>
<th>(2) SOE(^{b})</th>
<th>(2) / (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1.68</td>
<td>15.53</td>
<td>9.2</td>
</tr>
<tr>
<td>1988</td>
<td>3.39</td>
<td>25.15</td>
<td>7.4</td>
</tr>
<tr>
<td>1992</td>
<td>5.60</td>
<td>42.01</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Note: a. Capital is calculated as the aggregation of fixed assets and cumulative funds, both deflated to 1980 prices. b. Industrial enterprises only.
Source: Calculated from SSB various years and BTVE various years, see Appendix A2 at the end of the thesis.

Probably due to this constraint, the industrial structure changed only slightly during the reform period, with the share of industry decreased by a few percent and other non-agricultural sectors increased by a few percent (see Tables 2.7 and 2.8).

\(^{16}\) The situation changed in the east coast areas in the late 80s and 90s, when foreign direct investment provided another channel for transfer of technology.
TABLE 2.7 TVE OUTPUT, EMPLOYMENT AND FIRM NUMBER
BY INDUSTRY AND BY OWNERSHIP

<table>
<thead>
<tr>
<th>Year</th>
<th>Ownership</th>
<th></th>
<th>Industries</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Township</td>
<td>Village</td>
<td>Others a</td>
<td>Agriculture</td>
<td>Industry</td>
<td>Construction</td>
<td>Transpo-rtation</td>
</tr>
<tr>
<td>Output (100 mil. yuan, current price)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>281</td>
<td>212</td>
<td>-</td>
<td>36</td>
<td>385</td>
<td>35</td>
<td>189</td>
</tr>
<tr>
<td>1994</td>
<td>15041</td>
<td>13825</td>
<td>13722</td>
<td>576</td>
<td>32336</td>
<td>4076</td>
<td>2177</td>
</tr>
<tr>
<td>Employment (10,000 persons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>1258</td>
<td>1569</td>
<td>-</td>
<td>608</td>
<td>1734</td>
<td>236</td>
<td>104</td>
</tr>
<tr>
<td>1994</td>
<td>2961</td>
<td>2938</td>
<td>6119</td>
<td>261</td>
<td>6962</td>
<td>1622</td>
<td>726</td>
</tr>
<tr>
<td>Number of enterprises (10,000 unit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>32</td>
<td>121</td>
<td>-</td>
<td>50</td>
<td>79</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>1994</td>
<td>42</td>
<td>123</td>
<td>2330</td>
<td>25</td>
<td>699</td>
<td>83</td>
<td>369</td>
</tr>
</tbody>
</table>

Note: a. Individual and joint owned (i.e., private) enterprises. Data are not available for 1978.
b. Commerce and food service.
Sources: SSB 1995: 363-5.

TABLE 2.8 INDUSTRIAL STRUCTURE AND OWNERSHIP STRUCTURE
OF THE TVE SECTOR

<table>
<thead>
<tr>
<th>Year</th>
<th>Ownership</th>
<th></th>
<th>Industries</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Township</td>
<td>Village</td>
<td>Others a</td>
<td>Agriculture</td>
<td>Industry</td>
<td>Construction</td>
<td>Transpo-rtation</td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>57</td>
<td>43</td>
<td>-</td>
<td>7.3</td>
<td>78.1</td>
<td>7.1</td>
<td>3.8</td>
</tr>
<tr>
<td>1994</td>
<td>35</td>
<td>33</td>
<td>32</td>
<td>1.4</td>
<td>75.9</td>
<td>9.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>45</td>
<td>55</td>
<td>-</td>
<td>21.5</td>
<td>61.4</td>
<td>8.3</td>
<td>3.7</td>
</tr>
<tr>
<td>1994</td>
<td>25</td>
<td>24</td>
<td>51</td>
<td>2.2</td>
<td>57.9</td>
<td>13.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Enterprise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>21</td>
<td>79</td>
<td>-</td>
<td>32.5</td>
<td>52.1</td>
<td>3.1</td>
<td>4.3</td>
</tr>
<tr>
<td>1994</td>
<td>2</td>
<td>5</td>
<td>93</td>
<td>1.0</td>
<td>28.0</td>
<td>3.3</td>
<td>14.8</td>
</tr>
</tbody>
</table>

Note: same as Table 2.7.
Sources: Calculated from Table 2.7.

As shown in Table 2.8, the employment share of industrial TVEs, in total TVEs' employment, was smaller than their output share in total TVE output, implying a lower labor intensity than other TVEs; whereas other TVEs, particularly construction and service enterprises, showed an opposite situation. Therefore, the changes as shown in the Tables suggest a structural adjustment towards further comparative advantage of factors.
Table 2.8 only shows a partial picture for the actual structural change, since branch
structure and product structure within the industrial sector changed more significantly.
Table 2.9 indicates that, the shares of heavy industrial branches: machinery, building
materials and coal mining, dropped significantly; and that of light industrial branches:
textile, tailoring, food and beverage manufacturing increased largely. These changes
indicate an improvement in utilization of factors with comparative advantage, as well
as an market-oriented adjustment to meet the demand in the domestic and
international markets. Therefore, they suggest a better allocation of resource.

**TABLE 2.9 STRUCTURE CHANGE OF THE RURAL INDUSTRY**

<table>
<thead>
<tr>
<th>Year</th>
<th>1. Mach</th>
<th>2. b. mat</th>
<th>3. te&amp;tail</th>
<th>4. chemi</th>
<th>5. coal</th>
<th>6. food</th>
<th>7. other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 1978</td>
<td>33.5</td>
<td>19.5</td>
<td>9.5</td>
<td>8.3</td>
<td>5.7</td>
<td>5</td>
<td>18.5</td>
</tr>
<tr>
<td>1994</td>
<td>19.9</td>
<td>11.2</td>
<td>22.6</td>
<td>5.7</td>
<td>1.5</td>
<td>8.1</td>
<td>31.0</td>
</tr>
<tr>
<td>Employment 1978</td>
<td>28.3</td>
<td>26.7</td>
<td>8</td>
<td>5.7</td>
<td>6.1</td>
<td>4</td>
<td>21.2</td>
</tr>
<tr>
<td>1994</td>
<td>16.0</td>
<td>19.6</td>
<td>19.5</td>
<td>3.8</td>
<td>4.8</td>
<td>5.9</td>
<td>30.4</td>
</tr>
</tbody>
</table>

Note: * Township-owned enterprises only
1=machinery; 2=building materials (1994 data is for total nonmetal mineral products); 3=textile,
tailoring and leather; 4=chemicals; 5=coal mining; 6=food and beverage.

There were also significant structural changes in the lower level industrial branches
and products. For instance, the major TVE mechanical and electrical products in 1978
were agricultural machines, and their parts and components. However, in the 1990s,
they were replaced by consumer durable goods, like electric fans, refrigerators,
wkatches, and bicycles, etc. As an example, in 1992 the total output of electric fans
produced by TVEs was 32.1 million sets, accounting for 52% of the total output in

**Ownership structure**

Tables 2.7 and 2.8 also indicate the changing ownership pattern of the TVE sector.
In 1978, the collective enterprises (CBEs, or TVOEs later) were dominating and the
share of private enterprises was negligible. However, in 1994 the latter shared 51% of
the total TVE employment and 32% of the total output.
The higher share of TVOEs' output than employment suggests a higher labor productivity, as well as a higher capital intensity in TVOEs than private enterprises (also see Wang 1990). In 1992, the gross value of fixed assets per worker for TVOEs was 6744 yuan, whereas for private enterprises it was only 1926 yuan (calculated from BTVE 1993: 6, 498, 583). TVOEs also have a much larger firm size than other TVEs. In 1994, the average employment for township enterprises was 70 workers, and for village enterprises 24 workers, increased from 39 and 13, respectively, in 1978. There were 23 million private enterprises, but the average size was only 2.6 workers per firm, showing they were basically household industries. There were only a small number of large size private enterprises.

2.5 REGIONAL DISTRIBUTION OF RURAL INDUSTRY

Development of the rural industrial sector among regions has been unbalanced. Generally, in the East Coast areas of China, TVEs were developed earlier and achieved a higher performance. In the central areas, their achievement has been lower than in the east, but higher than in western China. Table 2.10 divides the thirty provinces into three regions, and shows the shares of the three regions in TVEs’ output and employment.

The three regions are similar in size of population. Rural labor in the three regions in 1994 was 163, 151 and 133 million respectively, although the area of the West is much larger than that of the East. In 1994, the share of these three regions in total TVE output was 68%, 23%, and 9%, respectively, indicating a better development performance in the East than the West. This pattern was not very different from that of 1980. Their share in total TVEs’ employment was 50%, 34% and 15%, respectively.

---

17 The thirty provinces include three large cities and four ethnic autonomous regions that operate administratively at the provincial level. The East includes: Liaoning, Beijing, Tianjin, Hebei, Shandong, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong and Hainan (which belonged to Guangdong province before 1988). The Central (and non-coastal east areas) includes: Jilin, Heilongjiang, Neimenggu (Inner Mongolia), Shanxi, Henan, Anhui, Jiangxi, Hubei, and Hunan. The West includes Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang, Sichuan, Yunnan, Xizang (Tibet), Guizhou, and Guangxi.
slightly converging from 1980.

<table>
<thead>
<tr>
<th></th>
<th>Regional share</th>
<th></th>
<th>Absorption rate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>64.8</td>
<td>65.8</td>
<td>68.2</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>24.8</td>
<td>23.8</td>
<td>23.1</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>10.4</td>
<td>10.3</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>56.9</td>
<td>50.6</td>
<td>50.4</td>
<td>14.1</td>
</tr>
<tr>
<td>Central</td>
<td>29.5</td>
<td>32.4</td>
<td>34.2</td>
<td>8.5</td>
</tr>
<tr>
<td>West</td>
<td>13.6</td>
<td>17.0</td>
<td>15.4</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Notes: Regional share is the share of each region in total output and employment respectively. Absorption ratio is the ratio of rural labor absorbed by the TVE sector to total rural labor. 1980 data are that of CBEs. Source: Calculated from provincial data from SSB and BTVE various years, see Appendix A1 at the end of the thesis.

In 1994, 37% of rural labor in the East was absorbed by the TVE sector, whereas absorption rate in the West was 14%, equal to the 1980 level of the former. This suggests a 14~15 year time lag between the two regions in the process of rural industrialization.

Calculation results from the provincial data further shows that the output growth rates of the rural industrial sector in all three regions were similar (Table 2.11). However, since the TVE sector in the West accounted a much smaller proportion of the rural economy than the East, growth of rural economy between the three regions can be said to be diverging.
TABLE 2.11 RURAL INPUT AND OUTPUT GROWTH RATE: 
BY SECTOR AND BY REGION

<table>
<thead>
<tr>
<th>Region</th>
<th>TVE sector</th>
<th></th>
<th></th>
<th></th>
<th>Agricultural sector</th>
<th></th>
<th></th>
<th></th>
<th>Rural Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output</td>
<td>Capital</td>
<td>Labor</td>
<td>Labour2</td>
<td>Output</td>
<td>Capital</td>
<td>Land</td>
<td>Labor</td>
<td></td>
</tr>
<tr>
<td>East</td>
<td>24.5</td>
<td>25.0</td>
<td>9.7</td>
<td>5.1</td>
<td>6.4</td>
<td>6.6</td>
<td>-0.6</td>
<td>0.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Central</td>
<td>23.4</td>
<td>18.8</td>
<td>12.1</td>
<td>3.6</td>
<td>5.7</td>
<td>5.9</td>
<td>-0.3</td>
<td>1.3</td>
<td>2.9</td>
</tr>
<tr>
<td>West</td>
<td>24.2</td>
<td>19.9</td>
<td>13.8</td>
<td>4.8</td>
<td>6.0</td>
<td>6.5</td>
<td>-0.3</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>24.2</td>
<td>22.8</td>
<td>11.1</td>
<td>4.6</td>
<td>6.1</td>
<td>6.3</td>
<td>-0.4</td>
<td>1.2</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Notes: Output is measured by GOV, deflated to 1980 constant price; capital stock is calculated from the fixed assets and circulating funds at the provincial level, both deflated to 1980 prices; labour2 is employment in TVOEes; land is cultivated land area; rural labor is total rural labor force.
Source: Calculated from provincial data in SSB and BTVE various years, see Appendix A1 and A2.

In the East region, the output growth rate was only slightly lower than the growth rate of capital stock, but much higher than the growth rate of labor. In the Central and West regions, output growth was higher than both capital and labor growth. This indicates a significant total factor productivity growth in all the three regions.

The interesting finding is that, the Central and West regions had lower growth rates of capital stock and higher growth rates of labor than the East, indicating a more labor intensive industrialization pattern. The higher level of capital intensity in the East may be related to the behavior of TVOEes (collective firms), which has been the main component of the TVE sector in the East region, but not in the Central and West regions. In 1994, TVOE shared 60% of TVE employment in the East, but only 37–39% in the other two regions (Calculated from SSB 1995: 364). The behavior of the TVOEes, and its effect on factor allocation, will be analyzed in Chapter 6.

Despite the fact that rural investment in the East was more intensive than the other regions, the labor intensive rural industrial development pattern in the Central and the West regions shows a high potential of further development in the future.

Surveys found that the ownership structure was very different, not only among the East, Central and West regions, but also among provinces and counties within a region. The following are shares of TVOEes in the total TVE industrial output for four different counties in four provinces in 1985 (Svejnar and Woo 1990: 67-69).

Wuxi County (Jiangsu Province), 95.7%;
Nanhai (Guangdong Province), 69.6%;  
Jieshou (Anhui Province), 48.4%;  
Shangrao (Jiangxi Province), 66.1%.  
The rests of the shares are mainly produced by private (i.e., individual owned or jointly owned) enterprises.

Both Wuxi and Nanhai are more industrialized counties in the Eastern area. There are 26 percentage points differences in TVOE shares between them. Both Jieshou and Shangrao are less industrialized counties in the Central region. There are also 18 percentage point differences in their TVOE shares. Wuxi achieved a high performance with a development pattern dominated by TVOEs, whereas Jieshou, with a private dominating model, was also significantly more successful than Shangrao.

The different style of TVEs’ development reflects different economic situations, as well as different local government policies. In many regions, TVOEs do provided a fast way to gather rural savings to invest in industrial projects, whereas this might not have been easy so for private enterprises owned by individual farmers. The financing mechanism appears to have been an important reason for the continued rapid growth, and relatively large firm size, of TVOEs in the Eastern areas.

During the period of Commune system, agricultural surplus was mainly held collectively and could be used directly for investment in rural industries. Although this mechanism no longer exists in the post-commune period, collectives still have some advantages over individuals in terms of investment financing such as the followings:

1. Township or village authorities can use their creditworthiness to borrow money from individual farmers or TVOE workers (this is called “bring your money to join the factory”), or in encouraging workers to join the TVOEs’ share holdings. Their capacity for investment financing, drawn from agricultural savings, is larger than for individual farmers.

2. Since the liability of a collective is more secured than individual farmers, the former can borrow money from banks more easily for industrial investment. By the
end of 1994, the total balance of bank loans of the nation-wide TVOEs accounted for 38% of their total assets, whereas bank loans of privately owned TVEs only accounted for 2% of their assets (calculated from BTVE 1993: 1, 499, 583). There may well be some discrimination against private firms by the state banks, however, the security problem is clearly one important cause for the difference.

3. In those areas where TVOEs have been more or less developed, a high proportion of the TVE profits were used in reinvestment in rural industries. However, private industries appeared to have a lower saving and investment rate than TVOE in some areas.\(^{18}\)

The creditworthiness or security of liability of a township or a village, also depends on its previous performance in industrial development. A better previous development of TVOE forms an advantage for further development of TVOE in the same township or village. This is probably the major reason for the Eastern region to keep its collective-dominated industrialization pattern even in the reform period. Collective rural industries were more successful in this than in other regions in the pre-reform period, as they already gained their credit from banks. The relations of creditability between township or village communities and the banks does not exist in many central and western areas. Therefore, starting from a lower level of development, township and village communities in the latter areas do not have much advantage over individual firms.

### 2.6 SUMMARY

China’s rural non-agricultural sector, or TVE sector, has its origins in the pre-reform period, when the People’s Communes have developed their own industry as a supplement to the centrally controlled state industrial sector and the collective agricultural sector.

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\(^{18}\) This is partially resulted from the policy uncertainty of the private owners’ expectation. Survey in 1980s found that private owners scared at possible policy changes towards re-collectivization, therefore spent more money in their current consumption and donations in community welfare other than reinvestment in their firms (Wang 1986).
Development of rural industries was restricted by the institutional framework and central policies in the pre-reform period. This has been gradually changed in the late 1970s and 1980s. These changes included agricultural reform (i.e., introduction of Household Responsibility System and abolition of the People’s Commune System), industrial reform (relaxation of central planning control to inputs and outputs), and changes in rural economic policies (relaxing restrictions on labor allocation between rural sectors, removing discriminative policies against private business, etc.)

Associated with these institutional reforms, the TVE sector has achieved a dramatic growth rate since 1978. After 16 years of rapid growth since reform, it employed 120 million workers in 1994, accounted for 27% of total rural labor. Output of rural industry exceeded that of SOEs, and it became the largest component of China’s industrial sector.

The TVE sector is a market-oriented labor intensive sector with a much lower capital intensity than the state sector. Its capital-labor ratio was only 1/7 of the industrial SOEs. TVOEs (collectively owned TVEs) are more capital intensive than private enterprises, but still far less capital intensive than SOEs. During the reform period, the structure of the TVE sector was further adjusted towards relatively more labor intensive industries\(^\text{19}\).

Since TVEs originated from the Commune System, a large percentage of it is still collective owned, and this does not appear to be completely changed in the near future, partly because TVOEs appeared to have some advantages, compared with private firms, in investment financing and organizing supply of technology and human capital. However, household enterprises (and a much smaller number of larger private enterprises) developed more rapidly in the reform period, particularly in the Central and Western areas. At the national level, they accounted for 1/3 of TVE output and 1/2 of TVE employment by 1994.

Rural industrialization in East China has been far ahead of the central and western

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\(^{19}\) This does not mean a decreasing capital intensity, due to the reason of capital-embodied technological progress.
areas. By 1994, the East shared 2/3 of total TVE output and ½ of total TVE employment. By the same year, 37% of its rural labor has been transferred from the agricultural sector and employed by the TVE sector, whereas, in the Western region, only 14% rural labor was transferred by the TVE sector.

Although the level of achievement, in terms of rural industrialization, was quite different among the three regions, there was no major divergence in the TVE growth rate. Interestingly, TVEs in the Central and the Western regions were developed in a less capital-intensive pattern, and also in a less collective based pattern, than in the East. The process of rural industrialization in the Western region is about 14-15 years behind the East, and it appears there is still great potential for future development of rural industries in the Central and Western regions, following a labor intensive growth path.
CHAPTER 3. LITERATURE REVIEW:
ECONOMIC GROWTH AND INDUSTRIALIZATION

3.1 INTRODUCTION

This chapter reviews the literature on East Asia and China’s economic growth, and theories of economic growth and industrialization, with attention to the features of China’s rural industrial growth, in order to establish a theoretical framework for the empirical study of China’s rural industrial growth in this thesis.

Section 3.2 reviews the extensive literature on rapid economic growth in East Asian economies and China. Paul Krugman (1994) argues that the rapid growth in East Asia is only a short run phenomenon, resulting from heavy input growth without productivity change. However, some other authors suggest significant total factor productivity growth in many of the East Asian economies, as well as significant contribution of the human capital development to economic growth (e.g., World Bank 1993, Targetti and Foti 1997), although TFP growth is not so remarkable as output and export growth in these economies (Young 1995). Young also notes a large intersector transfer of labor into manufacturing during the rapid growing period in most East Asian economies. This feature is shared by China.

Besides the contribution of rapid input growth, Garnaut (1989) stresses the importance of geographic proximity of these East Asian economies, their shared cultural traditions, such as the high value placed on formal education and the capacity for social cohesion, and some common characteristics of their economic structure, such as equitable income distribution and high saving rate. He points out that simple versions of Adam Smith theory could not explain the new economic growth phenomenon in these economies.

Other important determinants of higher growth rates that are frequently mentioned in the literature are export orientation, technological transfer (through foreign direct investment in some of these economies) and macroeconomic stability.
Many authors point out that fundamental government policy for macro stability, for high investment in human capital, for stabilizing the financial system, for limited price distortion, and, for openness to international market and technology, are essential for rapid growth. They also suggest that, where there are weak markets, technological spillovers, increasing returns to scale and coordination failure, some carefully selected government intervention, such as certain industrial policies, can make a positive contribution to economic growth (World Bank 1993, 1997, Stiglitz 1996, Terry 1996, etc.).

A number of researchers have found positive productivity growth in China during the reform period, which significantly increased from the pre-reform period. Increasing TFP growth mainly took place in the non-state sector (see Chen et al. 1988, Jefferson et al. 1992, Woo 1994). The faster TFP growth has been explained by either FDI and spillover of foreign technology, export orientation, human capital accumulation, (e.g., Chen, et al. 1995, Martellaro 1996, Mody and Wang 1997), or increasing firms’ efficiency and innovation, due to changing incentive mechanism, particularly in the agricultural and non-state industrial sectors (e.g., McMillan et al. 1989, Lin 1990, Jefferson et al. 1992, Drysdale, Kalirajan and Zhao 1995).

Other studies attribute a considerable part of rapid growth and productivity changes to factor reallocation, either resulting from changing development strategy (Lin et al. 1996) or from rural-urban migration (Woo 1996) and labor transfer between agricultural and rural industrial sectors (Islam and Jin 1994, Handa 1992, Cao and Tisdell 1992). Statistical data also suggest that labor reallocation is an important phenomenon in growth which is worth further investigation.

It appears that transfer of foreign technology can be an important source of economic growth in the 1990s, but institutional and policy changes in the economic reform period played a major role in rapid growth for at least the whole of the 1980s, either through improvement in factor allocation, or through increases in firms’ efficiency. This is particularly important for rural industrial growth.
In Section 3.3, major contribution of neoclassical growth theory and the endogenous growth theory are briefly summarized. Neoclassical growth theory describes a general relationship between economic growth and input growth. As a fundamental model of neoclassical growth theory, the Solow (1956) and Swan (1956) model suggests that, in the long run, the steady-state growth rate of an economy should be equal to the growth rate of labor, in the absence of technical progress. Any other exogenous change, including change in saving rate, only has a “level effect”. This means it changes the income level without varying the economic growth rate in the long run. This model explains the economic growth rate in the “long run growth path” higher than the labor growth rate as the result of exogenous technical progress.

The endogenous growth theory further introduces technical progress or accumulated human capital as endogenous variables into growth models (e.g., Lucas 1988, Romer 1986, 90). These models suggest that, in the long run, the steady-state growth rate of an economy should be higher than the labor growth rate, due to the contribution of endogenous technical changes or human capital accumulation. They also imply that economic growth can be enhanced by governments via encouraging education or investing in public goods. Another difference between the neoclassical growth model and the new growth model is that, according to the former, output per capita in different countries, rich and poor, tends to converge in the long run; whereas, according to the latter, divergence will exist, since rich countries do not necessarily grow slower.

These theories provided general methodology for study on economic growth. Although, either the neoclassical or endogenous growth theories are basically concerned with the steady-state growth in the long run, they have paid little attention to transitional dynamics like the process of industrialization in developing countries. Growth of an economy in transition often relates to structural change and factor reallocation, which results either from institutional changes or changes in economic behavior. Short run adjustment processes towards the long run growth path, resulting from exogenous shocks, are also not the major concern. To study rural industrial
growth in China, the transitional dynamics appear to be more important than the steady-state growth.

Interestingly, since the Solow model shows that an economy converges to the long run growth path at a certain level of per capita income, it implies a fast growth of poor countries to catch up with the rich. Although there are still many debates on “convergence” or “divergence”, and the real situation is different from country to country, the East Asian growth experience demonstrates a real “catch up” process.

Section 3.4 examines the theories of dynamic growth. In the major part of the growth literature, dynamic adjustment towards the equilibrium growth rate, from an initial disequilibrium situation, or from a shock caused by policy changes or changing economic behavior, is just a temporary process or a “level effect”, and the time it lasts is not an important issue. However, in experiments using their dynamic models, Sato (1963), Sato (1966), and King and Rebelo (1993) found that a “short run” adjustment could possibly last for more than a hundred years. These studies highlight the importance of the dynamic adjustment process in economic growth. In fact, as mentioned by Lucas (1988), just a twenty years “short run” rapid growth could totally change the situation of an economy. Indeed, with an economic growth rate of around 10 percent, China’s output has more than quadrupled in less than 20 years (1978-95), and its income per capita has more than trebled.

Additional findings are obtained by Mulligan and Sala-i-Martin (1993), who show a relationship between economic growth and human capital accumulation in transitional dynamics. An implication that could be drawn from this study is the importance of education for the fast growth of the East Asian economies.

In Section 3.5, theories of industrialization are examined. Harrod’s growth model (1948) is first reviewed, since it suggests a relationship between saving rate and economic growth which is more relevant to the transitional dynamics in the industrialization process rather than the “steady state” growth.

Rostow (1956, 1960) describes the “take-off” stage of economic growth as a transitional period from a traditional economy to a modern one, with a significant
increase in the growth rate. This directly results from changing economic behavior, i.e., behavior of saving and investing in physical capital, education, research and technical innovation, etc., and indirectly results from changes in the institutional framework of the society, since these economic behaviors are functions of the institutional framework. Therefore, he regards the economic take-off as a result of institutional changes. Nevertheless, the relationship between institutional changes and economic growth is not clearly defined.

The "dual-economy" model (Lewis 1954, Ranis and Fei 1961) considers the situation in developing countries with an unlimited supply of labor, where the marginal product of labor (MPL) in the traditional sector (e.g., agriculture) is so low that it is close, or equal, to zero. Agricultural labor earnings can not be determined by their MPL, but possibly by their average products or "institutional wages" higher than MPL. Thus, the MPL differential between the industrial and agricultural sector can not lead to reallocation of labor before the industrial MPL exceeds the "institutional wage" in the agricultural sector. Growth depends on saving and investment in the industrial sector, which increases capital stock and therefore increases the MPL. This leads to a continued transfer of agricultural labor to industry, until the surplus labor in agriculture (in the sense that their earning is higher than their MPL) is fully absorbed. MPLs will converge. Due to increases in agricultural MPL, agricultural wages will finally be determined by the MPL, and the agricultural sector will be capitalized. The industrialization process is then complete.

This model provides a good explanation for the transfer of rural labor and the process of industrialization. Nevertheless, considering the situation in China, other effects on rural industrial growth, such as institutional change, may also be important.

Harris and Todaro (1970) (H-T) provide another model to explain rural-urban migration and wage determination. Differing from Lewis, they assume that the marginal product of labor in the rural sector is always positive. In their model, a rural-urban wage differential exists because of government regulation on the urban minimum wage, which reduces employment capacity of the urban sector, and causes
urban unemployment. The rural-urban migration depends on an expected urban wage rate that is lower than the actual urban wage, due to the existence of urban unemployment. Given that the expected urban wage exceeds rural earnings, rural-urban migration can continue despite urban unemployment. This model explains the rural-urban wage differential as caused by government intervention. Empirically, there are some major differences between the actual rural situation in China that is currently under consideration and the H-T model.

3.2 LITERATURE ON ECONOMIC GROWTH IN EASTASIA AND CHINA

East Asian Economic Growth

The rapid growth of the East Asian economies has been a most remarkable economic phenomenon in the second half of the 20th century. First Japan, had a high growth rate in the 1950s and 60s; then Hong Kong, Taiwan, Singapore and Korea grew rapidly mainly in the 60-80s. In the 1980s, China, with 1/5 of the world population, joined with this fastest growing country group\(^1\). A few Southeast Asian countries, e.g., Thailand, Malaysia and Indonesia, also joined this group earlier or later. The economic growth rate in these countries in their fastest growing period of 2-3 decades, was within the range of 7-10 percent, far exceeding the world average of 4-5 per cent in the 1960-70s and 2-3 in the 80-90s (data see the World Bank 1980: 110-13; 1997: 214-35).

This has drawn great attention from world economists.

Garnaut (1989) analyzes geographic and cultural reasons for the rapid growth of six Northeast Asian economies: Japan, Korea, Taiwan, Hong Kong, Singapore and mainland China. He stresses the importance of the geographic proximity of these economies in their rapid growth, since the high rate of growth can be transmitted between economies at a low cost through trade, investment, exchange of information, technology and ambitions.

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\(^1\) China has reached 10.2% of the GDP growth rate in 1980-90 and 12.8% in 1990-95, was the fastest growing economy in these periods (The World Bank 1997: 234).
He also highlights the role of their shared cultural traditions in growth, not as often described as “Confucianism”, but in the high value placed on formal education and the capacity for social cohesion. The last point includes a preparedness to accept, or at least to restrain active opposition to, changes which have been identified as necessary for a wide social purpose, self-discipline, and the capacity to accept inconvenient change that is rationalized as having a larger and longer-term purpose. Indeed, without this social cohesion, or tolerance, it is difficult to imagine the continuation of China’s economic reform and rapid growth, which has largely changed the pattern of income distribution between different interest groups.

Other important elements for the growth of the Northeast Asian economies, mentioned by Garnaut, are some characteristics of their economic structure. These include equitable income distribution, high saving and investment rate, an acceptance of rapid change in industrial structure, and emphasis on exporting labor-intensive manufactured goods.

In a World Bank report, “The East Asian Miracle: Economic Growth and Public Policy” (1993), the authors stress the reasons for the high economic performance of East Asian economies is “largely due to superior accumulation of physical and human capital”, this was found accounting for 2/3 of the growth rate on average.

In a cross-country regression with 113 countries, the World Bank authors found both primary and secondary school enrollment rates and the investment rate (as a percentage of GDP) significantly contributed to real per capita income growth during 1960-85. Other influential variables are relative GDP per capita to US (meaning poor countries grew significantly faster than rich) and regional dummy for the high-performing Asian economies (HPAEs).

The above authors also found significantly higher TFP growth (calculated from the residuals) in Taiwan, Hong Kong, Japan, Korea and Thailand (3-4 percent) in 1960-89. In Singapore, Indonesia and Malaysia it was around 1.5 percent, close to high-income countries, but higher than other developing countries. Netting out allocative efficiency (i.e., use the higher output elasticities with respect to capital and human
capital that obtained from the high-income countries, which is assumed to have a higher allocative efficiency, to estimate technical efficiency change for the HPAEs), they found that TFP growth in Hong Kong, Japan, Taiwan, Thailand and Korea was still higher than, or about equal to, high-income countries. But Singapore, Malaysia and Indonesia were lower than the high-income countries by 1-3 percent, suggesting no technological progress in these economies (p.57-69).

The finding of TFP growth in East Asian economies is also supported by Targetti and Foti (1997) and some other authors. Targetti and Foti found significant TFP growth in both the OECD country group and the East Asia group, but not in the Latin American group. Young (1995) investigated the extraordinary postwar growth of Hong Kong, Singapore, South Korea, and Taiwan. He reported that TFP growth in these economies could be closely approximated by the historical performance of many of the OECD and Latin American economies. Although, compared with the dramatic output growth, the TFP growth in these economies is not unprecedented.

Another finding by Young (1995) is that in most cases there has been a large intersectoral transfer of labor into manufacturing, which has helped fuel growth in that sector. This is identical to what is happening in China, where a very rapid growth in the rural industrial sector, associated with a dramatic transfer of rural labor into the industrial sector, has occurred.

In a controvesial article, Krugman (1994) totally rejected the “East Asian miracle” statement. He analogized the rapid growth of the Asian economies (Japan, Singapore and, to some extent, other East Asian economies) with the earlier rapid growth of the USSR in the 1950s, and argued that they were both input-driven growth, caused only by high saving and intensive investment without increasing total factor productivity. Therefore he believed the rapid growth in those Asian economies is not sustainable and would soon diminish to a much lower rate.

Krugman’s argument is not fully supported by empirical studies, except for some evidence from Singapore and Japan. He may be correct in the sense that, any country transiting from a traditional economy to a modern economy, a fast growing period is
only a “short-run” effect that will finally diminish to a steady state growth path (see previous sections of this chapter for different theories). However, for the catching up with richer countries to occur, how high the growth rate that can be achieved, and how long the fast growing period can last, are the key questions which are equally important as sources of growth (i.e., input-driven growth or productivity changes). In addition, since the industrialization process is often associated with institutional change and structural adjustment, it may also change the mechanism of technical progress and human capital accumulation, earlier or later, and therefore change the rate of productivity growth in the future. Therefore, even if the current productivity growth rate is low, it is not fully evident that catching up is impossible.

A number of explanations have been provided for the rapid East Asian growth. Except for the “input driven growth” hypothesis, many studies attribute the rapid growth to education and human capital accumulation, macroeconomic stability, export orientation, and also historical, cultural and geographic characteristics (see, e.g., Sarel 1995). The East Asian growth can also be related to either the theory of convergence, economic take-off, or dynamic growth. All of these theories describe a fast growing period for an economy in a certain stage of development. What is most important is in what stage, under what conditions, and by what particular “catalysts” (see Stiglitz 1996), can the fast growth be induced.

The role of government in economic growth is another controversial issue. The WB authors (1993) classify government policies in East Asia into two broad groups: a), fundamental policies, i.e., those that encourage macroeconomic stability, high investment in human capital, stable and secure financial systems, limited price distortions, and openness to foreign technology, and b), selective interventions, e.g., mild financial repression (keeping low but positive interest rates), directed credit, selective industrial promotion, and trade policies pushing nontraditional exports. They highly evaluate the “fundamental policies”, and mention that government interventions in these countries did not significantly inhibit growth, or did result in
higher growth; although, other developing economies attempting similar interventions have often met with failure.

The above study drew debates along two main lines. Some complained that the report gives too much credit to government intervention in East Asia's success, whereas others criticized that it did not sufficiently weight the influence of the "development state" in East Asia (see, e.g., Terry 1996, Hayami 1996, Cassen and Lall 1996). Although, most of the authors agreed that, explicitly or implicitly, the rapid economic growth in East Asia is a miracle. Following this line, Stiglitz (1996) highlighted the following characteristics of government action in East Asia:

a) Complementing markets rather than replacing them;

b) Adopting industrial policies when there are weak markets or no market, technological spillovers, increasing returns to scale, and coordination failure;

c) Combining competition and cooperation;

d) Growth with equality; and

e) Export-oriented growth.

In the World Development Report 1997, the World Bank further extended its arguments. On one hand, it argued that privatizing and liberalizing markets in overextended states is essential. "The recent economic performance of such countries as China and Poland provides dramatic evidence of the benefits of shrinking the state in former centrally planned economies." On the other hand, it argued that: "Where externalities, lack of competition, or other market imperfections drive a wedge between private and social goals, most people accept that states maybe able to enhance welfare through regulation. ... In underdeveloped markets with few participants, learning can be extremely expensive. ... Governments in such economies can act as brokers of information and facilitators of mutual learning and collaboration, and thereby play a market-enhancing role in support of industrial development." (World Bank 1997: 61, 72)

When considering the great success of rural industrialization in China's East Coast areas, where the market mechanism undoubtedly played the crucial role but local
governments also played an important role in the development of the Township and Village Enterprise sector, the above statements are particularly notable.²

_Economic Growth in China_

There have been several studies on China’s economic growth and productivity changes during the period of economic reform. Although there are arguments on the reliability of data, there is little doubt about the high rate of growth of the Chinese economy during the period of economic reform.

Under the subtitle of “The Chinese Miracle”, the World Bank authors (1993) have highly evaluated China’s growth performance: the high economic growth rates, substantial changes in people’s living conditions, and discussed the policy changes that improved agriculture and export industry. They also highlighted the rapid productivity growth in the reform period.

A number of studies identified the difference in the growth pattern during the period of economic reform from the pre-reform period. As an important explanatory variable for economic growth, saving and investment rates were high in both the pre-reform and reform periods. However, most researchers rarely found any total factor productivity growth in the pre-reform period, but positive and significant productivity growth in the reform period (see, e.g., Chen et al. 1988, Jefferson 1989, Chow 1993). Jefferson et al. (1992) reported positive TFP growth in both the state and non-state sectors (the latter including urban and rural collective enterprises, but excluding private enterprises due to data shortage) in the reform period, but significantly faster in the non-state sector than in the state sector. Woo et al. (1994) found no TFP growth in the state sector, but significant TFP growth in the non-state sector. Except for some much earlier studies (e.g., World Bank 1985 and Rawski 1986), most of the authors pointed out that, at the aggregated level, both economic growth and TFP growth were significantly accelerated from the pre-reform period.

² Nevertheless, the model of Township and Village Owned Enterprise under the guidance of local governments or community authorities has also showed shortcomings. An important one was its employment behaviour. This issue is examined in Chapter 6 of this thesis.
There are various explanations for the rapid economic growth and productivity changes in the reform period. Some see the rapid growth as resulting (fully or partially) from foreign (and overseas Chinese) direct investment, absorption of western technology, and (or) the increases in export (e.g., Chen, Chang and Zhang 1995, Martellaro 1996, Mody and Wang 1997). These suggestions could explain a large part of economic growth in the 1990s, although they appear not to be the major reasons for the high growth rate during the whole of the 1980s. It can be argued that either FDI or export played minor roles in most of the 1980s. FDI (including investment from Hong Kong, Macao and Taiwan) plus foreign loans for investment in fixed assets, accounted for only 3.8% of the Total Investment in Fixed Assets in 1981, 4.8% in 1987, 7.3% in 1993, increased to 11.5% in 1995. Export value accounted for 6.0% of total GDP in 1980, 9.0% in 1985, 16.1% in 1990 and increased to 21.4% in 1995 (SSB 1988, 95, 96). The major increases in foreign trade took place after 1987, when a new trade policy was adopted, and the most rapid increases in FDI took place in the 1990s.

In addition to physical capital, Mody and Wang (1997) also suggest that regional stock of human capital and infrastructure made a contribution to economic growth in the coastal areas of China.

Together with Krugman’s input-driven growth hypothesis for other East Asian economies, he argued that, although China shows a dramatic improvement in efficiency since 1978, it seems more like a recovery from the disaster of the Cultural Revolution. He suggests that if growth measured for a longer period, say from the 1960s, then the picture would look more like the East Asian economies, “only modest growth in efficiency, with most growth driven by inputs”. Considering the market-oriented changes, he suggests only part of the efficiency increases in China possibly represent a “sustainable trend”, whereas the rest represent a one-time recovery.

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3 The later figures appear to be undervalued if compared with the total foreign capital statistics measured in US $ (SSB 1996: 597). Which source of the figures is more reliable is still a question.
Something that might have been ignored by Krugman is that China experienced 10 years of Cultural Revolution with 2 years of negative growth in 1967-68, whereas the rapid growth after the Cultural Revolution (i.e., since the economic reform) has continued for nearly 20 years (until 1997), at an annual average rate of 10%. This can be hardly called a recovery.

Instead of the input-driven growth hypothesis that attributes the rapid growth mainly to FDI or domestic saving, other authors explain the faster growth and TFP change as resulting from increasing firms' efficiency and innovation, mainly in the non-state industrial sector, as a result of changing incentive mechanism in the market-oriented reform period. A significant productivity growth in the agricultural sector after 1978 was found, which could mainly be attributed to changes in the incentive scheme (McMillan, Whalley and Zhu 1989, Lin 1990, Garnaut and Ma 1996). A strong technical innovation trend in the non-state industrial sector was also suggested (Jefferson, Rawski and Zheng 1992). Using a Production Frontier method, Drysdale, Kalirajan and Zhao (1995) found that economic reform induced a significant increase in firms' technical efficiency.

Lin, Cai and Li (1996) and Dong (1988) indicated another source of productivity growth. They suggested that a large part of the rapid growth and productivity change could be explained by improvement in factor reallocation, resulting from changing development strategy, i.e., from the capital intensive and import substitution strategy in the pre-reform period to the market oriented labor intensive, and export oriented, strategy.

Woo (1996), Islam and Jin (1994), Handa (1992), Cao and Tisdell (1992) also found evidence for factor reallocation to economic growth, particularly resulting from rural industrialization and rural-urban migration. Woo (1996) calculated the contribution of labor reallocation in China's TFP growth, as a result of illegal migration from the agricultural to the non-agricultural sector. He estimated that this effect increased GDP growth rate by 0.9-1.3 percentage points, and accounted for 37-54 percent of TFP growth in 1979-93.
Islam and Jin (1994) see rural industrialization as an engine of prosperity in post-reform rural China. They also noted that the institutional changes in industrial recruitment and wage determination made a contribution to rural industrialization.

Cao and Tisdell (1992) estimated the size and the transfer of the surplus agricultural labor, and focused on the effect of the “double-track” economic system.

Handa (1992) argued that: “Growth occurs not only by increasing the amount of each input, but also by shifting resources from the low productivity (traditional) sector to the higher productivity modern sector”. He uses a two sector dual-economy model, which allows marginal factor productivities to differ in each sector, to analyze the contribution of factor redistribution between sectors to economic growth. Under certain assumptions, his empirical result suggests a possibility of high contribution of factor reallocation to economic growth, as shifting resources from the traditional sector to the modern sector. However, there appears to be some weaknesses in the modeling, which raise doubts about the reliability of the result.4

There have also been many studies on China’s rural industrial sector (i.e., Township and Village Enterprises sector), its performance, productivity, institutional arrangements, and so on. These can be seen in, e.g., The Economics Institute (ed.) (1987), Byrd and Lin (ed.) (1990), Watanabi (ed.) (1991) and Hai W. (ed.) (1997). Many studies see TVEs as a great success of rural development and attribute a large part of China’s rapid economic growth to the development of TVEs.

When reviewing the literature on rapid economic growth in China, and other East Asian economies, many common features can be found among China and East Asian economies. Nevertheless, China also has distinctive features from the other economies. One important difference is that, China was previously a centrally planed.

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4 Although Handa’s study found marginal value product of factors are different between sectors, it appears that the model he used can not identify the actual factor reallocation between sectors. His result for MPL gap only shows a possibility of factor reallocation contributing to growth. His explanation (8.6 percent out of 9.0 of the growth rate was resulted from the marginal productivity difference) appears to have confused the possibility with the reality. There are also some assumptions made in this study that are questionable. In spite of these weaknesses, Handa’s paper made an important suggestion for the source of economic growth in China. A similar hypothesis is used in this thesis, although the author used a different method to Handa.
economy, its rapid growth is also a process growing out of plan (see Garnaut 1989). Therefore, institutional changes appear to have played a more important role in China’s rapid economic growth.

3.3 LONG-RUN GROWTH MODELS

Neoclassical growth models

These models provide a basic analytical framework to explain the process of economic growth, although, it emphasizes only on long run economic growth.

Solow (1956) and Swan (1956) models indicate that, given constant returns to scale technology, without technological progress or human capital accumulation, the long run economic growth rate in the steady state will be equal to the exogenously determined growth rate of labor. The production function in the Solow model is:

\[ Y = F(K,L), \]

where \( Y, K, \) and \( L \) refer to output, capital and labor respectively.

Assume that saving rate \( s \) is a constant, saving is equal to investment, and labor grows at an exogenous rate \( n \), change of capital stock \( K \) can be expressed as

\[ \dot{K} = sY = sF(K,L) = sF(K,L_0e^n) \]

Let \( k \) denotes capital-labor ratio, \( k=K/L \). Taking logarithm and differentiating the equation with respect to time, we can get:

\[ \frac{\dot{k}}{k} = \frac{\dot{K}}{K} - n \]

Substituting (2) in (3), we get

\[ \frac{\dot{k}}{k} = \frac{sy}{k} - n = \frac{sf(k)}{k} - n \]

where \( y = Y/L \). In steady state, capital-labor ratio remains constant and \( \dot{k} = 0 \), therefore

\[ \frac{sf(k^*)}{k^*} = n \]

This equation defines the equilibrium capital-labor ratio \( k^* \).

Since, according to the assumptions, \( k^* \), \( s \) and \( n \) are all constant, \( f(k^*) = y^* \) should also be a constant. Thus, in steady state, \( \dot{y} / y = 0 \).

Since \( \dot{y} / y = \dot{Y} / Y - n \), which can be derived from the definition of \( y \), then
\[
\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} = n
\]

This equation says that both growth rates of output and capital remain the same as that of labor in steady state. According to Equation (4), if initially \( sf(k)/k > n \), \( \dot{k}/k \) must be positive, \( k \) would increase faster than \( sf(k) \) does, then \( sf(k)/k \) decreases. If \( sf(k)/k < n \), \( \dot{k}/k \) must be negative, \( k \) would decrease faster than \( sf(k) \) does, then \( sf(k)/k \) increase. Therefore the economy will converge to the stable capital-labor ratio \( k^* \), where \( y = y^* \).

Similarly, if the economy is initially in the steady state, i.e. \( \dot{k}/k = 0 \), but an exogenous shock leads to an increase in saving rate \( s \), then we must have \( sf(k)/k > n \) and \( \dot{k}/k > 0 \); thus the original \( k \) will no longer be the balanced one, it will increase towards the new \( k^* \), where the value of \( sf(k)/k \) decreases to \( n \).

In this model, the economic growth rate higher than the labor growth rate is considered as a short run dynamic when the capital-labor ratio \( k \) is lower than the equilibrium capital-labor ratio \( k^* \); or equivalently, it can be thought as an intermediate transition from one long run growth path to another (thus, from the original equilibrium \( k^* \) to a new one), caused by an increase in saving rate. Once the economy achieves a new long run growth path, the fast growth will finish. Therefore, the Solow model states that a change in saving rate has no long run effect on the rate of economic growth. The saving effect is called “level effect” since it can only change the level of output without altering the economic growth rate in the long run.

With technological progress, the Solow model regards long run economic growth rate higher than labor growth rate as a result of an exogenous increase in productivity. A typical example is to include an increasing scale factor \( A(t) \) in a Cobb-Douglas production function (Solow 1956):

\[
Y = A(t)K^\alpha L^\beta
\]

\( A \) varies over time at a constant rate \( g \) (given \( A = e^{gt} \)), representing a technological progress over time. So the steady state growth rate of output per capita will be equal to
and the growth rate of the economy, \( \dot{Y} / Y \), will be equal to \( n + g \) (see Sala-i-Martin 1990a)\(^5\).

As described above, the Solow model emphasizes on the long run economic growth with little consideration of growth in transitional dynamics, yet it indicates the possibility of a faster than the balanced growth rate in the short run, resulting from changes in the level of technology, the saving rate, the rate of population growth, or the depreciation rate (see also Barro and Sala-i-Martin 1995).

Uzawa (1962) developed a two-sector growth model based on the neoclassical tradition. It is constituted by an investment-goods sector and a consumer-goods sector, both have constant returns to scale technology with diminishing returns to factor. By assuming capital and labor is allocated competitively among the two sectors, and always fully employed, and that prices of goods are determined so as to satisfy the demand conditions, a balanced capital-labor ratio, which remains the economy in a balanced growth path, is derived. When the consumer-goods sector is more capital intensive than the investment-goods sector, the economy is always stable.

In this model, factors are perfectly mobile between sectors, and the wage rate and capital rental rate in the two sectors are determined by the marginal product of labor and capital, respectively. Therefore, the marginal product of each factor in the two sectors always remains the same.

The above assumptions lead to the result that growth of the two sectors is in a balanced pattern. The Uzawa model provides a useful framework for analyzing economic growth of a multi-sector economy, yet for a developing country with an imperfect factor market, the presumption on factor mobility may need modification.

*Endogenous growth theory*

According to the newly developed endogenous growth theory, the economic growth rate is determined by endogenous variables like human capital accumulation. The major contribution of this theory is its endogenous explanation for economic

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\(^5\) There are some differences between Sala-i-Martin and Solow, but this is not important for the current analysis.
growth being faster than labor growth in the long run, which was explained by the 
neoclassical growth theory by exogenous technical changes.

The Lucas (1988) model assumes that the production function is constant returns to 
physical capital and human capital, whereas human capital is treated as effective 
labor, which can be enhanced by education (therefore growth of effective labor can be 
faster than growth of physical labor). Thus, in the long run, the economic growth rate 
can be higher than the growth of the physical labor force.

The production function in the Lucas model is:

\[ Y = AK^\beta (uhL)^{1-\beta} \quad (0<\beta<1) \tag{1} \]

where \( K \) is physical capital stock; \( u \) is the fraction of non-leisure time individuals 
spend working; \( h \) is a measure of average quality of the workers; \( uhL \) is human 
capital; and \( A \) is a constant technology level.

This production function is constant returns to physical and human capital. 
However, if the labor quality \( h \) is treated as an independent factor, the production 
function becomes increasing returns to scale; since, if \( K, L, \) and \( h \) are all increased by 
\( \lambda \) times, output \( Y \) increases by \( \lambda^{2-\beta} \geq \lambda \).

As an extension, human capital is further assumed to have a spill over effect on 
economic growth. The production function can be extended as follows:

\[ Y = AK^\beta (uhL)^{1-\beta} h^\psi \quad (\psi>0) \tag{1'} \]

where \( h^\psi \) represents a positive externality from average human capital. With this 
externality (it means an increase in one worker's human capital does not only increase 
the productivity of himself, but also of others), this function exhibits a characteristic 
of increasing returns to physical and human capital. By assuming \( h^\psi = h \), the degree of 
homogeneity of the production function is increased to \( 2+\psi-\beta \). Clearly, \( 2+\psi-\beta>2-\beta>1 \).

Individuals choose a stream of consumption to maximize utility subject to two 
constraints:

\[ \dot{K} = Y - C = AK^\beta (uLh)^{(1-\beta)} h^\psi - Lc \tag{2} \]

and

\[ \dot{h} = \phi h(1-u) \tag{3} \]
where \( C \) is consumption, \( c \) is consumption divided by the number of labor, \( \dot{K} \) is increase of \( K \), \( \dot{h} \) is increase of \( h \), and \( \phi \) is a fixed fraction. The first constraint says that investment equals output minus consumption. The second one assumes that knowledge that currently accumulated by individuals is proportional to their leisure time \((I-u)\) that can be used in study; and also proportional to the knowledge they previously accumulated \((h)\). Thus, the growth rate of human capital \( \dot{h}/h \) is proportional to the leisure time \((I-u)\). According to this assumption, human capital is increasing all the time given labor input \( L \) and the fraction \( u \) is constant.

The Hamiltonian is:

\[
H(\cdot) = e^{-\rho t} \left[ \frac{L(c, L, h, h)}{1 - \sigma} \right] + \nu\left[ AK^\beta (uLh)^{(1-\beta)}h^\gamma - Lc \right] + \lambda[h\phi(I-u)]
\]  

(4)

where \( \rho \) is the discount rate; \( \sigma \) is the coefficient of risk aversion; and \( \phi \) is a “studying productivity” parameter.

The first order condition (with respect to \( c, u, k, \) and \( h \) respectively):

\[
e^{-\rho t}c^{-\sigma} = \nu
\]  

(5)

\[
\nu(I-\beta)(AK^\beta (uLh)^{1-\beta}u^{-\beta}h^\gamma) - \lambda h \phi = 0
\]  

(6)

\[
\dot{\nu} = -\nu\left[ \beta AK^{-1-\beta}(uLh)^{1-\beta}h^\gamma \right]
\]  

(7)

\[
\dot{\lambda} = -\nu[(I-\beta)AK^\beta (uL)^{1-\beta}h^{-\beta}h^\gamma] - \lambda \phi(I-u)
\]  

(8)

Let

\[
h^\gamma = h
\]  

(9)

Taking logarithm and differentiating to (5), and combining (5), (7) and (9) to get

\[
\dot{c} / c \equiv \gamma = \sigma^{-1}\left[ \beta AK^{-(1-\beta)}(uL)^{(1-\beta)}h^{(1+\gamma-\beta)} - \rho \right]
\]  

(10)

From equation (2), the capital accumulation constraint, we can get

\[
\dot{k} / k = \dot{K} / K = n = AK^{(\beta-1)}(uL)^{(1-\beta)}h^{(1+\gamma-\beta)} - c / k - n
\]  

(11)

Since (10) can be rewritten as

\[
AK^{-(1-\beta)}(uL)^{(1-\beta)}h^{(1+\gamma-\beta)} = (\gamma \sigma + \rho) / \beta,
\]  

(10')

then (11) can be rewritten as

\[
c / k = (\gamma \sigma + \rho) / \beta - n - \dot{k} / k
\]  

(11')
In steady state, all factors at the right hand side are constants. Taking logarithm and differentiating, we get

\[ \frac{\dot{c}}{c} = \gamma = \frac{\dot{k}}{k} = \gamma_k \]  

(12)

So consumption and physical capital per capita grow at a common rate. From (10')

\[ \frac{(\gamma \sigma + \rho)}{A \beta} K^{(1-\beta)}(uL)^{(1-\beta)} h^{(1+\psi-\beta)} = k^{(1-\beta)} u^{(1-\beta)} h^{(1+\psi-\beta)} \]

by taking logs and derivatives we get

\[ 0 = -(1-\beta)\dot{k} / k + (1+\psi-\beta) \dot{h} / h \]

(13)

which implies

\[ \frac{\dot{h}}{h} \equiv \gamma_h = \frac{\gamma (1-\beta)}{1+\psi-\beta} \]

(14)

From equation (14), we can easily find that the economic growth rate depends on growth rate of human capital and magnitude of the externality of human capital:

\[ \gamma = \frac{1+\psi-\beta}{1-\beta} \gamma_h \]

(14')

The above equation also says that if the human capital externality \( \psi > 0 \), the market solution of human capital growth is lower than (per capita) economic growth.

From (6), we can get the solution of \( \gamma_h \):

\[ \gamma_h = \frac{(\phi - \rho + n)(1-\beta)}{\sigma(1+\psi-\beta) - \psi} \]

(15)

If \( \psi = 0 \), then

\[ \gamma = \gamma_h = \frac{(\phi - \rho + n)}{\sigma} \]

(16)

The market solution, when \( \psi > 0 \), is not efficient. The solution for efficient growth rate of human capital is

\[ \gamma_h = \frac{\phi - (1-\beta)\rho}{\sigma(1+\psi-\beta)} \]

(17)

Sala-i-Martin (1990b) calls this "the command economy solution", implying that the government can achieve optimum economic growth by encouraging education.

The above model identified an important source of economic growth as human capital accumulation. This is a long run effect that can affect the economic growth rate permanently. Although, human capital accumulation in this model is simply assumed
to be linearly related to workers’ leisure time, whereas determination of human capital growth in reality would be much more complicated.

Other implications of the model that are mentioned by Lucas are:

- The system will converge to a certain curve, which represents relations between physical capital and human capital. But the particular point to which it converges depends on the initial conditions.
- Under the assumption of closed economies, long-run growth rates between countries will be the same, so that poor countries will remain relatively poor. This is different from neoclassical growth models, which predict convergence between economies. In other words, the latter models state that if all poor and rich countries have the same parameters, poor countries with a lower capital labor ratio will grow faster than rich, until the common steady state capital labor ratio is achieved.
- The result of non-convergence from the Lucas model remains unchanged if trade of capital goods is introduced. However, if labor mobility is introduced, and there is externality of human capital, labor will move from poor countries to wealthy ones.

Finally, although Lucas did not mention this in his paper, a change in saving rate will result in a change in the economic growth rate, because the saving rate depends on $\sigma$ and $\rho$.

Rebelo’s (1990) model is called the “AK” model, where “K” is broadly defined as an aggregation of physical capital, human capital, stock of knowledge, and maybe some other type of capital. $A$ is an exogenous constant.

$$Y = F(K, L) = AK$$  \hspace{1cm} (1)

Households maximize the utility function

$$U(0) = \int_0 e^{-\rho t} \left( \frac{c^{1-\sigma} - 1}{1 - \sigma} \right) dt$$  \hspace{1cm} (2)

subject to

$$\dot{k} = Ak - c$$  \hspace{1cm} (3)

The Hamiltonian is
\[ H(\cdot) = e^{-\rho t} \left( \frac{c^{1-\sigma} - 1}{1 - \sigma} \right) + (Ak - c) \] (4)

The first order conditions are

\[ e^{-\rho t} c^{-\sigma} = v \] (5)

\[ \dot{v} = -vA \] (6)

From (5), (6) and (1) we can get the similar solution with Lucas model:

\[ \dot{c}/c = \gamma = \dot{k}/k = \gamma_k = \dot{y}/y \]

It says all (per capita) capital, consumption, and output grow at the same constant rate \( \gamma \). This result is the same as in the Lucas model. Since, \( \dot{k}/k \) grow at a constant rate all the time (assuming labor growth rate is zero), so there is no transitional dynamic in this model.

With a depreciation rate of \( \delta \) and an exogenous growth rate of labor \( n \) (see Sala-i-Martin 1990b), the saving rate can be expressed as

\[ s = (\dot{K} + \delta K) / Y = (K / K + \delta) / (Y / K) \]

\[ = (\dot{k} / k + n + \delta) / (AK / K) \]

\[ = (\gamma_k + n + \delta) / A \]

This gives the relation between the growth rate of per capita capital, \( \gamma_k \), and the saving rate \( s \). In steady state, the growth rate of per capita output is equal to the growth rate of \( k \), so that change of saving rate has a growth effect in the long run:

\[ \gamma = \gamma_k = sA - n - \delta. \]

Romer (1990) used a more complicated three-sector model to represent the growth effect of human capital and technology growth. The three sectors are:

a). A research sector, which uses human capital \( H_A \) and the existing stock of knowledge \( A \) as inputs to produce new knowledge \( \dot{A} \) (or in Romer's words, new designs). \( \dot{A} \) is assumed linearly related to \( H_A \) and \( A \) respectively:

\[ \dot{A} = \delta H_A A \] (1) 

Therefore the growth rate of knowledge is a linear function of human capital used in the research sector: \( \dot{A}/A = \delta H_A \). Where \( \delta \) is a productivity parameter for the research sector. The new designs can be sold to the intermediate goods sector to produce producer durables, under the patent protection, whereas the stock of knowledge is free
of charge if it is only used to produce new knowledge. This implies that knowledge has a spill over effect on the economy.

b). An intermediate goods sector, which uses foregone final outputs (can be thought of as a certain amount of inputs that otherwise would be used to produce final outputs) and new designs as inputs to produce producer durables $x_i$, where $i$ is the number of different type of durables. It is assumed that each firm produces one type of durable good using one design, therefore $i = 1 \ldots A$. As an expression of human knowledge, $A$ can increase infinitely. Each $x_i$ can be produced as many units as required. All the $x_i$s are perfect substitutes. Total capital $K$ consists of all the capital goods $x_i$s, but measured by units of physical final output:

$$K = \eta \sum_{i=1}^{\infty} x_i = \eta \sum_{i=1}^{A} x_i = \eta A \bar{x}$$

(2)

where $\eta$ is the units of forgone final goods to produce one unit of capital good, and $\bar{x}$ is the average of $x_i$; $x_i = \bar{x}$ since all $x$ will be supplied at the same level due to the symmetry of the model.

Investment subjects to the rule:

$$\dot{K}(t) = Y(t) - C(t).$$

(3)

c). A final goods sector, which uses labor $L$, human capital $H$, and capital goods $x$ as inputs to produce final outputs $Y$. A Cobb-Douglas production function is applicable:

$$Y(H, L, x) = H^\alpha L^\beta \sum_{i=1}^{\infty} x_i^{1-\alpha-\beta}$$

(4)

where $\alpha + \beta < 1$. For $i$ is treated to be continuous, (4) can be rewritten as:

$$Y(H, L, x) = H^\alpha L^\beta \int_0^{\infty} x(i)^{1-\alpha-\beta} di = H^\alpha L^\beta A \bar{x}^{1-\alpha-\beta}$$

(4')

Insert (2) to Equation (4') to get the expression in terms of total capital instead of in terms of physical capital goods:

$$Y(H, L, x) = H^\alpha L^\beta A \left( \frac{K}{\eta A} \right)^{1-\alpha-\beta} = (H, A)^\alpha (L A)^\beta \left( \frac{K}{\eta} \right)^{1-\alpha-\beta}$$

(4'')

In this model, total human capital is divided into two components and used in the research sector and final goods sector, respectively:
\[ H = H_y + H_x. \]

Take log form of the equation (4') and differentiate with respect to time, to get:
\[
\frac{\dot{Y}}{Y} = \alpha \frac{\dot{H}_y}{H_y} + \beta \frac{\dot{L}}{L} + \frac{\dot{A}}{A} + (1 - \alpha - \beta) \frac{\ddot{x}}{\bar{x}} \quad (5)
\]

According to the assumption, labor supply is constant, the ratio of \( K \) to \( A \) should be also constant along the balanced growth path. Therefore \( \bar{x} \) should be constant as well (from Equation 2). Thus the economic growth rate only depends on the growth rate of knowledge, \( \dot{A} / A \) (in this model, it is endogenously determined by how much human capital being used in the research sector) and growth rate of the human capital used in the final products sector. The proof of constant \( H_y \) can be seen in Romer (1990).

Under the assumption that total human capital is constant as well as labor being, human capital used in the research sector and the final goods sector will both remain constant in steady state. Thus, the balanced growth rate of the economy is exactly equal to the growth rate of knowledge, \( \dot{Y} / Y = \dot{A} / A \). Meanwhile, since \( \bar{x} \) is constant, \( K \) must grow at the same rate as \( A \). Combine with equation (1) to get:
\[
\frac{\dot{Y}}{Y} = \frac{\dot{C}}{C} - \frac{\dot{K}}{K} + \frac{\dot{A}}{A} = \delta \frac{H_A}{A}
\]

This equation says that the equilibrium growth rates of output, consumption, and capital are all equal to the growth rate of knowledge, which is proportional to the human capital used in the research sector.

No matter whether the assumption of constant labor and human capital holds, a combination of Equation (1) and (5) provides a direct expression for contribution of labor, capital and human capital growth on economic growth. This expression may be useful for empirical studies.
\[
\frac{\dot{Y}}{Y} = \alpha \frac{\dot{H}_y}{H_y} + \beta \frac{\dot{L}}{L} + \delta \frac{H_A}{A} + (1 - \alpha - \beta) \frac{\ddot{x}}{\bar{x}}
\]

This equation states that the economic growth rate is determined by the growth rates of labor, capital and human capital that are used in production, and the level of human capital used for R&D.
Barro (1990), Barro and Sala-i-Martin (1990). These authors assume that the national output is a function of private capital (broadly defined) and public inputs, and exhibit a constant return to scale technology. Public expenditure (on both physical and social infrastructures) is assumed to have an externality. Firms’ investment decisions and, therefore, the growth of their output, is assumed to affect public revenue and expenditure, given the budget constraint. Since firms do not take into account the externality, they underinvest so the competitive growth rate tends to be lower than optimal. Similar to the Lucas Model, this model implies that the government can enhance economic growth by providing public goods.

3.4 THEORIES OF DYNAMIC GROWTH

A number of authors have made contributions to economic growth in the period of dynamic adjustment. Some of them started from the neoclassical growth model but focused on the length of dynamic adjustment period instead of “long-run economic growth”. Their results are very different from the original neoclassical growth model.

R. Sato (1963) and K. Sato (1966). R. Sato started from Solow’s growth model, with slight modification of the methodology and assuming a fiscal policy change to increase the tax rate, he derived that the economy will experience an extremely long period of adjustment with a higher growth rate before the reinstatement of the equilibrium growth rate. Using the actual US data and assuming that the proportionate income tax rate increases from 17 per cent to 18 per cent, he found that: “A complete adjustment from one equilibrium to another is virtually never achieved. In our example, it takes from 50 to 150 years to achieve 90 per cent of the total adjustment.” (1963, 23). He derived some results about the length of the adjustment:

1. The greater the initial savings ratio, the longer the adjustment period.
2. The higher the new savings ratio, the shorter the adjustment period.

---

6 Sato uses the output-capital ration, Y/K, as the stability criterion instead of Solow’s criterion, capital-labor ratio K/L. He pointed out that when the technological growth rate is not zero, K/L cannot be constant in equilibrium, while Y/K will be constant.
3. The higher the productivity increase, the shorter the adjustment period.

4. The higher the population increase, the shorter the adjustment period.

5. The greater the share of labor or the smaller the share of capital, the shorter the adjustment period.

6. The larger the percentage of adjustment, the longer the adjustment period.

Since “the adjustment period is extremely long”, R. Sato stresses the importance of those factors, which, according to standard neoclassical growth models, only have a level effect on economic growth.

K. Sato (1966) carried out a similar experiment but derived more or less different results. By including a depreciation rate δ in the model and assuming the “effective volume of capital stock”, \( J \), at time \( t \) has the following form:

\[
J_t = e^{-3t} \int_{-\infty}^{t} e^{(\mu+\delta)v} I_v \, dv
\]

(where \( I_v \) is gross investment at time \( v \), and \( \mu \) is the rate of increase in technical efficiency of capital goods), K. Sato found that “the adjustment time at issue may be reduced by as much as three-quarters” (1966, 263). He thus argues that R. Sato’s conclusion is not generally valid.

However, as King and Rebelo (1993) pointed out, if the saving specification was as follows:

\[
I_t = sY_t + \delta K_t
\]

(where \( s \) is the saving rate and \( Y_t \) is income at time \( t \)), K. Sato’s results were much the same as R. Sato’s. Therefore, King and Rebelo believe that “the two Sato experiments led to the consensus view that plausible versions of the Solow model could generate protracted transitional dynamics” (1993, 913).

King and Rebelo (1993) first use a discrete time version of the Solow model to carry out an experiment of transitional dynamics. By assuming that the economy evolves from an initial situation of lower-than-steady-state capital stock, they found that “the adjustment process is indeed very lengthy, with transitional intervals close to those described by R. Sato (1963)”. 

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However, they claim that the basic neoclassical model’s prediction is inconsistent with the observed variation in interest rates across countries. Alternatively, they assume that saving rates are endogenously determined by an immortal family’s optimal consumption choices, instead of a fixed fraction of income. They then found that the length of adjustment period heavily depends on the parameters chosen. For instance, when they chose a different value of the intertemporal substitutability of consumption, the half-life of the output convergence varied between 5-18 years. They also found that different values of capital share can largely affect the length of the adjustment period. When capital share varies from 1/2 to approaching unity, the half-life of the adjustment period also varied from eight years to arbitrarily long.

In the latter case, the initial interest rate is closer to the reality. However, the investment-income ratio becomes counterfactual. They thus argue that the neo-classical transitional dynamics can only play a minor role in explaining the observed variation of economic growth rates across countries and over time. They therefore came to the position recommending endogenous growth models, which assign a larger role to human capital formation and endogenous technical progress as the reasons leading to different growth rate, other than physical capital accumulation. However, this does not seem to be a real answer to the question: how long does the adjustment process take to achieve the long run growth path?

*Mulligan and Sala-i-Martin (1993)* start from a two-sector endogenous growth model with consideration of human capital accumulation. They claim that, although all the analysis in the existing endogenous growth literature is generally restricted to the steady state, “there may be a transitional period where the relevant variables do not behave as predicted by the steady-state analysis” (pp739). Thus they focus on the transitional dynamics of growth. They show a relationship between economic growth and human capital accumulation in transitional dynamics, and report that, in their model, the steady-state growth rate is reached in about 25 years, from a 14-15 percent initial growth rate. During this period, the growth rate smoothly decreases toward the long run growth path.
Based on the relationship between economic growth and human capital accumulation, they suggest that the long term economic stagnation in Chinese history, after the Mongol invasion in the 13 century, was largely a result of destroying the stock of human capital.

Although different results are obtained, a common implication that can be derived from all of the above studies is the possibility of a protracted transitional dynamic before an economy achieves it steady state growth. In addition, changes in many factors can bring an economy into a transitional dynamic. This highlights the importance of analyzing economic growth in the process of transitional dynamics.

3.5 THEORIES OF INDUSTRIALIZATION

This section examine the theories of economic take-off and industrialization, relating economic growth in developing countries. An early growth model, suggested by Harrod (1948), is also reviewed, since it concerns the saving effect on growth that is more related to a dynamic process than the steady-state growth.

Harrod (1948) established a simple, but useful model for determination of the economic growth rate:

\[ G_w = s/C_r \]

where \( G_w \) is the economic growth rate, \( C_r \) is the marginal capital-output ratio, and \( s \) is the saving rate.

The above equation simply says that the economic growth rate is determined by the saving rate and the capital-output ratio. The higher the saving rate (given that saving=investment), or the lower the capital-output ratio (i.e., the higher the capital productivity), the higher the economic growth rate that can be achieved.

The Harrod equation can be justified when \( S=I \) (S for total saving and I for total investment). Since \( G_w = \Delta Y/Y \), \( C_r = \Delta K/\Delta Y = I/\Delta Y \), and \( s = S/Y = I/Y \), (where \( \Delta Y \), \( \Delta K \) and \( I \) are changes in output and capital stock, and investment, respectively) the equation can be written as

\[ \Delta Y/Y = I/Y(I/\Delta Y) \]
It is an identity.

In fact, the economic growth rate cannot be expected to be proportional to the saving rate all the time, since, when saving and investment increase, the marginal product of capital decreases due to diminishing returns to capital. This leads to increases in capital-output ratio $C_r$, partially offsetting the positive effect of saving on growth. Without spill-over effect of capital stock, the saving effect on the growth rate will finally fade away in the long run. Therefore saving effect is only effective in transitional dynamics, although the adjustment period could be considerably long.

To avoid the capital productivity from decreasing (i.e., to keep the capital-output ratio being constant), in a constant returns to scale situation, all the factors should grow at a common rate, so that the economy converges to the long run growth path. A constant capital-output ratio means $C_r=\Delta K/\Delta Y=K/Y$, therefore the Harrod equation can be written as:

$$\Delta Y/Y = I/Y(K/Y) = \Delta K/K$$

It is consistent with the long run solution of the neoclassical growth theory. It also implies a fixed saving rate in the long run.

Saving changes are a common phenomenon in the process of economic take-off in development economies. In this sense, the Harrod equation is useful for analyzing the saving effect on growth.

Rostow (1956) describes the industrialization stage of an economy as the economic take-off, transforming from a traditional type of economic growth to modern economic growth. He listed three common characteristics for economies in the take-off stage:

1. a rise in the rate of productive investment from (say) 5 per cent, or less, to over 10 per cent of national income (or net national product);
2. the development of one, or more, substantial manufacturing sector with a high rate of growth;
3. the existence, or quick emergence, of a political, social and institutional framework, which exploits the impulses to expansion in the modern sector and
the potential external economy effects of the take-off and gives to growth an ongoing character.

In this stage, there is a marked rise in the economic growth rate; income per capita growth rises from close to zero to about 2 per cent per year.

Rostow developed a conceptual framework to describe the determinants for economic growth. In his framework, the important factor leading to the economic take-off is the investment in physical capital, science and technology, whereas this has resulted from the changing institutional framework of the society.

He states that (1960: 15-55), the growth rate of an economy is a function of growth rates of labor (which is strengthened by education and incentives for workers' effort) and capital (including applied knowledge), whereas the later two rates are determined by six explicit and two implicit parameters: i.e., the propensity to develop fundamental science; the propensity to apply science; the propensity to accept innovation; the propensity to seek material advantage; the propensity to consume; the propensity to have children; the propensity to invest in education (e.g., human capital); and the propensity to make an effort in working.

Further, the effective strengths of the above propensities are partially related to the level of income (per capita), and partially "a function of the prior operation of economic, social, and political force, which determine the current social fabric, institutions, and effective political policy of the society".

Although the Rostow model is not clearly specified in mathematics, it shares some common features with the recently developed endogenous growth models in the sense that both stress the importance of knowledge, technology and education in economic growth, and treat knowledge, technology or human capital stock as endogenously determined.

There are also some major differences. One is that, the economic take-off described by Rostow is actually a transitional dynamic, resulting from changes in the institutional framework of the society, whereas most endogenous growth models deal with the steady-state of growth in the long run. In this context, the former is more
relevant for economic growth in the East Asian countries and China (of course, this theory is only based on earlier European and American experience of industrialization rather than the new experience of the Asian economies). Another is that, unlike the endogenous growth models, the relationship between those endogenous variables and economic growth in the Rostow framework is not clearly defined. Therefore its capacity for empirical studies is limited. Yet, it provided a way of thinking to link economic growth with institutional changes in a transitional period.

*Lewis* (1954) suggests a two sector model to represent the process of industrialization in an economy with an unlimited supply of labor. One sector is the "capitalist sector" or modern industrial sector, in which wages are equal to the marginal productivity of labor. Another is the "subsistence sector" (i.e., agriculture and urban casual jobs) that has a large "disguised" unemployment.

Lewis argued that, in the latter sector, "the family holding is so small that if some members of the family obtained other employment the remaining members could cultivate the holding just as well (of course they would have to work harder...)." Since the marginal product of labor can be zero, but workers cannot survive on zero wage, labor earning in this sector should be higher than labor marginal productivity. It could "be determined by a conventional view of the minimum required for subsistence; or it may be equal to the average product per man in subsistence agriculture, plus a margin" (pp 141, 189).

The disguised unemployment in the subsistence (or agricultural) sector provides an unlimited supply of labor to the industrial sector, thus industrial wages are determined by the earnings of agricultural labor, plus a gap of 30 percent, or more, due to higher living costs in the industrial sector, the psychological cost for workers changing their way of life, and the increase in workers' skill after they have been employed in the industrial sector, etc.. This wage determines the employment in the industrial sector, since wages are equal to the marginal value product of labor in this sector.

In this circumstance, an increase in capital stock in the industrial sector can increase labor productivity, and therefore employment opportunities, without
increasing industrial wages. More laborers can be absorbed from agriculture at the same wage rate. The expansion of the industrial sector makes more capitalist surplus, and more investment in industry, which sustains industrial growth. The process of industrialization will continue until the “disguised unemployment” is completely absorbed. During this process, the capital-labor ratio in the industrial sector can hold constant because of the unlimited supply of labor.

Therefore, according to Lewis, the central problem of industrialization is to increase savings to, e.g., 12-15 percent of national income or more, so that capital formation can be then accelerated. So long as this starts, the process of industrialization will take place. The Lewis model suggests that the faster the speed of capital accumulation, the higher the rate of economic growth.

Similar to Rostow, but different to most of the neoclassical and endogenous growth models, the Lewis model describes a process of economic transition which would be classified as a “short run dynamic” or a “level effect”, no matter how long the process can last. In this process, an increase in savings leads to a reallocation of labor between the agricultural and industrial sectors, thus a faster growth of industry and the whole economy.

Another distinctive feature is that Lewis emphasized only the case of labor abundant developing economies with scarcity of capital and land, whereas most growth models treat all economies, rich and poor, as having the same growth pattern.

In the Lewis model, the agricultural sector is also presumed to be constituted by self-employed farmers. Since their marginal product of labor (MPL) is close, or equal, to zero, each member of a family, or a community, shares the average products. So one may not take a job outside, unless the wage offered exceeds the average product of the family or community 7. Labor reallocation between the two sectors would not

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7 This is not necessarily true for a family, since an outside job for a worker with a wage higher than his MPL at home would increase his total family income, although not necessarily increase his personal income. However, in China’s collective agricultural sector during the pre-reform period, this could have been true. This is because the farmer would not take the job outside if the wage offered was lower than his current earning (say, determined by the average product of labor in the collective production unit), even if this would have increased the total income in the collective unit.
take place until the industrial MPL exceeded the average product of labor in agriculture.

The Lewis model also assumes that the profit made by the economy will be reinvested only in the industrial sector. Thus, any significant increase in saving and investment can start the process of industrialization until the "disguised" unemployment in the agricultural sector is fully absorbed. However, if we allow capital to be invested in the agricultural sector and to increase agricultural MPL, the result could be different. This is because labor earnings in agriculture could increase and the labor supply would no longer be "unlimited".

A similar process of industrialization may be described by a neoclassical model, with modification allowing diminishing marginal labor productivity in agriculture. In this case, labor transfer from agriculture to industry will increase MPL and labor's earning in agriculture. Therefore, compared with the Lewis case, a smaller amount of labor will be reallocated. The whole process will stop when MPLs in the two sectors converge. However, it could still continue if there is a faster accumulation of capital (or, human capital, or technology) in industry than in agriculture, but labor transfer would be slower than in the Lewis case.

Ranis and Fei (1961) made additional assumptions and further analysis, based on the Lewis model. First, they assume there is a fixed "institutional wage" when the marginal product of labor in the agricultural sector is equal, or close, to zero, instead of the Lewis' assumption that the wage is determined by the average product of labor. The industrial wage is simply equal to the institutional wage in agriculture. At this wage level, the industrial sector can obtain as much labor as it requires.

Associated with the reduction of labor in the agricultural sector, MPL in agriculture raises, but the institutional wage keeps constant. After achieving the point where MPL is equal to the institutional wage, the agricultural wage will be determined by its MPL. Ranis and Fei call this turning point the "commercialization point". When it is hit, further reallocation of labor requires an increase in the industrial wage. The
development process from an initial point, where the agricultural MPL is zero, to the "commercialization point", is defined as the "take off" stage.

As a further contribution to Lewis' theory, Ranis and Fei examined the effect of increasing productivity in the agricultural sector, as a result of investment in agriculture, and the effect of population growth. They found that both productivity growth and population growth have the effect of postponing the "commercialization point" to later. The latter effect is derived under the assumption of a two sector closed economy. With this assumption, an increase in agricultural productivity will worsen the situation of terms of trade in agriculture. However, in an open economy, or a closed economy in which the prices are exogenously determined, this would not be the case, an increase in agricultural productivity will advance the "commercialization point" earlier.

Ranis and Fei also reconfirmed that an increase in the productivity of industrial labor, through industrial investment, shifts the industrial demand curve for labor (which are determined by the marginal product of labor in the industrial sector) upward (curves i₁, i₂ and i₃ in Figure 3.1).

However, due to the reason mentioned above, agricultural investment shifts the industrial supply curve of labor (curves L₁, L₂ and L₃ in Figure 3.1) downward. These curves are determined by the marginal product of labor in the agricultural sector at a direction from right to left. In equilibrium the demand curve for labor, and the supply curve of labor, must intersect at a point lying on the horizontal line of the institutional wage w₃, otherwise investment funds must be automatically reallocated between the industrial sector and the agricultural sector so that the intersect point is shifted towards w₃. Therefore the equilibrium wage rate will move along the institutional wage line until the turning point p₃. The line w₃ is called a balanced growth path in the take-off stage.
Harris and Todaro (1970) provide another explanation for the wage (or MPL) differentials between the rural and urban sectors, and the transfer of labor between the two sectors. Different from the Lewis and L-F model, Harris and Todaro assume that the marginal product of labor in the rural sector is always positive. Yet, there exists a rural-urban wage differential since the government set a minimum wage for the urban sector. Since wages are equal to the marginal product of labor, and therefore determine the employment level, the minimum wage reduces the capacity of employment in the urban sector, and results in urban unemployment. In their model, the rural-urban migration is assumed to depend on expected urban wages rather than actual urban wages. The expected urban wage depends on the rate of urban unemployment, and is therefore lower than the actual urban wage. Rural-urban migration can continue, as long as the expected urban wage rate exceeds the actual rural labor earning. In equilibrium, migration stops at the point where the actual rural labor earning and the expected urban wage being equal, leave a gap between the actual rural and urban wages. This model made another contribution on rural-urban labor mobility. Although, empirically, the high rural-urban wage differential in developing
countries could result from a number of reasons, whereas the urban minimum wage is one of them.

There are two major differences between the actual rural situation in China that is currently under consideration and the H-T model. First, in China’s rural industrial sector, there is no minimum wage set by the government, although in the urban state-owned sector wages were fixed by the government. Second, since the major focus of this study is rural industrial growth, migration between rural sectors would be more relevant than rural-urban migration. However, no unemployment existed in the rural industrial sector, since all farmers who could not find job in the rural industrial sector, or job losers of that sector, naturally stay in, or return to, the agricultural sector.
CHAPTER 4. MODELING INSTITUTIONAL EFFECT ON RURAL INDUSTRIAL GROWTH

4.1 INTRODUCTION

This chapter aims to establish a theoretical model to analyze effects of institutional change on China’s rural industrial growth.

China experienced rapid economic growth during the period of economic reform that started in 1978. In that period, the rural nonagricultural industrial sector, or Township and Village Enterprise sector¹, played an extremely important role in the rapid growth. In 1979-94, the annual output growth rate of the TVE sector was 23% on average; employment in the TVE sector increased from 28 million to 120 million, accounting for 27% of total rural labor in 1994; and the TVE share in total gross industrial output increased from 9% to 44% in the same period (SSB1995, 364-75)².

The question naturally arises: What has been the major contributing factor to this dramatic growth of rural industry? In this chapter, it is hypothesized that an important source was institutional change that removed, or reduced, various restrictions on labor allocation against non-agricultural activities. These institutional changes resulted in a massive transfer of rural labor, and other factors, from the traditional agricultural sector to the rural industrial sector, which accelerated rural industrial growth.

As mentioned in Chapter 2, under the People’s Commune system in the pre-reform period (1958-78), development of rural industrial enterprises was restricted by various institutional constraints.

First, production was restricted to a few subsidiary sectors of agriculture.

¹ See Chapter 2 for the definition of TVEs. In this study, the whole TVE sector will be approximately treated as the rural non-agricultural industrial sector.
² Other data sources suggest either a share of 42% (SSB 1995: 365, 375) or over 50% (Economic Daily 1995, various issues), but the latter seems less reliable.
Second, these enterprises had to be strictly collectively owned (Commune and Brigade Enterprises or CBEs, which were the predecessors of TVEs) and under the control of the communes' administration. Private enterprises were prohibited.

Third, distribution of bank funds, and many important inputs, were subject to the government plan and only guaranteed for state-owned enterprises.

Fourth, there were restrictions on geographic migration, not only from rural to urban areas, but also among different rural areas.

Fifth, according to the government policy, CBEs should not compete with agriculture for labor. The collectives could not transfer their labor, capital, or land to non-agricultural activities without fulfilling the state quota for agricultural production (Kondo 1978: 142; LBSC 1987: 6-190).

These institutional restrictions were for the purpose of providing enough agricultural products at below-market prices to urban residents, in order to support the "heavy industry priority" development strategy under the central plan (see Dong 1988, and Lin, Cai and Li 1996). These restrictions also protected the central-planning system from the threat of free-market competition, and prevented "capitalism".

Under the restrictions, non-agricultural activities in the rural area were underdeveloped in the pre-reform period. A huge rural population and labor force remained in the agricultural sector. With the limitation of land (0.13 hectares per rural resident in 1978), agricultural labor had a very low productivity (0.39 ton of grain output per rural resident). In 1978, after twenty years of development, the Commune and Brigade Enterprises employed 28 million workers, only accounting for 9% of total rural labor (SSB 1995: 59, 331-64).

Some major institutional changes occurred in the rural economy during the period of reform. Most important were the introduction of the Household Responsibility System (HRS) in 1979-82, and abolition of the People's Commune System in 1982-

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3 This was also true at some stage of the reform period. For example, using 1980-82 data from a case study, Chang (1993) found a negative, and significant, relationship between the share of the TVE employment in the rural labor and per capita state quota for grain production. In his study, this relationship became insignificant in 1983-85.
83. These changed agriculture from collective-based production to household-based production. Since then, farmers have no longer been strictly tied to the land, and have had more choice in allocating their labor among sectors. Controls on migration have also been relaxed although not removed.

An other important change mainly occurred in 1984-85, which removed or eased the discriminative or restrictive policies against non-state enterprises. TVEs were officially allowed to compete with state-owned enterprises (SOEs). Entry barriers against non-state enterprises were removed. The ban on rural private enterprises was lifted. They were officially included in the TVE statistics. There was also a significant reduction in the level of central planing and liberalization of input-output control in the industrial sector.

Finally, government quotas on agricultural output were softened and reduced, although they were reinforced in some later stage, to some extent.

In this and the next chapters, an attempt is made to measure the contribution of institutional changes on China’s rural industrial growth. In light of theories of economic growth and industrialization, a two-sector model, incorporating an institutional factor, is established in this chapter. The model is used in the next chapter for empirical estimation of the contribution of the institutional effect on rural industrial growth.

For a fundamental neoclassical growth model see Solow (1956) and Swan (1956); for an extended version with two sectors see Uzawa (1962); for endogenous growth models with contribution of human capital see Lucas (1988), Romer (1986) and (1990); for two-sector models with transfer of rural labor see Lewis (1954), Ranis and Fei (1961), Harris and Todaro (1970); for growth with inter-sector wage differentials see, e.g., Beladi and Naqvi (1987).

Although most growth models focus on a “long run growth path”, it has been suggested that a transitional dynamic in the real world, especially in a developing country, can play an important role in economic growth over a fairly long period.
Growth relating transitional dynamics can be seen in Sato (1963), Sato (1966), King and Rebelo (1993), and also Lucas (1988).

In this and the following chapters, the central concern is rural industrial growth in the transitional period, relating to the institutional effects on inter-sector factor reallocation.

4.2 A TWO-SECTOR MODEL EXAMINING INSTITUTIONAL EFFECTS ON GROWTH

The model is established under the following assumptions:

1). The rural industrial sector and the agricultural sector constitute a rural economy. The rural industry uses capital \( K_1 \) and labor \( L_1 \) to produce homogeneous output \( Q_1 \), and agriculture uses capital \( K_2 \), labor \( L_2 \) and land \( D \) to produce output \( Q_2 \). Both products can be sold outside the rural economy, and their prices are determined exogenously. The price of \( Q_i \) (i=1,2, for the rural industry and agriculture, respectively) at the initial year is \( P_i(0) \), so the real value of \( Q_i \), measured by the constant prices in year 0, is \( Y_i = Q_i P_i(0) \).

2). Production in each sector has the characteristic of diminishing marginal factor productivity, i.e., \( \partial Y_i / \partial L_i > 0 \), \( \partial Y_i / \partial K_i > 0 \), \( \partial^2 Y_i / \partial L_i^2 < 0 \), and \( \partial^2 Y_i / \partial K_i^2 < 0 \).

3). Labor is assumed to be imperfectly mobile between the two rural sectors, and immobile between rural and urban areas. Rural-urban migration will be ignored.

4). Wages are determined by the value of the marginal product of labor (VMPL) in each sector. Labor allocation is then determined by the relative VMPL between the two sectors. Therefore, given an exogenously determined quantity and growth rate of total rural labor \( L \), the sectoral labor force \( L_1 \) and \( L_2 \) and their growth rates are determined endogenously.

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4 In the late 1970s and the 1980s, rural labor mainly transferred between the agricultural sector and the rural industrial sector. Rural-urban migration increased significantly in the early 90s. However, detailed data is not currently available.
5) Institutional restriction is assumed to be equivalent to a transaction cost to labor reallocated from agriculture to the rural industry, similar to a payroll tax on industrial employment\(^5\). It is proportional to workers’ net earnings with a proportionality factor \( t \), either borne by workers or by firms. Then wages in the two sectors are related as

\[
\frac{w_1}{1+t} = \frac{w_2}{1+t} \]

where \( w_1 \) is the labor cost to industrial firms, inclusive of the transaction-cost (payroll-tax-equivalent), and \( \frac{w_1}{1+t} \) is the wage net of the “tax” \((t\geq 0)\), received by industrial workers; \( w_2 \) is the income received by agricultural laborers. Firms set

\[
w_1 = VMPL_1 \quad \quad w_2 = VMPL_2
\]

\[
\therefore \quad \frac{VMPL_1}{VMPL_2} = \frac{w_1}{w_2} = 1 + t = B_L
\]

where \( B_L \) is the ratio of the two VMPLs. \( B_L > 1 \) when institutional barriers exist, and \( B_L = 1 \) otherwise.

Therefore, institutional barriers lead to a MPL gap between the two sectors and result in a misallocation of labor. The MPL ratio \( B_L \) then can be considered as an indicator for institutional barriers on labor allocation. It will be referred to as the “institutional factor”. An institutional change, say a reduction in institutional restrictions, will lead to a decrease in \( B_L \), resulting in a reallocation of labor from agriculture to the rural industry.

6) \( K_1 \) and \( K_2 \), are also determined endogenously according to the relative value of the marginal product of capital (VMPK) in the two sectors. The total capital stock \( K \) in the rural economy is given exogenously.

7) To allow capital market imperfections, the prices of capital are assumed to be related by \( r_2 = \frac{r_1}{1+s} \), where \( r_1 \) is the price of capital in the \( i \)th sector and \( s \) is an imposed restriction, equivalent to a tax or a subsidy on gains of industrial capital (\( s > 1 \)).

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\(^5\) The physical adjustment cost of labor transfer, e.g., cost of transportation and accommodation, etc., is ignored in this study.
Firms set
\[ r_i = \frac{\text{VMPK}_i}{\text{VMPK}} = \frac{r_1}{r_2} = 1 + s = B_k \]

Then

\[ B_k \] is the ratio of the two VMPKs. \( B_k > 0 \).

8). Cultivated land, \( D \), is given exogenously and, is used only in the agricultural sector.

The basic idea of the model is illustrated in Figure 4.1.

**FIGURE 4.1 INSTITUTIONAL COST TO LABOR REALLOCATION**

The horizontal axis in Figure 4.1 represents the total rural labor force \( L \), divided into industrial labor \( L_1 \) (read from left to right) and agricultural labor \( L_2 \) (read from right to left). The vertical axis represents the VMPLs in the two sectors. Note that the two VMPL curves are moving in opposite directions. Without institutional restrictions, i.e., labor is fully mobile between sectors, VMPLs (and wage rates) in the two sectors would converge at point \( c \), the intersection of the two VMPL curves. Equilibrium allocation of labor in the two sectors would be \( L_iL'' \) and \( L''L_2 \), respectively. When institutional restrictions exist, labor allocation is determined by

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point \( b \), where \( \frac{w_1}{1+t} = w_2 \). An institutional cost to transfer of labor is represented by the vertical distance between the \( VMPL_1 \) curve and the curve denoted as \( \frac{w_1}{1+t} \), where the latter represents the industrial wage, net of institutional cost, received by workers. Thus, \( VMPL_1 > VMPL_2 \), and a gap exists between the two VMPLs (equal to the distance between \( a \) and \( b \)). Labor is under-allocated in the industrial sector as \( L_1L' \), and over-allocated in the agricultural sector as \( L'L_2 \). The triangle \( abc \) shows the deadweight loss to the economy\(^6\).

When institutional change occurs, i.e., \( t \) is declining, the \( \frac{w_1}{1+t} \) curve shifts upwards. This moves the intersection point along the \( VMPL_2 \) curve to the right, leading to a convergence of VMPLs and a reallocation of labor from agriculture to industry. At the extreme, if the institutional cost approaches zero, labor will be reallocated as \( L_1L'' \) and \( L_2L'' \) respectively. In this case, the two VMPLs fully converge, and \( B_1 = 1 \).

In the period of transition, the reallocation of labor will result in faster growth in the rural industry and a net gain to the economy (equal to the area \( abc \) in Figure 4.1). Although this is only a "short-run effect", the economy will permanently achieve a higher output level. How high a growth rate can be achieved in the adjustment period and how long the fast growing period will take, depends on the original level of the institutional cost, and the speed of institutional change. The higher the pre-existing institutional cost, or the faster the institutional adjustment, the higher the growth rate that can be achieved. On the other hand, the higher the pre-existing cost, or the slower the institutional reform, the longer the adjustment period will take.

When capital is mobile and endogenously determined in each sector, i.e., the allocation of capital between the two sectors is determined by the relative marginal product of capital, the institutional effect on rural industrial growth would be stronger. This is explained as follows.

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\(^6\) This is based on the assumption that the institutional restriction is a tax-equivalent barrier. If it is a real cost for obtaining and keeping the job, the deadweight loss would be greater, equal to the area \( abc+abde \).
Given the production technology \( \frac{\partial Y}{\partial L} > 0, \frac{\partial Y}{\partial K} > 0, \frac{\partial^2 Y}{\partial L^2} < 0, \) and \( \frac{\partial^2 Y}{\partial K^2} < 0, \) a reallocation of labor from agriculture to industry, induced by institutional changes, will lead to a decrease in MPL and an increase in MPK in industry, but opposite changes in agriculture. VMPLs will converge, and VMPKs will diverge (if initially \( VMPL_1 \geq VMPL_2 \)). The changes in VMPKs will lead to a flow of capital from agriculture to industry\(^7\), further result in a VMPL convergence. In the adjustment process, the increasing \( K_1 \) will retard the decrease in \( VMPL_1 \), and expand the institutional effect on labor reallocation, therefore further accelerating rural industrial growth (see Figure 4.2).

\[\text{FIGURE 4.2 INSTITUTION EFFECT WITH ENDOGENOUS CAPITAL}\]

In Figure 4.2, the initial institutional cost on labor transfer is equal to the vertical distance between points \( a \) and \( b \). Determined by this cost and the curves \( VMPL_1 \) and \( VMPL_2 \), the rural labor is divided into industrial labor \( L_1L' \) and agricultural labor \( L_2L' \). Assume that the institutional cost is removed \((t=0)\), this shifts the curve \( \frac{w_1}{1+t} \) upwards to \( VMPL_1 \). A transfer of labor from the agricultural sector increases industrial labor from \( L_1L_1' \) to \( L_1L_1'' \). MPLs converged at point \( c \). However, this is not the end of

\(^7\) This may take the form of using agricultural savings to invest in industry.
adjustment. In the case that capital is endogenously determined, an increase in industrial labor will result in an increase in $MPK_1$, therefore in an increased incentive for reallocation of capital from agriculture to industry. The transfer of capital will shift the $VMPL_1$ curve upward to $VMPL_1^*$ and $VMPL_2$ downward to $VMPL_2^*$, therefore leading to a further transfer of labor into the rural industry. The whole process of adjustment will eventually converge to point $f$, where labor is allocated in the two sectors as $L_1^*$ and $L_2^*$, respectively.

Clearly, with capital endogenously determined, the institutional effect on labor reallocation and on industrial growth is stronger. The net gain to the economy is the area $abc$ plus the area between the curves $VMPL_1$ (to the left of point $c$) and $VMPL_1^*$ (to the left of $g$), minus the area between the curves $VMPL_2$ (to the right of $g$) and $VMPL_2^*$ (to the right of $f$).

Although the institutional effect will finally lead to MPL convergence, reallocation of capital can result in MPL divergence in the short-run. Therefore, in a short-run adjustment period, direction of changing MPLs is uncertain, depending on the relative speed of labor and capital movement.

Note that institutional change may not be the only reason for labor reallocation between sectors. For instance, technological progress in the industrial sector can lead to an upwards shift of both the $VMPL_1$ curve and the $\frac{w_1}{1+t}$ curve, followed by a reallocation of labor. For simplicity, this effect is ignored in the current analysis.

The model is specified as follows. For simplicity, Cobb-Douglas production functions are chosen for both sectors.\(^8\)

The production function in the rural industry is written as

$$Y_1 = A_1 K_1^{\alpha_1} L_1^{\beta_1} \quad (0<\alpha_1<1, 0<\beta_1<1) \quad (1)$$

The production function in agriculture ia represented by

$$Y_2 = A_2 K_2^{\alpha_2} L_2^{\beta_2} D^\gamma e^{\delta R} \quad (0<\alpha_2<1, 0<\beta_2<1, 0<\gamma<1, R>0) \quad (2)$$

---

\(^8\) A translog version of the model is estimated to compare with the results of the Cobb-Douglas version. See Appendix 5.3 of Chapter 5.
where \( Y_i \) is the constant price output of the \( i \)th sector \((i=1,2)\); \( L_i \) and \( K_i \) are labor and capital in the \( i \)th sector, respectively; \( D \) is land used in the agricultural sector; \( R \) is the land irrigation ratio \(^9\) \((R=\text{irrigated land} / \text{total cultivated land}; 0 \leq R \leq 1)\). \( D^T e^{\eta T} \) then is the contribution of effective land to output. \( A_i \) represents the level of total factor productivity (TFP) in sector \( i \). \( \alpha_i, \beta_i, \) and \( \gamma \) are the elasticities of output with respect to capital, labor and land, respectively. \( \eta \) is the coefficient of the irrigation ratio.

To allow technical progress, following Solow (1956), \( A_i \) is assumed to be a function of time, \( A_i = A_i(T) = A_{i(0)} e^{g_i T} \), where \( g_i \) is the rate of TFP growth, \( A_{i(0)} \) is a constant as the initial level of TFP, and \( T \) is a time trend. Hence, Equations (1) and (2) can be written as

\[
Y_1 = A_{i(0)} e^{g_i T} K_1^{\alpha_i} L_1^{\beta_i} \tag{1'}
\]
\[
Y_2 = A_{2(0)} e^{g_2 T} K_2^{\alpha_2} L_2^{\beta_2} D^T e^{\eta T} \tag{2'}
\]

Alternatively, to allow fluctuations of TFP over time, \( A_i \) \((i=1,2)\) can be written as \( A_{i(t)} = A_{i(0)} a_{i(t)} \), where \( a_{i(t)} = A_{i(t)}/A_{i(0)} \) for year \( t \), so that changing \( A_i \) in each year can be described in logarithm form. In this case, the above equations can be written as

\[
Y_1 = A_{i(0)} a_{i(1)} K_1^{\alpha_i} L_1^{\beta_i} \tag{1''}
\]
\[
Y_2 = A_{2(0)} a_{2(1)} K_2^{\alpha_2} L_2^{\beta_2} D^T e^{\eta T} \tag{2''}
\]

The labor cost is determined by VMPLs:

\[
w_1 = P_1 \frac{\partial Y_1}{\partial L_1} = P_1 \beta_i A_i K_1^{\alpha_i} L_1^{\beta_i-1} = \beta_i \frac{P_i Y_1}{L_1} \tag{3}
\]
\[
w_2 = P_2 \frac{\partial Y_2}{\partial L_2} = \beta_2 A_2 K_2^{\alpha_2} L_2^{\beta_2-1} D^T e^{\eta T} = \beta_2 \frac{P_2 Y_2}{L_2} \tag{4}
\]

where \( w_i \) is the value marginal product of labor (in current price) or the equilibrium wage rate in sector \( i \); \( P_1 \) is the price index for industrial and agricultural products, respectively.

The labor allocation condition with institutional barriers is written as

\[
w_1 = B_i w_2 \tag{5}
\]

\(^9\) Empirical study found it is important to distinguish the additional contribution of irrigated land area from total land area on agricultural output. Omission of \( R \) from the agricultural production function caused biased estimation.
where $B_L > 1$ indicates institutional barriers on labor transfer from industry to agriculture. The magnitude of $B_L$ relates to the level of institutional cost.

The labor supply constraint is

$$L_1 + L_2 = L$$

(6)

where $L$ is the total labor supply in the rural economy.

Substitute Equation (3) and (4) into (5) to get

$$\beta_1 \frac{P_1 Y_1}{L_1} = B_L \beta_2 \frac{P_2 Y_2}{L_2}$$

(7)

Assuming that $B_L$ varies at a constant rate $g_L$, over time, Equation (7) can be written as

$$\beta_1 \frac{P_1 Y_1}{L_1} = B_{L(0)} e^{g_L T} \beta_2 \frac{P_2 Y_2}{L_2}$$

(7')

Alternatively, to allow irregular changes of $B_L$, it can be written as

$$\beta_1 \frac{P_1 Y_1}{L_1} = B_{L(0)} b_{L(1)} \beta_2 \frac{P_2 Y_2}{L_2}$$

(7'')

where $B_{L(0)}$ is the initial level of $B_L$, $g_L$ is the growth rate of $B_L$, $b_{L(1)} = B_{L(0)}/B_{L(0)}$.

The constraint of capital ($K$ is the exogenous total capital stock in the rural economy) is

$$K_1 + K_2 = K$$

(13)

The price of capital $r_1$ is determined by the value of the marginal product of capital in each sector:

$$r_1 = P_1 \frac{\partial Y_1}{\partial K_1} = \alpha_1 P_1 A_1 K_1^{\alpha_1 - 1} L_1^{\beta_1} = \alpha_1 \frac{P_1 Y_1}{K_1}$$

(14)

$$r_2 = P_2 \frac{\partial Y_2}{\partial K_2} = \alpha_2 P_2 A_2 K_2^{\alpha_2 - 1} L_2^{\beta_2} D^\gamma e^{\eta K} = \alpha_2 \frac{P_2 Y_2}{K_2}$$

(15)

Capital allocation between the two sectors is subject to the following condition:

$$r_1 = B_K r_2 \quad (B_K > 0)$$

(16)
where $B_K$ is the ratio of VMPKs, and $B_K \neq 1$ represents the capital market imperfection.

Combine Equations (14) and (15) with (16) to get
\[ \alpha_1 \frac{P_Y}{K_1} = B_K \alpha_2 \frac{P_Z}{K_2} \]  
(17)

For possible variation of $B_K$, Equation (17) can be written as either of the following:
\[ \alpha_1 \frac{P_Y}{K_1} = B_K(1) e^{s \tau} \alpha_2 \frac{P_Z}{K_2} \]  
(17')
\[ \alpha_1 \frac{P_Y}{K_1} = B_K(1) b_{k(i)} \alpha_2 \frac{P_Z}{K_2} \]  
(17'')

Equations (1), (2), (6), (7), (13) and (17) constitute the two-sector model. From this model, the institutional effect on allocation of labor and capital, and then on output growth, can be derived as follows (see part two of Appendix 4.1). For simplicity, $B_K$ is assumed to be a constant. This assumption will be justified later). These effects are expressed in terms of elasticity of labor, capital and output with respect to the institutional factor $B_L$.

For the industrial sector
\[ E_{L, B_L}^i = -Z / X \]  
(20)
\[ E_{K, B_L}^i = -W / X \]  
(21)
\[ E_{Y, B_L}^i = -(\alpha_i W + \beta_i Z) / X \]  
(22)

For the agricultural sector
\[ E_{L, B_L}^i = \frac{Z}{X} \frac{L_i}{L_2} \]  
(23)
\[ E_{K, B_L}^i = \frac{W}{X} \frac{K_i}{K_2} \]  
(24)
\[ E_{Y, B_L}^i = (\alpha_i W \frac{K_i}{K_2} + \beta_i Z \frac{L_i}{L_2}) \frac{1}{X} \]  
(25)

where $E_{L, B_L}^i$, $E_{K, B_L}^i$ and $E_{Y, B_L}^i$ are elasticities of labor, capital and output in the $i$th sector with respect to $B_L$. $Z$, $W$ and $X$ are defined as follows:

\[ Z = (1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2} \]
\[ W = \beta_1 + \beta_2 \frac{L_1}{L_2} \]
\[ X = 1 - \alpha_1 - \beta_1 + (1 - \alpha_2 - \beta_2) \frac{K_1}{K_2} + (1 - \alpha_1 - \beta_1) \frac{L_1}{L_2} + (1 - \alpha_2 - \beta_2) \frac{K_1 L_1}{K_2 L_2} \]

Clearly both \( Z \) and \( W \) are positive, since both \( \alpha_i \) and \( \beta_i \) are smaller than one. It can be proved that, in the situation currently under consideration, \( X \) is also positive. Therefore these elasticities for industry are all negative, but those for agriculture are all positive (see Appendix 4.1). This indicates that when the institutional cost is reduced, both labor and capital would be reallocated from agriculture to the rural industry, generating a positive effect on industrial growth, but a negative effect on agricultural growth.

The institutional effect on aggregated rural economic growth is

\[ E_{Yb_t} = \frac{Y_1}{Y} E_{Yb_t} + \frac{Y_2}{Y} E_{Yb_t} = \frac{Y_1}{Y} \left( \beta_1 \frac{t}{1+t} \frac{Z}{X} + \alpha_1 \frac{s}{1+s} \frac{W}{X} \right) \]  

(26)

It can be proved that, when \( B_t > 1 \), \( E_{Yb_t} \) is negative, unless there exists a very serious discriminatory policy on capital allocation against agriculture, or \( \alpha_1 \) and \( \beta_1 \) take unusual values (Appendix 4.1). This indicates that, although institutional effects on industry and agriculture are in the opposite direction, a reduction in the institutional barriers has positive total effects on economic growth.

These elasticities give the institutional effect on sectoral or overall economic growth, i.e., growth rates with respect to the rate of change of \( B_t \).

Using \( \delta \) and \( \theta \) to represent \( E_{Yb_t} \) and \( E_{Yb_L} \), respectively, the growth rates of the two sectors and the rural economy can be decomposed as

\[ \hat{Y}_1 = g_1 + \alpha_1 \hat{K}^N_1 + \beta_1 \hat{L}^N_1 + \delta \hat{g}_L + \epsilon_1 \]
\[ \hat{Y}_2 = g_2 + \alpha_2 \hat{K}^N_2 + \beta_2 \hat{L}^N_2 + \gamma \hat{D} + \eta \frac{dR}{dt} + \theta \hat{g}_L + \epsilon_2 \]
\[ \hat{Y} = \frac{Y_1}{Y} (\hat{Y}_1^N + g_1 + \delta \hat{g}_L) + \frac{Y_2}{Y} (\hat{Y}_2^N + g_2 + \theta \hat{g}_L) + \epsilon \]

where the growth rate with superscript “\( N \)” is the “natural” growth rate for that variable, defined as the would-be input or output growth rate, if, without institutional change and TFP progress, \( g_i \) is TFP growth rate; \( g_L \) is the change rate of \( B_L \); and \( \epsilon \) is the growth residual.

Let \( E_{Yb_t} = \lambda \), the last equation can be alternatively written as
\[ \hat{Y} = \frac{Y_1}{Y} (\hat{Y}_1^N + g_1) + \frac{Y_2}{Y} (\hat{Y}_2^N + g_2) + \lambda g_L + \epsilon \]

where \( \lambda \) shows the total effect of institutional changes on the (rural) economic growth through factor reallocation between sectors.

Note that the elasticities \( \delta, \theta, \) and \( \lambda \) can not be directly estimated from the above equations, since they are non-constants, and \( g_L \) is unknown. However, these equations show how the institutional change contributes to economic growth.

**4.3 SUMMARY**

This chapter examines the reason for the rapid growth of China’s rural industry during the period of economic reform, emphasizing the contribution of institutional changes on industrial growth through factor reallocation between agriculture and the rural industry.

A two-sector model is established to investigate the institutional effect as well as the contribution of other factors on growth. The model indicates that, in the situation under consideration, a reduction in institutional barriers on labor mobility will result in a reallocation of both labor and capital between sectors, leading to faster growth in the rural industry in the transitional period. Overall economic growth will also be accelerated.
APPENDIX 4.1 THE SIGN OF THE INSTITUTIONAL EFFECT

This appendix discusses the signs of the institutional effects on growth of input and output in the two rural sectors. It is easier to derive the signs of the institutional effects in a case of capital stock in the two sectors being exogenously determined. Therefore, the first part of this appendix derives the institutional effect, under the assumption of exogenous capital stock. In the second part, the institutional effect is derived under a more complicated situation, i.e., sectoral capital is endogenously determined. The third part of this appendix is a discussion about the sign of the institutional effect in the endogenous capital case, according to the result derived in the second part.

**Institutional Effect with Exogenous Capital**

In the exogenous capital case, the model is constituted by the following three equations:

\[
Y_1 = A_1 K_1^\alpha_1 L_1^\beta_1 \quad (0<\alpha_1<1, \ 0<\beta_1<1) \tag{1}
\]

\[
Y_2 = A_2 K_2^\alpha_2 L_2^\beta_2 D^\gamma e^{\eta R} \quad (0<\alpha_2<1, \ 0<\beta_2<1, \ 0<\gamma<1, \ R>0) \tag{2}
\]

\[
\beta_1 \frac{P_1 Y_1}{L_1} = B_1 \beta_2 \frac{P_2 Y_2}{L_2} \tag{7}
\]

The first step is to derive the institutional effect on growth rates of labor and output in the rural industry. Take the logarithm to the reduced form equation and rearrange to get

\[
\ln L_i = \frac{1}{1-\beta_i} \left[ -\ln B_i + \ln \beta_i - \ln \beta_2 + \ln A_1 - \ln A_2 + \alpha_i \ln K_i \\
- \alpha_2 \ln K_2 + (1-\beta_i) \ln L_2 - \gamma \ln D - \eta R \right]
\]

Take the total differential to the above equation by ignoring the exogenous changes of TFP, capital stock and land to get

\[
d \ln L_i = \frac{-1}{1-\beta_i} d \ln R + \frac{1-\beta_2}{1-\beta_i} d \ln L_2
\]

Since \( d \ln L_i = dL_i / L_i \), and \( dL_2 = -dL_1 \) when \( L \) is given (see identity 6), the above equation can be expressed as the elasticity of industrial labor with respect to \( B_L \), representing the effect of institutional changes on labor growth:
\[
\frac{dL_1}{L_1} \cdot \frac{dB_L}{B_L} = \frac{-1}{1 - \beta_1} \left[ 1 + \frac{(1 - \beta_2) L_1}{(1 - \beta_1) L_2} \right] \\
= -1 / \left[ (1 - \beta_1) + (1 - \beta_2) \frac{L_1}{L_2} \right] \\
= \phi
\]

or

\[
\overline{E}_{L,t} = \phi \tag{8}
\]

where \( \phi \) is the solution for the institutional effect on the growth rate of industrial labor.

Combine the above and Equation (1) to obtain the institutional effect on rural industrial growth:

\[
\overline{E}_{Y,t} = E_{Y,t} \cdot \overline{E}_{L,t} = \beta_1 \phi
\tag{9}
\]

where \( \overline{E}_{Y,t} \) and \( \overline{E}_{Y,t} \) are the institutional factor elasticity of output and labor elasticity of output in rural industry, respectively. \( \beta_1 \phi \) is the solution for the effect of institutional changes on rural industrial growth.

Clearly, \( \phi < 0 \), since \( 0 < \beta_1 < 1 \) and \( 0 < \beta_2 < 1 \). The institutional effect on rural industrial growth has a negative sign. Equation (9) suggests that, if the institutional factor \( B_L \) (\( B_L \) for a positive institutional cost to labor reallocation from agriculture to the rural industry) reduced at a rate of \( x\% \), the rural industrial growth rate would be accelerated by \( (\beta_1 \phi) x\% \).

The second step is to get the symmetrical effect of the institutional changes on agricultural growth. Since

\[
\frac{dL_2}{dB_L} = - \frac{dL_1}{dB_L},
\]

Then the institutional effect on agricultural labor is as follows:

\[
\overline{E}_{L,t} = \frac{dL_2}{L_2} \cdot \frac{dB_L}{B_L} = - \frac{dL_1}{L_1} \cdot \frac{dB_L}{B_L} = - \frac{L_1}{L_2} \phi \tag{10}
\]

The institutional effect on agricultural growth can be easily derived from Equation (2) and (10):

\[
\overline{E}_{Y,t} = - \beta_2 \frac{L_1}{L_2} \phi \tag{11}
\]
Both $\bar{E}_{\beta_1}$ and $\bar{E}_{\beta_2}$ are positive, suggesting a reduction in the growth rate of agriculture, as a result of labor reallocation, when the institutional cost is reducing.

The total effect of institutional changes on aggregated output of the rural economy can be expressed as

$$\frac{dY}{dB_L} = \frac{dY_1}{dB_L} + \frac{dY_2}{dB_L} = \frac{\partial Y_1}{\partial L_1} \frac{dL_1}{dB_L} + \frac{\partial Y_2}{\partial L_2} \frac{dL_2}{dB_L}$$

Note that $\partial Y_i / \partial L_i$ is the marginal product of labor in the $i$th sector. According to Equation (6) and (8), $dL_1 / dB_L = -dL_2 / dB_L = (L_i / B_L) \phi$. Therefore:

$$\frac{dY}{dB_L} = (MPL_1 - MPL_2) \frac{L_i}{B_L} \phi$$

The total institutional effect on the rural economy in terms of elasticity can then be easily derived by multiplying both sides of the above equation by $B_L / Y$.

$$\bar{E}_{\beta_2} = (MPL_1 - MPL_2) \frac{L_i}{Y} \phi \quad (12)$$

Equation (12) indicates that, given the pre-condition $MPL_1 > MPL_2$, which results from a positive institutional cost on labor reallocation, the sign of the institutional effect on overall economic growth is always negative, i.e., a reduction in the institutional factor $B_L$ will result in an acceleration in economic growth.

Equation (12) also suggests that, the greater the MPL gap, the greater the institutional effect on economic growth. The strength of the institutional effect also depends on the relative size of $L_1$ and $L_2$, the relative magnitude of $L_1$ and $Y$, and the magnitude of the labor coefficients $\beta_1$ and $\beta_2$.

**Institutional Effect with Endogenous Capital**

Figure 4.1 and 4.2 in this chapter already show that, in the case of capital being endogenously determined, the institutional effect on labor reallocation between the two sectors would be in the same direction as, but stronger than, the exogenous capital case. However, mathematical proof for the endogenous capital case is complicated. The following part is not concerned with providing overall proof, but is presented as a discussion about the sign of the institutional effect in certain conditions.
In the endogenous capital case, the institutional effect can be derived from the following equations:

\begin{align}
Y_1 &= A_1 K_1^{\alpha_1} L_1^{\beta_1} \quad (0 < \alpha_1 < 1, 0 < \beta_1 < 1) \\
Y_2 &= A_2 K_2^{\alpha_2} L_2^{\beta_2} D^{\gamma} e^{\eta R} \quad (0 < \alpha_2 < 1, 0 < \beta_2 < 1, 0 < \gamma < 1, R > 0)
\end{align}

\begin{align}
\beta_1 \frac{P_1 Y_1}{L_1} &= B_1 \beta_2 \frac{P_2 Y_2}{L_2} \\
\alpha_1 \frac{P_1 Y_1}{K_1} &= B_2 \alpha_2 \frac{P_2 Y_2}{K_2}
\end{align}

Substitute \(Y_1\) and \(Y_2\) in Equation (7) and (17) by Equation (1) and (2), respectively, rearrange the two equations and take the logarithm to get

\[(1 - \beta_1) \ln L_1 = \ln A_1 - \ln A_2 + \ln \beta_1 - \ln \beta_2 - \ln B_L + \ln P_1 - \ln P_2 + \alpha_1 \ln K_1 - \alpha_2 \ln K_2 + (1 - \beta_2) \ln L_2 - \gamma \ln D - \eta R\]

and

\[\beta_1 \ln L_1 = \ln A_2 - \ln A_1 + \ln B_K + \ln \alpha_2 - \ln \alpha_1 + \ln P_2 - \ln P_1 + (1 - \alpha_1) \ln K_1 - (1 - \alpha_2) \ln K_2 + \beta_2 \ln L_2 + \gamma \ln D + \eta R\]

Take the total differential of the above equations, ignore all changes of exogenous variables that are irrelevant to \(B_L\), and substitute \(d \ln L_2\) and \(d \ln K_2\) by (obtained from the identities 6 and 13):

\[d \ln L_2 = L_2 / L_2 = -L_1 / L_1 d \ln L_1\]

and

\[d \ln K_2 = K_2 / K_2 d \ln K_1,\]

The following equations can be derived:

\[\left[(1 - \beta_1) + (1 - \beta_2) \frac{L_1}{L_2}\right] d \ln L_1 = -d \ln B_L + \left[\alpha_1 + \alpha_2 \frac{K_1}{K_2}\right] d \ln K_1\]

\[
\left[\beta_1 + \beta_2 \frac{L_1}{L_2}\right] d \ln L_1 = \left[(1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2}\right] d \ln K_1
\]

Equation (19) can also be written as an expression of \(d \ln K_1\) as a function of \(d \ln L_1\):
\[ d \ln K_1 = d \ln L_1 \frac{\beta_1 + \beta_2 \frac{L_1}{L_2}}{(1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2}} \]

Substitute \( d \ln K_1 \) in Equation (18) by the above equation to get the reduced form equation:

\[ (1 - \beta_1) + (1 - \beta_2) \frac{L_1}{L_2} \frac{(\alpha_1 + \alpha_2 \frac{K_1}{K_2})(\beta_1 + \beta_2 \frac{L_1}{L_2})}{(1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2}} = - \frac{d \ln B_L}{d \ln L_1} \]

Spread out the left hand side of the equation and simplify:

\[ \frac{1 - \alpha_1 - \beta_1 + (1 - \alpha_2 - \beta_1) \frac{K_1}{K_2} + (1 - \alpha_1 - \beta_2) \frac{L_1}{L_2} + (1 - \alpha_2 - \beta_2) \frac{K_1 L_1}{K_2 L_2}}{(1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2}} = - \frac{d \ln B_L}{d \ln L_1} \]

Use \( X \) to denote the numerator and \( Z \) the denominator of the LHS equation, i.e.,

\[ X = 1 - \alpha_1 - \beta_1 + (1 - \alpha_2 - \beta_1) \frac{K_1}{K_2} + (1 - \alpha_1 - \beta_2) \frac{L_1}{L_2} + (1 - \alpha_2 - \beta_2) \frac{K_1 L_1}{K_2 L_2} \]
\[ Z = (1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2} \]

Note that the RHS of the equation is the negative inverse of the institutional factor elasticity of industrial labor. Rearranging the equation to get the expression of institutional effect on reallocating labor to the industrial sector, in terms of elasticity:

\[ E_{L_1 B_L} = \frac{d \ln L_1}{d \ln B_L} = - \frac{Z}{X} \quad (20) \]

where \( E_{L_1 B_L} \) is the elasticity of industrial labor with respect to the institutional factor \( B_L \).

Following a similar procedure, the institutional effect on the change of industrial capital can also be derived. Rearrange Equation (19) as an expression of \( d \ln L_1 \) as a function of \( d \ln B_L \) and \( d \ln K_1 \), substitute this expression for \( d \ln L_1 \) in Equation (18), the following equation can be obtained:

\[ \frac{d \ln K_1}{d \ln B_L} = - \frac{\beta_1 + \beta_2 L_1 / L_2}{X} \]

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Let \( W = \beta_1 + \beta_2 L_1 / L_2 \), the above equation can be expressed as the elasticity of industrial capital with respect to the institutional factor \( B_L \):

\[
E_{K, B_L} = -\frac{W}{X}
\]  

(21)

The institutional effect on industrial output in terms of elasticity can be derived from Equation (20), (21) and production function (1):

\[
E_{Y, B_L} = \alpha_1 E_{K, B_L} + \beta_1 E_{L, B_L} = -(\alpha_1 W + \beta_1 Z) / X
\]

(22)

Substitute \( dL_1 \) and \( dK_1 \) in Equations (20) and (21) by \(-dL_2 = dL_1\) and \(-dK_2 = dK_1\), respectively, elasticities of agricultural capital and labor with respect to institutional factor \( B_L \) can then be derived as

\[
E_{L_1, B_L} = -\frac{dL_1}{dL_2} \frac{B_L}{L_1} = -\frac{dL_1}{L_2} \frac{B_L}{L_1} \frac{L_1}{L_2} = -E_{L, B_L} \frac{L_1}{L_2} \frac{L_1}{L_2} = -E_{L, B_L} \frac{Z_1}{X} \frac{L_1}{L_2}
\]

(23)

\[
E_{K_1, B_L} = -\frac{dK_1}{dK_2} \frac{B_L}{K_1} = -\frac{dK_1}{K_2} \frac{B_L}{K_1} \frac{K_1}{K_2} = -E_{K, B_L} \frac{K_1}{K_2} \frac{K_1}{K_2} = -E_{K, B_L} \frac{W_1}{X} \frac{K_1}{K_2}
\]

(24)

The elasticity of agricultural output in response to institutional changes:

\[
E_{Y, B_L} = \alpha_2 E_{K_2, B_L} + \beta_2 E_{L_2, B_L} = (\alpha_2 W \frac{K_1}{K_2} + \beta_2 Z \frac{L_1}{L_2}) \frac{1}{X}
\]

(25)

For the aggregated rural economic growth, the institutional effect is simply the weighted sum of the institutional effect on rural industrial growth and agricultural growth:

\[
E_{Y, B_L} = (Y_1 / Y) E_{K, B_L} + (Y_2 / Y) E_{Y, B_L}
\]

(26)

**The sign of the Institutional Effect with Endogenous Capital**

In the above, the institutional effect for the rural industrial sector is derived as

\[
E_{L_1, B_L} = -Z / X
\]

(20)

\[
E_{K_1, B_L} = -W / X
\]

(21)

\[
E_{Y, B_L} = (\alpha_1 W + \beta_1 Z)(1 + E_{R, C_2}) / (-X)
\]

(22)

where \( X, Z \) and \( W \) are defined as

\[
X = (1 - \alpha_1 - \beta_1) + (1 - \alpha_2 - \beta_2) \frac{K_1}{K_2} + (1 - \alpha_1 - \beta_1) \frac{L_1}{L_2} + (1 - \alpha_2 - \beta_2) \frac{K_1 L_1}{K_2 L_2}
\]

\[
W = \beta_1 + \beta_2 \frac{L_1}{L_2}
\]

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\[ Z = (1 - \alpha_1) + (1 - \alpha_2) \frac{K_1}{K_2} \]

Clearly both \( Z \) and \( W \) are positive since \( 0 < \alpha_1 < 1 \) and \( 0 < \beta_i < 1 \). If \( X > 0 \), \( E_{K_i \theta_i} \) and \( E_{K_i \theta_i} \) would be negative. The following discussion shows that, these elasticities are negative if

a) both sectors are constant returns to scale (CRS),

b) the capital-labor ratio in the rural industry is higher than in agriculture, and

c) \( \alpha_1 > \frac{APL_2}{APL_1} \alpha_2 \).\(^{10}\)

In the CRS case, the first term in the right hand side expression of \( X \) is equal to zero and the last term is positive, since \( 1 - \alpha_1 - \beta_1 = 0 \) and \( 1 - \alpha_2 - \beta_2 = \gamma > 0 \). The signs of the second and third terms are uncertain. \( X \) can be written as:

\[
X = (1 - \alpha_2 - \beta_2) \frac{K_1}{K_2} + (1 - \alpha_1 - \beta_1) \frac{L_1}{L_2} + (1 - \alpha_2 - \beta_2) \frac{K_1 L_1}{K_2 L_2}
\]

\[
= (\beta_2 - \beta_1) \frac{K_1 L_2 - K_2 L_1}{K_2 L_2} + K_1 L_1 - K_1 L_2
\]

We know \( \frac{K_1 L_2 - K_2 L_1}{K_2 L_2} > 0 \) since \( \frac{K_1}{L_1} > \frac{K_2}{L_2} \). Then \( X \) would be positive if:

\[
\beta_2 - \beta_1 > - \frac{K_1 L_2 - K_2 L_1}{K_1 L_2 - K_2 L_1}
\]

To simplify it, assume \( MPK_1 = MPK_2 \). Then the above condition can be expressed as:

\[
\frac{\alpha_1}{\beta_1} MPL_1 > \frac{\alpha_2}{\beta_2} MPL_2 \quad \text{or}
\]

\[
\alpha_1 APL_1 > \alpha_2 APL_2
\]

where \( MPK_i, MPL_i \) and \( APL_i \) (\( i = 1, 2 \)) are the marginal product of capital, labor, and average product of labor in the \( i \)th sector, respectively. In the Cobb-Douglas production function, \( MPK_i = \alpha_i \frac{Y_i}{K_i}, \ MPL_i = \beta_i \frac{Y_i}{L_i} \), and \( APL_i = \frac{Y_i}{L_i} \).

\(^{10}\) These conditions hold in the situation under consideration. CRS is tested and proved in Appendix 5.2. The higher capital-labor ratio is true, particularly because labor is under-allocated in the rural industry and over-allocated in agriculture, due to institutional restrictions. Therefore agriculture is far more labor intensive and less capital intensive than industry. In addition, estimation shows \( \alpha_1 > \alpha_2 \).
\(MPL_1 > MPL_2\) is the precondition under consideration, it is the result of institutional restrictions on labor allocation. \(APL_1 > APL_2\) also holds since agriculture is more labor intensive than the rural industry. When institutional restriction exists, \(\frac{APL_2}{APL_1}\) would be significantly smaller than 1. Thus, the above condition holds except in the special case that \(\alpha_1\) is unreasonably smaller than \(\alpha_2\).

This result indicates that, when there exists institutional restriction against the rural industrial sector, a reduction in this restriction can result in a transfer of labor and capital into the industrial sector (i.e., \(E_{L;B_l} < 0, E_{K;B_l} < 0\)), unless \(\alpha_1<<\alpha_2\).

It is more complicated in the increasing returns to scale case. Positive \(E_{L;B_l}\) and \(E_{K;B_l}\) may be derived. However, this does not mean a reduction in institutional restrictions would lead to an inverse reallocation of labor, from the high productivity sector to the low one. Rather, it would suggest that, during the transitional period, an increase in industrial labor, as a result of reducing institutional cost, might lead to an increase in the MPL gap between sectors. In this case, the value of \(B_L\) would no longer indicate the level of institutional cost.

The following is a discussion for the sign of \(E_{Y;L}\), i.e., elasticity of aggregated output with respect to \(B_L\).

First, changes in \(Y\), as a result of institutional changes, are the aggregation of the institutional effect on \(Y_1\) and \(Y_2\):

\[
\frac{dY}{dB_L} = \frac{dY_1}{dB_L} + \frac{dY_2}{dB_L} = \frac{\partial Y_1}{\partial L_1} \frac{dL_1}{dB_L} + \frac{\partial Y_1}{\partial K_1} \frac{dK_1}{dB_L} + \frac{\partial Y_2}{\partial L_2} \frac{dL_2}{dB_L} + \frac{\partial Y_2}{\partial K_2} \frac{dK_2}{dB_L}
\]

Note that \(dL_2 = -dL_1\) when \(L\) (i.e., \(L_1 + L_2\)) is unchanged. The equation is rearranged to get

\[
\frac{dY}{dB_L} = (MPL_1 - MPL_2) \frac{dL_1}{dB_L} + (MPK_1 - MPK_2) \frac{dK_1}{dB_L},
\]

\[
\frac{dY}{dB_L} = (MPL_1 - MPL_2) E_{L;B_l} \frac{L_1}{B_l} + (MPK_1 - MPK_2) E_{K;B_l} \frac{K_1}{B_l}
\]

Using the information in Equations (20) and (21) in section 4.2, the above equation can be rewritten as:
\[ E_{Y_{b_{1}}} = -(\frac{MPL_{1} - MPL_{2}}{X Y}) \frac{Z L_{1}}{X Y} - (\frac{MPK_{1} - MPK_{2}}{X Y}) \frac{W K_{1}}{X Y} \]

\[-\left( \frac{MPL_{1} - MPL_{2}}{MPL_{1}} \right) MPL_{1} \frac{Z L_{1}}{X Y} - \left( \frac{MPK_{1} - MPK_{2}}{MPK_{1}} \right) MPK_{1} \frac{W K_{1}}{X Y} \]

According to the definition, \( \frac{MPL_{1} - MPL_{2}}{MPL_{1}} = \frac{t}{1+t} \), and \( \frac{MPK_{1} - MPK_{2}}{MPK_{1}} = \frac{s}{1+s} \).

(1+t=B_{L} and 1+s=B_{K}, see section 4.2). The above equation can then be written as

\[ E_{Y_{b_{1}}} = -\frac{Y_{i}}{Y} \left( \frac{\beta_{1}}{1+t} \cdot \frac{Z}{X} + \frac{s}{1+s} \cdot \frac{W}{X} \right) \]

(26’)

By definition, \( t>0 \) and \( s>-1 \). In CRS technology, \( Z>W \) since the capital-labor ratio in the industrial sector is higher than agricultural sector. Given that \( W, X \) and \( Z \) are all positive, the above equation suggests that

- if \( s=0 \) (i.e., \( MPK_{1}=MPK_{2} \)), or \( s>0 \) (i.e., \( B_{K}>1 \)), \( E_{Y_{b_{1}}} \) is negative.
- if \( s<0 \) but \( \left| \frac{s}{1+s} \right| < \frac{\beta_{1}}{\alpha_{1}} \cdot \frac{t}{1+t} \cdot \frac{Z}{W} \), \( E_{Y_{b_{1}}} \) is negative.

The above conditions state that, the institutional factor elasticity of output is negative as long as \( MPK_{1} \) is not sufficiently smaller than \( MPK_{2} \), or, \( \alpha_{1} \) is not sufficiently greater than \( \beta_{1} \). In other words, unless there exists a very serious discriminatory policy on capital allocation against agriculture, or in some unusual cases of \( \alpha_{1} \) and \( \beta_{1} \), and if there is only a reduction in institutional restrictions on labor allocation without changing restrictions on capital allocation, the market oriented institutional change would positively contribute to economic growth. The above condition also suggests that, the larger the MPL gap, the smaller the possibility for \( E_{Y_{b_{1}}} \) to be non-negative.
CHAPTER 5. CONTRIBUTION OF INSTITUTIONAL CHANGES TO RURAL INDUSTRIAL GROWTH: AN EMPIRICAL STUDY

This chapter aims to identify important determinants for China’s rapid rural industrial growth during the period of economic reform, with an emphasis on estimating the impact of market-oriented institutional changes. The theoretical model was established in the last chapter. Section 5.2 provides a modified model for the purpose of empirical analysis, and description of data. Output elasticities with respect to factors, total factor productivity in the two sectors, and variation of the relative marginal product of labor are estimated, for the period of 1980-92, in Section 5.3. In Section 5.4, calculations based on the estimation result are made to derive the contribution of institutional changes and other factors to rural industrial growth and economic growth. In Section 5.5, reasons for capital misallocation, which was found in the empirical analysis, are discussed. Finally, Section 5.6 summarizes the major findings in this chapter. Appendixes are attached for detailed estimation results, data and some test results.

5.1 THE EMPIRICAL MODEL AND DATA

Based on the model provided in Chapter 4 (see Section 4.2), the empirical analysis is carried out to investigate the actual contribution to rural industrial growth and economic growth, from institutional-change-induced factor reallocation, TFP growth, and input growth. The institutional effect can be calculated from changes in the institutional factor $B_L$, i.e., the relative MPLs of the rural industry and agriculture, which will be estimated from the model.

Panel data are used at the provincial level for the period 1980-92 (except 81-84 and 87). The data set includes 28 provinces for 8 years. Total observations are 224. Original data came from BTVE(a), BTVE(b), RSED, and SSB (various years).
Calculations are made by the author to obtain the constant price output data and the capital stock for both the rural industrial sector and the agricultural sector (see Appendix A1 and A2). Input and output data are aggregated at the national level for each year, and their growth rates are shown in Table 5.15 in Appendix 5.1.

For empirical analysis, the logarithmic form of the model is taken. An earlier estimation included dummy variables for the 28 provinces to allow the cross-sectional variation (Greene 1991, 461-96). Since many cross-sectional dummies were found insignificant, they were replaced by regional dummies that classify the 28 provinces into three groups according to their nature (i.e., the East Coast, Central, and West regions). Dummy variables for either particular time periods or for each year are also added (in latter case they replaced the time trends). Dummies and time trends that were found to be statistically insignificant in some equations are omitted, unless they are necessary for the equation.

Version I (with time trends for \(g_i\) and \(g_k\)):

\[
\ln Y_i = \ln A_{i(0)} + g_1 T + \alpha_1 \ln K_i + \beta_1 \ln L_i \\
= C_{i1} \text{REG}_1 + C_{i2} \text{REG}_2 + C_{i3} + g_1 T + g_{1M1} M_i T + \alpha_1 \ln K_i + \beta_1 \ln L_i \tag{1'}
\]

\[
\ln Y_2 = \ln A_{2(0)} + g_2 T + \alpha_2 \ln K_2 + \beta_2 \ln L_2 + \gamma \ln D + \eta R \\
= C_2 + g_2 T + g_{2M1} M_i T + \alpha_2 \ln K_2 + \beta_2 \ln L_2 + \gamma \ln D + \eta R \tag{2'}
\]

\[
\ln (P_1 Y_i / L_i) - \ln (P_2 Y_i / L_2) = \ln (B_{i(0)} / \beta_2 / \beta_1) + g_T T \\
= C_3 + g_3 T + g_{3M1} M_i T + g_{3R1} \text{REG}_1 T + g_{3M2R1} \text{REG}_1 M_i T \tag{3'}
\]

\[
\ln (P_1 Y_i / K_i) - \ln (P_2 Y_i / K_2) = \ln (B_{K(0)} / \alpha_2 / \alpha_1) + g_T T \\
= C_{41} \text{REG}_1 + C_{42} \text{REG}_2 + C_{43} \tag{4'}
\]

subject to the constraint of capital and labor:

\[
L_1 + L_2 = L \tag{5}
\]

\[
K_1 + K_2 = K \tag{6}
\]

where \(\text{REG}_1\) is a dummy variable for the East coast region (Regions 1), which is more developed than the Central (Region 2) and West (Region 3) regions, and \(\text{REG}_2\) is the dummy variable for region 2; \(M_1\) and \(M_2\) are dummies for the periods 1980-85 (early stage of the reform) and 89-92 (later stage of reform), respectively.

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In Equation (1'), $C_{11}$, $C_{12}$ and $C_{13}$ represent $\ln A_{1(0)}$, i.e., the original levels of TFP in the rural industry, in different regions. $C_{11} + C_{13}$ is the TFP level for Region 1; $C_{12} + C_{13}$ for Region 2; and $C_{13}$ for Region 3. $g_1 + g_{1M1}$ is the TFP growth rate for the period 1980-85, and $g_1$ is the rate for the remaining period.

In Equation (2'), $C_2$ is equal to $\ln A_{2(0)}$ for agriculture, regional dummies are omitted due to insignificance. $g_2$ and $g_{2M1}$ are TFP growth rate for the periods the same as in Eq. (1').

Equation (3') and (4') are rearranged from Equation (7') and (17') of Chapter 4 (Section 4.2) by moving variables $\ln P_2 Y_2 / L$ and $\ln P_2 Y_2 / K$ to the left hand side, and all constants to the right. Now the RHS of Equation (3') is constituted by a constant $C_3$, representing $\ln(B_{L(0)} \beta_2 / \beta_1)$, and time trends for the rate of change of $B_L$ in different regions (Region 1 and Regions 2-3) in different periods (1980-88 and 89-92). Since both $\ln(B_{L(0)} \beta_2 / \beta_1)$ and $\beta_i$ (i=1,2) can be estimated from the system, $B_{L(0)}$ can be calculated.

Regional dummies are omitted due to insignificance. But growth rate of $B_L$ are found to be different between Region 1 and the other regions. For Region 1, $g_{1L} + g_{1LR1}$ is equal to the growth rate of $B_L$ in 1981-88, $g_{1L} + g_{1LM2} + g_{1LR1} + g_{1LM2R1}$ is equal to that rate in 1989-92. For other regions, $g_{1L}$ is the growth rate of $B_L$ in 1981-88, and $g_{1L} + g_{1LM}$ is that rate in 1989-92.

The RHS of Equation (4') is constituted by the constant $C_{a3}$ and regional dummies. $C_{a1} + C_{a4}$ is equal to $\ln(B_{K(0)} \alpha_2 / \alpha_4)$ for Region 1, $C_{a2} + C_{a4}$ for Region 2, and $C_{a3}$ itself for Region 3. Time trends are omitted due to insignificance.

Equation (5) and (6) are identities that do not need to be estimated.

Version II (with dummy variables for annual changes):

\[
\ln Y_1 = C_{11} REG_1 + C_{12} REG_2 + C_{13} + C_{1(i)} T_i + \alpha_1 \ln K_1 + \beta_1 \ln L_1 \quad (1'')
\]

\[
\ln Y_2 = C_2 + C_{2(i)} T_i + \alpha_2 \ln K_2 + \beta_2 \ln L_2 + \gamma \ln D + \eta R \quad (2'')
\]

\[
\ln(P_1 Y_1 / L_1) - \ln(P_2 Y_2 / L_2) = C_3 + C_{3(i)} T_i + C_{3(i)} REG_1 T_i \quad (3'')
\]

\[
\ln(P_1 Y_1 / K_1) - \ln(P_2 Y_2 / K_2) = C_{a1} REG_1 + C_{a2} REG_2 + C_{a3} + C_{a4} T_i \quad (4'')
\]

\[L_1 + L_2 = L \quad (5)\]
\[ K_1 + K_2 = K \]  

Equations (1’), (2’), (3’), and (4’) are derived from Equations (1’), (2’), (7’), and (17’) in Chapter 4, respectively.

In version II, a series of dummy variables for each year, \( T_i = 1 \) for year \( t \), \( T_t = 0 \) otherwise; \( t=1981, \ldots, 92 \) are used to replace the time trend in Version I. \( C_{ij} \) (\( i=1 \ldots 4 \) for the four equations, \( j=1 \ldots 3 \) for the three regions) represents the intercept terms in the four equations: \( \ln A_{i(0)}, \ln A_{2(0)}, \ln(B_{i(t)} / \beta_1 \cdot \beta_2), \) and \( \ln(B_{K(0)} / \alpha_2 / \alpha_1) \). Regional differences can be obtained in the same way as for Version I, e.g., \( C_{11} + C_{13} = \ln A_{1(0)} \) for Region 1, \( C_{13} \) alone for Region 3. The change in the intercept term in year \( t \) is represented by \( C_{ii(t)} \) that corresponds to different regions, e.g., for Region 1, \( \ln A_{1(1992)} = C_{11} + C_{13} + C_{1(1992)} \), \( \ln(B_{1(t)} / \beta_1 \cdot \beta_2) = C_{1} + C_{3(1992)} + C_{3(1992)} \).

Definitions for variables and parameters are provided as follows.

Endogenous variables:

\( Y_i \): Gross Output Value of the \( i \)th sector in 1980 constant price\(^1\).

\( K_i \): Calculated capital stock for each sector in 1980 constant prices\(^2\).

\( L_i \): Labor supply in each sector.

Exogenous variables:

\( K \): Total capital stock in the rural economy, \( K = K_1 + K_2 \).

\( L \): Total rural labor, \( L = L_1 + L_2 \).

\( D \): Cultivated land area used in agriculture.

\( R \): The irrigation ratio (irrigated land area to total cultivated land area).

\( P_1 \): Industrial Producer Price Index, \( P_{1(1980)} = 1 \).

\( P_2 \): Purchasing Price Index for Agricultural Products, \( P_{2(1980)} = 1 \).

\( T \): Time trend for the period 1980–92 (\( T = 0, \ldots, 12 \)).

\(^1\) An earlier estimation by the author using the official constant price output data caused systematic overvaluation of productivity changes in the rural industry. The data were found to be seriously underdeflated. To solve the problem, annual output in constant price for each province was recalculated by the author from current price output and the Industrial Producer Price Index. For details see Appendix 1.

\(^2\) \( K_i \) is calculated from the value of fixed assets and working capital of TVEs. \( K_2 \) is calculated from farmers’ household productive fixed assets, major agricultural machinery, annual application of chemical fertilizer, the compound prices for each variable, and their price indexes. See Appendix 2.
Dummy variables:

$REG_1$: Regional dummy for the ten east coast provinces$^3$: Liaoning, Beijing, Tianjin, Hebei, Shandong, Shanghai, Jiangsu, Zhejiang, Fujian, and Guangdong. $REG_1=1$ for the above provinces and $REG_1=0$ otherwise. Hainan is excluded due to the shortage of data.

$REG_2$: Regional dummy for the nine provinces in the central area or non-coastal east areas: Jilin, Heilongjiang, Neimenggu (Inner Mongolia), Shanxi, Henan, Anhui, Jiangxi, Hubei, and Hunan.

Nine north-west and south-west provinces, excluded from $REG_1$ and $REG_2$, fall into Region 3. They are Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang, Sichuan, Yunnan, Guizhou, and Guangxi. Xizang (Tibet) is excluded due to lack of data.

$M_1$ and $M_2$: Dummy variables for the earlier and later periods of economic reform. $M_1=1$ for year 1980-85 and $=0$ otherwise. $M_2=1$ for year 1989-92 and $=0$ otherwise.

$T_i$: A series of annual dummy variables. $T_i=1$ for year $t$ ($t=1981...92$), $T_i=0$ otherwise.

Parameters:

$A_i$: Level of total factor productivity in the $i$th sector, with $A_{i(0)}$ being the value of $A_i$ in the initial year (1980).

$g_i$: Instantaneous growth rate of $A_i$, i.e., TFP growth rate in the $i$th sector ($i=1,2$).

$\alpha$, $\beta$, and $\gamma$: Output elasticities with respect to capital, labor and land, respectively.

$\eta$: Coefficient of irrigation ratio.

$B_L$: The ratio $VMPL_1/VMPL_2$.

$B_K$: The ratio $VMPK_1/VMPK_2$.

$B_{L(0)}$ and $B_{K(0)}$: Constants, the initial level (1980) of $B_L$ and $B_K$.

$g_L$ and $g_K$: Instantaneous changing rate of $B_L$ and $B_K$, respectively.

$C_{ij}$: Constant or coefficient of dummies; $i=1...4$ for equations, and $j=1...3$ for regions.

---

$^3$ There are 30 provinces in Mainland China, including four autonomous ethnic regions and three large cities administratively at the provincial level. Guangxi is reclassified into Region 3.
$C_{it}$: coefficient of annual dummies $T_i$ in different regions. $t=1980...92$.

5.2 ESTIMATION RESULTS

The model is estimated simultaneously using the Three-Stage-Least-Squares (3SLS) method. Estimated shares of factors in output are shown in Table 5.1. Detailed estimation results are shown in Table 5.11-5.14 in Appendix 5.1. Most estimates are statistically significant at least at the 1% level, except some annual dummies and land in version II.

Both versions I and II suggest constant returns to scale character in both the rural industry and agriculture. Capital and labor shares are 0.6 and 0.4 in industry respectively. Capital, labor and land shares in agriculture are 0.5, 0.44 and 0.06 respectively (Version I). Land has a relatively low share in agricultural output; however, its contribution to output is also reflected through the coefficient of irrigation ratio$^4$.

<table>
<thead>
<tr>
<th>TABLE 5.1 ESTIMATION RESULTS: FACTOR CONTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>Capital</td>
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<tr>
<td>Labor</td>
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<tr>
<td>Equation R$^2$</td>
</tr>
<tr>
<td>Agriculture</td>
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<tr>
<td>Capital</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Land</td>
</tr>
<tr>
<td>Irrigation ratio</td>
</tr>
<tr>
<td>Equation R$^2$</td>
</tr>
</tbody>
</table>

Source: From Table 5.11 in Appendix 5.1.

TFP growth rates in both sectors (g$s$) are found to be positive and significant in the whole period, and obviously larger in 1981-85 than in 1986-92. Results from both

$^4$ For a test of constant returns to scale see Appendix 5.2. An early estimation by the author using official constant price output data without recalculation produced increasing returns to scale for the rural industry. Another estimation without including the irrigation ratio in the production function obtained a negative contribution for land. These appear to be biased estimations.
versions of the model suggest the same trend. No significant difference is found in TFP growth among the three regions, either for industry or for agriculture, although, the levels of industrial TFP among regions are different, significantly higher in Region 1 than in the other regions (see Table 5.2).

**TABLE 5.2 TFP GROWTH BY SECTOR AND BY REGION**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3 or overall</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Version I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP(80)</td>
<td>1.84</td>
<td>1.48</td>
<td>1.20</td>
<td>1.52</td>
</tr>
<tr>
<td>$g_1(81-85)$</td>
<td>8.6%</td>
<td>8.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$g_1(86-92)$</td>
<td>4.0%</td>
<td>4.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP(80)</td>
<td>0.99</td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$g_2(81-85)$</td>
<td>6.3%</td>
<td>6.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$g_2(86-92)$</td>
<td>2.6%</td>
<td>2.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Version II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP(80)</td>
<td>1.82</td>
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<td>1.50</td>
</tr>
<tr>
<td>TFP(85)</td>
<td>3.05</td>
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<tr>
<td>TFP(92)</td>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>TFP(92)</td>
<td></td>
<td></td>
<td>1.59</td>
<td></td>
</tr>
</tbody>
</table>

Source: calculated from Table 5.11-5.12 in Appendix 5.1.

The fast TFP growth during 1980-85 in both sectors was accompanied by major rural reforms: the introduction of the Household Responsibility System, the abolition of the Commune System, and the relaxation of industrial control. This suggests that institutional change also had an effect on productivity growth at the sectoral level. The slowdown of TFP growth after 1985 indicates that the effect diminished in the late eighties. In addition, annual estimates in Version II suggest that, industrial TFP dropped in several short periods, i.e., in 1986, 89, and 91; and agricultural TFP dropped in 86 and 89 (see Table 5.13 in Appendix 5.1). They coincided with the application of contractionary macro economic policies in those years. In practice, these macro contractions were also associated with the reinforcement of central control and temporary suspension of reforms.
From the estimation results, the values of $B_L$ and $B_K$ (the VMPL and VMPK ratios between the two sectors) and their rates of change ($g_L$ and $g_K$) are calculated and shown in Table 5.3. They illustrate that industrial MPL was nearly 3 times as high as agricultural MPL, indicating a high institutional cost on labor allocation against non-agricultural activities. A mild decreasing trend of $B_L$ (convergence of MPLs) was found in 1981-88 (not for all the regions), indicating a continued reduction in institutional restrictions on labor reallocation in this period, but a rapid increasing trend was also found in 1989-92.

**TABLE 5.3. CHANGING RELATIVE MPL AND MPK**

<table>
<thead>
<tr>
<th></th>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3 or overall</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_L$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$B_L(80)$</td>
<td>2.4%</td>
<td>-5.6%</td>
<td>2.92</td>
<td>2.92</td>
</tr>
<tr>
<td>$g_L(80-88)$</td>
<td>5.9%</td>
<td>20.6%</td>
<td>-5.6%</td>
<td>-2.9%</td>
</tr>
<tr>
<td>$g_L(89-92)$</td>
<td></td>
<td></td>
<td>20.6%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Version II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$B_L(80)$</td>
<td>3.15</td>
<td>2.55</td>
<td>2.55</td>
<td>2.75</td>
</tr>
<tr>
<td>$B_L(88)$</td>
<td>3.14</td>
<td>2.29</td>
<td>2.29</td>
<td>2.57</td>
</tr>
<tr>
<td>$B_L(92)$</td>
<td>5.22</td>
<td>3.68</td>
<td>3.68</td>
<td>4.19</td>
</tr>
<tr>
<td>$B_K$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$B_K(80)$</td>
<td>0.80</td>
<td>0.64</td>
<td>0.43</td>
<td>0.62</td>
</tr>
<tr>
<td>$g_K(80-88)$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$g_K(89-92)$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Version II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$B_K(80)$</td>
<td>0.74</td>
<td>0.61</td>
<td>0.40</td>
<td>0.58</td>
</tr>
<tr>
<td>$B_K(88)$</td>
<td>0.71</td>
<td>0.59</td>
<td>0.39</td>
<td>0.56</td>
</tr>
<tr>
<td>$B_K(92)$</td>
<td>0.82</td>
<td>0.68</td>
<td>0.45</td>
<td>0.65</td>
</tr>
</tbody>
</table>

a. Most estimates for $B_K$ in version II are insignificant.
Source: calculated from Table 5.11-5.12 in Appendix 5.1.

The estimated $B_K$ is smaller than 1, without significant change during 1981-92. This suggests a lower MPK in TVEs than in agriculture, indicating an overallocation of capital in the rural industry and an underallocation in agriculture. The reason for this will be discussed in Section 5.5. The non-variation of $B_K$ leads to acceptance of the hypothesis of constant $B_K$. Therefore the expression of institutional factor
elasticities derived in Section 4.2 is valid. These elasticities were derived under the assumption of constant $B_K$.

To compare with the Cobb-Douglas estimate of $B_L$, a translog version of the model is estimated. Although accurate estimates are not available, the result indicates the same directions of the changing MPL ratio during the two periods (see Appendix 5.3).

Two questions may be raised. (1) Does the result indicate the correct direction of institutional change during the two periods? (2) Does the estimated changing MPL ratio reflect the extent of institutional change?

On the first question, although there were policy fluctuations in the early period of reform, there was a general tendency towards reduction of institutional restrictions before 1988. However, a major change, from this trend, occurred in 1989 that attempted to partly reinstall central planning control, and protect the state sector from competition from the non-state sector. Many TVEs were forced to close down in 1989-90 (see Chapter 2). A reverse flow of labor, from the rural industry to agriculture, occurred. The situation changed again in 1992, when a new policy was announced to accelerate market-oriented economic reform.

Table 5.4 lists the major policies and institutional changes from 1977 to 1995, compared with the change in TVE employment. It indicates a clear relationship between rapid rural industrialization and institutional reform. The restoration of old restrictive policies in 1981, 89 and 90 all resulted in a direct reduction in TVE’s employment. In 1989 and 90, nearly three million TVE workers lost their jobs. This was much more serious than the situation in 1981.

Therefore the estimated decreases in $B_L$ in 1980-89, and increases in 1989-90, are basically consistent with the observed institutional changes. Nevertheless, the positive effect on TVE employment from relaxing central control in 1991, and market oriented reform in 1992, is not reflected by a drop in $B_L$. On the contrary, there is still a sharp increase in $B_L$ in 1991-92. The increasing $B_L$ in 1991-92 is inconsistent with the direction of institutional change.
TABLE 5.4. IMPACTS OF POLICY CHANGES ON TVE EMPLOYMENT

<table>
<thead>
<tr>
<th>Year</th>
<th>Major policy change</th>
<th>TVE Employment</th>
<th>Changes, + or -</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>relaxing control on CBE a, employment competing with agriculture</td>
<td>2328</td>
<td>532</td>
</tr>
<tr>
<td>1978</td>
<td>a.a., start agricultural reform</td>
<td>2827</td>
<td>499</td>
</tr>
<tr>
<td>1979</td>
<td>HRS b allowed only in exceptional cases; CBEs were restricted from competition with SOE</td>
<td>2909</td>
<td>82</td>
</tr>
<tr>
<td>1980</td>
<td>HRS introduced to some remote areas</td>
<td>3000</td>
<td>91</td>
</tr>
<tr>
<td>1981</td>
<td>contractionary policies; further strengthen the controls on CBE development</td>
<td>2970</td>
<td>-30</td>
</tr>
<tr>
<td>1982</td>
<td>abolishing communes, introducing HRS nation-wide</td>
<td>3113</td>
<td>143</td>
</tr>
<tr>
<td>1983</td>
<td>a.a. allow rural private firms to employ up to 5 workers</td>
<td>3235</td>
<td>122</td>
</tr>
<tr>
<td>1984</td>
<td>abolishing discriminative policy on TVEs; preferential policy in finance &amp; tax applied to TVEs</td>
<td>5208</td>
<td>1973</td>
</tr>
<tr>
<td>1985</td>
<td>relaxing control on human capital transfer to TVEs</td>
<td>6979</td>
<td>1771</td>
</tr>
<tr>
<td>1986</td>
<td>a short-lasting contractionary policy, relaxed later</td>
<td>7937</td>
<td>958</td>
</tr>
<tr>
<td>1987</td>
<td>continue reform</td>
<td>8805</td>
<td>868</td>
</tr>
<tr>
<td>1988</td>
<td>a.a. later start protecting SOEs, enhance control on TVEs, abolish preferential policy for TVEs</td>
<td>9546</td>
<td>741</td>
</tr>
<tr>
<td>1989</td>
<td>reinstall central control; tightening restriction on TVEs; and a contractionary macro policy</td>
<td>9367</td>
<td>-179</td>
</tr>
<tr>
<td>1990</td>
<td>a.a.</td>
<td>9265</td>
<td>-102</td>
</tr>
<tr>
<td>1991</td>
<td>relaxing restriction on TVEs</td>
<td>9609</td>
<td>344</td>
</tr>
<tr>
<td>1992</td>
<td>restart market oriented reform, encourage TVEs</td>
<td>10581</td>
<td>972</td>
</tr>
<tr>
<td>1993</td>
<td>a.a.</td>
<td>12345</td>
<td>1764</td>
</tr>
<tr>
<td>1994</td>
<td>contractionary macro policy</td>
<td>12018</td>
<td>-327</td>
</tr>
<tr>
<td>1995</td>
<td>continue reform</td>
<td>12862</td>
<td>844</td>
</tr>
</tbody>
</table>

Note: a. CBEs were the predecessors of TVEs. b. HRS = Household Responsibility System. c. In 1994 there was an adjustment of the TVE statistics. The apparent reduction in TVE employment in this year resulted from this adjustment. a.a. = as above.
Sources: LBSC 1987, 6-190; SSB 1993, 94-96.

Regarding the second question, from Tables 5.3 and 5.4, it can be concluded that the estimated speed of MPL divergence after 1989 seems to be too high, compared with the estimated speed of convergence in 1981-88, and real changes in TVE employment. In other words, there may have been some non-institutional factors causing MPL divergence in the period of 1989-92.

A number of non-institutional factors can be considered:

1) A possible over-stating of agricultural labor could have resulted in an underestimation of agricultural MPL, and therefore an estimated MPL
divergence. This is possible because of the rapid increases in rural-urban migration in the late 1980s (basically negligible in most of the 1980s) and in the early 1990s. The migrants were not deducted from the official statistics of agricultural labor due to lack of data. This might be the main reason for the estimated MPL divergence in the later period.

2) A possible overvaluation of TVE output data could result in an overestimation of industrial MPL. Although an under-deflating problem has been corrected in this study, some data bias is still possible. For instance, there have been a number of reports of local governments over-reporting TVE output in recent years (Economic Daily 1993-5, various issues).

3) Possible faster human capital accumulation in TVEs than in agriculture could result in a MPL divergence, since human capital was not distinguished from the labor force in the statistical data. This effect might be more significant in the later period than the earlier, when more educated farmers were employed by TVEs.

4) Faster technical progress or capital investment in the TVE sector could have a temporary effect on the MPL divergence.

In summary, the estimation result for changing $B_L$ is consistent with the observed direction of institutional change in most years of the sample period, but the MPL gap in 1989-92 is likely to have been overestimated due to some non-institutional effects and data problems.

In the following section, calculations are made to derive the expected change of $B_L$ that would have been induced purely by institutional change. This will be based on the estimate of initial $B_L$ in 1980 and information for the actual transfer of labor between the two sectors. Using the institutional elasticities derived from the model, the contribution of institutional changes to rural industrial growth and economic growth can be derived. Contributions from input growth and TFP growth, are also calculated.
5.3 A DECOMPOSITION OF GROWTH: CONTRIBUTION OF INSTITUTIONAL CHANGE AND OTHER FACTORS

In this section, the growth rates of rural industry, agriculture, and the rural economy at the aggregated level, are decomposed and attributed to the institutional effect and other factors. Calculation of the institutional effect will be based on the following assumptions:

1. Without institutional change, there would be no factor reallocation between sectors, and the labor and capital growth rates of the two sectors would be equal to the growth rate of total rural labor and capital\(^5\), i.e., \(\hat{L}^N_1 = \hat{L}^N_2 = \hat{L}\), \(\hat{K}^N_1 = \hat{K}^N_2 = \hat{K}\). We can call \(\hat{L}^N_1\) and \(\hat{K}^N_i\) as the natural growth rates of labor and capital respectively.

2. The MPL differential at the initial year (1980) was entirely caused by institutional restrictions. Therefore the estimated \(B_{1(1980)}\) indicates the true institutional barriers on labor allocation.

From Assumption 1, the sectoral output growth rate, if induced entirely by natural growth of inputs, can be further defined as the natural growth rate of output, denoted by \(\hat{Y}^N_i\), where \(\hat{Y}^N_1 = \alpha_1 \hat{K}^N_1 + \beta_1 \hat{L}^N_1\), and \(\hat{Y}^N_2 = \alpha_2 \hat{K}^N_2 + \beta_2 \hat{L}^N_2 + \gamma \hat{D} + \eta(dR / dt)\). The natural growth rate of the rural economy is a weighted aggregation of \(\hat{Y}^N_1\) and \(\hat{Y}^N_2\).

The actual sectoral input growth rate can then be decomposed into two components: 1) the natural growth rate; and 2) the institutional effect on factor reallocation. The actual sectoral output growth rate can be decomposed into four parts: 1) the natural growth rate; 2) the institutional effect on output growth through factor reallocation; 3) the TFP growth; and 4) a residual, i.e., growth induced by excluded effects or statistical errors.

The contribution of TFP growth to each sector is calculated year by year from the estimated TFP level from Version II of the model. TFP growth in the rural economy

---

\(^5\) This does not necessarily mean they induce the same output growth rates in the two sectors, since the shares of factors is unequal. Actually the difference in growth rates would change the relative MPLs and MPKs, and therefore induce a reallocation of factors between sectors. Since the differences will be small, this effect on factor reallocation is neglected.
(excluding the institutional effect on factor reallocation) is derived from the weighted TFP growth rates of the two sectors. TFP growth may result not only from technical progress, but also from an efficiency increase at the firm level induced by institutional changes. Therefore the institutional effect on growth through factor reallocation may not represent the whole effect of institutional change on growth. In this study, the former was called an institutional effect just for convenience.

The major issue of the decomposition is to derive the institutional effect on growth. According to Assumption 1 made above, the institutional effect on labor growth in the \( i \)th sector (\( i = 1, 2 \)) is derived as

\[
\hat{L}_i^{\text{ins}} = \hat{L}_i - \hat{L}_i^{\text{nl}} = \hat{L}_i - \hat{L}
\]

where \( \hat{L}_i^{\text{ins}} \) is the institutional effect on the growth rate of \( L_i \), through labor reallocation; \( \hat{L}_i \) is the actual growth rate of \( L_i \); \( \hat{L} \) is the actual growth rate of total rural labor.

Then the expected \( g_L \), i.e., the rate of change of the expected \( B_L \) (defined as the expected MPL ratio that would be purely induced by institutional barriers), can be derived from \( \hat{L}_i^{\text{ins}} \) and the elasticity \( E_{t_i B_L} \) (see Equation 20 in Section 4.2, Chapter 4) as

\[
g_L^E = \frac{\hat{L}_i^{\text{ins}}}{E_{t_i B_L}}
\]

\( E_{t_i B_L} \) can be calculated from the national level inputs data and the estimated coefficients (see Table 5.15 in Appendix 5.1). It is not a constant; therefore its values are calculated for each year. So is \( g_L^E \). Further, based on the derived \( g_L^E \) and the estimated \( B_L(1980) \) (according to Assumption 2), the level of the expected \( B_L \) for each year is derived. These calculation results are shown in Table 5.5.
### Table 5.5 Estimated and Expected $B_L$

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{I}^{mu}_c$</td>
<td>13.75&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.41</td>
<td>6.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-4.05</td>
<td>-3.76</td>
<td>1.17</td>
<td>8.36</td>
<td></td>
</tr>
<tr>
<td>$E_{L</td>
<td>x}B_L$</td>
<td>-16.08</td>
<td>-10.62</td>
<td>-8.62</td>
<td>-7.17</td>
<td>-7.16</td>
<td>-6.99</td>
<td>-6.56</td>
</tr>
<tr>
<td>$\delta^c_L$</td>
<td>-1.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-1.21%</td>
<td>-0.92&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.57%</td>
<td>0.54%</td>
<td>-0.18%</td>
<td>-1.37%</td>
<td></td>
</tr>
<tr>
<td>Expected $B_L$</td>
<td>2.75</td>
<td>2.58</td>
<td>2.55</td>
<td>2.50</td>
<td>2.52</td>
<td>2.53</td>
<td>2.52</td>
<td>2.49</td>
</tr>
<tr>
<td>Estimated $B_L$</td>
<td>2.75</td>
<td>2.54</td>
<td>2.62</td>
<td>2.57</td>
<td>2.81</td>
<td>3.17</td>
<td>3.66</td>
<td>4.19</td>
</tr>
</tbody>
</table>


Source: Table 5.13, 5.15-5.16 in Appendix 5.1.

The two different trends of changing relative MPLs (estimated, and expected) are compared in the last two rows of the table, and shown in Figure 5.1.

### Figure 5.1 Estimated and Expected MPL Ratios

![Graph showing estimated and expected MPL ratios from 1980 to 1992.]

In Figure 5.1, the expected $B_L$, which reflects the MPL gap that is fully induced by institutional barriers on labor allocation, shows a slow, but clear, converging tendency from 1980 to 92. This indicates a gradual reduction in institutional restrictions on labor reallocation during the economic reform. A mild divergence only appeared in 1989-90, when there was a temporary policy change towards partial re-centralization. The estimated and the expected MPL ratios are consistent in 1981-88, but show a rapid divergence after 1989. As discussed earlier, this was most probably the result of 1) an unrecorded rural-urban migration at the end of the 80s and in the 90s; 2)
overreporting of industrial output in recent years, and 3) faster human capital growth and short run effects of capital investment in the TVE sector.

Since the expected $B_L$ is derived from the real transfer of labor (and estimated $B_L$ in 1980 only), it avoids the data problem and therefore seems to be far more reliable. Although, by deducting the effect of human capital growth, the expected MPL gap could be smaller and converge faster than appeared. Unfortunately there are not enough data to include human capital in the study.

Based on the derived $g_L^e$, and the elasticities of capital and output with respect to $B_L^e$, the institutional effects on the growth rate of capital and output in each sector, and at the aggregated level, are derived.

Table 5.6 gives the results for the decomposition of the annual growth rates of the rural industry at the national level. Table 5.7 shows the decomposition of industrial, agricultural, and aggregated rural economic growth, as the average for 1981-92. Other results are shown in Table 5.17 in Appendix 5.1.

| TABLE 5.6 DECOMPOSITION OF RURAL INDUSTRIAL GROWTH a (%) |
|-----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Actual          | 26.70        | 23.59        | 21.47        | 2.82         | 9.14         | 13.29        | 35.26        |
| Natural         | 8.34         | 17.45        | 11.90        | 5.40         | 6.13         | 10.06        | 10.58        |
| Inst.efficiency | 10.89        | 7.63         | 4.45         | -2.61        | -2.39        | 0.72         | 4.94         |
| TFP$^e$         | 10.33        | -13.68       | 1.12         | -0.37        | 2.91         | -1.44        | 14.84        |
| Residual        | -2.86        | 12.19        | 4.00         | 0.40         | 2.49         | 3.95         | 4.90         |

Note: a. All are instantaneous growth rates. b. Average growth rate in that period. c. The estimated TFP growth in 1986 may not be accurate.
Source: Calculated from Table 5 and Table 5.15-5.16 in Appendix 5.1.

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6 See Equations 21-26 in Section 4.2, Chapter 4. These elasticities are non-constants, their values in each year are calculated in the same way as $E_{L,C}$. See Appendix 5.1: Table 5.15 and 5.16 for data and calculated elasticities.
TABLE 5.7 DECOMPOSITION OF AVERAGE SECTORAL GROWTH RATE

<table>
<thead>
<tr>
<th>Growth rate</th>
<th>Industry</th>
<th>Agriculture</th>
<th>Aggregated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual growth</td>
<td>21.7</td>
<td>6.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Natural growth</td>
<td>9.6</td>
<td>8.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Inst. Effect</td>
<td>6.0</td>
<td>-2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>TFP growth</td>
<td>4.7</td>
<td>2.6</td>
<td>3.5</td>
</tr>
<tr>
<td>Residual</td>
<td>1.4</td>
<td>-2.6</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Note: a. All are instantaneous growth rate. The annual growth rate for industry was 24.2%
Source: Calculated from Appendix 5.1, Table 5.15-5.17.

The important findings, shown in Table 5.6 and 5.7, are summarized as follows:

1. Institutional changes made a major contribution to the acceleration of rural industrial growth in 1981-92 (annual 6% in average), and accounted for 28% of the total growth of the rural industry. It is higher than the contribution of TFP growth (4.7% on average, accounting for 22% of total industrial growth). These two effects together contributed half in the annual 22% of the industrial growth rate, besides the contribution of the natural growth of factors.

2. The positive effect of institutional change on rural industrial growth far exceeded the negative effect on agricultural growth that resulted from factor outflow, because of the productivity differences between sectors. At the aggregated level, institutional changes positively contributed to the growth of the rural economy.

3. Short term policy changes towards re-centralization had a clearly negative effect on rural industrial growth and overall economic growth in 1989-90.


Other implications:

1. As indicated by the derived expected $B_L$ (see Table 5.5 and Figure 5.1), although institutional barriers were steadily reduced, they still existed at a considerably high level in 1992. This suggests further institutional reform is
necessary and would still be an important source of rapid rural industrial growth in a medium term in future, possibly another 15-20 years. (To get this result, it is assumed that, the expected $B_1$ was around 2 in 1992, after deducting the human capital effect.)

2. Although there has been a clear reduction in the institutional restrictions during the period of economic reform, the MPLs converged slowly. Therefore, besides the nation-wide institutional restrictions on labor mobility, other institutional problems at the firm level would possibly existed. An important one could be the employment behavior of the collective firms (TVOEs), which could be different from the profit-maximizing firms. This might have result in a larger MPL gap between the TVE and agricultural sectors. This possibility will be investigated in Chapter 6.

3. Although small in value, growth residuals were positive in the rural industry and negative in agriculture (see Table 5.7). This is consistent with finding of overallocation of capital in industry and underallocation in agriculture (indicated by the smaller industrial MPK than agricultural MPK). The reason for this will be discussed in the following section.

5.4 INTEREST CONTROL AND CAPITAL MISALLOCATION

This section aims to answer the following question: what is the reason for the overallocation of capital in the rural industry, compared with that in agriculture?

In China’s rural area, there were broadly located branches of the state owned Agricultural Bank of China or ABC (basically in each county), and the Rural Credit Cooperatives or RCC (basically in each town or township). RCCs are collective financial organizations, but in practice they work under the guidance of the ABC, more or less as local branches of the latter. These two systems existed before economic reform, absorbed rural savings in the rural area and played a major role in providing credit to the rural sectors. Interest rates were regulated. The low interest bank loans helped the TVEs in their finance. However, if the interest rate in the rural
industry was lower than in agriculture, the former sector would be encouraged to use more capital with a lower marginal return.

Although as shown in Table 5.8, the regulated interest rates for the rural industrial sector were not systematically lower than for the agricultural sector, actual interest rates for the two sectors were different. This is due to the different lending rates between the ABC and the RCC (the latter was allowed to float upwards to a certain percentage), and their different allocative structure of loans (compared with the ABC, RCCs deal more in agricultural lending than TVE lending). For instance, in 1990-91, interest rates for RCC loans were allowed to float upwards by 60% from the regulated basic interest rates (EDCFY 1992: 515). In other words, the RCC interest rates were closer to the market interest rates whereas the ABC interest rates were much lower.

<table>
<thead>
<tr>
<th>Year</th>
<th>For industrial working capital</th>
<th>For fixed assets*</th>
<th>For agricultural production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>5.04</td>
<td>2.16-4.32</td>
<td>2.16-4.32</td>
</tr>
<tr>
<td>1981</td>
<td>5.04-5.52</td>
<td>2.16-4.32</td>
<td>2.16-4.32</td>
</tr>
<tr>
<td>1982-83</td>
<td>3.6-7.2</td>
<td>4.32-5.76</td>
<td>4.32-7.2</td>
</tr>
<tr>
<td>1984</td>
<td>3.6-7.2</td>
<td>7.2-7.92</td>
<td>5.76-7.92</td>
</tr>
<tr>
<td>1985</td>
<td>3.6-7.92</td>
<td>7.92-10.8</td>
<td>5.76-10.8</td>
</tr>
<tr>
<td>1986</td>
<td>7.92</td>
<td>7.92-10.8</td>
<td>7.2-10.8</td>
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<tr>
<td>1987</td>
<td>7.92</td>
<td>7.92-10.8</td>
<td>3.96-10.8</td>
</tr>
<tr>
<td>1988-89</td>
<td>9.0</td>
<td>7.92-10.8</td>
<td>7.92-10.8</td>
</tr>
<tr>
<td>1990</td>
<td>7.92-11.34</td>
<td>3.6-12.0</td>
<td>7.92-11.34</td>
</tr>
<tr>
<td>1991</td>
<td>8.64-9.36</td>
<td>8.64-11.16</td>
<td>8.64-9.36</td>
</tr>
<tr>
<td>1992</td>
<td>8.64</td>
<td>8.64-9.72</td>
<td>8.64</td>
</tr>
</tbody>
</table>

Source: EDCFY 1993, pp385.
* For both sectors.

In addition, Table 5.9 shows, that in most years, RCCs were the major supplier of agricultural loans, whereas the ABC was the major supplier of TVE loans. Although the role of the ABC shrank after 1988, its role in financing TVEs was still more important than that in agricultural finance.
TABLE 5.9 BALANCE OF ABC AND RCC LOANS IN THE TWO SECTORS

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>TVE loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCC</td>
<td>27.5</td>
<td>164</td>
<td>266</td>
<td>440</td>
<td>910</td>
</tr>
<tr>
<td>%</td>
<td>34%</td>
<td>47%</td>
<td>48%</td>
<td>52%</td>
<td>65%</td>
</tr>
<tr>
<td>ABC</td>
<td>53.0</td>
<td>188</td>
<td>288</td>
<td>408</td>
<td>498</td>
</tr>
<tr>
<td>%</td>
<td>66%</td>
<td>53%</td>
<td>52%</td>
<td>48%</td>
<td>35%</td>
</tr>
<tr>
<td>Agri.loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCC</td>
<td>49.9</td>
<td>236</td>
<td>303</td>
<td>453</td>
<td>801</td>
</tr>
<tr>
<td>%</td>
<td>34%</td>
<td>66%</td>
<td>70%</td>
<td>73%</td>
<td>76%</td>
</tr>
<tr>
<td>ABC</td>
<td>97.7</td>
<td>120</td>
<td>129</td>
<td>170</td>
<td>258</td>
</tr>
<tr>
<td>%</td>
<td>66%</td>
<td>34%</td>
<td>30%</td>
<td>27%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Notes:
1. Sum of total TVE loans from RCC and ABC =100%, respectively. Sum of total agricultural loans from RCC and ABC =100%, respectively.
2. Agricultural loans are an aggregation of loans to collective agriculture and individual farmers.

The above facts led to the result that TVEs (not all of them, but a large part of them) enjoyed far lower interest rates than the agricultural producers.

In addition to the lower interest rates, TVEs also had a poorer record than agricultural producers in the rate of loan repayment. Table 5.10 indicates that, in most years, the bank loan repayment rate (which is defined as the ratio of accumulated repaid bank loans to accumulated granted loans of ABC & RCC) of TVEs was significantly lower than that of agriculture. This further lowers the actual interest rate of the TVE sector on average, compared with the agricultural sector.

TABLE 5.10 REPAYMENT RATE OF BANK LOANS IN THE TWO SECTORS

<table>
<thead>
<tr>
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<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TVE</td>
<td>70.3</td>
<td>88.2</td>
<td>72.6</td>
<td>89.7</td>
<td>86.2</td>
</tr>
<tr>
<td>Agriculture*</td>
<td>82.5</td>
<td>95.2</td>
<td>83.2</td>
<td>91.5</td>
<td>84.9</td>
</tr>
</tbody>
</table>

* Agriculture is an aggregation of collectives and individual farmers.
Source: Same as Table 5.9.

---

7 In 1991, TVEs’ repayment rate was slightly higher than agriculture. However, 1991 was a special case since it was affected by a contractionary finance policy. This policy was introduced in 1989-90 and was partly intended to contract TVEs’ bank credit.
The low repayment rate from the TVEs suggests the existence of the so-called “soft budget constraint” (Kornai 1980). This mainly existed in the collective enterprises, i.e., Township and Village Owned Enterprise (TVOEs), which accounted for a major part of the TVE sector. Surveys found that TVOE often got support from township governments and, sometimes, county governments, in obtaining bank loans. With the support of local governments, TVOE often delayed or sometimes even failed to return bank loans\(^8\). Nevertheless, compared with the state owned enterprise, TVOE have much better records.

The actual lower interest rate for rural industry compared with agriculture, as shown above, answers the question why the marginal value product of capital in the rural industrial sector was continuously lower than in the agricultural sector. It also explains the reason for overallocation of capital in rural industry.

5.5 SUMMARY

This chapter empirically investigates the reason for the rapid growth of China’s rural industry during the period of economic reform, with emphasize on the contribution of institutional changes on industrial growth through factor reallocation between rural sectors. A two sector model that established in the last Chapter is used to estimate the institutional effect as well as the contribution of other factors on growth.

Estimation shows a large initial MPL gap between the two sectors, and a converging tendency of MPLs in 1981-88, indicating a reduction in institutional barriers, but a diverging tendency after 1989. By subtracting non-institutional effects, the MPL gap that resulted from institutional barriers is found to be reduced through out the whole period under study, except for an increase in 1989-90.

Derived from the estimation, it is found that the reduction in institutional barriers made a major contribution to the acceleration of rural industrial growth in 1981-92

---

\(^8\) Unpublished information obtained from surveys on TVEs in 1982, 1985-86 that the author attended.
(average 6% out of the 22% growth rate of rural industry, accounts for 28% of the
growth rate). This effect was diminishing, but still important in 1992.

The agricultural growth rate was reduced by only 2%, due to factor reallocation
between sectors. Overall growth of the rural economy was found to be accelerated,
suggesting a net gain from the improvement in factor allocation\(^9\).

TFP increases made another important contribution to sectoral growth: 4.7% in
rural industry (accounting for 22% of the growth rate of rural industry) and 2.7% in
agriculture. TFP growth might also result from institutional change through increases
in efficiency at the firm level.

Although institutional change has made an important contribution to rural
industrial growth, the remaining MPL differential is still high, suggesting a high
potential for rapid growth of rural industry in a medium term in future, from further
removal of institutional barriers.

On the whole, institutional changes have played a very important role in the rapid
rural industrial growth and overall economic growth. However, this rapid growth is a
transitional dynamic that will eventually fade away in the long run. Technological
progress and human capital improvement will become more and more important, for
sustainable growth of the rural economy in the long-run.

\(^9\) It should be pointed out that, in this study, the positive institutional effect on economic growth might
be more or less underestimated. This is because of the existence of higher saving rate in industry than in
agriculture. If this effect is taken into account (but need additional data that is currently unavailable),
capital formation in the rural economy should be endogenously determined, directly relating to
institutional change. In this case the "natural" output growth rates in both sectors would be lower, and
the institutional effects would be higher.
### APPENDIX 5.1 ESTIMATION RESULTS AND DATA

#### TABLE 5.11 ESTIMATION RESULTS: PRODUCTION FUNCTIONS, RELATIVE MPL AND MPK

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Version I</th>
<th>Version II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(1') Industry</td>
<td>(2') Agricul.</td>
</tr>
<tr>
<td>$K_i$</td>
<td>$a_i$</td>
<td>0.599</td>
<td>0.504</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(19.67*)</td>
<td>(18.44*)</td>
</tr>
<tr>
<td>$L_i$</td>
<td>$\beta_i$</td>
<td>0.406</td>
<td>0.442</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(14.28*)</td>
<td>(32.92*)</td>
</tr>
<tr>
<td>$D$</td>
<td>$\gamma$</td>
<td>0.061</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.28*)</td>
<td>(1.14)</td>
</tr>
<tr>
<td>$R$</td>
<td>$\eta$</td>
<td>0.137</td>
<td>0.084</td>
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<tr>
<td></td>
<td></td>
<td>(3.16&quot;)</td>
<td>(2.41&quot;)</td>
</tr>
<tr>
<td>REG$_1$</td>
<td>$C_{11}$</td>
<td>0.425</td>
<td>0.431</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(11.23*)</td>
<td>(11.90*)</td>
</tr>
<tr>
<td>REG$_2$</td>
<td>$C_{12}$</td>
<td>0.210</td>
<td>0.217</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.79*)</td>
<td>(8.47*)</td>
</tr>
<tr>
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<td>$C_{13}$, $C_2$</td>
<td>0.184</td>
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<td></td>
<td>(2.44&quot;)</td>
<td>(0.13)</td>
</tr>
<tr>
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<td>$g_t$</td>
<td>0.040</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.18*)</td>
<td>(6.77*)</td>
</tr>
<tr>
<td>$M_iT$</td>
<td>$g_{im}$</td>
<td>0.046</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.00*)</td>
<td>(5.40*)</td>
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<tr>
<td>Eq R$^2$</td>
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<td>0.921</td>
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#### Table continued

<table>
<thead>
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<th>Version II</th>
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<td>(4')MPK ratio</td>
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<td>$C_{41}$</td>
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<td></td>
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<td>(8.82*)</td>
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<td>0.411</td>
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<td></td>
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<td>(7.62*)</td>
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<td></td>
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<td>(16.52*)</td>
</tr>
<tr>
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<td>$g_L$</td>
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<td>(5.17*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.17*)</td>
<td>(5.17*)</td>
</tr>
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<td>$g_{LM}$</td>
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<td>(8.47*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.47*)</td>
<td>(8.47*)</td>
</tr>
<tr>
<td>REG$_1$T</td>
<td>$g_{LMR1}$</td>
<td>0.080</td>
<td>(4.52*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.52*)</td>
<td>(4.52*)</td>
</tr>
<tr>
<td>REG$_1$M$_2$T</td>
<td>$g_{LMR2}$</td>
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<td>(2.99&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.99&quot;)</td>
<td>(2.99&quot;)</td>
</tr>
<tr>
<td>Eq R$^2$</td>
<td></td>
<td>0.224</td>
<td>0.206</td>
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</tbody>
</table>

Notes: Values in parentheses are t-ratios. T-ratios with * are significant at 5% level; ** at 1% level; and *** at 0.1% level.
<table>
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<th>Coefficient</th>
<th>(1’')industry</th>
<th>(2’')agriculture</th>
<th>(3’’)MPL ratio</th>
<th>(4’’)MPK ratio</th>
</tr>
</thead>
<tbody>
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<td>$T_{85}$</td>
<td>C_{i(85)}</td>
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<td>(3.21*)</td>
<td>(1.23)</td>
<td>(2.92&quot;)</td>
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<tr>
<td></td>
<td></td>
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<td>0.200</td>
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<td>C_{i(86)}</td>
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<td>(0.79)</td>
<td>(0.90)</td>
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<td>(3.52*)</td>
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<td>(0.36)</td>
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<td></td>
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<td>-0.046</td>
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<td>C_{i(89)}</td>
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<td>(0.27)</td>
<td>(0.24)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>0.209</td>
<td>-0.029</td>
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<td>$T_{91}$</td>
<td>C_{i(91)}</td>
<td>(7.88*)</td>
<td>(4.00*)</td>
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</tr>
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<td>C_{i(92)}</td>
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<td>(4.95*)</td>
<td>(3.39&quot;)</td>
<td>(0.77)</td>
</tr>
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<td></td>
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<td>0.563</td>
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<td>0.368</td>
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</table>

<table>
<thead>
<tr>
<th>REG$_i$</th>
<th>Coefficient</th>
<th>(1’’)</th>
<th>(3’’)</th>
<th>(4’’)</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG$_{T80}$</td>
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</tr>
<tr>
<td>REG$_{T85}$</td>
<td>C$_{i(85)}$</td>
<td>0.351</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REG$_{T86}$</td>
<td>C$_{i(86)}$</td>
<td>0.303</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REG$_{T88}$</td>
<td>C$_{i(88)}$</td>
<td>0.313</td>
<td></td>
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</tr>
<tr>
<td>REG$_{T89}$</td>
<td>C$_{i(89)}$</td>
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<td>(4.06&quot;)</td>
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</tr>
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<td>(4.19&quot;)</td>
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<tr>
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<td>C$_{i(92)}$</td>
<td>0.349</td>
<td></td>
<td>(4.20&quot;)</td>
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a. The subscript $i$ denotes the corresponding coefficients in the four equations ($i=1,...,4$).
### TABLE 5.13 TFP LEVEL AND GROWTH RATE

*(FROM VERSION II)*

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<tbody>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Industry</td>
<td>1.82</td>
<td>3.05</td>
<td>2.66</td>
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<td>2.71</td>
<td>2.79</td>
<td>2.75</td>
<td>3.19</td>
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<tr>
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<td>1.16</td>
<td>1.41</td>
<td>1.4</td>
<td>1.45</td>
<td>1.43</td>
<td>1.48</td>
<td>1.5</td>
<td>1.59</td>
</tr>
<tr>
<td>Region 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
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<td>2.46</td>
<td>2.15</td>
<td>2.20</td>
<td>2.19</td>
<td>2.25</td>
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<td>2.58</td>
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<tr>
<td>Agricul.</td>
<td>1.16</td>
<td>1.41</td>
<td>1.4</td>
<td>1.45</td>
<td>1.43</td>
<td>1.48</td>
<td>1.5</td>
<td>1.59</td>
</tr>
<tr>
<td>Region 3</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>1.18</td>
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<td>1.73</td>
<td>1.77</td>
<td>1.76</td>
<td>1.81</td>
<td>1.79</td>
<td>2.08</td>
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<td>1.41</td>
<td>1.4</td>
<td>1.45</td>
<td>1.43</td>
<td>1.48</td>
<td>1.5</td>
<td>1.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TFP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
</tr>
<tr>
<td>Agricul.</td>
</tr>
<tr>
<td>Aggregate</td>
</tr>
</tbody>
</table>

Source: Calculated from the estimation result of version II, see Table 5.12.

### TABLE 5.14 CHANGING MPL RATIO AND MPK RATIO

*(FROM VERSION II)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>Region 1</td>
<td>3.15</td>
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<td>3.17</td>
<td>3.14</td>
<td>3.47</td>
<td>3.93</td>
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<td>5.22</td>
</tr>
<tr>
<td>Region 2</td>
<td>2.55</td>
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<td>2.34</td>
<td>2.29</td>
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Source: Calculated from the estimation result of version II, see Table 5.12.
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Notes: 1=industry and 2=agriculture. Capital and output are calculated in 1980 constant price. 1 mu =1/15 hectare. Variable with ^ is instantaneous growth rate. \(^{a}\) No variation over time.

Sources: Appendix A1 and A2; SSB various years; BTV 1991-93; and estimation result in Table 5.11.
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Note:
1. 2. Definitions see Section 4.2 of Chapter 4, Equation 20-26.
3. 4. Calculated from estimated $B_{L}$ (1980), $E_{L}^{m}$ and $E_{L,t}b_{L}$.
5. Average of estimated regional $B_{L}$ from version II, see Table 5.14.
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Notes: a. all calculated as instantaneous growth rate; b. as average in that period.
Sources: Calculated from Table 5.11-5.16.
APPENDIX 5.2 TEST FOR CONSTANT RETURNS TO SCALE

The following are tests for constant returns to scale in the rural industrial and agricultural sectors. Based on the empirical model in Section 5.2, subtract $\ln L_1$ from both the LHS and the RHS of Equation (1'), and subtract $\ln L_2$ from both sides of Equation (2'), to get

\[
\begin{align*}
\ln Y_1 - \ln L_1 &= C_{11} \, REG_1 + C_{12} \, REG_2 + C_{13} + g_1 T + g_{1w} M_1 T \\
&\quad + \alpha_1 (\ln K_1 - \ln L_1) + (\alpha_1 + \beta_1 - 1) \ln L_1 \\
(1')
\end{align*}
\]

\[
\begin{align*}
\ln Y_2 - \ln L_2 &= C_2 + g_2 T + g_{2w} M_1 T + \alpha_2 (\ln K_2 - \ln L_2) \\
&\quad + (\alpha_2 + \beta_2 + \gamma - 1) \ln L_2 + \gamma (\ln D - \ln L_2) + \eta R \\
(2')
\end{align*}
\]

Test 1

$H_1$: $\alpha_1 + \beta_1 - 1 \neq 0$ against

$H_2$: $\alpha_1 + \beta_1 - 1 = 0$

Test 2

$H_1$: $\alpha_2 + \beta_2 + \gamma - 1 \neq 0$ against

$H_2$: $\alpha_2 + \beta_2 + \gamma - 1 = 0$

Using the same model and same estimation method (3SLS), the following results are obtained:

$\alpha_1 + \beta_1 - 1 = 0.004$ \hspace{1cm} (t-ratio=0.347)

$\alpha_2 + \beta_2 + \gamma - 1 = -0.018$ \hspace{1cm} (t-ratio=-0.834)

Since both results are insignificant, the non-constant returns to scale hypothesis $H_1$ in both tests are rejected. This suggests that both the rural industrial and agricultural sectors exhibit a constant returns to scale technology.
APPENDIX 5.3 A TRANSLOG ESTIMATATION FOR MPL DIFFERENTIAL

In Section 5.3, a Cobb-Douglas production function estimation suggests a general converging tendency of MPLs in rural industry and agriculture, during 1980-88, but a diverging tendency after 1989. To confirm the correctness of the result, an alternative estimation is carried out using translog functions.

The following is the model in a translog format\(^{10}\):

Production functions:

\[
\ln Y_1 = \beta_{11} + \beta_{12} \ln L_1 + \beta_{13} \ln K_1 + \beta_{14} (\ln L_1)^2 + \beta_{15} (\ln K_1)^2 + \beta_{16} \ln L_1 \ln K_1
\]

\[
\ln Y_2 = \beta_{21} + \beta_{22} \ln L_2 + \beta_{23} \ln K_2 + \beta_{24} (\ln L_2)^2 + \beta_{25} (\ln K_2)^2 + \beta_{26} \ln L_2 \ln K_2 + \beta_{27} \ln D + \beta_{28} (\ln D)^2 + \beta_{29} \ln L_2 \ln D + \beta_{30} \ln K_2 \ln D
\]

Wage determination:

\[
w_1 = \frac{\partial Y_1}{\partial L_1} = (\beta_{12} + \beta_{14} + \beta_{16} \ln K_1) \frac{Y_1}{L_1}
\]

\[
w_2 = \frac{\partial Y_2}{\partial L_2} = (\beta_{22} + \beta_{24} + \beta_{26} \ln K_2 + \beta_{29} \ln D) \frac{Y_2}{L_2}
\]

Labor allocation condition:

\[
Y_1 / L_1 = (B_L (\beta_{22} + \beta_{24} + \beta_{26} \ln K_2 + \beta_{29} \ln D) / (\beta_{12} + \beta_{14} + \beta_{16} \ln K_1)) Y_2 / L_2
\]

or

\[
\ln(Y_1 / L_1) - \ln(Y_2 / L_2) = \ln B_L + \ln(\beta_{22} + \beta_{24} + \beta_{26} \ln K_2 + \beta_{29} \ln D) - \ln(\beta_{12} + \beta_{14} + \beta_{16} \ln K_1)
\]

It is difficult to derive the accurate value of \( B_L \) from Equation (5). Calculating \( B_L \) using all the estimated coefficients could result in large errors due to the pile-up of estimating errors. However, since in reality \( K_1 \) grew much faster than \( K_2 \), and \( D \) was decreasing during the whole sample period (1980-92), the RHS of Equation (5) can be expected to be a decreasing vector across time, if \( B_L \) was unchanged or decreasing. If the RHS of the equation exhibited an increasing tendency, an increasing \( B_L \) would be suggested. Thus Equation (5) is replaced by the follows:

\(^{10}\) For simplicity, the exogenous capital assumption is adopted. This may result in a smaller value of derived institutional effect, but will not result in wrong direction of estimated institutional changes.
\[ \ln(Y_i / L_i) - \ln(Y_j / L_j) = C + a_1T + a_2T_2 + a_3\text{REG1T} + a_4\text{REG1T}_2 \quad (5') \]

where \( C \) is a constant; \( T \) and \( T_2 \) are two time trends for the period of 1980-88 and 89-92, respectively (\( T=t-1980 \) for year \( t \) in 1980-88, and \( T=0 \) otherwise. \( T_2=t_2-1980 \) for year \( t_2 \) in 1989-92, and \( T_2=0 \) otherwise). \( \text{REG1} \) is a dummy variable for region 1. The time trends and regional dummy used in this equation are consistent with the Cobb-Douglas estimation. \( a_1 - a_4 \) are the coefficients, represents growth rate of the RHS in different periods and different regions.

The above model, i.e., Equations (1), (2), and (5'), is estimated using a 3SLS method. The same data set is used with the Cobb-Douglas estimation. The result is shown in Table 5.18. All estimates are statistically significant at 0.1% level, except \( \text{REG1T}_2 \).

**TABLE 5.18 A TRANSLOG ESTIMATION RESULT**

<table>
<thead>
<tr>
<th>variable</th>
<th>Coefficient</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T )</td>
<td>-0.055</td>
<td>-4.90</td>
</tr>
<tr>
<td>( T_2 )</td>
<td>0.155</td>
<td>4.08</td>
</tr>
<tr>
<td>( \text{REG1T} )</td>
<td>0.037</td>
<td>4.41</td>
</tr>
<tr>
<td>( \text{REG1T}_2 )</td>
<td>-0.013</td>
<td>0.26</td>
</tr>
<tr>
<td>( C )</td>
<td>1.218</td>
<td>18.98</td>
</tr>
</tbody>
</table>

System \( R^2 = 0.94 \)
Equation (5') \( R^2 = 0.99 \)

The result suggests that the RHS of the equation consists of decreasing vectors for 1980-88, and increasing vectors for after 1989. In the first period, the decrease in region 1 is slower than in the other regions. In the second period, it increases rapidly in all regions. This indicates a trend of changing \( B_i \) that is the same as the Cobb-Douglas estimation.

The above result shows consistency between Cobb-Douglas estimates and translog estimates.
CHAPTER 6. FIRM BEHAVIOR AND FACTOR ALLOCATION IN CHINA’S RURAL INDUSTRY

6.1 INTRODUCTION

This chapter analyzes the behavior of China’s rural collective enterprises, i.e., Township and Village Owned Enterprises (TVOEs), in labor allocation. It attempts to answer the following question: did TVOEIs contribute to divergence of marginal product of labor (MPL) between rural industry and agriculture? In other words, do TVOEIs behave differently from competitive private firms, in labor allocation and wage determination?

In the past nearly two decades of economic reform, the rural non-agricultural sector, or Township and Village Enterprises sector, made a major contribution to China’s rapid economic growth. TVEs also made the major contribution to industrialization of China’s abundant agricultural labor. From 1978 to 1994, TVE employment increased from 28 million to 120 million, absorbed 92 million rural laborers from the low productivity agricultural sector. Its total employment accounted for 27% of the total rural labor force in 1994. Before the relaxation of rural-urban migration in the late 1980s and early 90s, the TVE sector was the only channel for transfer of the abundant agricultural labor to model sectors.

The major component of the TVE sector has been the Township and Village Owned Enterprises (TVOEs), which are owned collectively by township or village communities, and run by either township governments or village authorities. The name “TVE” (Township and Village Enterprises) originally came from those enterprises which were owned by townships and villages (earlier owned by the Communes and Brigades before 1983). Rural private enterprises developed rapidly and was included in the TVE statistics since early 1980s (see Chapter 2). In 1994,

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1 This has been changed since rural-urban migration became significantly high in 1990s.
TVOEs accounted for 68% of TVE gross output, and 49% of TVE employment, the rests were that of private enterprises (SSB 1995, 364-365). Because of the characteristic of collective ownership, TVOEes were found to have many common characteristics with Labor Managed Firms (LMF) such as those in former Yugoslavia, or those cooperatives in the American plywood industry (Wang 1986, Gelb and Svejnar 1990, Chen 1992, Weitzman and Xu 1994, Pitt and Putterman forthcoming,). Weitzman and Xu call TVEs “vaguely defined cooperatives”.

There have been many studies in the literature on LMFs’ behavior and its result on factor allocation. The LMF theory was founded by Ward B. (1958) and Vanek J. (1970), and followed Domar (1966), Furubotn (1976), Ireland and Law (1981), Stephen (1984), Berman K. and Berman M. (1989), Mitchell (1989) and so on. A common hypothesis that accepted by these authors for LMFs’ objective, instead of the profit maximization for the competitive private firms (CPF), is income (per member) maximization. Most authors agree that, in the long run, there is no remarkable difference between LMFs and CPFs, either theoretically or empirically. However, several argued that, in the short run, LMFs’ supply is inelastic in response to market variation, due to difficulties in expelling workers (because they are members) and admitting workers (because this may reduce insiders’ per capita income). This was suggested to generate inefficient uses of factors.

In China, TVEs (mainly TVOEes) have commonly been accepted to be more efficient than their state-owned counterpart in market competition\(^2\). Although opinions differ on whether TVOEes operate as efficiently as private enterprises (see, e.g., Weitzman and Xu 1994, Sachs 1996), some empirical studies, based on different firm level survey data, have suggested there is no significant difference in efficiency.

\(^2\) An earlier research found the collective enterprise sector (of which TVOEes are the major component) had a lower TFP level than the state owned enterprises (SOEs), but a higher growth rate of TFP (e.g., Jefferson, Rawski and Zheng 1992). More recent studies suggest that the TFP level in TVEs has exceeded that in SOEs lately (Jefferson 1993). Svejnar (1990) also suggests that “TVPs (stands for township, village and rural private enterprises) operate with much less featherbedding than their state-owned counterparts”. In China, this point of view appeared in many official statements. For example, former Premier Zhao Ziyang called for “introduce the TVE mechanism into state-owned enterprises” in 1987.
between TVOEqs and private enterprises (Svejnar 1990, Pitt and Puterman, forthcoming).

However, in terms of job creation, some authors have suggested that, TVOEqs may employ more, or less, workers than the profit-maximization employment level, if they have an objective of maximizing community employment, or maximizing per capita income in the community respectively (Svejnar 1990, Wang 1990, Pitt and Puterman, forthcoming). In the latter case, TVOEqs may adopt a strategy of substituting labor by capital, therefore tend to be more capital intensive. Empirically, the inefficient use of labor was not identified (Svejnar 1990). Nevertheless, they were found to have a higher (and increasing) capital-labor ratio than private enterprises, as well as far higher rates of locally sourced labor and lower rates of labor mobility, compared with private firms (Wang 1986, 1990, Zhao 1996).

The evidence also shows that, after an earlier period of rapid growth in employment of the TVE sector, employment growth has slowed while the output growth rate has remained high (Ody 1992). This was suggested to reflect an increase in labor productivity, and also TVE workers’ unwillingness to share their income with outsiders, as a “mild Ward Effect” (Smith 1996). Recent statistical data shows that the annual growth rate of TVE employment dropped from 12.9% in 1979-88, to 4.4% in 1989-94 (SSB 1995, 364). The average output growth rate dropped from 28% in the first period, to 23% in the second period (calculated from SSB 1995: 249, 365; BTVE(a) 1991, 92, 93). With the perception that there were some problems associated with the ownership of TVOEqs, a TVOE ownership reform campaign towards a shareholding system, or a “share-holding cooperative system”, was started in 1993-94 in several industrialized rural areas, e.g., Jiangsu and Shandong.

In the empirical study that carried out in Chapter 5, it was found that the different MPLs in the rural industrial and agricultural sectors, induced by the economy-wide institutional restrictions, were slowly converging in the reform period, as a result of

\footnote{One is that the vaguely defined property right in TVOEqs has led to, in some cases, improper use of public funds and corruption of community authorities.}
continued reduction in the institutional restrictions on non-agricultural activities and inter-sector labor mobility. However, the estimated converging tendency was slow, compared with the significant reduction in the economy-wide institutional restrictions. In addition, a non-converging trend was found in the more industrialized East-coast region.

In this chapter, non-profit-maximizing behavior of TVOEs is considered to have some impact on the MPL divergence, because of their intention to maximize community members’ per capita income. In some circumstances, this may lead to a more conservative employment policy than in the profit-maximizing firms, resulting in a higher MPL in the rural industrial sector than in the agricultural sector. This hypothesis is analyzed theoretically and tested empirically.

Although there have been a number of studies on firm behavior relating TVOEs to LMFs, there are some major differences between them, due to different institutional arrangements. These differences have not been clearly identified in the literature. An important difference being that, a TVOE is owned by a local community constituted by individual farmers (or collective farmers before the reform), both inside and outside the firm, not only owned by the insiders of the firm. This may be a key to understand the mysteries around TVEs, in terms of labor allocation.

In Section 6.2, some empirical evidence is provided for TVOE employment behavior and sectoral wage differences. Drawing on this, a theoretical description of TVOE behavior is presented in Section 6.3. Section 6.4 carries out an empirical analysis to test the hypothesis of the “TVOE effect” on MPL gaps. Section 6.5 summarizes theoretical and empirical findings.

6.2 TVOE BEHAVIOR AND WAGE DIFFERENTIAL: EMPIRICAL EVIDENCES

To investigate TVOE behavior, a case study is first reviewed⁴.

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⁴ The information was collected in a field survey by the author in October 1994. This survey was supported by the Office of Rural Reform Experimental Zones, in the Ministry of Agriculture (China); the Office of Rural Reform Experiment Zones in Zhoucun District, and Hengtong Industry Corporation.
Dongtang Village is located in the Zhoucun District of Shandong province. Until 1994, when the author visited, the village had set up 17 factories (mostly after 1984). They were all collective enterprises owned by the Dongtang community before 1992. The Villager Committee, i.e., the administrative authority of the village, controlled profit distribution, manager appointments, recruitment, new investments, and retained the right to veto all important decisions made by factory managers. In the 1980s, before the internal labor source was exhausted, all workers were recruited from inside the village with only technicians and engineers employed from outside.

In 1992, the village authority decided to introduce a so-called “Share-Holding-Cooperative System” into their TVEs. They set up a Hengxing Share Holding Company as the sole shareholder of all 17 TVEs, and then distributed 23% of the HSHC shares to all villagers as non-transferable shares. Each adult villager received 6,000 yuan shares. Those under 18 received 3,000 yuan shares. Another 15% were sold to both insiders and outsiders. The remaining 62% was held by the Hengxing Company as the collective shares of the village community. The village authority had a plan, encouraged by the District Government, to further reduce their collectively owned shares to 30% of the total, by distributing and selling more shares to villagers. The non-transferable shares would also be converted into ordinary shares, although the authority still had a policy of discouraging villagers from selling shares to outsiders. Even after further distribution, as a collective, the community would remain the largest shareholder, and have controlling power over the company.

By fall 1994, when the survey was conducted, most villagers were employed in the 17 factories, most of which were operating very successfully. In 1993, the average annual wage had increased to 6000 yuan, 4 times than that in 1985, and nearly 3 times as average farmers’ income in that district. In addition to wages, the dividend received had become a major source of villagers’ income, and seemed likely to exceed wage income in 1995.

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5 Zhoucun District was appointed by the Ministry of Agriculture as an “experimental zone for shareholding-cooperative system of TVEs” since 1988. This reform was encouraged by the district government.
The profit of the TVOEs, or, the dividend of the collective shares after 1992, was used mainly for new investment in TVEs and welfare facilities for all villagers. Those fewer farmers who had remained working in agriculture were also subsidized by the village, using TVOE profits. In recent years, the village had established an internal superannuation and a medical insurance system for all villagers, built a primary school, jointly built a high school with other villages, and constructed a theatre, a sports center and a recreational park. New apartments had been completed for all villagers, basically free of charge. Secondary, and even tertiary, education of young villagers was also fully supported by the village.

By the end of the 1980s, due to the rapid expansion of TVE employment, the internal source of labor had been exhausted. In 1994, the village had approximately 1000 residents, 300 were migrants from other villages, mainly as a result of TVE recruitment in the past years. However, In order to maintain the villagers’ high income, the village authority had a conservative policy regarding admitting new workers from outside. When a factory needed new workers, the manager had to submit an application to the Villager Committee. This was examined in detail to see if there was any alternative way, technically or socially, to avoid the increase in external employment. For example, where possible, the factory’s additional labor requirements were met by transferring workers from other factories, or replaced by a new investment plan. Once outsiders are admitted, they, and their family, automatically become community members with equal access to welfare facilities (this has been observed to be the usual case in TVOEs, see also Weitzman and Xu 1994). It was found that the capital-labor ratios in these TVEs were significantly higher than for privately owned TVEs in other nearby villages.

It is not clear whether the introduction of the “Share-Holding-Cooperative System” in 1992 changed the village’s employment policy. However, in the interview of 1994, village leaders expressed an intention to continue this policy of controlling entry for any new workers from outside.
Interviews with other village and township leaders in Zhoucun District revealed similar policies. Similar stories were also observed in other provinces, such as Jiangsu, Guangdong, and Shanxi, etc., drawn from two earlier surveys.  

Table 6.1 shows the percentage of all workers’ origins in the 160 sample TVEs. These TVEs were located in five different counties belonging to five provinces. The table suggests that geographic labor mobility was very low in most sample counties, where most of the TVE workers were from the local villages or townships where the firm has been located.

<table>
<thead>
<tr>
<th>County</th>
<th>1. same village/township*</th>
<th>2. same county (exclude 1)</th>
<th>3. same province (exclude 2)</th>
<th>4. other provinces</th>
<th>5. total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wuxi</td>
<td>94.0</td>
<td>3.0</td>
<td>1.6</td>
<td>1.4</td>
<td>100</td>
</tr>
<tr>
<td>Nanhai</td>
<td>50.9</td>
<td>33.8</td>
<td>14.2</td>
<td>1.1</td>
<td>100</td>
</tr>
<tr>
<td>Jieshou</td>
<td>79.9</td>
<td>12.7</td>
<td>4.8</td>
<td>2.8</td>
<td>100</td>
</tr>
<tr>
<td>Yuanping</td>
<td>80.2</td>
<td>10.6</td>
<td>9.2*</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Shangrao</td>
<td>80.9</td>
<td>14.8</td>
<td>2.1</td>
<td>2.2</td>
<td>100</td>
</tr>
</tbody>
</table>

* Same village if it is a village-owned enterprise; and same township if it is a township-owned enterprise.

** include 4.

Source: 1, 1986-87 survey, Manager Questionnaires; 2, 1986 survey, Manager Questionnaires. The two surveys investigated 160 sample TVEs and more than 3000 workers.

The extreme case was Wuxi county (in Jiangsu province), where local-origin workers accounted for 94% of total employment. Wuxi is regarded as one of the earliest and most developed rural areas in China; its TVEs stemmed from the People’s Commune period. In its 24 sample TVEs, 23 were owned by townships or villages (TVOEs). In contrast, in a later, but rapidly developed county, Nanhai, (in Guangdong

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6 One was organized by the World Bank and the Economic Institute in Chinese Academy of Social Sciences (CASS) and conducted in 1986-87. It included 139 sample TVEs. Another was organized by CASS and the Chinese Institute for Economic System Reform (CIESR), and conducted in 1986. 21 sample TVEs were included. Hereafter they will be called the “86-87 survey” and “86 survey” respectively.
province), where a high labor mobility was observed, half the sample TVEs were privately owned\(^7\).

Table 6.2 provides further evidence to compare TVOE employment with competitive private enterprises. Data are from the 1986 survey in Yuanping County, Shanxi Province. In Shanxi sample TVEs, TVOE workers were basically from the same villages or townships where the firms are located, only some small collective coal mines were found to have a relatively higher ratio of migrant workers (20-30% of the total employment), compared with other TVOEs. It was due to the shortage of local labor and the technical unavailability of substituting capital for labor (Wang 1986). Yet, in aggregation, labor mobility in sample TVOEs was still significantly lower than in the private enterprises.

<table>
<thead>
<tr>
<th>TVE type</th>
<th>1. Same village/township</th>
<th>2. Same county (exclude 1)</th>
<th>3. Other county or province</th>
<th>4. Unknown</th>
<th>5. Total workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVOE</td>
<td>83</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>CPE</td>
<td>61</td>
<td>16</td>
<td>16</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Samples include 15 township-owned enterprises and 6 private enterprises with total more than 400 workers.

Source: 1986 survey, Manager Questionnaires.

Information provided in Table 6.1 and 6.2 suggests that TVOEs prefer to recruit workers within local communities.

Interviews with TVOE managers and township/village leaders, in both surveys, found that TVOE managers were mainly concerned with the firm's own performance, i.e., profit and firm size, whereas the township or village administrators were more concerned with employment level and residents' income in the local community. Since TVOEs are controlled by the township and village administrators, their objectives usually dominate TVOEs' behavior.

\(^7\) Including those registered as TVOEs but was identified as actually private enterprises.
These interviews also revealed that most community authorities ranked local employment objectives first, when employment problem existed in the community's agriculture (due to shortages of cultivated land). The objective of increasing residents' income tended to be ranked first when the local labor source for TVOEs was exhausted.

A recent survey in Jiangsu province (TRPG 1993) supports the above findings. In the 16 sample TVEs, most were found to recruit new workers basically in the local townships or villages. Although, some changes had occurred since 1992. An interview with a village enterprise revealed that: “Before 1991, all factory workers were drawn from farmers within the village. This practice was broken in 1992, when 40 new workers all came from W township of P county in the Jiangsu province. ... The whole procedure of the recruitment was completed by the Labor Service Company of the W township (belonging to the W township government) but factory representative Zhou had the veto power. ... There were too many applicants (because of the low level of industrial development in P County, there was high pressure from unemployment) ...” (Survey Note No. 20: The Silk Weaving Mill in H Township, TRPG 1993)

The behavior of TVOEs would result in lower labor mobility, not only amongst different local communities, but also between the TVE sector and agricultural sector, because it reduces the chance for transferring agricultural labor to the TVE sector, from less to more industrialized areas. Therefore, it would lead to larger wage differences and MPL gap between TVOE and agricultural sectors, as well as wage variation among regions and local communities. Table 6.3 provides evidence on this impact, drawn from an early data survey covering 1129 villages in 11 provinces. Average wage rates for TVE workers are available for each province. Agricultural labor earnings were not directly available, they were calculated from the household per capita income and other survey data as:

\[ w_2 = I(y_2/y)(P/L_2)B_2 \]

---

8 Information from the author's interview notes, 1986, 87.
where \( w_2 \) is agricultural labor earning (2 denotes the agricultural sector and 1 denotes the TVE sector), \( I \) is rural household income-per-capita, \( y_2/y \) is the share of gross agricultural product in gross rural product, \( p/L_2 \) is the inverse ratio of rural labor to rural population, and \( \beta_2 \) is labor share in agricultural income; it takes the value 0.5\(^9\). All data are the weighted sample average at the provincial level.

Using the above calculation, ratios of rural labor earnings between TVE workers and farmers are derived and shown in the last column of Table 6.3. They suggest large wage differences between the two sectors in all 11 provinces, although converged from 4.4 in 1980 to 2.5 in 1986 on average. The table also clearly shows that, for those provinces with higher ratios of TVOEs in the TVE sector (TVOEs share more than 60% of the TVE employment; these provinces are classified into group 1), the wage differences between the two sectors are also larger than in other provinces (group 2, TVOEs share 60% or less of the TVE employment\(^10\)). In 1980, the average wage ratio (TVE to agriculture) for group 1 was 4.4, whereas for group 2 it was 3.6. In 1986, the wage ratio was 3.1 for the first group and only 1.9 for the second.

The table also shows regional wage variations across provinces. The ratio of maximum to minimum TVE wage, at the provincial level, was 3.6 folds in 1980 and 2.2 in 1986. The ratio of maximum to minimum farmer earning was 2.4 times in 1980 and 1.9 in 1986. Although these show significant regional gaps in both the TVE and agricultural sectors, they are smaller in value compared with the inter-sector wage gap. The latter gap was between 2.6 - 8.7 folds in 1980 and 1.6 -4.1 in 1986, in different provinces.

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\(^{9}\) A panel data estimation carried out in chapter 5, across 28 provinces in the period 1980-92, suggests that \( \beta_2=0.44 \) (see Table 5.1 in Chapter 5). There are also some other estimations in the literature suggest that \( \beta_2 \) takes the values between 0.4 and 0.6.

TABLE 6.3: COMPARING AGRICULTURAL LABOR EARNING AND TVE WAGE

<table>
<thead>
<tr>
<th>Province</th>
<th>Year</th>
<th>No. of villages</th>
<th>Population</th>
<th>L/L</th>
<th>TVOE/TVE</th>
<th>w1</th>
<th>w2</th>
<th>w1/w2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai</td>
<td>1980</td>
<td>114</td>
<td>14323</td>
<td>0.37</td>
<td>0.81</td>
<td>590</td>
<td>146</td>
<td>4.04</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>116</td>
<td>14079</td>
<td>0.61</td>
<td>0.91</td>
<td>1436</td>
<td>348</td>
<td>4.13</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>1980</td>
<td>81</td>
<td>17092</td>
<td>0.33</td>
<td>0.72</td>
<td>545</td>
<td>100</td>
<td>5.47</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>100</td>
<td>17714</td>
<td>0.66</td>
<td>0.82</td>
<td>1269</td>
<td>390</td>
<td>3.25</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>1980</td>
<td>88</td>
<td>17903</td>
<td>0.25</td>
<td>0.82</td>
<td>629</td>
<td>238</td>
<td>2.64</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>90</td>
<td>21133</td>
<td>0.49</td>
<td>0.72</td>
<td>1038</td>
<td>281</td>
<td>3.69</td>
</tr>
<tr>
<td>Fujian</td>
<td>1980</td>
<td>252</td>
<td>151191</td>
<td>0.13</td>
<td>0.63</td>
<td>583</td>
<td>159</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>252</td>
<td>164160</td>
<td>0.34</td>
<td>0.32</td>
<td>883</td>
<td>547</td>
<td>1.61</td>
</tr>
<tr>
<td>Hebei</td>
<td>1980</td>
<td>12</td>
<td>14501</td>
<td>0.16</td>
<td>0.60</td>
<td>584</td>
<td>178</td>
<td>3.29</td>
</tr>
<tr>
<td></td>
<td>1986</td>
<td>12</td>
<td>15512</td>
<td>0.39</td>
<td>0.50</td>
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<td>809</td>
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<td>8738</td>
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<td>13</td>
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<td>1980</td>
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<td>0.23</td>
<td>0.33</td>
<td>735</td>
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<td>1986</td>
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<td>10401</td>
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<td>1980</td>
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<td></td>
<td>1986</td>
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<td>Ningxia</td>
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<td>10494</td>
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<td></td>
<td>1986</td>
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<tr>
<td>Qinghai</td>
<td>1980</td>
<td>432</td>
<td>124444</td>
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<td></td>
<td>1986</td>
<td>428</td>
<td>133147</td>
<td>0.13</td>
<td>0.39</td>
<td>731</td>
<td>443</td>
<td>1.65</td>
</tr>
</tbody>
</table>

TVOE/TVE: 80 | 1073 | 378855 | 0.13 | 0.76 | 647 | 146 | 4.43 |
>60%: 86 | 346 | 72183 | 0.55 | 0.81 | 1239 | 404 | 3.07 |
TVOE/TVE: 80 | 39 | 26367 | 0.19 | 0.47 | 654 | 184 | 3.55 |
≤60%: 86 | 783 | 360205 | 0.24 | 0.36 | 854 | 439 | 1.94 |

Total: 80 | 1112 | 405222 | 0.13 | 0.73 | 647 | 148 | 4.37 |
86 | 1129 | 432388 | 0.31 | 0.53 | 1003 | 403 | 2.49 |

Notes: L/L is the ratio of TVE employment to total rural labor, representing the level of rural industrialization; TVOE/TVE is the ratio of TVOE employment to total TVE employment, representing the ownership structure in the TVE sector; w1 is TVE workers’ annual wage rate; w2 is the annual agricultural return to labor.


6.3 INCOME MAXIMIZATION AND EMPLOYMENT: A THEORETICAL DESCRIPTION

The above empirical evidence for TVOE employment behavior, and wage differentials between the TVE and agricultural sectors, lead to the following assumptions, for establishing a theoretical description of TVOE behavior.
(1) Consider a rural economy that is constituted by a number of villages. Initially, only village A has a manufacturing factory (a TVOE) with a limited number of workers. The remaining laborers in village A, and the other villages, work in the agricultural sector producing grain. Thus the economy is constituted by two sectors: a small industrial sector (TVE sector) and a large agricultural sector.

(2) The TVOE in village A is a competitive firm that can sell its products to a broader market outside the rural economy. The agricultural sector is constituted by individual farmers, who use collectively owned land and also sell their products to the outside market after fulfilling government purchasing quotas. Thus output prices in both sectors are exogenously determined.

(3) Both the TVE sector and the agricultural sector have a production technology with diminishing factor productivity, e.g.,

\[ Y_i = f(K_i, L_i), \quad (\partial Y_i/\partial K_i > 0, \partial Y_i/\partial L_i > 0, \partial^2 Y_i/\partial K_i^2 < 0, \partial^2 Y_i/\partial K_i \partial L_i < 0) \]

where \( Y_i \) and \( L_i \) are output and labor supply in the \( i \)th sector, respectively, \( K_i \) is a compound variable that denotes physical capital, human capital, land and technology that are not perfectly mobile between sectors and among villages. \( i=1,2; \) denotes the TVE sector (\( i=1 \)) and the agricultural sector (\( i=2 \)).

(4) In the short-run, the compound capital in both sectors is fixed. For simplicity, the natural labor growth rate in the economy is set to be zero. Due to the immobility of \( K \), the level of industrialization of each village is uneven.

(5) Labor supply and demand is restricted within the rural economy. In addition, due to the limitation of land, agricultural immigrations are not accepted by the targeted villages. Therefore labor is immobile in the agricultural sector. For simplicity, the initial level of agricultural MPL for all the villages was equal, resulting from the same preconditions.

(6) The government imposes grain output and purchasing quotas on each village, and prevents farmers from transferring to the non-agricultural sector unless they fulfill the quotas; i.e., \( Y_2 \geq \bar{Y}_2 \), where \( \bar{Y}_2 \) is the government quota on agricultural output.
(7) The community authority in village A can make decisions for the TVOE, on behalf of community members. The agency problem, at both the village and TVOE level, will be ignored for simplifying the analysis.

(8) The community of Village A has the objective of maximizing its members' income-per-capita. Income-per-capita means profits generated from the two sectors of the community that can be distributed to all members, plus total wages paid to TVE workers and total labor earnings in the agricultural sector, divided by the number of all members in the community (for simplicity, it is equal to the total labor supply of the village).

(9) If village A recruits new workers from other villages, these migrants automatically become community members of Village A.

With the above assumptions, further analysis of TVOEs’ behavior can be carried out.

At the beginning, due to the restriction of government quotas on agricultural production, only a limited number of laborers in village A are allowed to work in the TVOE. The abundance of labor, and relative scarcity of land, naturally results in a low marginal product of labor (MPL) in the agricultural sector in all villages, whereas the limitation of TVOE employment leads to a higher MPL in the TVE sector.

This limitation is considered an institutional barrier on labor mobility, which can be indicated by the MPL gap between the two sectors. To keep farmers in the agricultural sector, in order to fulfill government quotas, village A can either set the TVOE workers’ wage rates below their marginal product, or subsidize farmers’ income by TVOE profits. Either way will reduce the inter-sector wage difference in the village, but the MPL gap will remain\footnote{“Subsidizing agriculture by industry” is a policy that was encouraged by the government and broadly adopted by those industrialized townships and villages (i.e., those townships and villages which have established their own TVEs) in China. According to Islam and Jin (1994), in 1978, 29.9% of TVEs’ net profits were used as aid to agriculture. In 1992, there were still 18.3% used in this purpose. Although in some surveys TVE wages are found to be higher than farmers’ earning, the difference is minor compared with the sectoral wage difference at the economy level. For simplicity, the internal wage difference in the local community is ignored in this study.}. In the latter case, although agricultural wage rates will be driven up in those more industrialized villages, but will remain low.
in the unindustrialized villages. Thus, as an average, at the economic level, the inter-sector wage gap will remain.

Now consider a case where, during the economic reform, institutional restrictions (represented by government quotas on grain production) for all villages are abolished (i.e., $\bar{Y}_2=0$; note that, this would take time to happen in reality). Subsidizing agriculture or keeping TVE wage below MPL in village A is no longer needed. To improve factor allocation, the TVOE in village A can now employ more workers from the agricultural sector, from either village A or the other villages. Due to the lack of $K_1$, farmers in the other unindustrialized villages cannot set up their own TVEs in the short run, but may find jobs from the TVOE in village A. The major issue now is what decision will be made by the TVOE in village A, and what will be the result.

To answer these questions, the following model is established.

The objective of Village A is:

$$\text{Max } m=(\pi + \omega_1 L_1 + \omega_2 L_2)/(L_1 + L_2)$$

$$= (P_1 Y_1 + P_2 Y_2 - r K_1 - r K_2)/(L_1 + L_2)$$

subject to the following constraints:

1. The production technology constraint:

$$Y_i = f(K_i, L_i) \quad (\partial Y_i/\partial K_i > 0, \partial Y_i/\partial L_i > 0, \partial^2 Y_i/\partial K_i^2 < 0, \partial^2 Y_i/\partial L_i^2 < 0)$$

2. The labor supply constraint:

$$L_1 + L_2 = \bar{L} + L_N$$

3. The agricultural output quota constraint:

$$Y_2 \geq \bar{Y}_2$$

where: $m$ is income-per-capita in village A, $\pi$ is total profit generated by the two internal sectors, $P_i$ is prices for industrial output ($i=1$) and agricultural output ($i=2$), $Y_i$ is the sectoral output, $K_i$ and $L_i$ are compound capital stock and labor supply, respectively, in the $i$th sector, $\bar{L}$ is the total labor supply in the village, $L_N$ is the new workers as migrants from other villages, $w_i$ is the TVE wage rate or the agricultural labor earning, $r$ is the price of capital used in the two sectors, and $\bar{Y}_2$ is the
government quota on agricultural output ($\bar{Y}_2 = 0$ when the quota is removed, thus constraint 3 is no longer effective).

First order condition:

$$\frac{dm}{dL_1} =
\frac{\{(P_1dY_1/dL_1 + P_2dY_2/dL_1)(L_1 + L_2) - (P_1Y_1 + P_2Y_2 - rK_1 - rK_2)(1 + dL_2/dL_1)/(L_1 + L_2)^2\}}{0}
$$

Rearranging the equation and simplifying we get

$$P_1dY_1/dL_1 + P_2dY_2/dL_2(dL_2/dL_1) = m(1 + dL_2/dL_1), \text{ or}
$$

$$MPL_1 + MPL_2(dL_2/dL_1) = m(1 + dL_2/dL_1)
$$

From the labor supply constraint, $dL_1 = dL_{N}/dL_2$, therefore $dL_2/dL_1 = dL_{N}/dL_1 - 1$ ($0 \leq dL_{N}/dL_1 \leq 1$). Substituting $dL_2/dL_1$ by $dL_{N}/dL_1 - 1$, to get:

$$MPL_1 - MPL_2 = (m\cdot MPL_2)dL_N/dL_1
$$

(1)

The value of $dL_{N}$ depending on whether the new TVE workers selected are from the local community ($dL_{N}/dL_1 = 0$ as one extreme) or from outside the village ($dL_{N}/dL_1 = 1$ as another extreme).

Now consider the case $dL_{N}/dL_1 = 0$, i.e., all new TVE workers come from the internal agricultural sector of village A. Then Equation (1) implies that, the maximal income-per-capita for Village A is achieved at the internal optimal point, where MPLs of the two internal sectors converge:

$$MPL_1 = MPL_2 = MPL^*
$$

(1')

At $MPL^*$, all labor reallocation stops, no further adjustment will be taken. Ignoring the fixed cost of capital, $m > MPL^*$ since the average product of labor is higher than the MPL.

Note that, the MPLs converge through the internal reallocation of labor in village A. According to the production technology constraint, $\partial^2 Y / \partial L_1^2 < 0$, the reallocation of internal labor leads to a decrease in $MPL_1$ and an increase in the internal $MPL_2$ of village A, while the external (other villages) marginal product of agricultural labor (denoted by $MPL_2^*$) remains unchanged. Therefore, $MPL^* > MPL_2^*$. On the average at the economy level, the MPL gap will be smaller but still exist, indicating an existence
of misallocation of labor. Therefore the internal optimum of Village A is not the optimum of the economy.

Now consider the case $dL_x/dL_I=I$, i.e., all the new TVOE workers come from outside the village A. Equation (1) becomes:

$$m=MPL_I$$

This is achieved through an inflow of labor to village A, which would continuously reduces $MPL_I$ before achieving $MPL_I=MPL_2^*$. If the external labor market is big enough, both $MPL_2^*$ and $MPL_2$ would not be changed and would be kept equal, therefore when the MPLs converge, the above equation implies:

$$m=MPL_I=MPL_2=MPL_2^*$$ (1’)

Obviously, $m$ is smaller than in the first case; therefore, this is not the solution for maximizing $m$, and will not be chosen by village A. Although, this is the economy-wide optimum, because all MPLs converge.

Finally, if village A faces a small external labor market, $MPL_2^*$ would be driven up by the transfer of labor to village A. To achieve the converging point, the internal $MPL_2$ would also be driven up. Therefore this is the case $0<dL_x/dL_I<I$, i.e., the TVOE accepts both internal and external labor at the same time. With the external labor being involved, the labor supply curve is flatter than in the first case (internal labor supply), therefore the achieved $MPL^*$ would be lower than in the first case but higher than in the second case (purely external labor supply). Equation (1‘) still holds at the converging point; $m$ would be smaller than in the first case but greater than in the second case. Similar to the second case, this is the economic-wide optimum, but not the internal optimum for village A, therefore is not a solution.

In summary, the internal recruitment case will lead to a maximum income-per-capita. This is an internal optimum, but not the economy-wide optimum, therefore is a "second best" from the economy point of view. The external recruitment case and the mixture can lead to a converging point for both internal and external MPLs, which is an economy-wide optimum, but can not be achieved by maximizing internal income-
per-capita. For a TVOE that takes income-per-capita maximization as the main objective, the internal recruitment policy will be adopted.

The situation described above is illustrated intuitively in Figure 6.1, which is developed from Figure 4.1 in Chapter 4.

FIGURE 6.1 FIRM BEHAVIOUR AND LABOR ALLOCATION IN A LOCAL COMMUNITY

In Figure 6.1, the horizontal axis represents the total internal labor of Village A; divided into $L_1$ and $L_2$. The two curves, $MPL_1$ and $MPL_2$, represent the marginal product of labor of the two sectors. Note that the $MPL_2$ curve has an inverse direction. Without any restrictions, labor allocation between sectors would be determined by the intersection of the two curves. Originally, due to the institutional restrictions on labor allocation, there is a gap between the two MPLs. The triangle area $dei$ represents the deadweight losses resulting from the misallocation of labor. Areas $abcd$ and $cefg$ are labor costs in the TVE and agricultural sectors, respectively (but the village could reduce TVE wage or subsidize farmers' earning). Areas $had$ and $eff$ are the profits of the two sectors (fixed cost of capital is included). The income-per-capita of the
villagers can be calculated as the area $hbcdecgj$, divided by the total labor force $\bar{L} = L_1 + L_2$.

When the institutional barriers are removed, the village community can increase its income-per-capita by reallocating labor from the internal agricultural sector to the TVE sector to achieve the internal optimum $i$, where $MPL_1 = MPL_2$. The net increase in income-per-capita is $dei$ divided by $\bar{L}$. It is easy to see that the income-per-capita at this point is the maximum.

Figure 6.1 also shows the result of external-sourced labor reallocation. If, alternatively, village A adopts a policy to admit new TVE workers from outside the village ($dL_2/dL_1 = 1$ as the extreme), the total labor force in the village would increase from $L_1 + L_2$ to $L_1' + L_2'$, and the $MPL_2$ curve would shift to the $MPL_2'$. Associated with the labor reallocation, $MPL_1$ would continuously decrease until converging with the marginal product of external agricultural labor, $MPL_2'$, at point $i'$. The economy-wide optimal labor allocation would be achieved. Compared with the former (internal recruitment) case, the net gain to the economy would be the area $dei'$, greater than $dei$ of the former case. More employment opportunities would also be created. However, income-per-capita in village A would reduce. This is explained as follows:

Since the area $i'klj'$ is equal to the area $ecgj$, the additional increase in total income (compared with the former case), brought by new immigrant TVE workers, is the area $ecki'$, whereas the increase in new workers is the horizontal distance $ck$ ($L_1 = L_1' + L_2' - L_1 + L_2$). The average income produced by each new worker would be $ecki'ilkc$, which can be measured by a vertical distance smaller than the height of point $i$. However, income-per-capita without immigration would be equal to the area $hijgb$ divided by $bg$, greater than the height of point $i$ (since point $i$ is the lowest point of the curve $hij$). This confirms that the external recruitment of the TVOE will lead to a lower income-per-capita than internal recruitment in the village.

To compare with this, a profit-maximizing firm would prefer the latter (external recruitment) policy to the former. Shown in Figure 6.1, the total profit in the latter
case is the areas $hw'_1 i'+i'w'_2 j'$, greater than the former case (the areas below the curve $hij$ and above a horizontal line that passes point $i$).

Therefore, both Figure 6.1 and Equations (1) suggest that:

Under the given assumptions, TVOE's with an objective of maximizing income-per-capita in the local community tend to employ new workers only from its internal agricultural sector. When the internal optimal allocation of labor achieved, TVOE's will no longer accept new workers either from inside or from outside (unless there is an up-ward shift of the $MPL_1$ curve or a down-ward shift of the $MPL_2$ curve, resulting from, e.g., a technical change), ignoring the $MPL_2^*$ being lower than its $MPL^*$. The economy-wide MPL gap will exist, indicating a misallocation of labor. This is a sub-optimal solution for the economy.$^{12}$

Now replacing assumption (9) by a new assumption (9*), i.e., the new workers admitted from outside the village are not accepted as community members. They are only employees of the community members, with no rights to share profit.

The model is revised as follows:

$$Max \quad m=\{\pi + w_1(L_1 - L_N) + w_2 L_2\}/\bar{L} = (P_1 Y_1 + P_2 Y_2 - r K_1 - r K_2 - w_1 L_N) / \bar{L}$$

subject to

$$Y_i = f(K_i, L_i) \quad (\partial Y / \partial K_i > 0, \partial Y / \partial L_i > 0, \partial^2 Y / \partial K_i^2 < 0, \partial^2 Y / \partial L_i^2 < 0)$$

and

$$L_1 + L_2 = \bar{L} + L_N$$

First order condition:

$$dm/dL_1 = [(P_1 dY_1/dL_1 + P_2 dY_2/dL_2 (dL_2/dL_1) - w_1 dL_N/dL_1) \bar{L} - m \bar{L} d \bar{L}/dL_1] / \bar{L}^2 = 0$$

Since $\bar{L}$ is a constant, $d \bar{L}/dL_1 = 0$. Substituting $dL_2/dL_1$ by $dL_N/dL_1$, 1 to get

$$MPL_1 - MPL_2 = (w_1 - MPL_2) dL_N/dL_1$$

(2)

---

$^{12}$ TVOE's showed a great success in the earlier stage of rural economic development in many provinces. Some authors therefore argued that the performance of the TVOE's is at least as good as the private firms (i.e., Weitzman and Xu 1994). A comprehensive study on the role of the TVOE's in rural development is beyond the scope of this paper. This study only focuses on the issue of resource allocation.
Instead of the income-per-capita $m$, the TVE wage rate $w_i$ appears in Equation (2). It states that, at the equilibrium $MPL_1 = MPL_2$, the TVE wage rate $w_i$ should be equal to $MPL^*$. To maximizing $m$, the insiders’ wage level does not matter, since both wages and profits positively contribute to $m$. However, a higher wage rate for the outsiders means a higher cost and lower $m$. Therefore, to maximizing $m$, $w_i$ should be minimized. This depends on the value of $dL_\infty/dL_1$. Since $MPL^*$ is diminishing with the increasing external labor, the higher the $dL_\infty/dL_1$ (i.e., the more external workers being admitted), the lower the level of $MPL^*$ and $w_i$, thus the higher the level of $m$ can be achieved. Therefore, Equation (2) implies that, under a policy to separate internal and external labor in sharing profits, the TVOE of village A will admit as much external labor as it can, until achieving the point $MPL^* = MPL_1 = MPL_2 = MPL_1^*$. The MPL gap, and therefore the misallocation of labor between sectors, will be eliminated. The economy will achieve its optimum. This result is consistent with some suggestions in the literature, e.g., Smith (1996) suggests that, a discrimination principle may help to reduce the insiders’ unwillingness to employ outsiders, and may lead to a recovery of TVEs’ original high employment growth rate.

This can also be seen in Figure 6.1.

In Figure 1, $MPL^*$ is achieved at the point $i^*$. The number of external workers admitted equals the distance $ek$. The total wage paid to the new workers equal the area $ei'kc$. The increased members’ per-capita-income in village A, gained from the economy-wide labor reallocation, is the area $dei'$ divided by $\bar{L}$, which is the maximum. Therefore, in this case, an external employment policy will be adopted.

The above alternative results implies that:

(1) When a MPL gap exists, to maximizing members’ income-per-capita in the local community, and to act consistently as a collective firm (in the sense of sharing its profits with all workers and farmers in the community), a TVOE can improve labor allocation by admitting new workers from the internal agricultural sector, towards an internal full employment status. Once the internal optimum is achieved, TVOEs may become more conservative than CPEs in admitting new workers from outside the
community, despite the potential for additional profits. In the short run, this is a
second best solution for the economy. Given that other factors are not perfectly
mobile, a rural industrial sector that is constituted mainly by TVOEs will employ less
labor than otherwise\textsuperscript{13}, and the process of MPL convergence is slower.

(2) On the other hand, with the same income-maximization objective, if a TVOE
treats new workers only as employees of the community members (acts as a
“collective capitalist”), it will continuously increase employment through admitting
new workers from outside, as long as the external MPL in agriculture is below MPL
of the TVOE. In this case, a TVOE behaves exactly as same as a profit-maximizing
firm, which can achieve both internal and external optima.

(3) Further implications can be derived from the implication (1). When there is a
rapid institutional change that reducing restrictions on factor allocation, there will be a
significant increase in TVOE employment as an adjustment process towards their
internal optimum, the differences between behavior of TVOEs and CPEs may not be
observed or not significant. However, after a period of adjustment, when those more
industrialized villages achieved their internal full-employment status, the process of
labor reallocation in the TVOE dominating areas would be slow down or stop, despite
the agricultural MPL in the unindustrialized areas or villages being low. Thus, in this
stage, the industry-agriculture MPL differential may also appear to be regional income
differentials between industrialized and unindustrialized regions and villages.

From this point of view, reforming the ownership structure in the TVE sector is
important for improving nation-wide resource allocation and for reducing regional
differentials

The above results on TVOE behavior may have some exceptions:

(1) The communities may not always make decisions for TVOEs. Surveys found
that, in some areas, TVOEs’ managers do make some important decisions. In these
cases, a TVOE may behave like an ordinary LMF, which is concerned more with the

\textsuperscript{13} In some cases, they may not, as described by the theoretical analysis, refuse to admit new workers
from outside, possibly due to the situation that capital and labor are non-substitutes.
firm's own income-per-capita rather than that of the local community. Thus the internal optimum may not be achieved. On the other hand, if a TVOE manager runs the enterprises based on a personal profit contract, or on a lease with the local community, the TVOE may behave just like a CPE.

(2) In the long-run, improving mobility of physical capital, human capital and technology among regions and across sectors, may be helpful in creating new employment opportunities in those unindustrialized villages. This is implied by the theory of factor price equalization. Even though, low labor mobility is harmful to scale-economy.

(3) In the case where the industrial sector is constituted by a mixture of TVOEs and CPEs, the situation becomes more complicated. CPEs will intend to admit more workers while TVOEs may stop somewhere. This may more or less vary the above result, but would not change the major conclusion. Or, TVOEs may follow the behavior of CPEs in some cases since they need to compete with CPEs in the cost of production.

The above exceptions are unlikely to entirely change the theoretical result derived above, but may moderate the side-effect of TVOEs’ employment behavior.

6.4 AN EMPIRICAL TEST

This section aims to test the impact of TVOE behavior on the MPL gap between the rural industrial sector and the agricultural sector (and therefore on labor allocation). The test is carried out on the basis of calculated MPL ratios between the rural industrial sector and the agricultural sector at the provincial level.

Two factors are considered to be mainly responsible for the MPL differentials: 1, the economy-wide institutional restrictions on non-agricultural activities and on labor transfer; and 2, the effect of TVOE employment behavior. Hereafter these impacts on the MPL differential refer to “institutional effect” and “TVOE effect”, although, they both related to certain institutional arrangement.
In the empirical test, the dependent variable is the ratio of MPLs between the TVE and agricultural sectors. According to the Cobb-Douglas production function, the MPL ratio between the rural industrial sector and the agricultural sector is derived, from the provincial input and output data, as follows (see Equation 7 in chapter 4): 

\[ B_L = \frac{\beta_1 Y_1 P_1 L_2}{\beta_2 Y_2 P_2 L_1} \]

where \( B_L \) is the MPL ratio \((MPL_1/MPL_2)\); \( Y_i \), \( L_i \), and \( P_i \) are sectoral output value (in constant price), employment and price indexes, respectively; \( \beta_i \) is the output elasticity of labor \((i=1 \text{ for rural industry and } i=2 \text{ for agriculture})\).

A series of annual dummy variables, \( T_i \)'s, are used to capture the economy-wide institutional effect, and the ratios of TVOE employment to total TVE employment at the provincial level \((R_i)\), refers to TVOE ratio), representing the extent of the TVOE dominating the TVE sector, is used as an explanatory variable for the TVOE effect.

In the empirical estimation in Chapter 5, MPLs were found diverged in 1989-92, resulted from some non-institutional effect and data problem. They will appear in the estimated institutional effect.

Data for the TVE and agricultural sectors are at the provincial level (28 provinces) for the years of 1980, 85, 86, 88, 89, 90, 91 and 92 (see Section 5.2 of Chapter 5 for data description). Values for the coefficients \( \beta_i \) are taken from the estimation in Chapter 5 (see Section 5.3), they are: \( \beta_1=0.406 \) and \( \beta_2=0.442 \). From these data and coefficients, the annual value of \( B_L \) for the 28 provinces are calculated respectively.

The hypothesis to be tested is as follows:

The MPL gap between the two sectors resulted not only from the economy-wide institutional barriers, but also from the TVOEs non-profit-maximization behavior; since, to accomplish the local communities' objective of income-per-capita maximization, TVOEs tend to hire fewer workers than CPEs, after achieving the internal optimum of their community. However, due to the reason discussed in implication (3) in the last section, this effect may not be observed, or may not be

---

14 A test in the last chapter has shown that, both a Cobb-Douglas production function estimation and a translog production function estimation provided generally consistent results on MPL gaps.
significant, in the early stage of rural industrialization, where the number of TVEs increases rapidly.

To test the above hypothesis, the following equation will be estimated:

$$B_{ti} = B_{t(0)} + \sum_{s=5}^{12}(a_{h(s)}T_s) + \sum_{i=0}^{27}(a_{j(t)}R_{it}T_i) + \varepsilon_{it}$$ (3)

where $B_{ti}$ is the MPL ratio for each province in each year; $B_{t(0)}$ is a constant for the MPL ratio in year 1980; $t$ ($t=0...12$) denotes the years from 1980 to 1992, short of 1981-84 and 87; $s$ ($s=5...12$) denotes the years from 1985 to 1992; $i$ ($i=1...28$) denotes the 28 provinces. $T_s$ and $T_i$ are two series of annual dummy variables for years 1985-92 and 1980-92, respectively ($T_{t=1}$ for a particular year $t$ and $T_{t=0}$ otherwise, same as $T_s$). Note that $T_0$ (for the year 1980) is excluded according to the model specification, and observations in 1981-84 are not available, therefore dummy variables $T_s$ actually start from 1985. $R_{it}$ is the TVOE ratio ($R=LVVOE/L_t$, i.e., TVOE employment to total TVE employment) for each province for the period 1980-1992. Coefficients $a_{i(s)}$ measure changes of the economic-wide institutional barriers on MPL gap after 1980, therefore reflects the institutional effect on labor allocation at the economy level. Coefficients $a_{20}$ measure the “TVOE” effect on MPL gap. $\varepsilon_{it}$ is the error term.

The hypothesis of the “TVOE effect” would be accepted if the TVOE ratios have significant positive effects ($a_{20}>0$) on the MPL ratio $B_{t}$. This would mean that a higher proportion of TVOEs in the TVE sector results in a higher MPL differential between the TVE and agricultural sectors. Due to the reason discussed in the implication (3) in the last section, $a_{20}$ may not be significant in the earlier period of economic reform.

OLS estimation results are shown in Table 6.4. Negative values of $a_{i(s)}$, except for 1992, are obtained, showing a reduction in the economic-wide institutional barriers

---

$^1$ $R_{1(1980)}$ is omitted, since in an earlier estimation it was insignificant ($t=0.92$) and caused some estimation bias. Therefore the two series of dummies, $T_i$ and $T_s$, actually have the same range, i.e., from 1985 to 1992.
from the pre-reform period. The trend of its change are consistent with the empirical result obtained in Chapter 5 (see the explanations for the estimated $B_{L0}$ changes).

The table shows positive $a_{20}$s in all the sample years since 1985, mostly are statistically significant. Thus, the null hypothesis is rejected and the existence of the “TVOE effect” is confirmed. Consistent with the theoretical expectation, the estimates for 1986 and earlier are insignificant, become significant (at the 10% level) in 1988-89, and more significant (5% level) in 1990-92. The values of $a_{20}$ are increasing with time.

### TABLE 6.4 THE “TVOE EFFECT” ON MPL RATIO:
ESTIMATION RESULT

<table>
<thead>
<tr>
<th>$\bar{R}^2$</th>
<th>0.249</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B_{L(1980)}$</td>
<td>2.69</td>
</tr>
<tr>
<td></td>
<td>(12.3’)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>$a_1$</th>
<th>t-ratio</th>
<th>$a_2$</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>-1.27</td>
<td>(-1.57)</td>
<td>1.81</td>
<td>(1.38)</td>
</tr>
<tr>
<td>1986</td>
<td>-0.94</td>
<td>(-1.25)</td>
<td>1.46</td>
<td>(1.14)</td>
</tr>
<tr>
<td>1988</td>
<td>-1.29</td>
<td>(-1.83’)</td>
<td>2.28</td>
<td>(1.80’)</td>
</tr>
<tr>
<td>1989</td>
<td>-1.09</td>
<td>(-1.60)</td>
<td>2.33</td>
<td>(1.89’)</td>
</tr>
<tr>
<td>1990</td>
<td>-0.74</td>
<td>(-1.11)</td>
<td>2.47</td>
<td>(2.04”)</td>
</tr>
<tr>
<td>1991</td>
<td>-0.37</td>
<td>(-0.58)</td>
<td>2.75</td>
<td>(2.36”)</td>
</tr>
<tr>
<td>1992</td>
<td>0.44</td>
<td>(0.67)</td>
<td>2.50</td>
<td>(2.07”)</td>
</tr>
</tbody>
</table>

Notes: 1. $a_{1(0)}$ denotes the institutional effect on changing $B_L$; $a_{20}$ denotes the TVOE effect on changing $B_L$.

2. T-ratios with ‘’, ‘‘’, and * are significant at 10%, 5%, and 1% level, respectively.

According to the estimation results in Table 6.4, the MPL ratio, $B_L$s, at the national level are decomposed into the economy-wide institutional effect, combined with other unidentified non-institutional effect (see Section 5.3 of Chapter 5), and the “TVOE effect”. The calculation results according to the national average $R_s$ ($B_{L(TVOE)} = a_{20} \cdot R_s$) and shown in Table 6.5.

In Table 6.5, the estimation result suggests that the “TVOE effect” extended the MPL ratio by more than unity in average. Take 1988 for example, it increased the MPL ratio from 1.40 to 2.57. It weakened the tendency of MPL convergence before 1988 and strengthened the diverging tendency since 1989.
TABLE 6.5 CALCULATED “TVOE EFFECT” ON MPL RATIO

<table>
<thead>
<tr>
<th>year</th>
<th>$B_L^{(\text{inst})}$</th>
<th>$R_1^{(%)}$</th>
<th>$B_L^{(\text{TVOE})}$</th>
<th>$B_L^{(\text{tot})}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(institutional &amp;</td>
<td>(ownership</td>
<td>(TVOE effect)</td>
<td>(total effect)</td>
</tr>
<tr>
<td></td>
<td>other effects)</td>
<td>structure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>2.69</td>
<td>-</td>
<td>1.08</td>
<td>2.69</td>
</tr>
<tr>
<td>1985</td>
<td>1.42</td>
<td>59.4</td>
<td>0.81</td>
<td>2.50</td>
</tr>
<tr>
<td>1986</td>
<td>1.75</td>
<td>55.3</td>
<td>1.17</td>
<td>2.56</td>
</tr>
<tr>
<td>1988</td>
<td>1.40</td>
<td>51.3</td>
<td>1.23</td>
<td>3.18</td>
</tr>
<tr>
<td>1989</td>
<td>1.60</td>
<td>50.4</td>
<td>1.36</td>
<td>3.68</td>
</tr>
<tr>
<td>1990</td>
<td>1.95</td>
<td>49.6</td>
<td>1.22</td>
<td>4.35</td>
</tr>
<tr>
<td>1991</td>
<td>2.32</td>
<td>49.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>3.13</td>
<td>48.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: $B_L^{(\text{inst})} = B_L^{(1980)} + a_{i1}(\delta)$ (see Table 6.4). $B_L^{(\text{TVOE})} = a_{2(i)}R_1$. $B_L^{(\text{inst})}$ denotes the estimated MPL ratio as the result of the two effects. $B_L^{(\text{inst})} = B_L^{(\text{inst})} + B_L^{(\text{TVOE})}$. $R_1$ is defined as the TVOE employment to total TVE employment at the national level.

Source: Calculated from Table 6.4 and SSB 1995, 364.

The “TVOE effect” also explained a major part of the regional differences in MPL ratios (see Table 5.3 in Chapter 5), since the ratio $R_1$ (TVOE to total TVE employment) in the East-coast area is much higher than the other areas (See Table 6.6). Table 6.6 provided the calculated TVOE effect for the three regions, using the estimated $a_{2(i)}$.

TABLE 6.6 OWNERSHIP STRUCTURE AND “TVOE EFFECT” BY REGION

<table>
<thead>
<tr>
<th>Year</th>
<th>1. East</th>
<th>2. Central</th>
<th>3. West</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R_1^{(%)}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>72.5</td>
<td>49.7</td>
<td>48.4</td>
</tr>
<tr>
<td>1988</td>
<td>66.4</td>
<td>42.5</td>
<td>38.5</td>
</tr>
<tr>
<td>1992</td>
<td>65.4</td>
<td>39.3</td>
<td>35.3</td>
</tr>
<tr>
<td></td>
<td>$B_L^{(\text{TVOE})}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>1.31</td>
<td>0.90</td>
<td>0.88</td>
</tr>
<tr>
<td>1988</td>
<td>1.51</td>
<td>0.97</td>
<td>0.88</td>
</tr>
<tr>
<td>1992</td>
<td>1.64</td>
<td>0.98</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Note: $B_L^{(\text{TVOE})} = a_{2(i)}R_1$. ($R_i$ is the TVOE ratio for the three regions).

Source: From Table 6.4 and Appendix 5.1 of Chapter 5.

According to Table 6.6, the ownership structure variable $R$ in the East area in 1992 is 30 percentage point higher than the West. This leads to 0.76 higher of $B_L$ in the East.
than the West. This explained why MPLs diverged in the East region, while the economy-wide institutional restrictions were reducing.

6.5 SUMMARY

In this chapter, TVOE s’ employment behavior is investigated. The theoretical outcome suggests that, when the economic-wide institutional restrictions being reduced, a TVOE with the objective of maximizing income-per-capita in the local community tends to employ new workers within the community, and therefore can achieve an internal optimal labor allocation. After achieving this point, the TVOE may employ fewer workers than a CPE since it does not intend to employ new workers from outside the community. Therefore, the internal optimum is not necessarily equal to the optimum of the economy. With other factors (capital, human capital and technology) being not perfectly mobile, this behavior can lead to a MPL differential between the rural industrial and agricultural sectors in the short run.

The above hypothesis is empirically tested and identified by using provincial data during the period of economic reform (1980-92). It is found that, the MPL differentials positively and significantly related to the shares of TVOE s in the TVE sector. In 1988, in addition to the economy-wide institutional restrictions, the “TVOE effect” enlarged the MPL ratio from 1.40 to 2.57 at the national level.

This finding generates a policy implication: if TVOE s redirect their economic objective from income-per-capita maximization to profit-maximization, the process of rural industrialization, as well as economic growth, would be further accelerated, and the transitional period for rapid growth would last longer. This possibility has been practically indicated by the recent experiment of “TVOE reform for share-holding ownership system” in some regions.

TVOE s have made a major contribution to China’s rural industrial growth during the period of economic reform. They developed rapidly and achieved good performance in many rural areas, particularly in the east coast areas. In a situation that capital, human capital and technology is not perfectly mobile, TVOE s appeared to
have some advantages in the aspects of investment finance, and in the access to supply of human capital and technology (see Chapter 2), particularly in the initial stage of industrialization in a rural area. However, the findings in this chapter suggest that, they also have some shortcomings in terms of employment behavior. This indicates the necessity of the TVOE ownership structural reform, in order to further promote rural industrialization.
CHAPTER 7. EXTERNALITIES AND RELATIVE PRODUCTIVITY BETWEEN THE TVE AND STATE SECTORS

This chapter reviews the different growth performance between the market-oriented TVE sector (and also other non-state sectors) and the State owned sector, during the economic reform period, and examine the externalities between the two sectors. The state sector was the dominant sector in the Chinese economy in the pre-reform period. Although it still plays an important role in the economy, its importance has dropped significantly since reform. In contrast, the TVE sector has developed from a minor sector to a major sector during the same period. In this chapter, the direct and indirect contribution of the TVE and other non-state sectors to China's economic growth are examined.

Section 7.1 provides a brief comparison between the growth performance of the state sector, and the TVE and other non-state sectors, it also discusses the direct contribution of the TVE sector to economic growth. Section 7.2 reviews previous empirical analyses on growth and productivity changes in the state and the non-state sector in the pre-reform and reform period. Some cross-country studies regarding the impact of the government and non-government sectors on economic growth are also examined. In Section 7.3, a model modified from Feder (1983) and Ram (1986) is used to analyze possible externalities between the state and the non-state industrial sectors, and to examine their relative productivity growth. Section 7.4 is a brief summary. Results of earlier estimations using the original F-R model are attached in Appendix 7.1 to be compared with the results in Section 7.3.
7.1 GROWTH PERFORMANCE OF THE TVE AND STATE SECTORS

Growth of the non-state and the state sector

China's economic reform that began in 1978 has gradually transferred the central planning economy to a market economy. It significantly accelerated economic growth from an annual growth rate of gross output 7.9% in 1953-78, to 11.5% in 1979-94. The annual growth rate of the state sector dropped in the reform period from the pre-reform period. Its industrial output growth rate declined from 14.2% to 7.8%, whereas the industrial output growth rate of the non-state sector increased dramatically from 7.4% to 21.9%. In the non-state sector, the growth rate of TVEs' industrial output was 23.1% in the same period. Therefore acceleration of economic growth in the reform period can be entirely attributed to growth of the market-oriented non-state sector, particularly the TVE sector (data source see Table 2.2 in Chapter 2).

As the result of fast growth of the non-state sector, the ownership structure of the economy has changed significantly from the central planning period. Table 7.1 shows that the share of the State Owned Enterprise (SOE) sector in the gross industrial output dropped dramatically from 78% in 1978 to 40% in 1994. The non-state enterprise (NSE) sector output now exceeds that of the state sector. In the total NSE industrial output of 1994, the TVEs produced two thirds.

<table>
<thead>
<tr>
<th>Year</th>
<th>SOE</th>
<th>NSE</th>
<th>NSE by ownership</th>
<th>NSE by rural/urban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Collective</td>
<td>Private</td>
</tr>
<tr>
<td>1978</td>
<td>78</td>
<td>22</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>1985</td>
<td>65</td>
<td>35</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>1992</td>
<td>48</td>
<td>52</td>
<td>38</td>
<td>7</td>
</tr>
<tr>
<td>1994</td>
<td>40c</td>
<td>60</td>
<td>41</td>
<td>11</td>
</tr>
</tbody>
</table>

Note: a. Total industrial output=100. b. TVEs are rural collective and private enterprises. c. Data include state share holding companies.

1 See footnote 2 in Chapter 1.
2 All collective firms in the pre-reform period.
The dramatic growth of the market-oriented TVE and other non-state sectors shows the rapid growth of marketization of the Chinese economy. Nevertheless, marketization also took place in the state sector. Government control on pricing, goods production and distribution, have been reduced substantially via the introduction of the "double track price system" (see Tisdell 1992). SOEs now have more autonomy to operate in the market. Yet, the state sector has achieved a far lower growth and productivity performance than the non-state sector; the gap between the two sectors is getting larger.

In 1994, the output growth rate of the state industrial sector was only 6.5%, when the growth rate of the whole industrial sector was 26.1%. One third of the SOEs were making financial losses. The proportion of the SOEs making losses increased dramatically to about two third of the total SOEs in 1996, when the financial situation was tightening. In the industrial sector, total losses made by SOEs exceeded the SOEs' total profits in 1996. In comparison, the ratio of losses to profits for SOEs was only 8% in 1978 (SSB(a) 1995). These figures suggest that the state sector is worse off compared with the pre-reform period.

A recent survey by the author which included 70 SOEs and 32 NSEs (mainly large size urban enterprises) found that nearly 30% of SOEs made losses in 1995, whereas this ratio for the stock-sharing companies was 19%. For Chinese-foreign joint ventures only 9% made losses. Only 11% SOEs made high rates of return (20% or higher), whereas more than 50% of the joint-ventures achieved this rate. To answer the question in the questionnaire, "how do you rank the reasons that are causing operation difficulties for your firm?", firm managers ranked the institutional problem of SOEs, including that with the ownership system, as the number one problem. The second serious problem, complained by the managers, was "over-competition". The third was "weak market demand"; the fourth: "management failure"; and the fifth: "tight financial control". However, although also facing sharp market competition and

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3 Information from a number of reports in Economic Daily, Beijing, 1994-96.
4 This survey was carried out by the author in Beijing, Shanghai and Shandong, in 1995. Sample data also included enterprises located in other provinces. For detailed information see Wang (1996).
financial control, most NSEs continued to grow fast, when many SOEs were in great difficulties.

How to assess the impact of marketization on the SOEs?

The negative effects of marketization, from the state sector’s point of view, is obvious:

SOEs lost major policy favors and monopolistic status during the reform period. They lost guaranteed inputs supply and outputs purchasing at the fixed state prices, free fund supply and financial subsidies. Their traditional markets are often shrinking due to changing demand, or squeezed by their competitors: the domestic NSEs, firms with foreign investment, and importers.

More resources are gradually being reallocated to the non-state sector through the market mechanism. Table 7.2 shows that, in the pre-reform period (1953-78), the employment growth rate for SOEs and NSEs (collective enterprises only at that time) were both 6.1% on average, keeping a relatively small proportion of NSEs in the economy. However, in the reform period (1979-94), the rate of SOEs dropped to 2.6%, whereas that for NSEs increased to 9.1%. The employment growth rate in the TVE sector was even higher.

<table>
<thead>
<tr>
<th>Year</th>
<th>1952</th>
<th>1978</th>
<th>1994</th>
<th>Growth rate 53-78 (%)</th>
<th>Growth rate 79-94 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SOE</td>
<td>15.8</td>
<td>74.5</td>
<td>112.1</td>
<td>6.1</td>
<td>2.6</td>
</tr>
<tr>
<td>2. NSE</td>
<td>9.1</td>
<td>42.8</td>
<td>173.6</td>
<td>6.1</td>
<td>9.1</td>
</tr>
<tr>
<td>2.1 TVEs</td>
<td>-</td>
<td>22.2</td>
<td>117.6</td>
<td>-</td>
<td>11.0</td>
</tr>
<tr>
<td>SOE in total (%)</td>
<td>63.5</td>
<td>63.5</td>
<td>35.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Agriculture is excluded.
Source: SSB(a) 1995, 84-85, 365.

Reallocation of capital between state and non-state sectors also took place, although slower than reallocation of labor. This can be seen by comparing the growth rates of inputs between the state and TVE sectors (Table 7.3). Although growth of
capital stock in the state sector was significantly slower than the TVE sector, the capital-labor ratios show that the former is still much more capital intensive than the latter, and was more capital intensive in 1992 than in 1980. The table also shows that output growth was faster than the growth of the capital stock in the TVE sector, but was slower than that in the state sector, suggesting a remarkable difference in productivity growth of the two sectors.

<table>
<thead>
<tr>
<th></th>
<th>Capital(^{b})</th>
<th>Labor (^{c})</th>
<th>Output(^{c})</th>
<th>Capital-labor ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVE Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>50.4</td>
<td>30.0</td>
<td>65.7</td>
<td>1.7</td>
</tr>
<tr>
<td>1992</td>
<td>594.2</td>
<td>105.9</td>
<td>905.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Growth rate (%)</td>
<td>22.9</td>
<td>11.1</td>
<td>24.2</td>
<td></td>
</tr>
<tr>
<td>State Sector(^{d})</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>478.6</td>
<td>30.9</td>
<td>376.7</td>
<td>15.5</td>
</tr>
<tr>
<td>1992</td>
<td>1869.1</td>
<td>44.5</td>
<td>922.6</td>
<td>42.0</td>
</tr>
<tr>
<td>Growth rate (%)</td>
<td>12.0</td>
<td>3.1</td>
<td>7.8</td>
<td></td>
</tr>
</tbody>
</table>


Source: Calculated from current price data in SSB(a) 1986, 95; BTVE 1990, 91, 92. Also see Appendix A1 and A2. The deflator is Producer Price Index for Industrial Products.

In 1981, investment in fixed assets by the state sector accounted for 69% of the national total. This ratio dropped to 57% in 1994 (SSB(a) 1988: 559; 1995: 137). The state sector still accounted for the major part of the total investment.

The slow reallocation of capital, compared with the faster reallocation of labor, indicates that SOEs still enjoyed some policy advantages then NSEs in terms of finance. Yet, many SOEs are losing in competition with NSEs. This suggests some congenital defects of SOEs, either physical, or institutional. Under the central plan and the “heavy-industry-priority” development strategy during the pre-reform period, many SOEs were built under designs to produce heavy machines or other products
that are no longer demanded by the market now. To convert their old equipment and installations to produce new products may be either impossible or need huge investment that is financially unavailable. Many SOEs are heavily burdened by the continued pension payment to their large number of retired workers. They may also have a large number of redundant workers and staff members who cannot be dismissed\(^5\). More importantly, SOEs have institutional disadvantages, such as weaker incentives, and weaker monitoring or improper intervention from the state owner.

Although the situation in SOEs is worse than the pre-reform period, this does not necessarily imply a lower efficiency in SOEs than the pre-reform period. Due to changes in the development strategy and introduction of market competition, factor allocation has improved (see Lin et. al. 1996). This is also true for the state sector. Market competition also generates pressure on SOEs to increase their productivity, which should positively contribute to their growth. In practice, SOEs are observed to have relatively stronger incentives for making profits than in the pre-reform period, although these incentives are weaker than those of the NSEs. As long as an incentive mechanism exists, pressure of market competition might have the effect of pushing the SOEs towards increasing efficiency. Studies on the SOE productivity since reform suggest either positive but slow TFP growth, or no improvement (for references see next section). The SOEs are facing a crucial situation: to be more efficient, or die.

The lower growth rate of the state sector compared with the pre-reform period might also result from statistical reasons. Under the central-planning system in the pre-reform period, the values of output, and their growth rates, were likely to be inaccurate. Output was valued by planning prices that were determined as average cost plus markup. Products would be counted as real outputs at the planning values even if they were never sold. Products using obsolete technology and outmoded designs were produced for decades without any change. These products could be sold only because

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\(^5\) A 20-30% surplus labor commonly reported by SOE managers, however, most of the SOEs can hardly, or not intend, to dismiss workers and staff members, although legally they can do so since reform (information from interviews with a number of SOE managers in 1985, 86, and 88, carried out by the author and his colleagues).
there was no available alternative in the market. An increasing number of the state construction projects with heavy investment, in the pre-reform period, failed, or were simply completed under a wrong design. However, their values were included in the statistics of the real output of construction, once the papers for project completion were signed. If using a market valuation system, the total output in the pre-reform period might have to be heavily depreciated. In addition, high industrial growth rate of SOEs was sustained by capital-intensive investment, at a cost of slow growth of agriculture and services. In the reform period, the situation gradually changed since both production and investment in the state sector has been more market-oriented. Therefore, the high growth rate of the state sector in the central planning period does not indicate a "good quality of growth" and may not really comparable with that in the reform period.

7.2 PRODUCTIVITY AND EXTERNALITY OF THE STATE AND NON-STATE SECTORS – A LITERATURE REVIEW

*Estimations of productivity change in China*

There have been a number of studies of China's state and the non-state sector growth and productivity changes in the reform and pre-reform period.

Some earlier studies (e.g., World Bank 1985, Rawski 1986) suggested that reform policies had failed to end the long term stagnation of productivity in state industry. A World Bank report (1985) indicated that TFP declined during 1978-82 by about 7-8%, to be even lower than in 1957. This result was calculated based on only three years data: 1957, 78 and 82, under a simple assumption that the shares of labor and capital were 60% and 40%, respectively.

It should be noted that, in 1978, the growth rate in China reached the highest since 1970. It dropped from 13.1% of 1978 to 4.7% in 1981, due to a short-run macroeconomic adjustment in 1979-81, and then started to recover. The above result

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6 A rough estimation suggested that about 200 billion Yuan's investment projects in "the third defence line construction", in the 1960s-70s, actually failed (from the author's notes for a speech of a former senior official of the State Planning Committee, 1979).
actually reflected a short run fluctuation, in which the output growth dropped more rapidly than input growth.

From a production function estimation, Chen et al. (1988) found a slight increase in multi-factor productivity growth in the state-owned industrial sector, from 0.4% to 1.1% during 1957-1978, accelerating to 1.9% or 2.7% during the economic reform period (1979-85).

Jefferson (1989) compared productivity growth between the state and collective owned industrial sectors. A Cobb-Douglas production function with an industrial efficiency variable, and cross section data for 293 cities and counties, were used to estimate productivity in both sectors. The results show that the marginal revenue product of capital (VMPK) in the collective sector was about 4 times that of the state sector, whereas the marginal revenue product of labor (VMPL) in the former was one quarter of the latter. These results are not surprising since the state sector is much more capital intensive than others. In aggregate, TFP in the state sector was found to be about 2.6 times that of the collective sector. Jefferson explains this gap by technological differences across sectors.

In a later study, Jefferson, Rawski and Zheng (1992a) developed a quasi-frontier estimation procedure to estimate total productivity in the state and the collective industrial sectors. They suggested that productivity in both sectors rose substantially in the reform period (1978-1988) after the long term stagnation before reform. Although productivity in the collective sector was still lower than the state sector, it was found to grow faster in the former sector than the latter, therefore the TFP levels in the two sectors tended to converge.

Different from the above result, in another empirical estimation, Woo, Hai, Jan and Fan (1994) found no TFP growth in the state sector, but significant TFP growth in the non-state sector. They suggest that the positive TFP growth in SOEs found by some earlier studies might be due to underdeflation of gross output and overdeflation of intermediate inputs. They also indicated that increases in technical efficiency do not necessarily improve SOEs’ financial performance.
Jefferson et al. (1992b) also examined the relative capacity to undertake new product innovation in three types of industrial enterprises: SOEs, TVEs, and urban collectives enterprises (UCOEs). Some interesting data are provided in Table 7.4:

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>SOE(L)</th>
<th>SOE(S)</th>
<th>UCOE</th>
<th>TVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. new products(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1985</td>
<td>10.2</td>
<td>9.2</td>
<td>9.4</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>26.9</td>
<td>19.8</td>
<td>37.3</td>
<td>26.4</td>
<td>38.8</td>
</tr>
<tr>
<td>85-89</td>
<td>14</td>
<td>10</td>
<td>n.a.</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>2. resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>10.9</td>
<td>13.0</td>
<td>12.2</td>
<td>10.3</td>
<td>8.7</td>
</tr>
<tr>
<td>b.</td>
<td>10.2</td>
<td>9.3</td>
<td>2.3</td>
<td>12.5</td>
<td>12.7</td>
</tr>
</tbody>
</table>

Notes: 1 is share of new products in Gross Value of Industrial Output; 2a is percentage of senior technicians in total workforce; 2b is the expenditure for technical innovation as a percentage of net value of industrial output in 1985-89. “L” and “S” stand for “large and medium size” and “small size” enterprises, respectively.


The above data show that, compared with SOEs, the market oriented NSEs, particularly TVEs, had fewer technicians but stronger incentives and achieved better performance in technical innovations. This finding explains the above estimated result of faster growth of the non-state sector productivity. In a later study, Jefferson (1993) also suggested that the TFP level in TVEs has exceeded that in SOEs by the late 1980s or early 90s.

A number of reasons can explain the estimated productivity level being higher in SOEs than NSEs, in the earlier period of economic reform. One reason is that SOEs had much higher technical input and human capital stock than NSEs under the central planning system. In most of the empirical analyses, technology and human capital was not taken into account as inputs, often due to the unavailability of data. This is probably the basic reason for the estimated higher TFP in SOEs. Another reason is that SOEs enjoyed much lower input prices and lower interest of bank loans than their
non-state counterpart in the pre-reform and early reform period. These reduced SOEs' needs of working capital in use, and could result in a lower input-output ratio.

Effect of government and non-government sectors on growth: cross-country studies

Several cross-country empirical studies investigated the effect of government sector expansion on economic growth. Two contradictory hypotheses, both derived from economic theory, form the bases of these studies. The first, because of market failure in some sectors and externalities of public goods, the growth of the public sector could have a positive externality on other sectors, and therefore on economic growth. The alternative hypothesis states that, since government intervention can lead to a market distortion in resource allocation and inefficient operation of government firms, the public sector could have lower productivity than the private sector. The expansion of the government sector could have negative effect on growth. Both positive and negative impact of the government sector on economic growth have been reported in the literature.

D. Landau (1983) carried out a cross country regression using data from 96 countries for two period averages (1961-70 and 1970-76). He estimated the impact of government expenditure on per capita GDP growth. The independent variables include share of government expenditure in GDP, level of per capita GDP, total investment in education, energy consumption per capita, and dummy variables for the geographical location of the country. He found that government expenditure had a negative, and significant, impact on the economic growth rate. Similar results are obtained by Edwards (1992). However, Landau's model was criticized as lacking a theoretical base (Carr 1989, Rao 1989).

In another cross-country analysis, Ram (1986) used Feder's export and non-export model (1983) to estimate relative productivity between the government and the non-government sectors, and the effect of the government sector on economic growth. Different from Landau and Edwards, Ram found that the government sector had a higher productivity than the non-government sector, and also a positive externality on non-government growth.
Since a reconstructed F-R model will be used for the empirical estimation in this study, the major features of the F-R model are described as follows.

Ram’s model includes two production functions for the government and the non-government sector, respectively:

\[ C = C(L_c, K_c, G) \]  
\[ G = G(L_g, K_g) \]

where C and G refer to the output of the private and government sector, respectively; \( L_i \) and \( K_i \) \((i = c, g)\) are capital and labor, respectively, in each sector. The private sector’s production function includes the government output G, in order to estimate the externality of the latter on the former.

To allow for the estimation of sectoral marginal productivity using aggregate data, it is assumed that the ratio of the two sectors’ marginal product of capital is equal to the ratio of their marginal product of labor:

\[ (G_k/C_k)/(G_c/C_c) = 1 + \delta \]

where \( G_k \) and \( C_k \) are the government and the private sector’s marginal productivity of capital, respectively, \( G_c \) and \( C_c \) are that of labor. \( \delta \) is the relative productivity difference between the two sectors. \( \delta > 0 \) indicates that productivity in the government sector is greater than the private sector, and \( \delta \leq 0 \) otherwise.

By differentiation of the production functions, the following reduced form equation is derived:

\[ y = \alpha (l/Y) + \beta l + [(\delta/(1+\delta)) - \theta] g(G/Y) + \theta g \]

where \( y = dY/Y \), \( g = dG/G \), \( l = dL/L \), they are growth rates of \( Y \), \( G \), and \( L \) respectively. \( Y = C + G \), the aggregated output of the economy. \( L \) is total labor in the economy. \( I = dK \), investment in the economy. \( \theta = \frac{C_g}{G/C} \), the elasticity of \( C \) with respect to \( G \). \( \theta > 0 \) would suggest a positive externality from the government sector on the private sector. The coefficient \( \alpha \) is the marginal product of capital for the private sector, and \( \beta \) is labor elasticity of output for the private sector.

From both cross section (115 countries) and time series estimation of Equation 5, Ram obtained both positive \( \delta \) and \( \theta \). He then concluded that the government sector
has a higher productivity than the private sector; the former also has a positive external effect on the latter. In aggregation, the government sector has a positive impact on economic growth. He believes that this is true particularly in less developed countries.

Carr (1989) argues that the positive $\delta$ probably results from a data problem, since government output may often be overestimated. Carr claimed that since most government goods do not pass through the market, they are usually evaluated at their cost of production, even though they may have zero ex post value to citizens of the country. However, no evidence was provided to support his argument. Another criticism was made by Rao (1989). He pointed out that Ram's model has a better theoretical base than Landau's model, yet may have some specification problems since some assumptions are not justified. They are:

- marginal product of each factor input in the government sector is assumed to have the equal proportional relationship to its counterpart in the private sector, this may be not true; yet without this assumption the main equation can not be obtained.

- elasticity $\theta = C_\delta (G/C)$ is assumed to be a constant, but this is doubtful across countries and over time.

In a re-estimation using the same model, Rao found a specification bias in the cross-section regressions, suggested by the RESET test, and some insignificant estimates in the time-series regressions.

The above studies provide contradictory results in the contribution of the government and non-government sectors to economic growth. In the following section, a modified Feder-Ram model is used to estimate relative productivity and externality between the state and non-state industrial sectors in China.
7.3 ESTIMATING EXTERNALITIES AND RELATIVE PRODUCTIVITY BETWEEN THE TVE AND STATE SECTORS

The model

This section aims to estimate the possible external effect between China’s state sector and the TVE sector (which has been the major component of the non-state sectors), and their relative productivity changes. For the empirical test, modifications are made to the Feder-Ram model as follows.

First, externalities are allowed in both sectors, instead of the original specification that only allows for the state sector to have an externality on the non-state sector. However, if the symmetry effect does exist, e.g., if $C$ has a positive effect on $G$, the exclusion of $C$ in Equation (2) of Ram model would cause an overestimation of factor productivities, $G_L$ and $G_K$, in the government sector. The productivity differential $\delta$ in that model could also be overestimated. In order to estimate the possible symmetry effect, and to avoid the possible estimation bias, non-state sector output $C$ should be included in the RHS of Equation (2) (see section 7.2 for the original model).

Second, the original Ram model (Equation 3) assumes that, if the marginal product of labor of the government sector is higher than that of the private sector, its marginal product of capital must be equally higher. This assumption lacks a theoretical basis, and is not supported by empirical studies on the Chinese economy (see, e.g., Jefferson 1989). The capital and labor intensities are very different in the two sectors. The state sector has a far higher labor productivity and a far lower capital productivity than the non-state sectors. To avoid estimation bias, this restriction is relaxed.

Third, the above modification requires using separated input and output data for each sector. The two production functions therefore will be estimated simultaneously, instead of estimating the reduced form equation. The initial level and growth rate of total factor productivity in each sector can be directly derived from the estimates.

Fourth, to allow for changes in the marginal product of capital and labor, the pre-assumption of constant relative MPL and MPK in the original model will be relaxed. Each sector’s MPL and MPK will be derived on a year-by-year basis.
Fifth, the original assumption in the Ram model, $\delta/(1+\delta)=\theta$, is removed due to its lack of theoretical basis ($\delta$ is the marginal factor productivity differential between the two sectors, and $\theta$ is the government sector externality).

Sixth, for the convenience of obtaining elasticities of output with respect to capital and labor, a Cobb-Douglas production function is applied for both sectors.

Finally, since the major purpose of the study is not to investigate the effect of public goods, but to investigate the interaction of the SOEs and TVEs in market competition, the estimation uses only industrial (manufacture, mining and power generation) data for SOEs, so that it can be comparable with TVEs, in which 70 per cent of output was industrial goods. In this way, any possible externality resulting from public goods (e.g., education or infrastructure) will be excluded.

The production function for the two sectors:

$$Y_i = A_i K_i^{\alpha_i} L_i^{\beta_i} Y_j^{\theta_i}$$  \hspace{1cm} (a1)

where $Y_i$ and $Y_j$ are the values of output in sector $i$ and $j$, respectively ($i \neq j$), $K_i$ is value of capital stock in sector $i$; $L_i$ is employment in the $i$th sector; $\alpha_i$ and $\beta_i$ are elasticities of output with respect to capital and labor, respectively (to be consistent with the symbol use in earlier chapters, $i=1,3$; $j=1,3$; 1 denotes the TVE sector and 3 the SOE sector. Note that $i=2$ is used in the previous chapters to denote the agricultural sector); $\theta_{ij}$ is the elasticity of the $i$th sector output with respect to $j$th sector, it represents the possible externalities from sector $j$ to $i$.

MPK and MPL in each sector can be derived from the following equations:

$$MPK_i = \frac{\partial Y_i}{\partial K_i} = \alpha_i A_i K_i^{\alpha_i - 1} L_i^{\beta_i} Y_j^{\theta_i} = \alpha_i Y_i / K_i$$  \hspace{1cm} (a3)

$$MPL_i = \frac{\partial Y_i}{\partial L_i} = \beta_i A_i K_i^{\alpha_i} L_i^{\beta_i - 1} Y_j^{\theta_i} = \beta_i Y_i / L_i$$  \hspace{1cm} (a4)

Following Solow (1956), $A_i$ is assumed to be a function of time:

$$A_i = A_i(T) = A_i(0)e^{g_i T}$$  \hspace{1cm} (a2)

where $A_i(0)$ is a constant, represents the initial level of TFP in the $i$th sector. $g_i$ is the growth rate of TFP, excluding the effect of externality, $\theta_{ij}$. $T$ is a time trend.
If both \( Y_1 \) and \( Y_3 \) are correlated with time, this might result in a significant \( \theta_i \), which did not reflect the externality. Including a time trend in the production function also helps to reduce this possible problem.

Alternatively, the time trend can be replaced by dummy variables for each year, \( \sum_{t=2}^m T_i \), so that the assumption \( A_i = A_i(0)e^{kt} \) can be relaxed. The \( T_i \) denotes the dummy variable for the \( t \)th year, \( m \) is the total number of years.

To allow use panel data with fixed effect, cross sectional dummy variables, \( \sum_{k=2}^n D_k \), are included. Where \( D_k \) is a dummy variable for the \( k \)th cross sectional unit, \( n \) is the total number of cross sectional units. Alternatively, the cross sectional dummies may be replaced by a few dummy variables for groups of cross sectional units. In our case, the cross sectional units will be 28 provinces, which may be grouped into 3 regions.

Add (a2) or year dummies into (a1), take logarithm of the equations, and include the cross sectional dummies in the model, to get two versions of the model:

\[
\ln Y_i = \ln A_i(0) + \sum_{k=2}^n D_k + g_j T + \alpha_j \ln K_j + \beta_j \ln L_j + \theta_{jj} \ln Y_j \quad (1)
\]

\[
\ln Y_i = \ln A_i(0) + \sum_{k=2}^n D_k + g_j T + \alpha_j \ln K_j + \beta_j \ln L_j + \theta_{ij} \ln Y_j \quad (2)
\]

or, alternatively

\[
\ln Y_i = \ln A_i(0) + \sum_{k=2}^n D_k + \sum_{t=2}^m T_i + \alpha_j \ln K_j + \beta_j \ln L_j + \theta_{ij} \ln Y_j \quad (1')
\]

\[
\ln Y_i = \ln A_i(0) + \sum_{k=2}^n D_k + \sum_{t=2}^m T_i + \alpha_j \ln K_j + \beta_j \ln L_j + \theta_{ij} \ln Y_i \quad (2')
\]

Note that \( \ln Y_i = dY_i/Y_i \), which is growth rate of \( Y_i \). Similar definition apply to \( \ln K_i \) and \( \ln L_i \). Coefficients \( \alpha_i, \beta_i \), and \( \theta_{ii} \) indicate the contribution of the corresponding input growth on output growth.

Since each equation contains an endogenous variable in the right hand side, the model has to be estimated simultaneously.

**Data and estimation results**

The TVE and the state industrial sector data at the provincial level are used for the estimation. Data for twenty-eight provinces are available for 1980, 85, 88, 90 and 92
(i.e., n=28, m=5). The total number of observations is 140. Data are calculated from SSB(a) 1986, 91, 95; SSB(b) 1990; and BTVE 1990, 91, 92.

Data used for each variable are described as follows:

$Y_1$ is value of gross output of the TVE sector, and $Y_3$ is value of gross industrial output of the SOE sector, both deflated to 1980 prices. The official data for constant price output of the TVE sector (BTV 1990-92) was found to be seriously under-deflated. This seems to have caused an overestimation of the TVE sector productivity growth\footnote{For example, Weitzman and Xu (1994), using official data, estimated TFP growth rate in the TVE sector in 1979-1991 as 12% annually. This seems to be an overestimation.}. Therefore TVE output in constant price is recalculated from the current price data (see Appendix A1 for the data and calculation).

$K_i$, capital stock, is a combination of value of fixed assets and working capital in the $i$th sector, deflated to the 1980 price level.

$L_i$ is total employment in the $i$th sector.

Time trend $T=t-1980$ for year $t$ (i.e., $T=0, 5, 8, ...$ for 1980, 85, 88, ...).

Annual dummy variables, $T_i$, is defined as: $T_i =1$ for the year $t$ and $=0$ for other years. They are: $T_{85}, T_{88}, T_{90},$ and $T_{92}$. The time trends is used in Version 1 of the model and the annual dummy variables are used in Version 2.

Since many cross sectional dummies are insignificant in the initial estimation, they are replaced by the regional dummies for the East, Central, and West regions of China, i.e., REG$_1$ for the East, REG$_2$ for the Central, and the constant of the model represent the West region (for description of the three regions see Section 5.1 in Chapter 5).

Table 7.5 shows Three-Stage-Least-Squire (3SLS) estimation results. High $R^2$s are obtained from both versions of the estimation. Capital and labor elasticities, $\alpha$ and $\beta$, are significant for both sectors in both versions, although slightly different in values. The significant estimates for region dummies indicate high level of total factor productivity in the East Coast region than the other regions, of both sectors. TFP level
of TVEs is slightly higher in the Central region than the West, but that of SOEs is indifferent between these two regions.

<table>
<thead>
<tr>
<th>Version</th>
<th>1 (TVE)</th>
<th>3 (SOE)</th>
<th>2 (TVE)</th>
<th>3 (SOE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System R²</td>
<td>0.984</td>
<td>0.959</td>
<td>0.988</td>
<td>0.962</td>
</tr>
<tr>
<td>Sector Equation R²</td>
<td>0.097</td>
<td>0.098</td>
<td></td>
<td></td>
</tr>
<tr>
<td>α₄</td>
<td>0.471 (9.04** )</td>
<td>0.537 (5.37** )</td>
<td>0.623 (11.91** )</td>
<td>0.666 (6.28** )</td>
</tr>
<tr>
<td>β₁</td>
<td>0.501 (13.31** )</td>
<td>0.434 (3.35** )</td>
<td>0.378 (10.01** )</td>
<td>0.283 (2.13 )</td>
</tr>
<tr>
<td>θ₀</td>
<td>0.116 (2.29* )</td>
<td>0.101 (2.65** )</td>
<td>0.069 (1.53)</td>
<td>0.122 (3.28** )</td>
</tr>
<tr>
<td>lnAₐ₀</td>
<td>-0.522 (-1.90)</td>
<td>0.262 (0.78)</td>
<td>-0.415 (-1.72)</td>
<td>-0.128 (-0.359)</td>
</tr>
<tr>
<td>REG₁</td>
<td>0.364 (6.50** )</td>
<td>0.313 (5.61** )</td>
<td>0.295 (5.93** )</td>
<td>0.308 (5.64** )</td>
</tr>
<tr>
<td>REG₂</td>
<td>0.152 (3.13** )</td>
<td>0.002 (0.04)</td>
<td>0.148 (3.49** )</td>
<td>0.021 (0.423)</td>
</tr>
<tr>
<td>gₑ</td>
<td>0.043 (6.69** )</td>
<td>-0.010 (-0.808)</td>
<td>0.467 (-0.82)</td>
<td>-0.063 (-0.82)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are t-ratios. T-ratio with *, *, and ** are significant at 10%, 5%, and 1% level, respectively.

The estimated externality of the state sector on the TVE sector, θ₁₃, is significant in version 1, but insignificant at the 10% level in version 2. However, in both versions, the estimates of the externality of the TVE sector on the state sector, θ₃₁, are significant at the 1% level. The result clearly indicates a positive externality from the TVE sector on the SOE state, but the result for the state sector externality is not clear.

The value of θ₃₁, e.g., 0.122 as estimated from version 2, suggests that every one percentage point growth rate of the TVE sector contributed to the state sector growth
by 0.122 percentage point. In this period, the average growth rate of the TVE sector was 24.2%, this contributed to the state sector growth by 2.7 percentage points, accounting for 1/3 of the SOEs' growth rate, which was annually 7.8% on average.

The externality of TVEs on SOEs can be explained as the pressure of market competition that induced TVEs to push SOEs to increase their efficiency, because, without market competition, SOEs were running below their production frontier during the pre-reform period. The externality of SOEs on TVEs, if exist, might result from the sector-linkage effect. This is possible since most TVEs were operating to produce consumer goods, due to the entry-threshold in the intermediate goods and capital goods sectors that resulted from either technical or policy restrictions. Most capital goods and intermediate goods were produced by SOEs in the 1970s and 80s, although, this situation is changing gradually.

TFP level, derived from $\ln A_i$, was higher in the SOE sector than the TVE sector in the year of 1980, but insignificant for SOEs. Version 1 suggests a significant TFP growth in the TVE sector during the period 1981-92, at an average rate of 4.3%, but possibly a slight negative growth in the SOE sector, at an average rate of -1.0% (not significant). Version 2 indicates gradual, and significant, increases in TFP level from 1980 to 88, 90 and 92, except a peak in 1985. The change of TFP level from 1980 to 1992 implies a TFP growth rate of 3.8%, close enough to that estimated in version 1. They are consistent with the estimation result of TFP growth of TVEs in Chapter 5. The changes in TFP level of SOEs, derived from version 2, suggest a possibly even more serious decline (-3.7%) than that from version 1, but this cannot be confirmed since all the levels are insignificant.

Note that the possible negative TFP growth rate of the SOE sector does not necessarily mean a decreasing productivity, since the externality from TVEs on its

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8. There were serious supply restrictions in terms of energy and some important materials, in the early stage of reform, particularly to the non-state enterprises.
9. Which possibly resulted from a data bias.
growth rate is estimated separately. However, it suggests that without the externality from market competition, the TFP of SOEs was possibly decreasing in 1981-92.

Contribution of the TFP growth rates, and the externalities, to growth of the TVE and SOE sectors are calculated according to the estimation result, and shown in Table 7.6.

<table>
<thead>
<tr>
<th>Sector</th>
<th>TVE Version 1</th>
<th>TVE Version 2</th>
<th>SOE Version 1</th>
<th>SOE Version 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFP level a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>0.593*</td>
<td>0.660*</td>
<td>1.299</td>
<td>0.880</td>
</tr>
<tr>
<td>1992</td>
<td>0.997*</td>
<td>1.039*</td>
<td>1.145</td>
<td>0.561*</td>
</tr>
<tr>
<td>TFP growth rate (%)</td>
<td>4.4*</td>
<td>3.9*</td>
<td>-1.0</td>
<td>-3.7</td>
</tr>
<tr>
<td>Externality (%) b</td>
<td>0.9*</td>
<td>0.5</td>
<td>2.4*</td>
<td>2.7*</td>
</tr>
<tr>
<td>Total growth rate (%)</td>
<td>24.2</td>
<td>24.2</td>
<td>7.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Contribution c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFP</td>
<td>18%*</td>
<td>16%*</td>
<td>-13%</td>
<td>-47%</td>
</tr>
<tr>
<td>Externality</td>
<td>4%*</td>
<td>2%</td>
<td>31%*</td>
<td>35%*</td>
</tr>
</tbody>
</table>

Notes: Figures with * are derived from significant estimates (10% or higher level), other figures are not reliable estimates, and for reference only. All the instantaneous growth rates have been converted into annual growth rates.

a. The level of TFPs are that of Region 3. They are higher in Region 1, and slightly higher in Region 2 for TVEs.
b. Contribution of the externality from the other sector to its growth rate; for the $i$th sector, it is derived as $\theta_{ij}$ times the actual growth rate of the $j$th sector. For example, the externality of TVE on growth of SOEs, $\theta_{31}$, is derived as $0.101 \times 24.2\% = 2.4\%$.
c. The actual sectoral growth rates as 100%.

As shown in Table 7.6, by adding the contribution of the externality $\theta_{31} \hat{Y}_t$ ($\hat{Y}_t$ is growth rate of $Y_t$) to $g_2$, version 1 suggests that the externality from competition of TVEs might have fully offset the decline of TFP level in the state sector, and made a slight positive productivity growth in the state sector; but the result of version 2 implies that, the externality only offset a part of TFP decline in the SOE sector, left the total effect to be a slight decrease in productivity. Neither results can be justified due to the insignificance of TFP estimates in the SOE sector. Nevertheless, the significant $\theta_{31}$ in both versions clearly indicates that the market competition from
TVEs made a positive and substantial contribution to the State sector growth, accounting for one third of the growth rate.

In general, the above result suggests that, in 1981-92, although SOEs lost their monopolistic advantage, they benefited from market competition, particularly from the market-oriented TVEs, which generated pressure on SOEs to increase their efficiency. This positive effect has either fully or partly offset the negative effect from losing policy advantages, but did not eliminate the gap of performance between the state and the non-state sectors. To support this finding, additional evidence is provided later.

From the estimates of $\alpha_i$ and $\beta_i$ from version 2, which are generally consistent with estimates in Chapter 5, the values of marginal product of capital (MPK) and labor (MPL) for each sector are calculated according to Equation (a3) and (a4), and the national level input and output data. Results are given in Table 7.7.

Table 7.7 shows that the TVE sector had a lower labor productivity but a higher capital productivity than the state sector, because of that the state sector was much more capital intensive than the TVE sector. During 1980-92, both MPK and MPL increased in the TVE sector. In the state sector, the MPL increased but the MPK decreased. The different directions of changing MPK led to a divergence of MPKs, remarkably higher in TVEs than SOEs in 1992. Although the MPL of TVEs was still lower than the that of SOEs in 1992, they converged from a relative ratio of 0.24 to 0.60, due to faster increase in labor productivity in TVEs than SOEs (11.8% annually in the former and 4.5% in the latter).
TABLE 7.7 MARGINAL FACTOR PRODUCTIVITY IN THE TVE AND STATE SECTORS

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MPK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TVE</td>
<td>0.812</td>
<td>1.23</td>
<td>0.935</td>
<td>0.869</td>
<td>0.931</td>
<td>1.1%</td>
</tr>
<tr>
<td>State</td>
<td>0.526</td>
<td>0.506</td>
<td>0.48</td>
<td>0.406</td>
<td>0.326</td>
<td>-3.9%</td>
</tr>
<tr>
<td>MPL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TVE</td>
<td>0.828</td>
<td>1.352</td>
<td>1.922</td>
<td>2.234</td>
<td>3.165</td>
<td>11.8%</td>
</tr>
<tr>
<td>State</td>
<td>3.453</td>
<td>4.302</td>
<td>5.114</td>
<td>5.267</td>
<td>5.867</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

Note:
1. $\alpha_1 = 0.623$, $\alpha_2 = 0.666$, $\beta_1 = 0.378$, $\beta_2 = 0.283$.
2. MPK are measured by Yuan/Yuan; MPL are measured by 1000 Yuan/person. All values are in 1980 constant prices.

Source: Calculated from the estimation results in Table 7.5, TVE data in Table 5.15, and SOE data in SSB(a) 1986, 91, 94; SSB(b) 1990.

The reason for the decreasing capital productivity in SOEs is the fast growth of capital with a significant diminishing returns in the state sector, showing an input-driven growth pattern in SOEs. The capital intensity of the state sector resulted from the free-distribution of investment funds through the state budget, during the pre-reform period. Although this has been changed since reform, some SOEs, particularly large SOEs, are still paying lower interest rate and having priorities in obtaining bank loans than TVEs. Capital intensity is growing faster in the SOEs than the TVEs.

The estimation results obtained above can be compared with the results of earlier cross-sectional estimations using the original Feder (1983) and Ram (1986) model (FR1 for short) and two versions of slightly modified F-R model (FR2 and 3) (see Appendix 7.1). The modification is made to FR2 and FR3 to allow the externalities exist in both sectors, but without removing the restriction for equal ratio of MPL and MPK between the two sectors. The difference in FR3 from FR2 is that it further includes regional dummy variables to allow cross sectional variation. Results of all these models suggest positive externality of the state sector, higher in FR1 than in the others. The FR1 and FR2 suggest that both the marginal product of capital and labor

180
are higher in SOEs than NSEs\textsuperscript{10}. Positive externality of the TVE sector is suggested by FR2 and FR3. However, diagnostic tests indicate estimation bias existing in FR1 and FR2.

The model used in above estimation is a further improved version from FR3 by removing the restriction of the equal ratio of the MPL and MPK. Data set is also improved. Diagnostic tests for single equation estimations are not applicable to the system estimation, therefore they cannot be compared by same diagnostic tests. However, since the restriction that removed from the current study has been identified to be incorrect (see Table 7.7), the current estimation is preferred to FR1, 2 and 3.

*Additional evidence for the effect of market competition on SOEs*

Various technical indicators are available in 1985, 87 and 95 in statistics for “major industrial enterprises” (which are all state-owned large or medium size enterprises), in 13 industrial branches. These indicators include quality of products (e.g., percentage of qualified product), material and energy consumption per unit of product (e.g., Standard coal consumption for power generation, g/kwh), ratio of equipment utilization, labor productivity in kind (volume of physical product per worker), etc. Each indicator reflects one particular technical feature relating to productivity or efficiency. Due to differences in technologies, indicators are different among branches, and therefore are not completely comparable. A group of indicators, however, will provide a general direction of changing efficiency or productivity of SOEs in a certain industrial branch. Thus they are used to judge the direction of changing productivity in SOEs, between the year of 1995 and 1985/87.

The 13 industrial branches are classified into 3 categories according to the extent of market competition\textsuperscript{11}:

- Category 1. The state sector is completely or basically in a monopolistic position, due to the entry-threshold of investment that resulted from scale economies and

\textsuperscript{10} According to the original model restriction, if the MPK is higher in one sector than another, the MPL of the former sector has to be equally higher.

\textsuperscript{11} The classification is made according to the information obtained by the author from industrial surveys in 1985, 86, 87, 88, and 96. Also see Wang, Diao, et al. 1986, and Wang 1996.
technological constraints, or due to government restrictions on non-state investment. These industries are electricity generating, oil developing and processing, steel smelting and press forging, and forest industries. This group of industrial branches are noted as “monopoly”.

Category 2. The SOEs are facing competition from TVEs and other non-state enterprises, but entry-thresholds to the latter also exist to some extent, or production is diversified so that products of SOEs and TVEs are not perfect substitutes. These industries are iron smelting, chemical, engineering, chemical fiber, and papermaking, noted as “monopolistic competition”.

Category 3. The SOEs are facing sharp competition from TVEs and other NSEs since both products are perfect or near-perfect substitutes. These industries are coal mining, iron ore, building materials, and textile, noted as “competition”.

By comparing the technical performance of the three groups of industrial branches, the effects of market competition on SOEs is indicated in Table 7.8. In the table, the sign “+” indicates improvement in 1995 compared with 1985 and 87; “-” indicates worsening, “?” indicates no-change, improving from 1985 but worsening from 1987, or the opposite. The fractions indicate the number of indicators showing improvement (or worsening) over the number of total indicators for each industrial branch (e.g., 4/5 in the “+” column means four indicators out of total five showing improvement in that branch).

Table 7.8 shows a clear and striking fact. In those industrial sectors where the SOEs were facing sharp competition from NSEs and experiencing hardships, most technical indicators improved from 1985 to 95, indicating an increase in efficiency. In contrast, most technical indicators were worse off in monopolistic state enterprises, indicating decreases in efficiency. In the competition group, the only exemption is the textile industry, for which the improving and worsening indicators were half-and-half. In this sector, SOEs were facing the most acute competition from NSEs, and many of them were in great difficulties, resulting from their loss of traditional markets to NSEs. Two of the three worsening indicators are rates of equipment utilization, which
reflect the fact of loss of markets to NSEs, whereas all the three improving indicators show increases in the quality of their products. In general, Table 7.8 strongly supports the estimation result of the model provided in the last section. There appears to be a positive externality from the non-state sector to the state sector originating from the pressure of market competition.

<table>
<thead>
<tr>
<th>Industry</th>
<th>+</th>
<th>?</th>
<th>-</th>
<th>Improving %</th>
<th>Worsening %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopoly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>2/6</td>
<td>1/6</td>
<td>3/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>1/5</td>
<td>0/5</td>
<td>4/5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>0/3</td>
<td>1/3</td>
<td>2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>0/3</td>
<td>0/3</td>
<td>3/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>3/17</td>
<td>2/17</td>
<td>12/17</td>
<td>18%</td>
<td>71%</td>
</tr>
<tr>
<td>Monop. Competition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron smelting</td>
<td>0/3</td>
<td>3/3</td>
<td>0/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical</td>
<td>1/10</td>
<td>2/10</td>
<td>7/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>1/2</td>
<td>0/2</td>
<td>1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical fiber</td>
<td>0/1</td>
<td>1/1</td>
<td>0/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papermaking</td>
<td>1/3</td>
<td>0/3</td>
<td>2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>3/19</td>
<td>6/19</td>
<td>10/19</td>
<td>16%</td>
<td>53%</td>
</tr>
<tr>
<td>Competition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal mining</td>
<td>8/10</td>
<td>0/10</td>
<td>2/10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron ore</td>
<td>2/3</td>
<td>1/3</td>
<td>0/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building materials</td>
<td>2/4</td>
<td>1/4</td>
<td>1/4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textile</td>
<td>3/7</td>
<td>1/7</td>
<td>3/7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>15/24</td>
<td>3/24</td>
<td>6/24</td>
<td>63%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Note: +, ? and – show the number of indicators suggesting improvement, unclear or unchanged, and worsening, respectively. The last two columns show the percentage of the number of indicators showing improvement or worsening in the total number of indicators in that group.

Source: SSB(a) 1996: 444-6, 1988, 365-72.

**Contribution of the TVE and other non-state sectors to economic growth**

This sub-section adopts the earlier framework to analyze the economic growth of China’s non-agricultural sector. It calculates the direct contribution of the TVEs and other NSEs in the usual way. The new contribution is to calculate the indirect contributions of the NSE sector through their positive effect on growth of SOEs. To complete the calculations the non-industrial sector needs to be added to the data, that
is, the construction, transportation and service sectors. The input and output data in
the non-industrial sectors are not complete however, therefore there is a need to make
a number of assumptions. For the state sector it is assumed that the non-industrial
sector has the same technology and output-input mix as its industrial sector
counterpart. For TVEs it is assumed that the production technology estimated in Table
7.5 applies to the rest part of the non-state sector where the data are missing. With
these two assumptions, the growth rate of TVEs can be used as the growth rate of the
whole NSE sector, and the growth rate of industrial SOEs can be used as the growth
rate of the SOE sector.

Further, the proportion of the TVEs in the NSE sector and the proportion of the
industrial SOEs in the SOE sector are assumed to be equal, so that the relative size of
the NSE and the SOE sectors can be represented by the relative sizes of the TVE and
industrial SOE sectors. Since TVEs are the major components of the NSE sector, and
the industrial SOEs are the major components of the SOE sector, these assumptions
will not lead to large errors.

Thus, direct and indirect contributions of the non-state sector to economic growth
can be approximately derived according to output shares of the TVE and state
industrial sectors, and their growth rates.

Table 7.9 provides the relative output shares and the actual growth rates of the SOE
and NSE sectors (from those of the industrial SOEs and TVEs). Y_1 and Y_3 denote the
NSE and SOE sectors, Y represents the non-agricultural economy, Y=Y_1+Y_3. The
growth rates of Y are weighted aggregations of the growth rates of the two sectors,
The average output shares in the corresponding period, Y_1/Y and Y_3/Y, are taken as
the weights.

Table 7.10 gives the calculation results of the direct and indirect contribution of the
NSEs to economic growth that derived from Table 7.9, and the estimated externality
in Table 7.5. The economic growth rate (3) is divided into the direct contribution of
the NSEs’ growth
TABLE 7.9 GROWTH RATES OF THE NSE AND SOE SECTORS

<table>
<thead>
<tr>
<th></th>
<th>81-85</th>
<th>86-88</th>
<th>89-90</th>
<th>91-92</th>
<th>81-92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Share (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSE</td>
<td>Y_1/Y</td>
<td>22.7</td>
<td>34.7</td>
<td>39.9</td>
<td>44.8</td>
</tr>
<tr>
<td>SOE</td>
<td>Y_3/Y</td>
<td>77.3</td>
<td>65.3</td>
<td>60.1</td>
<td>55.2</td>
</tr>
<tr>
<td>Total</td>
<td>Y</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Growth Rate (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSE</td>
<td>Y_1</td>
<td>30.1</td>
<td>24.7</td>
<td>6.2</td>
<td>27.5</td>
</tr>
<tr>
<td>SOE</td>
<td>Y_3</td>
<td>8.5</td>
<td>9.7</td>
<td>3.4</td>
<td>7.5</td>
</tr>
<tr>
<td>Total</td>
<td>Y</td>
<td>13.4</td>
<td>14.9</td>
<td>4.6</td>
<td>16.4</td>
</tr>
</tbody>
</table>

Source: See Table 7.7.

TABLE 7.10 DIRECT AND INDIRECT CONTRIBUTION OF THE NSE SECTOR TO ECONOMIC GROWTH

<table>
<thead>
<tr>
<th></th>
<th>81-85</th>
<th>86-88</th>
<th>89-90</th>
<th>91-92</th>
<th>81-92</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Direct contri. of NSE</td>
<td>6.8</td>
<td>8.6</td>
<td>2.5</td>
<td>12.3</td>
<td>7.8</td>
</tr>
<tr>
<td>(2) Contrib. of SOEs</td>
<td>6.6</td>
<td>6.3</td>
<td>2.1</td>
<td>4.1</td>
<td>5.3</td>
</tr>
<tr>
<td>(2.1) NSE’s indirect effect</td>
<td>2.8</td>
<td>2</td>
<td>0.4</td>
<td>1.8</td>
<td>2.0</td>
</tr>
<tr>
<td>(2.2) SOEs’ own contrib.</td>
<td>3.8</td>
<td>4.3</td>
<td>1.7</td>
<td>2.3</td>
<td>3.3</td>
</tr>
<tr>
<td>(3) Economic growth %</td>
<td>13.4</td>
<td>14.9</td>
<td>4.6</td>
<td>16.4</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Source: See Table 7.7.

In Table 7.10, the direct contribution of NSEs is derived from its growth rate and its output share in the non-agricultural economy as \( \hat{Y}_i(Y_i / Y) \). The contribution of the SOEs are derived in the same way, but it is divided into two parts: (2.1), the indirect effect of NSEs, calculated as \( \theta_{y} \hat{Y}_i(Y_i / Y) \); and (2.2), the rest part, i.e., the SOEs’ own contribution.

Thus, as shown in the last column of Table 7.10, the total contribution of the NSE sector to the annual non-agricultural economic growth, during 1980-92, is its direct contribution (7.8 percentage points) plus its indirect contribution through the SOE sector growth (2.0 percentage points). Together, the NSE sector contributed three quarters of the 13.1 percent economic growth. After deducting the NSE externality, the SOE sector only contributed one quarter to the economic growth.
7.4 SUMMARY

This chapter examines the interaction between the rural industrial sector (TVE sector) and the state-owned industrial sector, and assesses the external impact of the market-oriented TVE sector on growth of the state sector and the economy. The direct and indirect contributions of the TVE and other NSE sector to economic growth are calculated.

Although the SOEs are having difficulties due to losing favorable policy treatment and facing sharp competition from the non-state sector, this study find a positive externality of the TVE sector on the state sector growth, and therefore on economic growth, through market competition. The finding suggests that the positive effect of market competition upon SOEs’ growth have at least partially offset the negative impact of the difficulties they faced on TFP growth. Although the TFP growth rate in the state sector could not be identified in this study, the result does not support either strong TFP growth or heavy declines in this sector.

However, TFP growth during the period of 1980-92 in the TVE sector is found to be clearly positive and fast, at an annual rate about 3.9-4.4%.

The study result suggests that, during the reform period, the rapid growing non-state sector, mainly the TVE sector, made the major contribution to China’s economic growth, not only through its rapid growth and productivity changes, but also through its externality on the state sector. By including the indirect impact, the total contribution of the non-state sector accounted for about 75% of the growth rate of the non-agricultural economy, during the period of 1981-92.

Labor productivity in the state sector is found to be increasing, but at a slower rate than in the TVE sector. Capital productivity is decreasing in the former and increasing in the latter. With lower capital intensity and higher labor intensity than SOEs, TVEs’ capital productivity has much exceeded that of SOEs by 1992. Its labor productivity was still lower than the latter, but was getting closer.

Using an analytical method that is improved from the literature, the result of the current study using China’s two sectors data could not find clear evidence to support
an earlier cross-country study, which suggested that the expansion of the government sector has a positive externality on economic growth. The market competition of the non-state TVE sector is found to have a clear positive effect on the state sector, but the effect of the state sector on the non-state sector growth is not clear.

The above findings also generate some policy implications.

Since marginal product of capital in the state sector was found to be significantly lower than the TVE sector, market orientation will naturally lead to a reallocation of capital from the former to the latter. This will increase economic efficiency, but protection measures for the state sector, such as low interest rate bank loans, hindered an optimal allocation, and therefore reduce the overall efficiency level of the economy. Instead of policy protection, government policies on SOEs might be preferred to focus on the following aspects:

1. To promote market-oriented structural adjustment and technical innovation at the firm level.

2. To promote factor mobility among firms, sectors, and regions by creating a more transparent factor market with more equalized factor prices.

3. Further reform SOEs to include reforming the ownership structure to improve the incentive mechanism.
APPENDIX 7.1 ESTIMATIONS OF EXTERNALITIES AND RELATIVE PRODUCTIVITY USING THE F-R MODEL

Model 1 (Ram's original model)

Production functions in the state sector and the non-state sector:

\[ N = N(L_N, K_N, S) \]
\[ S = S(L_S, K_S) \]

where

\( S \) is the gross output of the state industrial sector;
\( N \) is the gross output of the non-state industrial sector;
\( K_i \) is the capital input in the \( i \)th sector (\( i = N, S \); and same below);
\( L_i \) is labor input in the \( i \)th sector;

By taking total differentiation of the two equations and assuming:

\[ S_L/N_L = S_K/N_K = 1 + \delta, \]

Combine the above to get

\[ dY = dN + dS = N_K dK + N_L dL + [\delta(1+\delta) + N_S] dS \]

Let \( N_L = \beta(Y/L), N_K = \alpha \), and divide both sides of the equation by \( Y \) to get the form in growth rate, the following equation can be obtained:

\[ y = \alpha(I/Y) + \beta l + [\delta(1+\delta)/\theta] s(S/Y) + \theta s \]

where

\( Y \) is the Gross Industrial Output, GIO;
\( y = dY/Y \), GIO growth rate of the whole industrial sector;
\( s = dS/S \), GIO growth rate of the state industrial sector;
\( I = dK \), investment in the industrial sector;
\( l = dL/L \), growth rate of labor in the industrial sector;
\( \alpha \) is marginal product of capital in the industrial sector;
\( \beta \) is elasticity of the non-state industrial sector output with respect to labor input;
\[ a = (\hat{\delta}/(1+\delta)) - \theta, \]  
the coefficient of \( s(S/Y) \);

\[ \theta = N_S(S/N), \]  
elasticity of the non-state industrial output with respect to \( S \), representing 
the "externality effect" of the state sector on the non-state sector;

\( \delta \) is the difference between the productivity of the state and non-state industrial sector; 
i.e., the relative factor productivity minus one. If \( \delta > 0 \), the productivity in the state 
sector is higher than the non-state sector.

**Model 2 (A modified model allowing externality from both sectors)**

Production functions:

\[
N = N(L_N, K_N, S) \\
S = S(L_S, K_S, N)
\]

By the process similar to above, and under the same assumption, the following 
equation can be obtained:

\[
y = \alpha(I/Y) + \beta \ell + a_1 s(S/Y) + \theta s + b_1 n(S/Y) \\
= \alpha(I/Y) + \beta \ell + a_1 s(S/Y) + \theta s + b \cdot n(S/Y) \\
\]

where \( \rho = S_N N / S \), the elasticity of the state sector output with respect to the non-state 
sector output; \( b = \rho / (1+\delta) \); \( n = dN/N \), growth rate of \( N \).

**Model 3 (Another version of the modified model with dummy variables)**

To distinguish the productivity difference between the more marketized provinces 
and less marketized provinces, dummy variables are added to the above model:

\[
y = C + \alpha(I/Y) + \beta \ell + a s(S/Y) + a_1 D_s(S/Y) + \theta s + \theta_1 D_s + b n(S/Y) + b_1 D_n(S/Y) \\
\]

where:

\( \theta, a \) and \( d \) are the parameters for Group 1, and  
\( \theta + \theta_1, a + a_1 \) and \( d + d_1 \) are these for Group 2;  
\( a + a_1 = (\hat{\delta})/(1+\hat{\delta}) - (\theta + \theta_1) \);  
\( b + b_1 = \rho/(1+\rho) \);  
\( \hat{\delta} \) is the productivity difference for Group 2 and \( \rho \) is the non-state sector externality for 
group 2;
D is a dummy variable. D=0 if the non-state sector accounts for less than 50% of the total industrial output (these provinces are classified as Group 1); and D=1 otherwise (classified as Group 2).

Estimation results

The above three models are estimated by using cross provincial data, as averages in 1987-90. There are 29 observations. Table 7.11 shows the estimation results.

<table>
<thead>
<tr>
<th>adj. R²</th>
<th>Eq1</th>
<th>Eq2</th>
<th>Eq3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.816</td>
<td>0.930</td>
<td>0.984</td>
<td></td>
</tr>
<tr>
<td>(C)</td>
<td>-0.560</td>
<td>-0.189</td>
<td>0.099</td>
</tr>
<tr>
<td>((-2.38^*))</td>
<td>((-1.21))</td>
<td>((1.22))</td>
<td></td>
</tr>
<tr>
<td>(\alpha)</td>
<td>0.008</td>
<td>0.061</td>
<td>0.016</td>
</tr>
<tr>
<td>((0.16))</td>
<td>((1.97))</td>
<td>((1.04))</td>
<td></td>
</tr>
<tr>
<td>(\beta)</td>
<td>0.774</td>
<td>0.146</td>
<td>-0.109</td>
</tr>
<tr>
<td>((2.53^*))</td>
<td>((0.688))</td>
<td>((-1.04))</td>
<td></td>
</tr>
<tr>
<td>(\theta)</td>
<td>0.859</td>
<td>1.104</td>
<td>1.067</td>
</tr>
<tr>
<td>((6.19^{**}))</td>
<td>((11.77^{**}))</td>
<td>((21.8^{**}))</td>
<td></td>
</tr>
<tr>
<td>(\theta_1)</td>
<td>0.030</td>
<td>(0.55)</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>-0.094</td>
<td>-0.516</td>
<td>-0.401</td>
</tr>
<tr>
<td>((-3.67^{**}))</td>
<td>((-7.55^{**}))</td>
<td>((-10.7^{**}))</td>
<td></td>
</tr>
<tr>
<td>(a_1)</td>
<td>-1.425</td>
<td>(0.327)</td>
<td></td>
</tr>
<tr>
<td>((-2.16^*))</td>
<td>(9.98^{**})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>0.415</td>
<td>(6.34^{**})</td>
<td></td>
</tr>
<tr>
<td>((6.34^{**}))</td>
<td>(9.98^{**})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b_1)</td>
<td>1.258</td>
<td>(2.58^*)</td>
<td></td>
</tr>
</tbody>
</table>

Note: T-ratio with * are significant at the 5% level, with ** are significant at the 1% or higher level.

Based on the estimation results shown in Table 7.11, productivity ratio \(\delta\) and externalities \(\theta\) and \(\rho\) are calculated and shown in Table 7.12.
TABLE 7.12 CALCULATED PARAMETERS FOR THE THREE MODELS

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>group 1</td>
<td>group 2</td>
</tr>
<tr>
<td>$\delta$</td>
<td>3.255</td>
<td>1.427</td>
<td>2.003</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.859</td>
<td>1.104</td>
<td>1.067</td>
</tr>
<tr>
<td>$\rho$</td>
<td>1.007</td>
<td>0.979</td>
<td>0.944</td>
</tr>
</tbody>
</table>

Note:
$\delta$ is calculated from $a$ and $\theta$, where $a=(\delta/(1-\delta))\cdot\theta$. $\rho$ is calculated form $\delta$ and $b$, where $b=\rho/(1+\delta)$.

Group 2 is the more marketized provinces, in which the non-state sector output exceeding 50% of total industrial output; Group 1 is the rest.

Test of nested hypothesis prefers Model 2 to Model 1, suggesting a missing variable problem and an overestimation for the state sector productivity in Model 1, compared with Model 2. However, diagnostic tests suggest possible estimation bias in both Model 1 and 2. There is also a heteroscedasticity problem with Model 2, which is corrected in Model 3. These tests show that Model 3 is preferred than the others. Test results are given in Table 7.13.

TABLE 7.13 SOME RESULTS OF DIAGNOSTIC TESTS

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional form (F test)</td>
<td>4.743*</td>
<td>8.356*</td>
<td>0.427</td>
</tr>
<tr>
<td>Functional form (F test)</td>
<td>4.497*</td>
<td>8.905*</td>
<td>0.284</td>
</tr>
<tr>
<td>Heteroscedasticity</td>
<td>0.031</td>
<td>7.149*</td>
<td>0.110</td>
</tr>
</tbody>
</table>

Note:
The ratio with * is significant at the 5% level. The functional form is tested by Ramsey's RESET. It may also represent problems of omitting variables or heteroscedasticity. The third raw for heteroscedasticity is obtained by White test.

According to the results of Model 3, productivity of the state sector is higher than the non-state sector only in the less marketized provinces, whereas in the more market-oriented provinces it is lower. The original Ram model appears overestimated the state sector productivity. In addition, both Model 2 and 3 suggest a positive externality of the non-state sector on growth of the state sector.
CHAPTER 8. CONCLUSION

This thesis attempts to answer the question: what determined the rapid growth of China’s rural industry during the period of economic reform?

China’s rural non-agricultural industrial sector (or, Township and Village Enterprises Sector) achieved an extraordinary growth performance during the period of economic reform. It was the most important contributor to China’s rapid economic growth for nearly two decades. From 1978 to 1995, the annual growth rate of the TVEs was 24% on average, and dropped below 10% only in 1989 and 90, when a policy tightening central planning control was adopted. TVE employment increased from 28 million in 1978 to 128 million in 1995 when it accounted for 29% of the total rural labor force. The contribution of the TVE sector to China’s GDP was 13% in 1985 and rose dramatically to 31% in 1994. (World Bank 1996).

Chapter 2 reviews the history of the development of the TVEs. The TVE sector originated from the collectively owned Commune and Brigade Enterprises of the pre-reform period, that only achieved a minor performance. Their growth significantly accelerated from the beginning of the rural reforms, when the Household Responsibility System was introduced into the agricultural sector; and the People’s Communes were abolished. After that, there was a substantial reduction or removal of planning controls on industrial production, inputs and output distribution, and pricing, a relaxation of controls on migration, a removal of discriminative policies against non-state enterprises, and a reduction and softening of the state quota on agricultural output.

The CBEs were renamed TVEs after the abolition of the Commune system in the early 1980s (but still continued to be owned collectively by local communities), and grew continuously fast since then. Rural private enterprises, which were prohibited before reform, were also developed rapidly and have become an important component
of the TVE sector. They accounted for one third of TVE gross output and half of TVE employment in 1994 (SSB 1995).

TVEs have been better developed in China’s East-coast area. In 1994, about 70% of TVE output, and 55% of its employment, were from this area. This significantly increased the level of income per capita, and improved living conditions of the rural residents in that area. In most of the Central and the West provinces, TVEs were also growing at rates close to those in the East. Although, they have been a smaller component of the regional economies. Since the level of industrialization in the Central and the West areas has been low, there appears to still be great potential for fast growth of the TVE sector in the future.

Compared with the SOEs, TVEs have been far less capital intensive and more labor intensive. In the TVE sector, private enterprises have been more labor intensive than the collective enterprises. In the Central and West regions, TVEs have been more labor intensive than in the East.

The recent literature concerned with the rapid growth in the East Asian economies, and China, has been reviewed in Chapter 3. The rapid growth in East Asia has been explained as resulting from market-orientation, export-orientation, macroeconomic stability, education, cultural and geographic reasons, government policies, etc., or driven by high saving and investment (Garnaut 1989, World Bank 1993, Stiglitz 1996, Krugman 1994). In addition, there is a literature discussing the effects of policy and institutional changes during the economic reform period (Lin et al. 1996, Garnaut and Ma 1996, Woo 1996). A number of studies compare productivity growth and firms technical and allocative efficiency between the pre-reform and reform periods, and found significant improvement particularly in the non-state sectors (MacMillan et al. 1989, Lin 1990, Jefferson et al. 1992, Woo 1994, Drysdale, Kalirajan and Zhao 1995).

In order to establish a theoretical framework for the empirical analysis on rural industrial growth, Chapter 3 also reviews the literature on growth theories, and on theories concerning economic development and industrialization. Neoclassical growth theory describes a standard process of economic growth. It states that, in the steady
state of growth, without technical progress, an economy will grow along a long run growth path, in which the economic growth rate equals the growth rate of the labor force (Solow 1956, Swan 1956). Endogenous growth theory, which stemmed from the former, added new factors, particularly human capital, into the growth models. It suggests that, in the long run, the economic growth rate is determined by the variables that relate to the accumulation of human capital or knowledge (Lucas 1988, Romer 1986, 1990). These models provide a basic theoretical framework for the empirical analysis of economic growth.

Many growth models focus on long run steady state economic growth. However, some analyses of the transitional dynamics of growth suggest an extremely long period before entering the long run growth path (Sato 1963, King and Rebelo 1993, Mulligan and Sala-i-Martin 1993). Therefore the analysis of transitional dynamics could be very important for growth studies, particularly for developing countries, in which economic growth appears to be affected more often by short run shocks, such as change of policies, of institutional frameworks and economic behavior (Lucas 1988).

 Besides these long run growth theories, there are other contributions analysing economic growth and development, relating industrialization and rural-urban migration. The Lewis (1954), Ranis-Fei (1961), and Harris-Todaro (1970) models, provide different explanations for rural-urban migration and industrialization. Beladi and Naqvi (1987) explain inter-industry migration with wage differentials. In considering the features of rural industrial growth in China, the important part of these theories is their concern for structural change and factor reallocation between sectors.

To answer the question: what contributed to China’s rapid rural industrial growth during the period of economic reform? a hypothesis is raised in Chapter 4. Before economic reform, the institutional arrangement in the rural economy, and the institutional restrictions for protecting agriculture, formed a cost on labor mobility between sectors. This resulted in heavy misallocation of rural labor between the two sectors, and very low productivity in agriculture. The marginal product of labor was
very different between industrial and agricultural activities in the rural sector. Institutional changes during the reform period gradually eased these restrictions, and thereby reduced the institutional cost on labor mobility. This induced a massive reallocation of labor from agriculture to rural industry, generating the rapid growth of the latter. This institutional change is considered a major source for the rapid growth of the rural industrial sector during this period.

In Chapter 4, a two-sector model is established to analyse China’s rural industrial growth with the effect of institutional changes. The model consists of production functions for the rural industrial and agricultural sectors, equations for the relative marginal product of labor and capital of the two sectors, and constraints for labor supply and capital stock. Sectoral labor and capital are endogenous variables; their allocation between sectors depends on the relative marginal product of labor (MPL). It is assumed that institutional restrictions form a cost on labor mobility and result in a gap between the two sectors’ MPL.

The model shows that, when a MPL differential exists, removing the institutional barriers can lead to a reallocation of labor from the low productivity sector (agriculture) to the high productivity one (rural industry). This, in turn, leads to a convergence of MPLs, and an acceleration of rural industrial growth. Total factor productivity growth at the aggregate economy level can also be increased, as a net gain to the economy. This is due to the improvement in factor allocation.

With capital stock being endogenously determined between the two sectors, the model suggests that removing institutional restrictions on labor mobility can also result in a reallocation of capital in the same direction as that of labor. Therefore, rural industrial growth can be further accelerated.

Using the above analytical framework, an econometric model is established in Chapter 5 to empirically estimate the institutional effect and calculate the actual contribution of institutional changes to rural industrial growth. Input and output data for 28 provinces in 1980-92, for both the TVE and agricultural sectors, are used for the empirical study.
The empirical estimation found a large gap of labor marginal productivity between rural industry and agriculture at the initial stage of reform, suggesting an institutional barrier on labor mobility. The MPL of rural industry was 2.9 times that of agriculture in 1980. The trend of the relative MPL changes during the reform period is derived from two different methods. Directly from the estimation result, the MPLs converged from 2.9 in 1980 to 2.4 in 1988, indicating a reduction in institutional restrictions on labor reallocation. However, the marginal product of labor significantly diverged in 1989-1992. The divergence was found to be partly coincident with a temporary policy change in 1989-90 attempting to reinstall central planning controls, but also, more significantly, a result of some non-institutional effects and data problems.

To avoid these problems, the second method uses only the estimated relative MPL in the initial year (1980), the actual data for transfer of labor between the two sectors, and the input and output elasticities with respect to the institutional factor that derived from the model, to calculate the trend of the relative MPL changes. The result is highly consistent with the estimation result in 1980-88. Due to eliminating the non-institutional effect and data bias, the result shows a continued converging tendency of MPLs during the whole of the period 1980-92, except for a slight divergence in 1989-90. This accords with the empirical observations of the institutional and policy changes in those periods.

The growth accounting derived from the second method clearly indicates that both the institutional effect, and total factor productivity changes, played a major role in the rapid growth of rural industry during the reform period. Their contribution was particularly high in the early stages of economic reform. The institutional effect subsequently diminished, and became negative in 1989-90, but recovered in 1992. As the average in 1981-92 at the national level, the institutional effect contributed 6.0 percentage points to the 21.7 percent annual growth of rural industry. The contribution of TFP growth was 4.7. Together, institutional changes and TFP growth contributed 10.7 percentage points, accounting for half of rural industrial growth. The natural input growth (i.e., input growth in the rural economy without institutional change)
contributed 9.6 percentage points. Thus, the result rejects the input-driven growth explanations for China’s rapid rural industrial growth.

In terms of allocation of capital, the estimation shows a minor gap of MPK between the two sectors in 1980, lower in rural industry than in agriculture by 28%. No significant change was found in 1980-92. The MPK differential suggests a misallocation of capital between the two rural sectors. The misallocation of capital is also indicated by the positive growth residual in rural industry (1.4), and the negative one in agriculture (-2.3), which are found in the growth accounting for these two sectors. Evidence suggests that this misallocation resulted from the government policy on interest rate control, causing an actual lower interest rate for rural industry than for agriculture.

The results for the direction of the effect of institutional changes are consistent with the theoretical expectations. However, the MPL convergence appears slower than expected, given that the economic-wide institutional restrictions were significantly eased. In addition, for some regions, no clear MPL convergence was found. These appearances cannot be fully explained by economy-wide institutional changes. A hypothesis has been raised in Chapter 6 to suggest that, besides the economy-wide institutional restrictions, the behavior of the rural collective enterprises, i.e., Township and Village Owned Enterprises (TVOEs), also have an impact on the MPL differential. This hypothesis is drawn from the empirical evidence for the extremely low geographic labor mobility in the TVOE dominated rural areas, and the slowing down of the TVE employment growth (Wang 1986, 1990, Ody 1992, Smith 1996).

Till now, TVOE have been the major component of the TVE sector. They are owned collectively by township or village communities. In some aspects, they have similar features to Labor Managed Firms (LMFs), such as those in former Yugoslavia, or those cooperatives in the American plywood industry. Some authors suggest that TVOE are “vaguely defined cooperatives” (Weitzman and Xu 1994). The literature concerning LMF behaviour suggests that, in the long run, there is no remarkable difference between LMFs and competitive private firms (CPF) in market
competition. However, some studies found that LMFs’ employment is inelastic in the short run, and can result in inefficient uses of factors. (for the LMF literature see Ward 1958, Vanek 1970, Furubotn 1976, Stephen 1984, Berman and Berman 1989, and Mitchell 1989). In Chapter 6, similarities and differences between TVOEs and LMFs are further discussed. The major difference is that a TVOE is owned by the local community, not only by the insiders of the firm, therefore its behavior may be subject to the objective of maximizing per capita income in the community.

From modeling the TVOE employment behavior, the theoretical findings in Chapter 6 suggest that, with the objective of maximizing income-per-capita in a local community, TVOEs can recruit workers from the internal agricultural labor force and achieve an internal optimal allocation of labor in the local communities. After achieving this point, TVOEs tend to be more conservative than profit-maximizing firms in admitting new workers from outside the community. Therefore TVOEs tend to employ fewer workers and to be more capital intensive than profit-maximisation firms. This results in a sub-optimum allocation of labor in the rural economy.

The above hypothesis is empirically tested and identified. Both calculation results from survey data and regression results from statistical data suggest that, in areas with higher ratios of TVOEs in the rural industrial sector, the wage gaps and MPL differentials are significantly larger. The estimation indicates a clear positive impact of the TVOEs on the MPL differential, suggesting a conservative employment behaviour of TVOEs. This result implies a high potential for further reallocation of agricultural labor to rural industry, if the TVEs in the more industrialized rural villages and regions would accept new workers from the less industrialized villages and regions. In other words, if the objective of these collective enterprises could be redirected from income-per-capita maximization to profit maximization (this possibility has been practically indicated by the experiment of “TVOE reform for share-holding ownership system” in some regions), rural industrial growth would be further accelerated, and the transitional period for rapid growth would last longer.
Although some misallocation of factors was found in the TVE sector, several empirical studies have suggested that the market-oriented TVE sector has been more efficient than the less market-oriented state sector (Svejnar 1990, Jefferson 1993). There have been debates in China as to whether TVE development has affected either positively or negatively on the state sector. In Chapter 7, the externalities and relative factor productivity of the TVE and state sectors are investigated.

In the literature, empirical studies from the international perspective have provided contradictory results regarding the issues of government and non-government sector productivity and their impact on economic growth. Some of the contradictions appear to be the result of methodology problems.

In Chapter 7, modifications were made to the Feder (1983) and Ram (1986)’s two-sector model to:

1. allow possible externalities induced from both sectors;
2. remove some doubtful model restrictions; and,
3. estimate the structure form equations simultaneously, instead of estimating the reduced form equation.

Provincial level data in 1980-92 for TVE and state industrial enterprise are used for the empirical study. A positive and significant externality was found from the TVEs on the industrial SOEs, but it could not satisfactorily identify an externality from SOEs on TVEs.

The estimation also found a significant total factor productivity growth in the TVE sector, at an annual rate around 4%. TFP growth is statistically insignificant in the SOE sector and possibly slightly declining. But this decline in productivity has been at least partially offset by the positive externality generated from the TVE sector.

The externality from the TVE sector on the state sector can be explained as the result of the pressure of market competition, coming from the market-oriented TVEs, pushing the state enterprises to increase their efficiency and level of technology. Additional evidence provided in Chapter 7 corroborated this explanation. Thirteen industrial branches of the SOE sector were classified into three groups: state
monopoly (the SOEs dominating the branch), monopolistic competition (SOEs and TVEs coexisting, but their products being imperfect substitutes), and market competition (the SOEs competing with the TVEs). There are a number of technical indicators for each branch relating firms’ productivity or efficiency, e.g., quality of the products, material and energy consumption per unit of product, equipment capacity utilization ratio, etc. These indicators clearly show that, compared with 1985-87, in the state monopolistic and monopolistic competition groups, the SOEs generally worsened in 1995, whereas in the market competition group, they improved (data from SSB 1988, 1996).

Thus, the empirical result in Chapter 7 shows that the rural industrial sector and other non-state sectors not only directly contributed to China’s economic growth, but also contributed indirectly through its externality on the state sector. The direct and indirect effect contributed three quarters of the non-agricultural economic growth during 1981-92.

In summary, the rural industrial sector has been the major driving force of the fast economic growth in China during the period of economic reform. The rapid rural industrial growth of the last decades can be largely attributed to the effect of market-oriented institutional changes, that removed restrictions on factor allocation, and to total factor productivity growth (the latter also partially resulted from the impact of institutional changes at the firm level). These two together contributed more than 10 percentage points to the annual average growth rate in 1980-92, and accounted for half of the TVE growth rate. TVEs also indirectly contributed to economic growth by competing with the state sector in the market. Their competition, as an externality, forced SOEs to increase their efficiency.

Despite the great improvement, distortions on labor and capital allocation still exist and reduce economic efficiency. They are caused either by the remaining restrictions at the economy level, or by institutional problems at the firm level (e.g., the conservative employment behavior of the collective enterprises). Therefore, there is still considerable potential for continued fast growth in the intermediate future. This
would be realized by further market-oriented institutional reform. Although, in the long run, economic growth will depend more on technical progress and human capital accumulation.

This study has also contributed a new capital data series in the agriculture and TVE sectors. In addition, the official TVE output data at constant prices were found to be seriously underdeflated. Accordingly, recalculation of constant price TVE output at the provincial level was carried out. According to the recalculated data, the annual growth rate in the period 1981-92 was 24% instead of the 30% implied by the original official data.
APPENDIX A1. RECALCULATION OF TVE OUTPUT AND GROWTH RATE

Although there is little doubt about the very rapid growth of China’s Township and Village Enterprise sector, some inconsistency and unreliability appeared in different sources of the TVE output and growth rate. In this appendix, the TVE growth rates are calculated from the reconstructed constant price output data for the reform period.

In the official TVE statistics, data for net output or value-added are available only for some selected years, and mainly for the Township and Village Owned Industrial Enterprises, and therefore could not be used for econometric analysis as an overall indicator for TVE growth. Gross output data are more complete at the national and provincial levels, for the reform period. There have been mainly two available data sets for TVEs’ gross output, provided by the Bureau of Township and Village Enterprises in the Ministry of Agriculture (see BTVE(a), various years)\(^1\). One is noted as “gross output value of TVEs” in 1970, 80 and 90 constant price, respectively\(^2\). They are available for each year since 1978, at the national level, and available with the author for 1978, 80, 85, 86, 88-92, at the provincial level.

Another is the gross output value data set in current prices. These data are available in selected years, at the national level. Fewer years’ data are available at the provincial

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\(^1\) The BTVE has been the major data source for TVEs. The State Statistical Bureau data for TVEs appeared to be based on the BTVE data. Output data for rural household and private enterprises (i.e., “enterprises below village”) are included only since 1984. However, these enterprises were basically negligible in the 1970s, and relatively small in number before 1984. Therefore data for 1980, and earlier, and for 1984, and later, basically indicates the true trend of TVE growth.\(^2\)

For data in 1978-90 see BTVE(a) 1991. A note in BTVE(a) 1991 at page 5 says that “data before 1980 are in 1970 constant price, and, after 1980, are in 1980 constant price”. For data after 1990 see BTVE(a) 1992, 93. The 1991 output data are noted as in “constant price” without noting which year’s price is being used, but data for 1992 are noted as “in 1990 constant price”.

The BTVE data set, from 1978 to 90, was adopted by the State Statistical Bureau in China Statistical Yearbook, without indicating in ‘constant price’ (SSB 1995, 365). They appear to be simply treated as current price data by the SSB, since data in the same series for the 1990s are either equal, or similar, to the “current price” data in BTVE (1992-93). This may suggest that, the SSB believes this data set is close enough to, and therefore can be used as, the current price output data. Another thing that should be noted is that, according to BTVE(a), the 1991 and 92 “constant price” data are even greater than the current price data. This suggests a low creditability for the constant price data.
level. The two data sets, i.e., gross output value in constant and current prices, at the national level, are shown in column (2) and (3) in Table A1.1.

A direct approach to derive the growth rate of TVEs, is to convert the constant price data in prices of different base years into that of one base year. To convert the output data in the 1970s into 1980 constant price, a conversion factor between 1970 and 80 prices is not available. Fortunately, column (2) and (3) of Table A1.1 shows that the 1978 output in constant price and in current price are the same. Moreover, it was found that, using the IPPI (Industrial Producer Price Index, SSB 1995: 249) to deflate the current price output of 1980 (669.5) results in nearly the same number as the constant price one (656.9) in column (2). This shows that the official data for 1978-80 output in “1970 constant price” are actually based on 1978 prices. Therefore, to convert these three years’ data into 1980 constant price, a conversion factor between 1978 and 80 prices (instead of between 1970 and 80 prices) should be used. This can be derived from the 1980 current price output and the same year output in the 1978 price. According to Table A1.1, the conversion factor at the national level is 66950/65690=1.0192. Using this conversion factor, the national level output data in 1978 price for 1978, 79 and 80 are converted into 1980 constant prices and shown in column (5). Data for 1981-90 in column (5) are simply copied from column (2).

A similar method is applied to convert output of 1991, and after, into the 1980 constant price, i.e., to derive a conversion factor from both 1990 output in current price and in 1980 constant price, then using it to convert 1991 and 92 output into the 1980 constant price (column 5). The national level conversion factor is derived as: 8461.64/9581.10= 0.8832.

The above calculation results in a series of output data in 1980 constant price, shown in column (5) of Table A1.1. Theoretically it is now ready to be used to derive the TVE growth rate. However, comparing column (5) with (3), it can be found that the derived 1980 constant price outputs are too close to the current price outputs. It is known that China faced two digit level inflation in the late 1980s and for some years in the early 90s. The IPPI price index in Table A1.1 shows that the price level for
industrial products tripled in 1995 from 1980 (see column 4), although, the current price output in 1992 is higher than the derived “1980 constant price output” by only 22.9%. In 1986, the IPPI is 14.3% higher than 1980, but the current price output is nearly the same as the derived constant price output (only 1.2% difference). This suggests that the BTVE “constant price” data was seriously under-deflated.

To derive a more reliable constant price output data set, the current price output data are used. An available and reasonable deflator that can be used for the calculation is IPPI (see column 3 and 4, respectively, in Table A1.1; sources: SSB 1995: 249; 96: 271).

The derived TVE output values in 1980 price, at the national level, are given in column 6 of Table A1.1. They show remarkable differences from the previously derived “1980 constant price” output based on the official data (column 5).

For comparison, TVE growth rates are calculated from both sets of “1980 constant price output” data. According to the first (official) constant price data set, TVE output in 1995 was 112 times that in 1978; the annual growth rate during the period of 1979-95 was 32.0%. However, according to the recalculated data, output in 1995 was 41 times that in 1978, and the annual growth rate was 24.2%. The latter growth rate being lower than the former by 7.8 percentage points.

The overstatement of the official constant price data appears to be mainly due to statistical difficulties:

1. Many TVEs do not have historical records for prices of their products. These records can hardly be obtained by the official statistical agents.

2. Most TVEs are small enterprises. The number of firms is extremely large (e.g., in 1995, there were 22 million enterprises). In addition, since the TVE sector is in rapid expansion, many new TVEs emerged each year, and some disappeared, this seriously increasing the statistical difficulties.

3. Technical innovation in the TVE sector is fast (see, e.g., G. H. Jefferson, 1989). Firms frequently change the design of their products and develop new ones to
fit the market demand. This increased the difficulty in obtaining continued pricing records for their products.

4. The TVE statistical system needs improvement.

Further calculation is carried out to obtain constant price output data at the provincial level, in order to carry out the econometric analysis using panel data. At this level, output data in current prices are available only for the years 1986, 90, 91 and 92. For other years, they have to be derived from the official (BTVE) “constant price” provincial data, using the national level ratios between the “constant price” and current price data. The ratio for 1988 is estimated from previous and later years’ information, due to lack of data. The calculated current price output data at the provincial level are shown in Table A1.2.

The next step is to deflate the obtained current price provincial output into 1980 constant price, using the IPPI price index. The derived constant price output data at the provincial level are shown in Table A1.3. Due to lack of primary information, the derived constant price output data at the provincial level may not be very accurate. However, from the available information, these may be the best that can be obtained.

In Table A1.4, provincial output data are aggregated into three regions. Growth rates are derived from the recalculated 1980 constant price output, by province and by region.

From these results, some new conclusions can immediately be derived. An important one being that some earlier estimations on total factor productivity growth in the TVE sector may be upward-biased\(^3\).

As shown by the derived provincial and regional level TVE output and growth rates (Table A1.3 and A1.4), although there are large gaps in the level of output among the Eastern, Central and Western regions, growth rates of these three regions are surprisingly close, suggesting no significant divergence in growth rates amongst them.

\(^3\) For example, Weitzman and Xu (1994) estimated TFP growth rate in the TVE sector in 1979-1991 as 12% annually. This appears to be an overestimation, possibly resulting from the biased constant price data.
To conclude, the official TVE output data in constant prices were found to be seriously under-deflated. This caused over stating of the TVE growth rate. In this appendix, TVE output in constant prices at the national and provincial levels were recalculated from current price output and other information. According to the derived data, the annual TVE output growth rate from 1979 to 95 was 24.2%, significantly lower than the 32.0%, implied by the official “constant price” output data. Although this is still a dramatic growth rate, productivity growth would be significantly lower than some earlier estimations.

It is not clear whether the overstatement of the TVE output in constant price had any impact on official data for the overall economic growth rate. According to official statistics, China’s average annual GDP growth rate was 10.2% in 1981-95 (SSB 1996: 23). There has been no detailed information of the methods used in the GNP and GDP statistics. Since the TVE sector shared a large proportion of China’s total output in recent years (see Chapter 2), the data bias in TVE output may have resulted in a more than one percentage point over reporting of the overall economic growth rate, if official TVE output data in “constant price” are used in the national growth accounting.
### TABLE A1.1 DIFFERENT CALCULATIONS FOR TVE OUTPUT LEVEL AND GROWTH RATES

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Sources: Calculated from Table A1.2 and SSB 1995, 249. 
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| Sum       | 23.49% | Sum      | 21.37% | Sum      | 22.34% |

Source: Calculated from Table A1.3.
APPENDIX A2. CALCULATION OF CAPITAL STOCK IN THE TVE AND AGRICULTURAL SECTORS

For estimation of factor contribution to China’s rural industrial growth and agricultural growth, capital stock data for these two sectors are necessary, but are not available in statistics. This Appendix provides calculated annual capital stock data at the provincial level, for both the Township and Village Enterprise (TVE) sector and the agricultural sector, over the period 1980-1992.

CAPITAL STOCK IN THE TVE SECTOR

For TVEs’ capital stock, two data series at the provincial level are available for most years in 1978-92. These are: Original Value of Fixed Assets of TVEs (denoted as FK₁ hereafter. The subscript ‘1’ refers to the TVE sector), and the Year-end Balance of Circulating Funds of TVEs (denoted as CK₁) (BTVE 1991, 16-17; 1992, 402-433; 1993, 549-583). For 1991 and 92, FK₁ and CK₁ are calculated as the sum of those for “Township and Village Owned Enterprises” (TVOE) and “Enterprises below Village”⁴.

The original data for FK₁ is a cumulated value that is added up by yearly increments at current prices. Therefore, to obtain a FK₁ data series in constant prices, the original data must be decomposed into each year’s increment, and deflated separately, and consistently, into prices of one basis year. That is:

\[ f_{Kt} = \frac{(FK_{t-1}-FK_{t-1})/P_{t}+(FK_{t-1}-FK_{t-2})/P_{t-1}+...+FK_{0}/P_{0}}{FK_{t-1}} \]

where \( f_{Kt} \) is the real value of fixed assets at year \( t \), in constant price of year 0; \( FK_{t} \) is the book value of fixed assets at year \( t \); \( P_{t} \) is the price index for fixed assets at year \( t \) (\( P_{0}=1 \)); and year 0 is the first year (in this study it is set to be 1980). In the calculation, all values are deflated into 1980 constant prices. Since

\[ f_{K(t-1)} = (FK_{t-1}-FK_{t-2})/P_{t-1}+...+FK_{0}/P_{0} \]

⁴ Meaning rural household and private enterprises, also including cooperatives.
therefore

\[ f_{k1} = (F_{K1} - F_{K1(0-1)})/P_{1t} + f_{k1(t-1)} \]

To deflate \( F_{K1} \), Price Indexes of Investment in Fixed Assets (KPI), for each province, are used. For those years that the KPI is not available, Industrial Producer Price Indexes (IPPI) are used (SSB, various years).

No historical data can be used to convert the value of fixed assets before 1980 into 1980 prices. Two facts make this work simple:

1. The fixed assets in 1980 are small in value (only about 8% of that in 1992); and
2. under the central price control, the price level was nearly constant before 1980.

Therefore the book values of the 1980 fixed assets are treated approximately as in the current prices of that year.

Data for \( CK_1 \) are easier to be deflated. It is simply:

\[ c_{k1} = CK_{1t}/P_t \]

where IPPI is used for the deflator \( P_t \).

The total capital stock in the TVE sector is then calculated as

\[ K_{tt} = f_{k1t} + c_{k1t} \]

The calculation results for capital stock in the TVE sector by province, from 1980 to 1992, are shown in Table A2.1. They are in 1980 constant prices.

**CAPITAL STOCK IN THE AGRICULTURAL SECTOR**

Due to data shortage, calculation of capital stock in the agricultural sector is a more difficult task. The available information for the period of 1980-92, at the provincial level, is the following data series:

(1), major agricultural machinery by provinces, measured by machine power in 10,000 KW (SSB and RSED, various years);

(2), chemical fertilizer applied each year by provinces, measured by effective tons\(^5\) (SSB and RSED, various years).

\(^5\) The expenditure on chemical fertilizer can be treated as the major part of circulating funds in agricultural production, which are circulated between each harvest.
(3), original value of producer goods per rural household used in agricultural production, by provinces (rural household sample survey data, SSB and RSED, various years). It is decomposed into draught and livestock product animals, agricultural machinery, production-used buildings, large and medium farm tools, etc. Since the household agricultural machinery is basically a part of series (1), it was deducted from series (3) to avoid double counting.

The above three data series cover the major part of agricultural capital stock, but can not be aggregated directly. Additional information is needed to convert series (1) and (2) into value; to convert series (3) from per household data to aggregated data, and to deflate all three data series into constant prices in a consistent base year. For doing so, other useful available information is as follows:

(4), original value of major agricultural machinery (100 million yuan) by provinces, in 1990 and 1985 (RSED 1991, 280; SSB 1985, 249);

(5), Industrial Producer Price Indexes for general (IPPI) and for machine building industry (MPPI). Data from SSB (1995: 249);

(6), Agricultural Producer Goods Price Indexes for general (APGPI) and for chemical fertilizers (CFPI), by provinces (SSB and SPB, various years);

(7), prices for various kinds of chemical fertilizers in 1990 (SPB 1991, 485);

(8), rural population by provinces (SSB and RSED, various years).

(9), rural household size by provinces (rural household sample survey data, SSB and RSED, various years).

The first step is to calculate the original value of major agricultural machinery, i.e., series (1), in 1980 constant prices. Series (4) provides useful information in two different years to derive the compound price for series (1). The compound 1990 prices for agricultural machinery (Yuan per KW machine power, denoted as $P_{\text{AM}(90)}$), for each province, were derived by dividing the 1990 values of series (4) by the 1990 data of series (1). Some adjustment was made, according to the 1985 values of series (4). They were further deflated into 1980 constant prices by MPPI (see series 5) as the deflator. Using these prices, the original values of major agricultural machinery in
1980 constant prices at the provincial level, for all the sample years, are derived. The result is denoted as $K_{21}$. The equation for calculation is as follows:

$$K_{21}(t) = AM_t \times \left( \frac{P_{AM(90)}}{P_{M90}} \right)$$

where $AM_t$ is the physical agricultural machinery (measured by 10000 KW machine power) at the year $t$, $P_{AM(90)}$ is the derived prices for $AM_{1990}$ (10000 yuan), and $P_{M90}$ is the MPPI price index for year 1990 ($P_{M80}=1$).

The second step is to derive the value of chemical fertilizer, i.e., series (2), in 1980 constant prices (denoted as $K_{22}$). The compound 1980 prices for chemical fertilizer were calculated from series (6) and (7), then the values of series (2) were calculated using the following equation:

$$K_{22}(t) = CF_t \times \left( \frac{P_{CF(90)}}{P_{C90}} \right)$$

where $CF_t$ is the effective weight of chemical fertilizer used at year $t$ (measured by effective tones), $P_{CF(90)}$ is a compound price of $CF_{(1990)}$, derived from 1990 prices of various fertilizers in series (7) by taking weights, and $P_{C90}$ is the price index for chemical fertilizers (CFPI, see series 6) at the year 1990, ($P_{C80}=1$).

The weighted price $P_{CF(90)}$ for chemical fertilizers is derived as:

$$P_{CF(90)} = \frac{1}{w} \sum_{i=1}^{n} \left[ P_{CFi(90)} \times (cf_i/ctotal) \right]$$

where $P_{CFi(90)}$ is the price for the $i$th category of chemical fertilizer, $cf_i/ctotal$ is its weight, i.e., percentage of actual application of the $i$th chemical fertilizer in total fertilizer application, $w$ is the average concentration ratio of all fertilizers. Taking an estimated value of 0.3, it was used to convert the prices for actual tons to that for effective tons.

The third step is to convert the value of other agricultural-using producer goods at the household level, i.e., series (3), into the provincial aggregation, and to deflate them into 1980 constant prices by province (denoted as $K_{23}$). Values of household agricultural machinery is deducted from series (3) because they were already included in $K_{21}$. The values of producer goods were deflated by using the price index APGPI.
(see series 6). From series (8) and (9), the number of rural households for each province in each year is obtained. Then $K_{23}$ is derived using the following equation:

$$K_{23}(t) = K_{H(t)} * H_t / P_{A1}$$

where $K_{H(t)}$ is the original value of agricultural-used producer goods per rural household (series 3) in year $t$, $H_t$ is the number of rural households by provinces in year $t$, and $P_{A1}$ is the price index APGPI ($P_{A80}=1$). Since $K_{H(t)}$ consists mainly of draught animals that were usually accounted in their market value, and farm tools that can be renewed in relatively short periods, it is treated as entirely in current prices, and therefore can be directly deflated into 1980 constant by using $P_{A1}$.

The last step is to aggregate the above results to obtain the total agricultural capital stock for each province in each year:

$$K_2(t) = K_{21}(t) + K_{22}(t) + K_{23}(t)$$

where $K_{21}$ and a part of $K_{23}$ is the agricultural used fixed assets; $K_{22}$ and the rest of $K_{23}$ is the circulated funds used in agriculture. $K_2(t)$ is the derived provincial capital stock in the agricultural sector at year $t$, in 1980 constant prices.

Due to the incomplete information and possible data problems, errors may exist in the derived $K_2$. However, compared with the common usage of only agricultural machinery to represent capital stock for the agricultural production function, the calculation provided in this Appendix has made an improvement.

Table A2.2 gives the calculation result of capital stock in the agricultural sector, in 1980 prices, during the period of 1980-92.

In Table A2.3, the calculated national level rural capital stock by sectors (denoted as $K_i$, $i=1,2$ for the TVE and agricultural sectors, respectively), and their annual growth rate ($\hat{K}_i$), are provided. $K$ is the aggregation of capital stock in the rural economy ($K=K_1+K_2$) and $\hat{K}$ is the growth rate of $K$. The results at the national level may be slightly different from the aggregation of the derived provincial level capital stock, due to different sources of the original data.
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Source: Calculated from SSB and BTVE, various years.
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Source: Calculated from SSB and BTVE, various years.
TABLE A2.3 CAPITAL STOCK AND ITS GROWTH RATE
IN THE TVE AND AGRICULTURAL SECTORS

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growth rate (%; 81-92 average)

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Notes:

a. Growth rates in this column are the average growth rate in 1981-85.
b. Growth rates in this column are the average growth rate in 1987-88.
Source: Calculated from SSB and BTVE, various years.


BTVE(a) (Bureau of Township and Village Enterprises, Agricultural Ministry), various years, *Statistic Data of Township and Village Enterprises*, Beijing.

BTVE(b) (Bureau of Township and Village Enterprises, Agricultural Ministry), various years, *China Township and Village Enterprises Yearbook*, Agricultural Press, Beijing.


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SPB (State Price Bureau), various years, Price Yearbook of China, Price Press, Beijing.

SSB(a) (State Statistic Bureau), various years, Statistical Yearbook of China. Statistic Press, Beijing.


TRPG (TVE Research Project Group, Department of Sociology, Beijing University), 1993: Survey Notes.


