

# The Transition Process in China

## A theoretic and empirical Study

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### **Abstract**

In this paper we analyse the driving forces of the transition from plan to market in China. A two segments and two sectors model is constructed to take into account the particular economic situation in China during the transition process: a large agricultural sector and an industrial sector; a large centrally planned segment and a market segment. The transition from plan to market is described by the increasing share the market segment in the whole economy on the one hand and the forced adjustment of the behaviour of the planned segment to the market situation on the other. Thus this model provides a well structured way to understand the complex phenomenon during the transition process and to analysis the driving forces of the transition process.

**JEL Classification:** O1, O14, P2

**Key Words:** Transition, Economic reform, Industrialization

## Introduction

During last 20 years, the Chinese economy has experienced significant changes: the centrally planned economy has been reformed step by step into a market economy; the traditional agricultural economy is becoming more and more a modern industrial economy. To describe the transition process<sup>1</sup> and to analyse the impact of the reform policies on the transition process are the main concern in this paper.

The paper consists of 4 sections. In the first section, we review the economic reform since 1978 in China, based on which the theoretical model is constructed. In particular, we will discuss those reform policies that promote the transition from plan to market. First we discuss in detail the rural reform. Then we review the urban reform with the „two-tiers“-system. At the end of this section, we summarise the particularities of the transition process in China in four working hypotheses, which compose the main ideas used in the construction of the theoretical model in this paper.

Based on the description in section 1, a two-segment-model is constructed, where the economy is divided according to the institutional conditions of the activities into a planned economic segment and a market economic segment. Because the main interest does not lie in modelling the planning behaviour, the planned prices and the allocation of the capital stock in the planned segment are treated exogenously. The producers in the market segment are assumed to be price-takers and try to maximise their profit. The market mechanism is functioning mainly through the flexible prices, the flexible production and the flexible allocation of resources, and keeps total demand and total supply in balance. In this sense, the model can be viewed as a general equilibrium model, with a planned segment that always produces some distortion in the model, and a market segment that tries to correct this distortion keeps the whole economy in equilibrium. In this section, we examine the conditions for the existence of the temporal equilibrium and the growth path derived from temporal equilibriums. The difference in the growth rates due to different institutional conditions in the two segments is considered the engine of the transition from plan to market in this paper.

In section 3 we will examine factors, that may influence the transition process. We begin with factors, that have impact on the extrinsic transition. To these factors, belong the different growth mechanisms in the two segments, the saving behaviour, and the distribution of savings for investment in the two segments. Then we will examine the factors, that determine the intrinsic transition. Facing the faster growth in the market segment and the shrinking share of the planned segment, the policy makers in the planned segment try in various ways to adjust to the new situation. We will study the impact of different adjustment policies in the planned economic segment. We will discuss the most important issues in the economic reform – the price reform, the financial market reform, and the labour market reform. Following the discussion of the reform policies, the importance of correct timing of a policy will be

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<sup>1</sup> Chinese transition process followed typically the gradual approach where market activities were introduced into the economy, while keeping the planned economic activities functioning.

Of course, an institutional framework has to be set up for the market activities to function. This institutional framework is itself an important issue in the transition from the planned to the market economy. It has become the most discussed topic in the literature about the transition. Perkins, for instance, listed 5 conditions for the reform to be successful.<sup>1</sup> Byrd discussed the prerequisites for an effectively functioning market.<sup>1</sup> In this manuscript we take the existence of the necessary conditions for market activities as given, without discussing them. The main concern here is, what will happen, if the market comes into being.

considered. Then, we will also examine the welfare gains during the transition process among different participants in the economy. At the end of this section, we present a feasible transition path and try to resolve the question, whether the planned and market segments can exist side by side in the long run.

The section 4 involves some numerical simulations of the model. From the discussion in section 4 and section 5, we gain an understanding of the qualitative properties of the transition from plan to market in the model. We try to demonstrate these properties in section 6 through numerical simulations. We will also show the alternative transition paths due to different policies and various economic conditions. Finally, we will simulate the realised development and compare the numerical simulation with the empirical observations, in order to give the latter a theoretical explanation.

In the last section, the main conclusions of this study will be summarised and commented from a view point of further development of the study.

## Section 1

### The Economic Reform in China

#### 1.1 Rural Reform

The Chinese economic reform began with the agricultural reform, which was officially announced in the third Congress of the 11th Plenum of the Communist Party in December 1978. The reform aimed at the reorganisation of the production structure in the rural area, in order to achieve a better performance in the agricultural production. In the 1950s, the Chinese agriculture had experienced great success. In 1957 the total agricultural production surpassed all previous records. During the late 1960s and the 1970s, great effort was made to improve the performance of the collective production<sup>2</sup>. There were campaigns lasting for decades to promote the development of agriculture production all over the country. In spite of this, the agriculture production showed a kind of stagnation from the 1960s to the end of the 1970s.

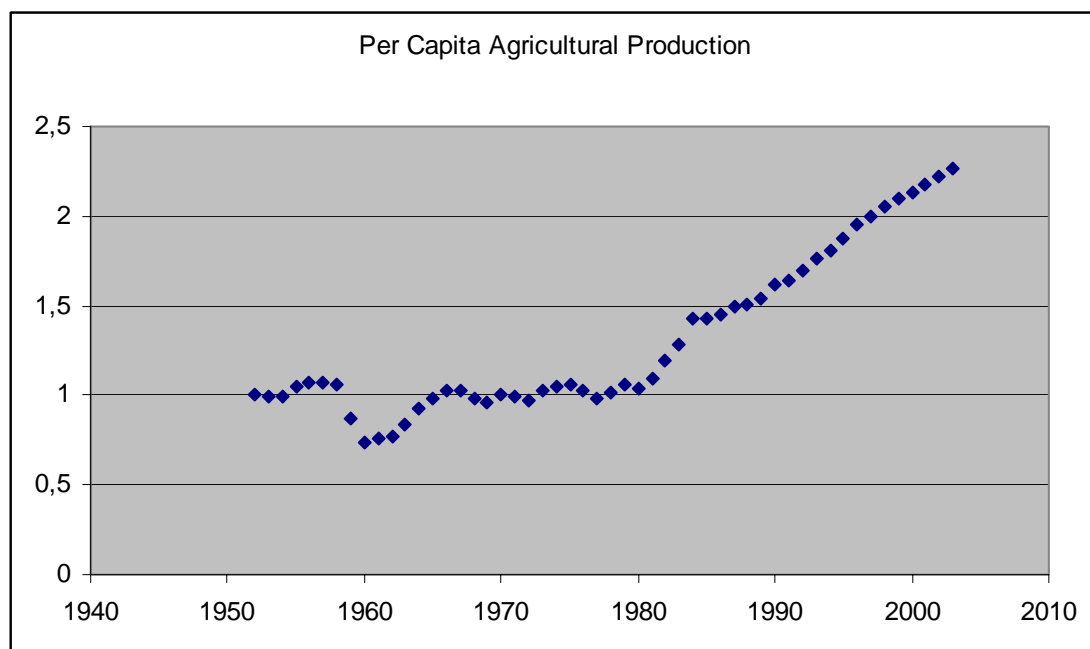


Figure 1 Per Capita Agricultural Production

This was the very reason that a reform in agriculture was undertaken. Moreover, the Chinese leadership had learned from the lessons made during the campaign of „great leap forwards“ in the late 50s, that there will be no growth in the whole the economy, if there is no growth in

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<sup>2</sup>In the campagne known as ‘Learn from Dazai’ that was set as a model of collective production by Mao zedong, every production team was called to cultivate a kind of standerd field called Dazai-field and to adapt the experience of Dazai in the organisation of production.

the agriculture<sup>3</sup>. Due to the impatience of realising „the four modernisation“<sup>4</sup> the rural reform became a political task of first rank.<sup>5</sup>

The experience of the early 60s naturally served as a reference for the rural reform. At the beginning, the reform was just the come-back of Liu and Deng's economic consolidation policy in the early 1960s, which had successfully led China out of the economic crisis at the end of 1950s<sup>6</sup>.

The so called „household responsibility system“ and the freeing up of the market for agriculture products and sideline products constituted the principle components of the rural reform, supported by an increase of planned purchasing prices for agricultural products. The key words for this reform were „incentive“ and „efficiency“.

The „household responsibility system“ transferred the collective production teams, which consisted of around 10 to 100 families, into household-based production organisation. The households were offered the right to use the farmland for around 10 or 20 years and were promised a prolongation. As repayment the household was obligated to sell a certain amount of their crop to the state at the planned price. Beyond this, the household could decide on production independently and could dispose the rest of the production and the profit freely. Within two years, the decollectivization was almost completed. At the end of 1980, the government announced that there was no more direct intervention in the production plan of the farmers<sup>7</sup>.

The freeing up of the market for agricultural products and sideline products was carried out through the promotion of activities in the existing markets and fairs. Instead of the strict control as practised before the reform, various infrastructures were provided for the markets and fairs. The markets and fairs in the rural area have always been one of the most important opportunities for the farmers to get their money income. They existed already before the rural reform, however, they had been tightly controlled by the local government. The control had been carried out more through the ideological pressure rather than through a strict price

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<sup>3</sup>It was written in the Kommunique of the third Congress of the 11th Plenum of Communist Party China, „Die rasche Entwicklung der gesamten Wirtschaft und die ununterbrochene Hebung des Lebensstandards des ganzen Volks basieren darauf, daß die Landwirtschaft energisch wiederhergestellt und beschleunigt entwickelt wird.“ Peking Rundschau 1978, Vol. 52 p.13

<sup>4</sup>The four modernizations were: modernization of agriculture, modernization of industry, modernization of notional defence, and modernization of science and technology. The four modernizations had been set as main political target by the communist party of China in the middle 1970s.

<sup>5</sup>Fan Gang explained the starting of reform in agricultur in a 'least resistance' approach. See Fan Gang (1994), p.99 ff.

<sup>6</sup>After the failure of Mao's „great leap forewords“, Chinese economy fell into a serious crisis. In line of the consolidation policy of Liu Shaoqi and Deng Xiaopin markets of agricultural products and sideline products were given free and the collective communes were reorganised in family-based production. With the consolidation policy the economy recovered very soon. But this policy ceased with the beginning of the culture revolution and had been criticised as 'revisionism'.

<sup>7</sup>See Peking Rundschau Vol.50 1980, p.4.

administration. In short, the existing markets and fairs served as a good starting point for the development of market economic activities<sup>8</sup>.

The „household responsibility system“ and the favourable market situation, which was strongly supported by an expanded demand due to the increase of wages in the industrial sector and an increase in planned price for agricultural products, generated a great incentive for the farmers to raise their production. The success of the rural reform responded very soon (see Figure 1).

## 1.2 Decentralised Industrialisation

Based on an improved financial situation in the rural area, the so called township- village enterprises (TVEs) were founded in large numbers. They are mostly engaged in non-agriculture production. The rural area underwent an industrialisation process during the reform period. This development can be clearly seen in the composition of the social product in the rural area (see **Figure 2** and **Table 1.3**).

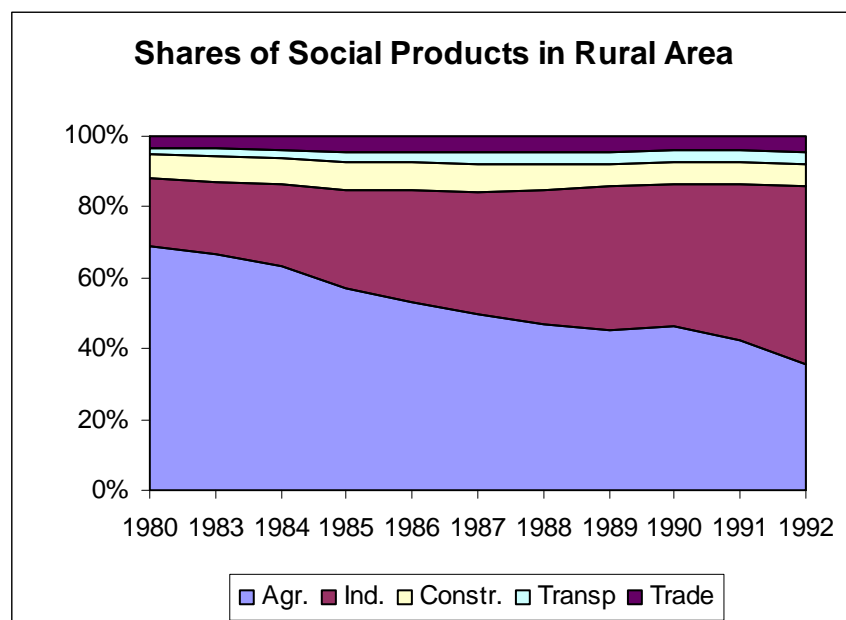


Figure 2 Shares of Social Products in Rural Area

The first year in Figure 1 is 1980 the last is 1992. Until 1985 the rural production was still concentrated in agriculture, after 1985 it was shifting continuously from agricultural to industrial production.

By the end of 1991, the industrial production had outweighed the agricultural production in the rural area. Obviously, the economic reform was marked by a rapid development from rural-agricultural to urban-industrial activities in terms of dualistic economics. The TVEs were founded through self-financing, and therefore independent from any state planning. From the very beginning they operated according to the market principle, because their

<sup>8</sup>For details about the existing market, compare Byrd, William (1991), p.44 ff.

existence depended fully on their economic success. Due to the increasing share of the production of the TVEs in the whole economy, market activities played a more and more important role in the economy. A shift from plan to market took place continuously with the industrialisation process. This decentralised industrialisation became a key driving force for the transition from plan to market. The TVEs are now the most active force in Chinese Economy (see **Table 1.4**).<sup>9</sup>

The dramatic development of the TVEs is favoured by the following factors: (1) The rural reform freed the farmers from the tight organisation of the early production teams. The increased productivity in the agriculture made it possible for the peasants to engage themselves in non-agricultural production. The newly established incentive system promoted an entrepreneurial spirit, and the rapidly raised income in the rural area formed the starting capital for the entrepreneurial undertakings. (2) A comprehensive market was established, consisting of the markets and fairs in rural area, and the so called secondary market beside the planned economy, which was tolerated and later accepted by the planning authority during the economic reform. Within the „two-tiers“-system this secondary market was legitimated and developed rapidly. This market became the environment of independent enterprises, since both input and output were available and could be sold on the market. (3) The disequilibrium situation of the planned segment – the unsatisfied demand of state-owned enterprises and consumers – favoured the existence and growth of the TVEs<sup>10</sup>. (4) The support of the local government was also very important for the growth of TVEs. Because the TVEs were the most important income source for the local governments, they supported the enterprises by providing infrastructure, and especially, by gathering credit for the enterprises. (5) The widespread industrial sector, which was founded during the three decades before the reform, provided sufficient technological precondition for the TVEs to get a start with the industrialisation in the rural area. In particular, the location of the industry in underdeveloped rural areas, which was pursued during the cultural revolution as a kind of strategic policy, revealed the long run effect in the 80s and 90s.

**Table 1.4** shows that from 1978 to 1992 the ratio of gross production value of the TVEs to that of the state-owned enterprises increased from 0.11 to 0.76. Hence, the production growth of township village enterprises accounts for a great part of the overall growth of the economy. These figures indicate typically the Chinese pattern of the transition: growing out of plan.

### 1.3 Urban Reform

„Incentive“ and „efficiency“ were also the key words in the urban reform. Similar to the start of rural reform, the first reform effort in industry was carried out around 1980 through re-executing the consolidation policy of the early 1960s. This was designed to improve the performance of the state-owned enterprises within a framework dominated by mandatory output planning and administrative allocation of inputs and products through a restricted material incentive system.<sup>11</sup> This reform consisted mainly of two components. First, the state-owned enterprises were allowed to retain a modest share of total profits, which previously had to be completely transferred to the state, so that now the state-owned

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<sup>9</sup>For detail discussion about township- village enterprises, see Shen Guanbao (1991) p.158 ff.

<sup>10</sup>Peking Rundschau 1983 Vol.50 P.22-26.

<sup>11</sup>See also, Jefferson and Rawski (1994),p.50 ff.

enterprises would have more incentive to perform more efficiently. The free disposal of this profit on the enterprise level expanded the activities outside the plan, even if they were very modest at the very beginning. Second, a premium system was reintroduced in the industrial enterprises to motivate both executives and workers. This was the first increment of the average wage for more than 20 years. This policy led to a growth of the final demand and created a favourable condition for the formation of free markets in the economy.

The result of these reform measures was the establishment of a material incentive and expansion of the activities outside the planned economy. The response to the reform can be seen in **Table 1.5**.

In comparison to the success in the agriculture between 1978 and 1984, the achievement in the industry during the same time was very modest. This difference in the development was compelling enough to adopt the experience of the rural reform into the industry. Meanwhile the secondary market had expanded massively. Many transactions were made outside the planning<sup>12</sup>. The executives of the state-owned enterprises knew well the advantage of selling the products on the secondary market at a higher price. Hence, there formed a strong request for a price reform from the state-owned enterprises.

In 1984 a further set of reforms was undertaken. It consisted of the "two-tiers system" and the "contract responsibility system". Quite in the spirit of the traditional Chinese philosophy school of the golden mean, the „two-tiers system“ was neither a clear decision for market nor for plan, but just a mixture of them. In the „two-tiers“ system, the supply of industrial products was portioned into planned and market economic components. The central planning covered only a part of the production capacity. The transaction within the plan supply was made at planned prices. This planned supply was formally guaranteed through the contract responsibility system. Under this system the enterprise had to fulfil specified obligations, that included, typically, the amount of production and profits that had to be delivered to the state. Beyond these obligations, the enterprises were encouraged to produce and sell their products on the market at the market price, which responded to relation of supply and demand on the market.

The „two-tiers“ system legitimated the activities in the existing secondary market and promoted this kind of market activities<sup>13</sup>. Because the activities on the market had a higher financial return than the activities within the plan, profit-oriented enterprises had no incentive for investment in the plan portion but to put their funds in the more profitable market portion. This led to the tendency towards „growing out of plan“. „This tendency to grow out of the plan could be offset by investment funds being ploughed into expansion of the planned sector. But the state budget now accounts for a much lower share of the total investment than in the past“<sup>14</sup> (see **Table 1.6**). Based on the activities outside the central planning, a large number of new profit-oriented enterprises were founded. Although many of them were supported by state-owned or collective enterprise, and thus, they belonged, so far the property right is concerned, to the group of state-owned or collective enterprise, they were however not integrated into any planning. They operated as independent enterprises, whose existence and

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<sup>12</sup>For details see: Wu Jinglian and Zhao Renwei(1987), p.319 ff.

<sup>13</sup>For a detail discussion about the impact of the two tiers system on the economy see:Byrd, William A. (1987) p.295-308

<sup>14</sup>Compare: Byrd, William A.(1987), p.299.

growth depended fully on their economic success. Accordingly, a new type of employment emerged, the so called "contract worker". In contrast to the traditional employment relationship in state-owned enterprises, where employees were hired for their life with all the social benefits, the contract workers were hired for a limited time, and generally, with only a minimum of social benefits.

In general, we say, that with the introduction of the „two-tiers system“ an economic framework for market activities began to establish, though this framework was not at all clearly defined, many important questions such as property rights, ownership, legal basis of an enterprise etc. remained and are even not answered up to today.

## 1.4 Price Reform

At the very beginning of the reform, the importance of a market-oriented price forming was already recognised by the reformers. Various reform measures were undertaken to drive the price away from bureaucratic control towards the market price formation.

In line with the rural reform, the market for agricultural sideline products was set free, and the prices were flexibly determined according to the demand and the supply situation on the market. This was the first step in the price reform. Since 1984, corresponding to the „two-tiers system“, a so called „dual price system“ was practised in the economy. The „dual price system“ meant, that there were two different prices for the same kind of products in the economy. As some of the products had to be sold at the planned price according to the plan, the other could be dealt on the market at a market price, which was, in general, much higher than the planned price.

Before the introduction of the „dual price system“, the transaction outside the central plan and the flexible prices were viewed as a kind of activities in the „grey strip“. The „dual price system“ provided a kind of legal basis for these activities. With the introduction of the „dual price system“, prices of a large category of goods were set totally free. Actually, the number of the categories of materials controlled by the state reduced from 256 to 23 in 1985<sup>15</sup>. At the end of 1980s most prices, except the prices for basic food, energy products and some raw materials, were set free. In 1993 even the prices for basic foods were freed from planning.

Along with the progress in the price reform, a material incentive system was gradually forming. The market saw a flourish of development after 1984. Through the involvement in the market activities, the executives of the state-owned enterprises became more and more conscious of the economic interest of the autonomy of enterprises. Although the „dual price system“ and the „two-tiers system“ were originally designed to make the economy more flexible and more efficient with the help of market elements in the planned economy, they generated also unexpected effects, which influenced directly the plan execution and forced the plan system to change itself. Wu and Zhao summarised these effects as: „hypocritical behaviour by enterprises, loss of objective standard for performance assessment by the state, induced smuggling in distribution and irrational utilisation of resources“<sup>16</sup>. The effects

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<sup>15</sup>For details see: Wu and Zhao (1987) p.312 ff.

<sup>16</sup>Wu and Zhao (1987), p. 312 ff.

pictured negatively by Wu and Zhao, expressed just that the forces of market went its way whether it was wished or not. The plan became more and more indicative<sup>17</sup>.

### 1.5 Shift from Plan to Market

The response to the „two-tiers system“ was immediate and tremendous. The data from the National Conference on Material Flow in the early 1986 indicated that the planned allocation of coal, timber, steel and cement to enterprises fell respectively by 50%, 30.7%, 56.9% and 19.4% in 1985<sup>18</sup>. Surveys of state-owned enterprises show a clear shift from plan to market. The share of material input purchased through the market rose from 12% to 66%, from 1980 to 1989<sup>19</sup>. The output sold on the market rose from 13% to 66% in the same time<sup>20</sup>. The investment financed by bank credits and by self-financing of the enterprises took continuously larger share in the whole investment. (see **Table 1.6** and Figure 1.6)

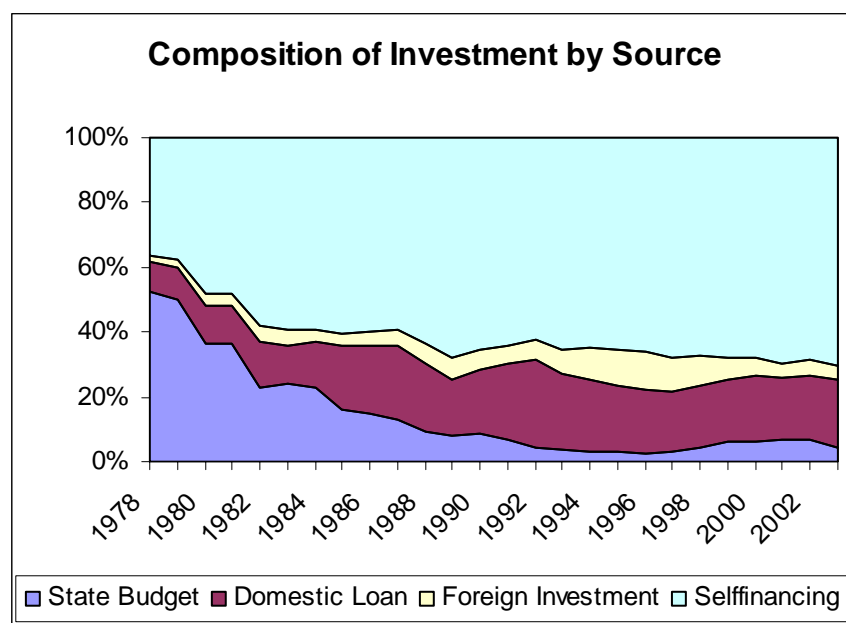


Figure 1.6 Composition on Investment by Source

In an increasingly market-like environment, where the incentive had established, the competence of the enterprise had expanded and the competition from the market was always effective, the state-owned enterprises tended to become a cost minimiser. The empirical evidence confirmed this tendency<sup>21</sup>.

Even more far-reaching was the impact of the „dual prices system“ with its built-in-dynamics to overcome the planning system altogether. The large price difference between the plan price

<sup>17</sup>For details see: Naughton, Barry (1990), p.743-767.

<sup>18</sup>Source: Wu and Zhao Dual (1987),p.309-318.

<sup>19</sup>Caimao Jinji 1992 3-15

<sup>20</sup>Compare: Jefferson Rawski (1994) p.51.

<sup>21</sup>Compare: Jefferson and Rawski (1994) p.55.

and the market price, and the increased involvement in the market resulted in a rapid rise in costs and a fall in profits in the state-owned enterprises, so that the government revenue from the enterprises could not benefit from the growth in the industry (See Table 1.5).

This fact produced inevitably a strong pressure from both the enterprises and from the planning authority, to raise the plan price. An adaptive adjustment of the plan price to the market price took place.

The increase of the production capacity contributed to by market activities and the adaptive adjustment of the plan price to the market price led to the convergence of the two prices. This process went so far, that the plan allocation lost more and more of its effectiveness. For example, in 1992 the difference between the state-controlled grain price and the market price was so negligible, that most people bought the grain from the private supplier for better service. This led to the totally free setting of the grain price in 1993. In 1993 the plan allocation accounted only for 7% of the total industrial production<sup>22</sup>.

## 1.6 Summary

The Chinese economy experienced one of the fastest growth periods of all countries in the world in the last 25 years. It seems to be on the way towards a successful transition from a planned to a market economy, while most other post-socialist countries suffer from economic and social problems – the so called transition crisis. The question naturally arises: what are the specific reasons for the Chinese economy to perform differently than the post-socialist countries? To answer the question we can sketch out four hypotheses as a means to summarise the Chinese special development.

The first hypothesis is that the gradual approach to the transition from plan to market in China has protected the old economic structure and the planned economic mechanism from a sudden collapse and, thus, avoided a radical decline of the domestic production, to which social disturbance would always be connected. The transition is driven by the rapid growth of the newly emerged market sector in the economy. The state-owned enterprises did not suffer from any radical structure changes. By contrast, they could profit from the general favourable economic boom situation, such that they could develop rather well.

This gradual approach to the transition was, in fact, a de facto result of the economic development stimulated by a series of reform policies, most of which were originally designed to enforce the growth of the planned economy and were, by no means, aimed at any kind of transition towards a market economy<sup>23</sup>. The built-in mechanism of market had driven the Chinese economy on the way to a market economy. In this sense, the transition in China was a „by-product“ of the economic reform rather than a designed political target.

In the Communiqué of the third congress of the 11th plenum of the CPC, which is considered as the document of the beginning of the economic reform, the market was not a topic. Even the word ‘market’ did not appear in the document. Obviously, the policy makers had not thought anything about the market. The reform effort in the industry in 1979 was designed to

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<sup>22</sup>Source: Su in Jefferson and Rawski (1994) p.69.

<sup>23</sup>Perkins, Dwight (1994), p.24

give the state-owned enterprises more vitality and to let them work more actively through setting up a material incentive system in the state-owned enterprises, but not to make any essential change in the planned economic system.

In the „CCCP Decision about the Economic System Reform“, which is considered as the most important document on the urban reform in 1984, it was stated that „the socialist economy is a planned commodity economy based on public ownership. It is not that kind of market economy, that is fully regulated by market mechanism.“ At that time the policy makers were aware of some functions of market through the successful reform practice in the rural area, but they were not willing to give up the doctrine of the „superiority of planned economy“. „The planned economy should play the central role and the market adjustment should play the subsidiary role.“ The policy makers wanted to make the planned economy more effective with the help of a market, that had done very well in the agriculture. The „two-tiers system“ and the „dual price system“ were supposed to give the state-owned enterprises more autonomy, so that they could better cope with the new situation in the economy and the economy may function more efficiently. „Plan influencing and market fine tuning“ summarises the main ideal of this policy.

In 1987 the second stage of urban reform began. There was no remarkable political intention in the direction of transition from plan to market. The political design of the policy makers stayed on the level of 1984. In the document of the 13th Plenum of CCCP the economy was defined as „a socialist planned commodity-economic system, which should be an inherent unity of plan and market.“ The wide spreading of the „responsibility contract system“ was an experiment in seeking for a new organisational form in the planned economy.

In 1992 decentralised market activities had long since been a reality in the economy. With the breaking down of the socialist block in eastern Europe, „planned economy“ was naturally connected „failure economy“. To rescue itself from the political crisis lasted since 1989, the policy makers in China urgently needed a new orientation. The „socialist market economy“ as a political slogan was born in this situation. Although no one knew, how this system should function in the reality, the combination of ‘socialist’ and ‘market economy’ is something, that the policy makers had been searching for. On the one hand, the attribute „socialist“ claims the leading pretension of the Communist Party of China, on the other hand, through the phrase „market economy“ a difference should be made clear between the Communist Party of China and its former colleagues in eastern Europe. The economic reform in China is still a project without a blueprint. However, why is there any need for a blueprint, now that it has done well without any blueprint?

The second hypothesis is that the rural reform and the urban reform changed the industrialisation mechanism in the economy and provided favourable conditions for a decentralised industrialisation and urbanisation process. This process was characterised by a rapid growth of the non-agricultural production in the rural area. The share of industrial production in the domestic production increased rapidly. As the result of decentralised industrialisation, the newly formed TVEs and other non-state-owned enterprises were profit-oriented. These profit-oriented enterprises took the advantage of their flexibility and could grow faster than the state-owned enterprises. Consequently, the share of the planned activities in the economy decreased, while the share of market activities increased. In short, the rapid growth led to the special pattern of transition - „growing out of plan“.

The third hypothesis is that the rapid market oriented growth has widely hidden the structural problems<sup>24</sup>, which are inevitable in the reform of the old economic structure with the planned economic organisation and the planned co-ordination system. On the one hand, the rapid growth of the market activities could outweigh the decline of the production, which would have occurred, if there has not been such a rapid growth of market activities. On the other hand, the rapid growth of the market activities enhanced the market force and strengthened the competition in the economy. This, in turn, motivated and forced the policy-makers to adjust the planned activities to the new situation and make the planned segment become more and more market-like, because this seemed to be the only way for it to survive in the economy.

To interpret the reform measures as a forced adjustment to the market situation sheds new light on the gradual approach of reform. We could compare the Chinese policy-maker without a blueprint with a „blind“ man, who could not see the way from plan to market, but the challenge from the market segment would serve him as a best „seeing-eye dog“, who would know instinctually the way to market.

The fourth hypothesis is the logical implication of the former three. If the former three hypotheses are correct, the issues about the transition from plan to market will be passé, since the existing market force will drive the transition process automatically. The policy makers do not need to bother any more about, how to promote the transition process. The main focus of the attention should be, how to cope with the negative effects of the market.

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<sup>24</sup>For detail discussion of the problem in transition see: Schmieding, H. (1993), p. 233.

## Section 2

### A Theoretical Model for Transition Process

#### 2.1 General Approach

The economy during the transition from plan to market can be viewed as a mixture of centrally planned economic activities and free market economic activities. Changes in this mixture in favour of the market activities is the transition from plan to market. In this context, we should distinguish between two kinds of changes during the transition from plan to market. The first one, is the quantitative expansion of the market activities. The other kind is the change in the planned activities, where the planning behaviour becomes increasingly market-like, due to the reforms and the adjustments to the new situation in the economy. We call it an intrinsic transition.

The overall state of the economic system during the transition depends on, which kind of transition form plays the dominant role in the system. If the extrinsic transition is the dominant one, the overall transition process will be a smooth process, which can be properly described in the framework of a growth model. If the intrinsic transition plays the governing role, the system behaviour will be turbulent, according to the chosen policies<sup>25</sup>.

The model is constructed with two segments, plan and market, and two sectors, industry and agriculture to reflect the particular economic structure in China during the transition process. The transition from plan to market is described as the change of the relative weight of the two economic segments in the whole economy.

At the outset, there exists a certain productive capacity in the planned economic segment already. This subsystem bears the basic features of a centrally planned economy:

- 1) The prices in this segment are fix (determined by the planning authority).
- 2) There exists no equilibrium in this segment.
- 3) The production structure is rigid (shares of investment products and consumer products do not react to the demand situation).

The market economic segment, contrary to the planned economic segment, is a newly emerged subsystem. But the functioning of this subsystem carries the basic features of a free market economy:

- 1) The producers are price-taker and they are in pursuit of maximal profits under the given conditions on the market.
- 2) The prices response to the demand and the supply on the market and, thus keep supply and demand in balance.
- 3) The allocation of resources is determined according to the supply and demand on the market.

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<sup>25</sup> Most of current literature about the transition from plan to market focuses on the transition topics in the sense of intrinsic transition. There are many unsolved theoretical problems concerning this form of transition<sup>25</sup>, These problems obstacle the theory from providing a good travel guide for the reform policy-makers to find their way successfully to a market economy.

We consider the economy as a closed one<sup>26</sup> with an agricultural and an industrial sector, each of which produces a homogenous commodity. The output of agricultural good will only be consumed. The industrial output may be consumed or invested<sup>27</sup>.

## 2.2 The Planned Economic Segment

### *Production Technology*

The production technology is expressed by a neo-classic production function with two homogeneous production factors: labour and capital. The production function is assumed to be twice differentiable and single valued with a constant return of scale<sup>28</sup>.

$$Y_{iP} = F^i(K_{iP}, L_{iP}) \quad (1p)$$

with:  $i = 1$  denotes the agricultural sector.

$i = 2$  denotes the industrial sector.

The subscript P denote the planned segment

$L_{iP}$ : labour used in  $i$ -th sector of the planned segment

$K_{iP}$ : capital used in  $i$ -th sector of the planned segment

$Y_{iP}$ : production of the  $i$ -th sector of the planned segment

The first partial differentials are supposed to be positive:  $F_{K_{iP}}^i(K_{iP}, L_{iP}) > 0$ ;  $F_{L_{iP}}^i(K_{iP}, L_{iP}) > 0$  and the second differentials to be negative:  $F_{K_{iP}}^i(K_{iP}, L_{iP}) < 0$ ;  $F_{L_{iP}}^i(K_{iP}, L_{iP}) < 0$ .

At the very beginning, the technological progress is not considered, because the main interest lies in the analysis of the interaction between the two segments, which can be traced back institutionally but not technologically. Considering the special situation in China, we assume the agricultural production takes place only in the market segment but not the planned segment. The influence of planning on the agriculture will be discussed later. Therefore, the following terms equal zero:  $K_{1P} = 0$ ,  $L_{1P} = 0$  and  $Y_{1P} = 0$ .

The total industrial production consists of the production of investment goods and the production of consumption goods.

$$Y_{2P} = I_{2P} + C_{2P} \quad (2p)$$

### *Planner's Decision about factor demand*

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<sup>26</sup>Through the assumption of a closed economy we neglect the impact of international trade and foreign investment on the transition and industrialisation process. The importance of international trade and foreign on the industrialisation can be seen in Perkins (1994).

<sup>27</sup>In the development-theoretical literature as by Fei and Ranis, and Jorgenson the industrial output is admitted for both consumption and investment purposes.

<sup>28</sup>Non-constant return to scale has weakness in growth model, see Conlisk 1968.

We assume the price and the wage rate are fixed in the planned segment. All capital will be utilized. The labour demand will decide according to cost minimizing principle:

$$\begin{aligned} K_{2P} &= K_P \\ \frac{\partial F^2}{\partial L_{2P}} &= \frac{w_P}{P_{2P}} \end{aligned} \quad (3p)^{29}$$

From (3p) we get the demand for labour as the function of the real wage rate and the capital stock.

$$L_{2P} = L_{2P}\left(K_{2P}, \frac{w_P}{P_{2P}}\right) \quad (3p-b)$$

To take into account the benefit provided by the SOEs beyond the wage bill, we assume further that the total wage rate consists of money wage rate and the benefit, and ratio between money wage rate and benefit is constant:

$$w_p = w_{pp} + b$$

$$w_{pp} = v_E w_p$$

with  $v_E \leq 1$

Because it always holds that  $K_{2P} = K_P$ , we consider later only  $K_{2P}$ . The capital stock at each period is the past level minus depreciation plus investment:

$$K_{2P}(t) = K_{2P}(t-1) + I_P^P(t) - \delta K_{2P}(t-1)$$

### ***Capital Payment***

The capital payment can be determined residually as the difference between the whole income and the labour payment.

$$r_P K_P = r_P K_{2P} = P_{2P} Y_{2P} - w_P L_{2P}$$

The rental rate of capital can be calculated accordingly:

$$r_P = \frac{P_{2P} Y_{2P} - w_P L_{2P}}{K_{2P}} \quad (4p)$$

### ***Commodity Market***

The demand in the traditional CPE is always latent and plays no effective role in the

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<sup>29</sup>We have get this condition from the maximising behaviour of the planner. It suits especially the case before the economic reform. But this condition implies also cost minimising behaviour, if the price and the wage rate are kept fix.

economy. While the market segment emerges in the economy, the demand, that is originally kept latent through the supply constraint, can be articulated now on the free market. Concerning the disposition of the income, we make the assumption of the classical saving behaviour<sup>30</sup>. We assume that the labour incomes will all be consumed, and that the saving fraction of the capital income is  $s_r$  and the savings will be directly used for investment by the planner. Thus we get nominal demand for consumption from the planned segment:

$$NC_p^d = w_p L_p + (1 - s_r) r_p K_p, \quad (5p)$$

and nominal demand for investment from the planned segment:

$$NI_p^d = s_r r_p K_p. \quad (6p)$$

As discussed in section 2, the practice in the planned economy will lead to a shortage of supply for consumption. The determination of the realised share of investment goods and consumer goods in the total production is a very complicated matter, in which the ideological doctrine and economic calculation, as well as, the bureaucratic practice are entangled. To simplify the complication, we adopt the Koran's hypothesis of the „constant relation<sup>31</sup>“ and take the ratio between the investment and consumption as an exogenous variable (7p).

$$\frac{I_{2p}}{C_{2p}} = \mu \quad (7p)$$

We assume, that the realised supply of consumption can not be larger than the demand, so that the difference between demand and supply is always positive. We can take this difference between the nominal demand and nominal supply as a measurement of the disequilibrium and denote it as E:

$$E = NC_p^d - P_{2p} C_{2p} \quad (8p)$$

or

$$E = P_{2p} I_{2p} - NI_p^d \quad (8p-b)$$

The equation (8p-b) seems at first glance to be an excess supply of the investment good, that would be contradictory to the specific features of CPE, where there are shortages of supply in every sector as described in section two. The almost infinite demand for investment goods means, that the produced investment goods can always be sold. Under the soft budget constraint the investor does not pay much attention to the budget constraint. The spillover of the shortage of supply of consumer goods i.e. the forced saving, can, through the central planning, just cover the financial deficit expressed in (8p-b). In the planned economic segment the willingness for investment is everywhere, as in a CPE<sup>32</sup>. The realised investment depends only on the financial capability of the planning authority. If forced saving exists, the total amount of investment is equal to the sum of the capital income and the forced saving. It should be noticed, that the forced saving and the financially uncovered investment demands take place at the same time. It is not the forced saving that causes the infinite demand for

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<sup>30</sup>Marglin (1984): Growth, Distribution and Prices p.111.

<sup>31</sup>Kornai (1980): „Economics of Shortage“, p.218 ff.

<sup>32</sup>Jefferson, Gary H. and Rawski Thomas G. (1994): p.55

investment. By contrast, the quantity drive causes the over-evaluation of investment, that results in the insufficient production of consumer goods and forced saving.

## 2.3 Market Economic Segment

### *Production Technology*

Similar to the planned economic segment, the production technology in the market segment is assumed to be expressed through the same production function,

$$Y_{iM} = F^i(K_{iM}, L_{iM}) \quad (1m-2m)$$

with:

The subscript M denote the market segment

$K_{iM}$  : capital stock i-th sector of the market segment

$L_{iM}$  : labour used in i-th sector of the market segment

$Y_{iM}$  : production of the i-th sector of the market segment

The industrial production consists of production of investment goods and consumption goods:

$$Y_{2M} = I_{2M} + C_{2M} \quad (3m)$$

### *Factor Market*

The total capital stock in the market segment at period t is denoted as  $K_M(t)$  and will be fully utilised in these two sectors.

$$K_M(t) = K_{1M}(t) + K_{2M}(t) \quad (4m)$$

At the given period t, the total capital stock is determined by the level of last period plus the net investment:

$$K_M(t) = K_M(t-1) + I_M^m(t) - \delta K_M(t-1)$$

We assume that the allocation of factors is efficient and the factors are paid at their marginal value products. That is, the factor combinations fulfil the minimum cost condition:

$$\frac{\partial F^i}{\partial K_{iM}} = \frac{r_{iM}}{P_{iM}} \quad i = 1,2 \quad (5m-6m)$$

$$\frac{\partial F^i}{\partial L_{iM}} = \frac{w_{iM}}{P_{iM}} \quad i = 1,2 \quad (7m-8m)$$

As in the planned economic segment, the labour demand can be expressed as a function of the capital stock and the real wage rate in this segment:

$$L_{iM} = L_{iM}\left(K_{iM}, \frac{w_{iM}}{P_{iM}}\right).$$

The total employed labour is the sum of the labour employed in the two sectors.

$$L_M = L_{1M} + L_{2M}. \quad (9m)$$

We assume that all the surplus labour force will be absorbed in the agriculture. Therefore, it must hold:

$$L_M + L_{2P} = L_G \quad (10m)$$

Because the production function has a constant return of scale, the total income can be divided into capital income and labour income:

$$P_{iM} Y_{iM} = w_{iM} L_{iM} + r_{iM} K_{iM}$$

Accordingly, the rental rate of the capital can be determined as follows:

$$r_{iM} = \frac{P_{iM} Y_{iM} - w_{iM} L_{iM}}{K_{iM}}$$

We assume, that the capital movement within the market segment is subject to no institutional constraints and is, therefore, much more flexible. The capital movement will cease, if the rental rates are equal in both sectors.

$$r_{1M} = r_{2M} = r_M \quad (11m)$$

The total capital income and the total labour income are the sum of those incomes, respectively, in both sectors:

$$r_M K_M = r_M (K_{1M} + K_{2M})$$

$$w_M L_M = w_{1M} L_{1M} + w_{2M} L_{2M}$$

### ***Wages and Labour***

We assume that in the market segment the wage in industrial sector is the same as that in the planned segment without the additional benefit.

$$W_{2M} = W_{pp} = v_E W_p \quad (12m)$$

Due to the dualistic structure of the economy, there is a large labour force willing to work in the industrial sector, because the wage rate in the industry is higher than that of agriculture, at least at the beginning of the transition process. This tendency of labour movement leads the real wage rate to decrease to the minimum level in the industrial sector. This minimum level can be seen as some kind of existence minimum in the urban area. The rigidity of minimum level of real wage can be described through a wage function<sup>33</sup>, where the nominal wage is tied to the prices in a certain relationship. We assume, that the influence of agricultural

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<sup>33</sup>For the use of wage function see: Motoshige Itoh and Takashi Negishi, (1987) p.6.

products is negligible in the determination of the consumption level for the industrial workers. Hence, the minimum wage can be written as follows:

$$w_{2M} = W(P_{2P}, P_{2M}).$$

We assume, that there is no money illusion and the minimum living standard in the urban area depends mainly on the price of industrial products. The wage functions become linearly homogenous in the prices. In our case, there are two prices for a same product. The minimum wage condition takes following form:

$$w_{2M} = \delta_E (\lambda P_{2P} + (1 - \lambda) P_{2M}). \quad (13m)$$

$\lambda$  is the weight of the product from the planned segment in the whole economy. This wage function says simply, that the nominal wage is proportional to the average price for the industrial products, that is expressed through  $\lambda P_{2P} + (1 - \lambda) P_{2M}$ .  $\delta_E$  is the minimum level of consumption per capita. From the definition of  $\lambda$ , we get:  $\lambda = \frac{Y_{2P}}{Y_{2P} + Y_{2M}}$

### ***Demand***

For the agricultural product, we assume an inelastic demand:<sup>34</sup>

$$Y_{1M}^d = \varepsilon L_G. \quad (14m)$$

$\varepsilon$  is the amount of food needed per capita.

For the disposition of labour income and capital income, we make a similar assumption as we have done for the planned segment. Thus the nominal demand for consumption is:

$$NC_M^d = w_{1M} L_{1M} + w_{2M} L_{2M} + (1 - s_r) r_M K_M \quad (15m)$$

The nominal demand for investment is:

$$NI_M^d = s_r r_M K_M \quad (16m)$$

## **2.4 Market Balance**

For a pure market economy, it is quite natural to accept the conception of equilibrium, as suggested by the general equilibrium theory. The existence of the planned economic segment in this model affects through the deficit in supply of consumption product expressed by E. If production and prices of the market segment are flexible enough, so that they can cover this deficit, then there will be an equilibrium. If the deficit can not be covered by the production from the market segment, there will be no equilibrium and then there exist forced saving and

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<sup>34</sup> More general assumption about the demand for agricultural products would be that after reaching a certain level( $\varepsilon$ ), the expenditure for agricultural products takes a small and decreasing share in the total consumption expenditure. Compare. Kelly et al (1972) p.44 ff.

forced substitution. The condition of the equilibrium on the commodity markets can be put as follows:

$$Y_{1M}^d = Y_{1M} \quad (17m)$$

$$P_{2M} I_{2M} = NI_M^d - E \quad (18m)$$

$$P_{2M} C_{2M} = NC_M^d - P_{1M} Y_{1M} + E \quad (19m)$$

According to Walras' law, one of the three equations is dependent on the other two, so we need to study only two of them. This equilibrium condition can be understood as follows: The existence of the planned segment results in a deficit of supply for consumer goods in the planned segment. The market force adjusts the production and the price for the consumer goods in the market segment, so that this deficit is closed. At the same time, the supply and the demand for the investment good is also brought into balance.

## 2.7 Temporal Equilibrium

We say the model is in an equilibrium, if some positive prices  $P_{1M}, P_{2M}, r_M, w_{2M}, w_{1M}$  exist, such that the equations of market balance (18m), (19m) and (20m) and the equations of factor utilization (4m), (10m) can be fulfilled. That means market prices can keep the total demand and total supply for agricultural product and industrial products for consumption and for investment in balance respectively.

In order to study the property of equilibrium we make following assumptions in addition to the assumptions made in the specification of the model.

Assumption 1

$$F(K_M, L_M) > \delta L_G$$

This is an assumption that the agricultural production is able to provide surplus for industrialisation process.

Assumption 2

$$\frac{w_{pp}}{P_{2p}} = \frac{v_E w_p}{P_{2p}} > \delta_E \quad \text{This assumption is to interpret that the planned real wage rate should}$$

above the existence minimum. Implication of this assumption is that the market price will be above the planned price if labour surplus prevails.

Assumption 3

$$E < w_p L_p - \delta_E \bar{P}_2$$

This assumption implies that even under forced saving the per capital real consumption in the planned segment should be over the existence minimum.

### Proposition 1

*Under A1, A2, if  $E=0$  there exists a unique stable equilibrium for the model specified from (1p) to (19m).*

### Proposition 2

*Under A1, A2, A3 and  $E>0$  there exists a constant  $\tau_K$  such that (1) there is no equilibrium for  $K_P / K_M > \tau_K$  and (2) there exists a unique stable equilibrium for  $K_P / K_M < \tau_K$ .*

### Proposition 3

*Under A1, A2, A3,  $K_M$  will grow faster than  $K_P$ .*

#### *Colloray 3.1*

*If the model is in a disequilibrium state, it will evolve to the equilibrium state after some periods.*

#### *Colloray 3.2*

*Once the model is in an equilibrium state, its evolution will always be in the equilibrium state.*

## **2.6 Long Run Dynamics**

The long run dynamic behaviour of the system depends on how fast capital stocks grow in each segment. At the beginning of the transition, it holds typically  $K_P / K_M > \tau_K$ . Following proposition 2 there is no equilibrium for the model. According to proposition 3,  $K_{Pt} / K_{Mt}$  will become smaller and smaller. Consequently the system will evolve from disequilibrium to equilibrium. We call the process during the disequilibrium state the complementary stage. In this stage the model is overall in disequilibrium, the market segment reduces the disequilibrium to some extent but cannot totally compensate it.

According to Proposition 3  $K_P$  will grow slower than  $K_M$ . Once  $K_P / K_M < \tau_K$  the model will be in an equilibrium. We call this stage the transitional stage.

The wage rate in the agricultural sector keeps increasing during the transitional stage. Once it approaches the wage rate in the industrial sector, the labour surplus disappears. The real wage rate in the market segment will start to increase. The market price for industrial product will decrease. The planned segment will face hard competition from the market and it is forced to adjust its behaviour to the market situation. We call this phase the forces adjustment phase.

## Chapter 3

### Analysis of the Driving Forces of the Transition

The transition process in the model is described by the difference in growth between the two segments. Driving forces of the transition are those that can influence the growth in both the market segment and the planned segment. In the following section, we will analyse these forces and examine their impact on the transition process.

#### 3.1 The Planned Segment and Kalecki's Model

In our model, the growth mechanism of the planned segment has the pattern of the growth in Kalecki's Model. Suppose the price and the wage rate in the planned segment are given exogenously. From the linear homogenous production we find that the cost minimising labour demand depends linearly on the capital stock.

$$L_p = \alpha \left( \frac{w_p}{P_p} \right) K_p$$

Thus the production depends also linearly on the capital stock.

$$Y_p = F(K_p, \alpha \left( \frac{w_p}{P_p} \right) K_p) = F(1, \alpha \left( \frac{w_p}{P_p} \right) K_p) = \phi \left( \frac{w_p}{P_p} \right) K_p$$

The increment of production results from the increment of the capital stock.

$$\Delta Y_p = \phi \left( \frac{w_p}{P_p} \right) \Delta K_p = \phi \left( \frac{w_p}{P_p} \right) (I - \delta K_p) = \phi \left( \frac{w_p}{P_p} \right) I - \delta Y_p$$

The growth rate of the production will be:

$$g = \frac{\Delta Y_p}{Y_p} = \phi i - \delta \quad \text{or} \quad g + \phi c = \phi - \delta$$

$$\text{with: } i = \frac{I}{Y} \text{ share of productive accumulation,}$$
$$c = \frac{C}{Y} \text{ share of consumption.}$$

If we compare this equation with the fundamental equation in Kalecki's model we see that the equation in our model is a special case with a production function of constant returns to scale.

As  $\phi - \delta$  is independent from the decision, the decision about the growth is a „trade off“ between the growth rate and the contemporary consumption. This is exactly the growth pattern described by Kalecki. Because wage income is the main source of consumption, the political desire for quick growth is instrumentalised through keeping the wage rate at a low level. The evidence for the pursuit of this policy is the fact that in China despite a rather

considerable growth rate of the GNP during the sixties and seventies, there was no remarkable improvement of the living standard. In fact the real average wage in 1983 did not reach the level of that in 1957<sup>35</sup>. Nevertheless, even this low level of consumption could not be satisfied, because in the practice of CPE the production of consumer goods often had to give way to the production of investment goods.(see Table 3.1)

During the economic reform this kind of growth pattern changed significantly. First, the source of growth came not only from investment in the planned segment, but much more from that in the market segment. The supply deficit of consumer goods in the planned segment was met through the transaction between the planned segment and the market segment. At same time, the investment goods produced in the planned segment were bought by the market segment to enlarge the production capacity there. The rate of growth was the result of the equilibrium state determined by the market forces. The CPE specific logic of the growth mechanism, - “the trade-off between growth and contemporary consumption“-, does not function here any more. The growth is no more a simple matter of a decision of the planning authority.

### **3.2 Market Segment and Dualistic Economic Model**

The dualistic features of the model are expressed through the asymmetric treatment of the two sectors in market segment. According to Kelley, „the existence of dualism has been argued on the basis of difference in (1) social system, (2) racial or ethnic background, (3) production condition, (4) demographic behaviour, (5) consumer expenditure and consumer savings behaviour, and (6) the domestic and foreign sectors.“<sup>36</sup> In our model the dualism lies, first, in the differential production condition. The production in the agricultural sector is assumed to be always more labour intensive than in the industrial sector. Second, the agricultural sector is expected to absorb all the labour forces, which can not be utilised in the industrial sector. Although the wage rate in the industrial sector is postulated at a level of existence minimum in the urban areas, the wage rate in the agricultural sector lies even lower, which implies that the living standard is different in the rural and urban areas. Third, we have assumed asymmetric consumer expenditure in two sectors. (For simplicity the demand for agricultural product was assumed to be inelastic.)

If we would neglect the planned segment, the model would become a dualistic model in a two sectors neo-classic general equilibrium framework. (The model could also be viewed as a special case of the dualistic model developed by Kelley Williamson and Cheetham<sup>37</sup>.) The growth in the market segment will lead to the structural change in the economy, due to the dualistic properties of the two sectors in the economy. This structural change is to be understood as the process of industrialisation, where the share of industrial production is increasing and the labour force moves from agriculture into industry continuously. Now it is natural to raise the question, why this industrialisation process did not take place earlier? In the following section, we will explain why this industrialisation process did not take place until the beginning of the economic reform.

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<sup>35</sup>See Chinese Statistic Year book 1988 p.190 Tab.4-35.

<sup>36</sup>See:Kelley, Williamson, and Cheetham (1972) p.8-9.

<sup>37</sup> See:Kelley, Williamson, and Cheetham (1972).

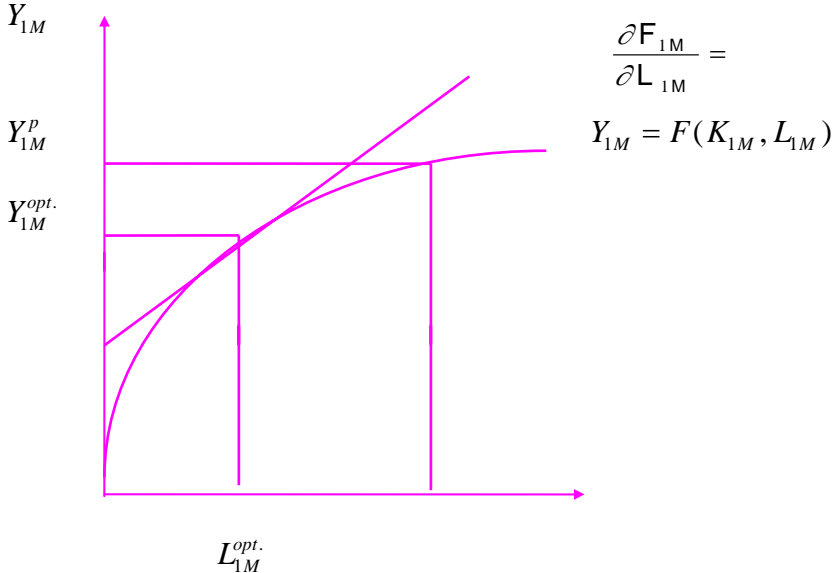
### 3.3 The Rural Reform and the Stimulation of Transition

The Chinese agriculture feeds more than 1 billion people and provides jobs for more than 80% of them in 1978. Before the economic reform, the agriculture in China was integrated in the planning system through an obligated quantity planning and a strict price control. Moreover, peasants were only allowed to engage in the agricultural production. Any activities in other sector were strictly controlled through the bureaucratic administration. The farmers had to fulfil the planned target of production. They had to deliver to the state a given amount of food, that was needed by the people living in the urban area, and they had to produce enough food for themselves. In this case, the decision of farmers could be modelled as follows:

$$\frac{\partial F_{1M}}{\partial L_{1M}} = \frac{w_1^\circ}{P_{1P}} \quad \text{with: } P_{1P} \text{ the planned price for agricultural product}$$

$$w_1^\circ \text{ the prevailing wage rate}$$

The amount of capital stock is irrelevant, because farmers could only use their capital in the agriculture. However, before the reform, they had to carry out the production plan of the state, even if it was economically unprofitable. We assume, that the planned amount was higher than the optimal amount, such that the agricultural production was running unprofitably. The surplus labour force was another burden of the agriculture. We can demonstrate the situation of the agriculture in the graph below:



**Graph 5.1.** Influence of planning on agriculture

The optimal decision for the farmer would be  $L_{1M}^{opt.}$  with a production amount  $Y_{1M}^{opt.}$  lower than the planned production  $Y_{1M}^P$ . Because the planned target was obligatory, everything would be done to fulfil the plan. That means more labour input would be used, even if the marginal productivity was lower than the real wage rate, which is supposed to have reached its lower limit. Another reason for the unprofitable using of labour in the agriculture was that the agriculture had to absorb all the surplus labour, which could not be utilised in the industrial

sector.<sup>38</sup> This economic loss through using surplus labour results in reduction of the capital income. Thus, the following equation holds:

$$\frac{\partial F_{1M}}{\partial K_{1M}} > \frac{r_1}{P_{1P}}$$

and

$$\frac{\partial F_{1M}}{\partial L_{1M}} < \frac{w_1^\circ}{P_{1P}}.$$

The capital income can be determined residually from the difference between total income and the labour income.

$$r_1 = \frac{P_{1P}Y_{1M} - w_1^\circ L_{1M}}{K_{1M}}$$

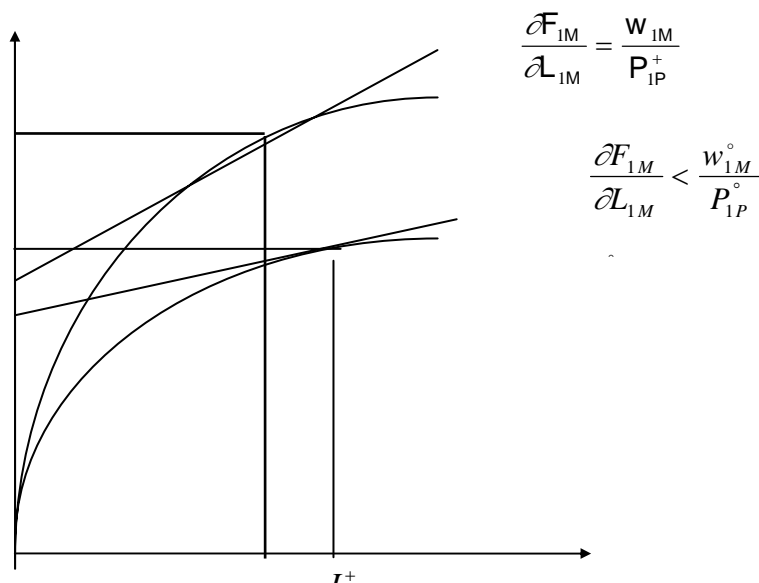
If the price is so low, that the rental rate of capital can only keep pace with the depreciation, the marginal labour productivity will not rise. Consequently, the labour productivity, and thus, the living standard of the farmers can not get decisive improvement. The agricultural production available for the state can not rise as well, i.e. there is no chance for the agriculture to get a remarkable improvement. Before the reform, the low planned price of agriculture product and the bureaucratically controlled production manner had been the main obstacle to the development in the rural area. It destroyed the economic vitality of agriculture, so that a spontaneous industrialisation became economically impossible.

In the **Table 3.2**, we can see, that from the beginning of the sixties to the beginning of the economic reform (in 1978), the planned price did not change significantly.

The rising price of agricultural products, as practised at the beginning of the rural reform and the decollectivization has given a big push in the development of agriculture.

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<sup>38</sup>For detail discussion see also: Perish (1990) and Perkins (1990).



**Graph 3.2.** Impact of rural reform on agriculture

There are two direct effects resulting from rising the prices. First, the rising price leads to increases in the rental rate of the capital. The farmers are able to put more capital into production, which in turn leads to increases in labour productivity. The production curve turns upwards. Second, the real wage rate in terms of agricultural price will decrease, thus it is more profitable to use the labour force than before the reform. These two effects result in increasing production. If the increase of the production is big enough, so that the supply of agricultural products at the old level of the labour input is larger than the food demand, the level of employment in the agriculture will go down. Marginal productivity will rise in agriculture. The improvement of the farmers' living standard will be economically founded. From then on, the expansion of the capital stock in the rural areas and the labourers freed from agriculture will transfer into industrial production. We assume that before the rural reform the planned price for agricultural products was set so low that it suppressed the vitality of the industrialization on the rural area, even if the technological condition for such industrialization was mature. The increased price for agricultural product at the beginning of the rural reform stimulated this industrialization process.

### 3.4 Savings and Financial Market

In the previous discussion, we have assumed, that the wage saving fraction is zero and that of capital income is 100%. A more realistic assumption would be  $0 \leq s_{wM} \leq s_r \leq 1$  and  $0 \leq s_{wP} \leq s_r \leq 1$ , where  $s_{wM}$ ,  $s_{wP}$ ,  $s_r$  are the saving fractions of labour income in the market segment, the plan segment and the saving fraction of capital income, respectively. Accordingly the shortage of supply of consumer products in the planned segment can be written as:

$$E = (1 - s_{wP})w_P L_P + (1 - s_r)r_P K_P - P_{2P}C_{2P} > 0 \quad (8pb)$$

The market balance condition for the investment goods is now:

$$\begin{aligned}
& P_{2M} I_{2M} + P_{2P} I_{2P} \\
& = s_r r_M K_M + s_{wM} (L_{1M} w_{1M} + L_{2M} w_{2M}) + s_{wP} L_P w_P + s_r r_P K_P
\end{aligned} \tag{18mb}$$

$$\text{or} \quad P_{2M} I_{2M} = s_r r_M K_M + s_{wM} (L_{2M} w_{2M} + L_{1M} w_{1M}) - E.$$

If we replace the (8p) and (18m) in the original model by (8pb) and (18mb) above we find, that the saving behaviour only influences the distribution of the production between the consumer goods and investment goods within the industrial sector. The argument for the existence, uniqueness and stability of the equilibrium also holds in this case as in section 2.

However, with different saving behaviours, the dynamics of the capital accumulation should be modified accordingly. We assume that all savings from labour income will be used for investment through the financial system, which is still under rather strong central control. It becomes essential, how the savings from the labour income are distributed in the two segments. We suppose that the savings of the capital income will be used for the investment in the same segment. We denote  $\kappa$  as the share of savings from labour income, which is used for investment in the plan segment. The capital stock accumulation in the two segments can be described through following two equations. We denote the sum of savings from the labour income with  $S = s_{wM} (L_{1M} w_{1M} + L_{2M} w_{2M}) + s_{wP} L_P w_P$ .

$$\rho_P = -\delta + (s_r r_P + \kappa \frac{S}{K_P(t)}) / \bar{P}_2 \tag{A}$$

$$\rho_M = -\delta + (s_r r_M + (1 - \kappa) \frac{S}{K_P(t)}) / \bar{P}_2 \tag{B}$$

Similar to the case of the basic model, the difference between  $s_r r_P + \kappa S / K_P$  and  $s_r r_M + (1 - \kappa) S / K_M$  is key to the dynamic behaviour of the system. The difference depends first of all on the rental rate in both segments. It depends also on the distribution of saved labour income. As discussed above, the rental rate in the market segment is higher than that in the planned segment. If the difference between the rental rates can outweigh the saving fraction (i.e. if it holds that,  $s_r r_P + \kappa S / K_P < s_r r_M$ ), the market segment will always have a faster growth rate. The share of the planned segment in the economy will diminish. Of course, this assumption can hold, only if the saving fraction of labour income is very small. Generally, we may have to consider the case, where the inequality does not hold. In this case, the long run behaviour of the system depends on the distribution of the labour income saved. If there is no competitive financial market, which is exactly the case in China, the flow of the financial asset will run according to administrative rules. The simplest rule is that the distribution is held at a fixed ratio.  $\kappa$  is supposed to be constant between 0 and 1. For a given  $\kappa$ , even if  $s_r r_M + (1 - \kappa) S / K_M$  is larger than  $s_r r_P + \kappa S / K_P$ , the share of the planned segment will not diminish, because the former will decrease faster than the latter, until they are equal. Then the planned segment will take a constant share in the economy. In case the former is smaller than the latter, the planned segment will grow faster. However, the difference between them will converge to zero, so that in the long run the growth rates in both segments will be equal.

If the saving of labour income is distributed somehow competitively, the enterprises in the market segment have a better chance to get the financial asset than those from the planned segment. They can pay a higher interest rate, because the rental rate in the market segment is

higher. Suppose that the savings are distributed in proportion to the capital stock in both segments, then  $\kappa$  can be calculated follows :

$$\kappa = \frac{K_P}{K_P + K_M}.$$

The growth rates of the capital stock in both segments are:

$$\rho_P = 1 - \delta + (s_r r_P + \frac{K_P}{K_P + K_M} S / K_P) / \bar{P}_2 = 1 - \delta + (s_r r_P + \frac{S}{K_P + K_M}) / \bar{P}_2 \quad (\text{A})$$

$$\rho_M = 1 - \delta + (s_r r_M + \frac{K_M}{K_P + K_M} \frac{S}{K_M}) / \bar{P}_2 = 1 - \delta + (s_r r_M + \frac{S}{K_P + K_M}) / \bar{P}_2 \quad (\text{B})$$

Obviously, the growth rate in the market segment will be higher than that in the planned segment, and thus, the share of the plan segment in the economy will diminish. In other words, the transition from plan to market will proceed.

The discussion above has shown, that the reform of the financial market is crucial for the transition from plan to market. The transition process will be impeded, if the financial market is run administratively and the financial flow does not react to the situation on the market. The financial market will become even more important if the allocation of the capital income is also deposited on the financial market.

### 3.5 The Tax Policy

Tax policy is one of the most important instruments for the government to intervene in the economy, especially, in the market segment. In this section, we will analyse the influence of tax policy on the transition process. Because the transition from plan to market is understood as the increase/decrease in the share of market segment/(planned segment), we only have to examine the impact of tax policy on the growth of the capital stock in the two segments and it is important to distinguish between tax spent for consumption and for investment, because these two kinds of uses have a different impact on the growth of the capital stock.

#### *Tax Used for Consumption:*

We assume, that a constant tax rate is charged on the capital income<sup>39</sup>. This policy leads to a larger share in the investment income being used for consumption. For simplicity, we assume  $s_{wM} = s_{wP} = 0$ . The shortage of supply for consumption products in the planned segment is expressed in the following equation:

$$E^\circ = w_P L_P + t_r r_P K_P + (1 - s_r)(1 - t_r) r_P K_P - P_{2P} C_{2P} \quad (9pc)$$

The market balance for the investment good is expressed as:

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<sup>39</sup> The tax on wage is neglected, because the income of most wage-erners is well below the taxation limit.

$$P_{2M}I_{2M} = s_r(1-t_r)r_M K_M - E^\circ \quad (18mc)$$

and for consumer goods:

$$P_{2M}C_{2M} = (1-s_r)(1-t_r)r_M K_M + w_{1M}L_{1M} + w_{2M}L_{2M} + t_r r_M K_M + E^\circ \quad (19mc)$$

Obviously the argument for the existence, uniqueness and stability of the equilibrium solution holds here as in the case of the basic model in chapter 4. The difference is that the expenditure of tax income for consumption raises the final demand for consumption, so that the portion of consumer goods in the whole industrial production will increase. The growth of capital stocks in the two segments can be determined accordingly:

$$\rho_P = s_r(1-t_r)r_P / \bar{P}_2 - \delta \quad (Ac)$$

$$\rho_P = s_r(1-t_r)r_M / \bar{P}_2 - \delta \quad (Bc)$$

These two equations differ from the equations (A) and (B) only in the positive factor  $s_r(1-t_r)$ . Hence, the conclusion about the long run dynamic property of the system holds also in this case. The imposed tax only slows down the growth of the capital stocks in both segment. But the growth is faster in the market segment than in the planned segment, so that in the long run the share of planned segment will converge to zero. In other word, the transition will proceed.

#### ***Tax used for investment in the planned segment:***

Is the tax income completely used for investment in the planned segment, the growth rate in the planned segment will naturally benefit. We examine in following the impact of this policy on the transition process. The deficit of supply for consumption in the planned segment is written:

$$E = w_P L_P + (1-t_r)(1-s_r)r_P K_P - P_{2P}C_{2P} \quad (8pd)$$

The market balance condition for the investment goods in the market segment can be written as follows:

$$P_{2M}I_{2M} = s_r(1-t_r)r_M K_M - E + t_r r_M K_M \quad (18md)$$

For the consumption products:

$$P_{2M}C_{2M} = (1-s_r)(1-t_r)r_M K_M + w_{1M}L_{1M} + w_{2M}L_{2M} + E - P_{1M}Y_{1M} \quad (19md)$$

Similar to the case of using tax income for consumption, the equilibrium solution is unique. However, the long run property of the system will change. Instead of the diminishing share of the planned segment in the economy, the planned segment will take at least a constant share over time. The growth rates of the capital stock in the two segments are, respectively:

$$\begin{aligned}\rho_P &= (s_r(1-t_r)r_P + \frac{t_r r_M K_M + t_r r_P K_P}{K_P}) / \bar{P}_2 - \delta \\ &= (s_r(1-t_r) + t_r)r_P + \frac{t_r r_M K_M}{K_P} / \bar{P}_2 - \delta\end{aligned}\tag{Ad}$$

$$\rho_M = s_r(1-t_r)r_M / \bar{P}_2 - \delta\tag{Bd}$$

The difference between  $(s_r(1-t_r) + t_r)r_P + \frac{t_r r_M K_M}{K_P}$  and  $s_r(1-t_r)r_M$  is decisive for the long run behaviour of the system. It worthies to note, that  $(s_r(1-t_r) + t_r)r_P + \frac{t_r r_M K_M}{K_P}$  is increasing, as  $s_r(1-t_r)r_M$  is decreasing, if  $s_r(1-t_r)r_M > (s_r(1-t_r) + t_r)r_P + \frac{t_r r_M K_M}{K_P}$  holds. With the progress of the evolution, the difference between the growth rates in the two segments becomes increasingly smaller until they are equal. Both segments will then take a constant share in the economy and the transition will cease.

The tax income may also be used for investment in the market segments, through subsidies or supports for the enterprises of the market segment. For the long run dynamic property of the system, it becomes crucial, how total investment, that is financed through the tax income, is distributed between the two segments. Similar to the discussion in the section 5.4., we can conclude that, if the total investment fund is distributed with a constant fraction for each segment, both segments will have a constant share in the economy in the long run. The transition will not be carried out to the end. If the total investment fund is distributed in proportion to the production capacities of the two segments, the share of planned segment will converge to zero. The transition will proceed to the end.

### 3.6 Adjustment of the Planned Segment

With the appearance of the market segment, the economic environment changes in the economy. There are two prices for the same product. The first one is the planned price, which is determined and controlled by the planning authority. The second one is the market price, that results from the demand and the supply on the market and always lies above the planned price. The higher price in the market segment results in the higher rate of return of capital in the market segment, which leads in turn to the faster growth in the market segment. The flourishing in the market segment motivates the planned segment to adjust itself to the new situation. During the economic reform, where the profitability and efficiency of a enterprises is always the central topic of the management, the managers become conscious of the price as an instrument of management. In the following section, we will discuss a few variations of the price adjustment in the planned segment.

#### 3.6.1 Partial Price Adjustment:

With partial price adjustment we mean a certain kind of price policy during the reform, where the planned price for the industrial good is raised to reduce its difference to the market price. Because the price raising implies, at same time, the radical decreasing of the real wage rate,

that would reduce the living standard of workers and cause social disturbance, the planning authority tends to raise the wage rate in order to compensate the effect of the rising price. Generally we assume, that the ratio of wage rate to the planned price  $w_p / P_{2p}$  is kept at a constant level.

Now we will examine the effects of this kind of policy. If the planned price for consumer goods is raised by  $\rho$  percent, the nominal wage rate will also be  $\rho$  percent higher. Owing to the fact, that the employment can not change in short time in the planned segment, the capital income will be changed.

For the distribution of the factor income we get:

$$(1 + \rho)P_{2p}Y_{2p} = (1 + \rho)r_{2p}K_{2p} + (1 + \rho)w_{2p}L_{2p}$$

Thus the rental rate of capital in consumer sector will rise at  $\rho$  percent, as shown in the equation:

$$r_{2p}^* = (1 + \rho)r_{2p}$$

The impact on the market segment is carried out through the deficit of supply of consumer goods. This is expressed as:

$$E = w_p L_p - P_{2p} Y_{2p}$$

As  $w_p$  and  $P_{2p}$  are increased by  $\rho$  percent and the  $y_{2p}$  and  $L_{2p}$  are unchanged, shortage of supply will increase by the same percentage. From the equation (13m) we can easily see, that the rising of the price does not affect the labour intensities in the two sectors of the market segment. We insert  $\lambda$  and rearrange all market variables to the left hand side:

$$\frac{w_M}{\delta_E} = \frac{Y_{2p}}{Y_{2p} + Y_{2M}} (P_{2p} - P_{2M}) + P_{2M}$$

$$Y_{2M} \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) = \left( \frac{1}{\delta_E} - \frac{P_{2p}}{v_E w_p} \right) Y_{2p} \quad (13me)$$

Because right hand side do not change, the price ratio and the real variables in the market segment will not change. Following (12m) all nominal variables of the market segment will rise by  $\rho$  percent.

To summarise, the partial price adjustment causes the rising of all the monetary variables by  $\rho$  percent, as the real variables remain unchanged, so that the allocation of the resource and the difference between the growth rate also remain unchanged. In this context, the wage rate can be treated as the Walrasian numéraire in our model<sup>40</sup>.

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<sup>40</sup>Brems, Hans. (1968), "Quantitative Economic Theory: A Synthetic Approach", John Wiley & Sons, Inc. New York, London, and Sydney, 1968, p.256

### 3.6.2 Dual Prices

The "two-tiers system" is another variant of the price reform. According to the „two-tiers system“, the state-owned company must fulfil certain plan targets. A certain amount of product has to be produced and sold at the planned price, but the company is free to dispose of the remaining product and its resources, after it has met the plan target. This policy has brought a new light into the management of the state-owned enterprises. The executives of the enterprises become more and more conscious of their own interests of the enterprise. Of course, it takes time for the executives of the state-owned enterprises to take advantage of this constrained freedom in the management and to adjust the production accordingly. So we will discuss two cases. In the first case, the production is determined independently from the market price, thus it is somehow exogenous. In the second case, the amount above the plan is determined in accordance with the market situation.

For the first case:

$$Y_{2P} = Y_{2P}^P + Y_{2P}^+ \quad Y_{2P}^P = I_{2P}^P + C_{2P}^P \quad Y_{2P}^+ = I_{2P}^+ + C_{2P}^+$$

with  $Y_{2P}^P, I_{2P}^P, C_{2P}^P$ : the plan target;  $Y_{2P}^+, I_{2P}^+, C_{2P}^+$ : the amount over the plan target and  $Y_{2P}$ : the total amount of production.

$$P_{2P}Y_{2P}^P + P_{2M}Y_{2P}^+ = r_P K_P + w_P L_P$$

The shortage of supply in the planned portion is expressed as:

$$E = w_P L_P - P_{2P}Y_{2P}^P$$

The market balance for the consumer goods is:

$$P_{2M}(C_{2M} + C_{2P}^+) = w_{2M}L_{2M} + w_{1M}L_{1M} + E - P_{1M}Y_{1M}. \quad (19mf)$$

The market balance for the investment goods is:

$$P_{2M}(I_{2M} + I_{2P}^+) = r_M K_M + r_P K_P - P_{2P}I_{2P}^P, \quad (18mf)$$

or

$$P_{2M}I_{2M} = r_M K_M + P_{2M}C_{2M}^+ - E.$$

The minimum wage condition is now given as:

$$w_{2M} = \delta_E \left( \frac{Y_{2P}^P}{Y_{2P}^P + Y_{2P}^+ + Y_{2M}} P_{2P} + \frac{Y_{2P}^+ + Y_{2M}}{Y_{2P}^P + Y_{2P}^+ + Y_{2M}} P_{2M} \right),$$

$$(Y_{2M} + Y_{2P}^+)(\frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E}) = (\frac{1}{\delta_E} - \frac{P_{2P}}{v_E w_P})Y_{2P} \quad (13mf)$$

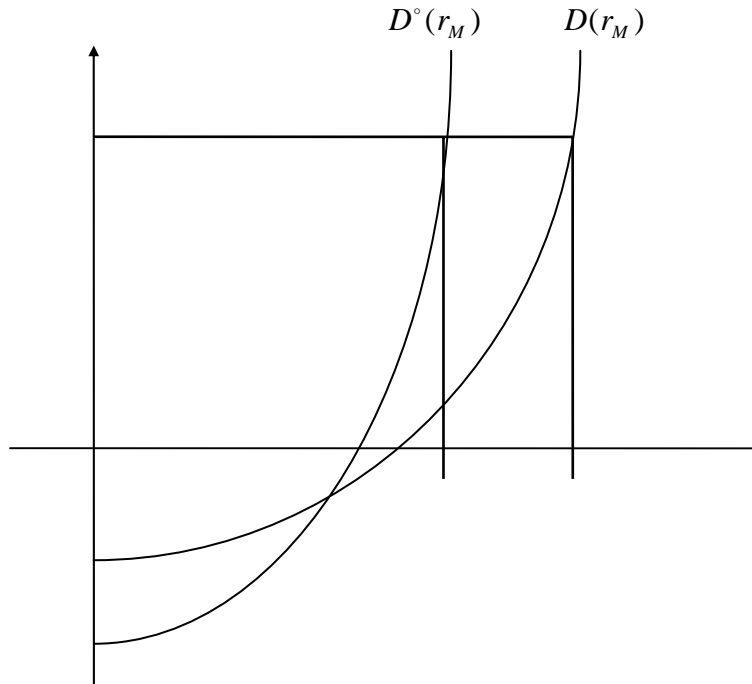
Because  $Y_{2P}^+ / K_M$  is constant, the left hand side of equation (13mf) is monotonously increasing in  $r_M$ <sup>41</sup>, so the conclusion that the equilibrium solution exists and is unique will not change. We define the left hand side with  $D^\circ(r_M)$ :

$$D^\circ(r_M) = Y_{2M} \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) + Y_{2P}^+ \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) = D(r_M) + (Y_{2P}^+) \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right)$$

Obviously it holds, that  $D^\circ(r_M) > D(r_M)$  and  $D^\circ(r_M)' > D(r_M)'$ . This means, that assuming other conditions remain unchanged, the equilibrium rental rate of capital will be smaller.

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<sup>41</sup> See Proof of Proposition 1.



**Graph 3.3** Existence of Equilibrium under Two-Tiers-System

Under the dual price system, the state-owned enterprises could also profit from the liberal economic environment, through selling a part of the products at the higher market price. More production capacity is involved in the market-oriented production, such that the rental rate in the market segment decreases. (See **Graph 3.3**) Due to the higher price of the product, the rental rate will increase in the planned segment. In spite of this, the rental rate in the market segment is still higher than that in the planned segment. Therefore, the growth rate will be higher in the market segment.

In the case of endogenous production, where the production in the planned segment is determined according to the market prices of the products, the equations for the system remain the same, but  $Y_{2P}^+ / K_M$  is no longer exogenous. It will be determined according to the market situation. Generally, the over-plan-production is determined so, that the real wage rate equals the marginal labour productivity.

$$F_{2P}'(K_{2P}, L_{2P}) = \frac{w_P}{P_{2M}}$$

or

$$f_{2P}'(l_{2P}) = \frac{w_P}{P_{2M}}$$

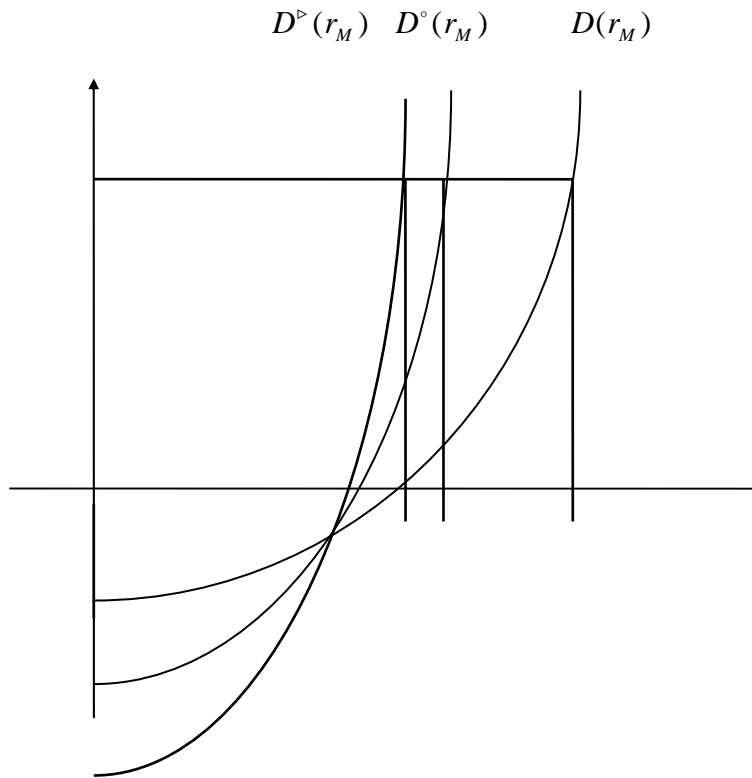
The labour intensity in the planned segment can be seen as an increasing function of the wage-price ratio:

$$l_{2P} = l_{2P}\left(\frac{w_P}{P_{2M}}\right)$$

Because marginal productivity is decreasing, the labour intensity will increase with the market price. The market price increases with the rental rate in the market segment, so the

labour intensity in the planned segment increases with the rental rate. As the capital stock is constant, the over-production is an increasing function of  $r_M$ . We denote the left hand side of equation (10m-c) as  $D^\triangleright(r_{2M})$ .  $D^\triangleright(r_{2M})$  is still monotonously increasing in  $r_M$ . Therefore, there exists a unique solution to the equilibrium problem, which is expressed in the equation below:

$$D^\Delta(r_M) = Y_{2M} \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) + Y_{2P}^+ \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) = D(r_M) + Y_{2P}^+ \left( \frac{w_P}{P_{2M}} \right) \left( \frac{P_{2M}}{w_{2M}} - \frac{1}{\delta_E} \right) \quad (13mg)$$



**Graph 3.3b** Existence of equilibrium under two-tiers-system

### 3.6.3 Freeing up of the Price Control

The last step of the price reform is to give up the planned price and let all prices respond freely to supply and demand of the market. The practice of this policy can be viewed as continuation of the two-tiers-policy, as the plan target becomes smaller and smaller. In this case, the minimum wage condition takes a very simple form:

$$w_{2M} = \delta_E P_{2M} \quad (13mh)$$

This shows, that even if all the prices are set free, the wage-price-ratio can not become arbitrarily small.  $\delta_E$  is the minimum real consumption level, which is determined by the social background.

The equilibrium rental rate in the market segment can be solved in the following equation:

$$f'(l_2) = \delta_E = \frac{w_{2M}}{P_{2M}}.$$

The employment in the market segment can be calculated as:

$$L_{2P} = l_{2P} K_{2P},$$

where the labour intensity should meet following condition:

$$f_{2P}'(l_{2P}) = \frac{w_{2P}}{P_{2M}} = \frac{w_{2M} / v_E}{P_{2M}} = \delta_E / v_E.$$

The disequilibrium in the planned segment is expressed through:

$$E = w_P L_P - P_{2M} C_{2P}$$

As long as the planned segment plays a dominant role in the economy, we assume, that the deficit of supply for consumption is positive. Because the production structure of the capital stock in the planned segment does not respond to the market situation immediately, it would be a coincidence for the  $E$  to equal zero. However, the resource allocation in the market segment will react to this disequilibrium and keep the whole economy in equilibrium.

Since the planned prices are the foundation of the planning calculation, abolishing the price control is likely giving up the planning. Without the planned price as the basis of the evaluation of the target, it is impossible to control and to judge, whether the plan is carried out well or not. The practicability of the plan is now very questionable. The planned segment is no longer a subsystem, that could function independently. This dependence of the planned segment on the market changes the role of the planning in the economy qualitatively.

The direct effect of abandoning price control is, that the difference in the growth rates will be reduced, as the price advantage of the market segment diminishes. The planned segment gets more vitality and can grow faster than before. Without price control, the enterprises in the planned segment operate under more market-like environment and gain more and more market-specific features. The intrinsic transition is taking place. The most far reaching influence of this policy is the dissolution of the planning mechanism. Because a strict control of the execution of the plan depends strongly on the information about the prices, this price reform policy made the control impossible.

The impact of freeing up of the prices on the whole economy is tremendous. However, this policy may result in different effect at different times during the transition. At a certain stage of the transition, this policy may promote the development of the market segment, in another stage of the transition, it may even block the transition process. The correct timing is crucial for this policy (see 3.10.).

### 3.7 Advantages in the Market Segment

In an economy with two subsystems organised by different principles, the vitality of a subsystem could be judged on the rate of growth of that subsystem. Generally, the ratio of the growth rate can be displayed as:<sup>42</sup>

$$\frac{\rho_P}{\rho_M} = \frac{r_P}{r_M} = \frac{P_P H_P(w_P/P_P)}{P_M H_M(w_M/P_M)}$$

In this formula the advantage in the market segment in regard to the rate of growth of the capital stock can be traced back to three advantages in the market segment. The first one is the price advantage. Producers from the market segment can take advantage of the shortage situation and always sell their products at a higher price. It holds that  $P_M > P_P$ . The second one is wage advantage. Owing to the large labour reserve in agriculture, the industrial enterprises of the market segment are facing an almost unlimited labour supply, especially at the beginning of the transition, when the demand for labour is relatively small. Therefore, they can hire the labour at lower wage rate  $w_M < w_P$ . The last one is the advantage of more efficient production. In the previous discussion, we have always assumed, that the production technologies are the same in both segments. There are some good reasons, why the production in the market segment is more efficient than that in the planned segment. The most important one is the selectivity of the investment: The enterprises of the market segment do not need to cover every branch of the economy. They produce only in the most profitable branches through selective investment, while the enterprises of planned economy have to cover all the branches, where some production will be unprofitable. Consequently, with the same amount of resources, more goods and service can be produced in the market segment than in the planned segment. Better management is another important reason for more efficient production in the market segment.

These three aspects can also be put in another way: the difference in the growth rates between the two segments consists of the difference in the price, the difference in the production technologies, which is expressed through the function  $g_P$  and  $g_M$ , and the difference in the labour intensities, that are expressed separately through  $l_P$  and  $l_M$ :

$$\frac{\rho_P}{\rho_M} = \frac{r_P}{r_M} = \frac{P_P(f_P(l_P) - f'_P(l_P)l_P)}{P_M(f_M(l_M) - f'_M(l_M)l_M)} = \frac{P_P g_P(l_P)}{P_M g_M(l_M)} \quad (D)$$

$$\text{with: } g(l) := f(l) - f'(l)l$$

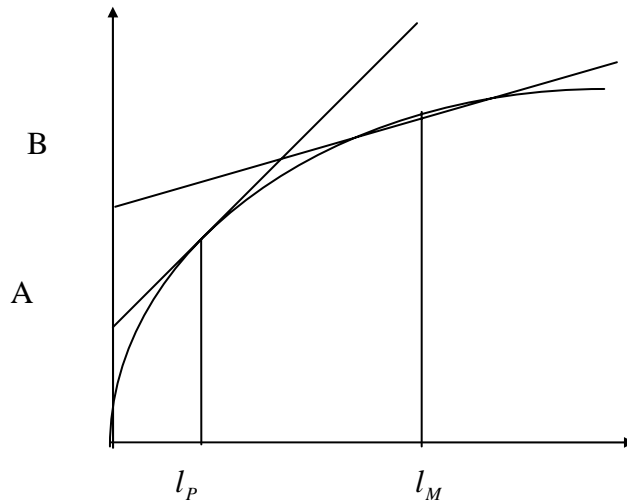
If the production technology is the same in both segments, the difference resulting from the labour intensity can be illustrated in the following graph:

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<sup>42</sup> We neglect the depreciation in the following discussion to simplify the discussion, because its effects on the two segments do not change the relative advantage/disadvantage of any segment.

$$f'(l_p) = w_p / P_p$$

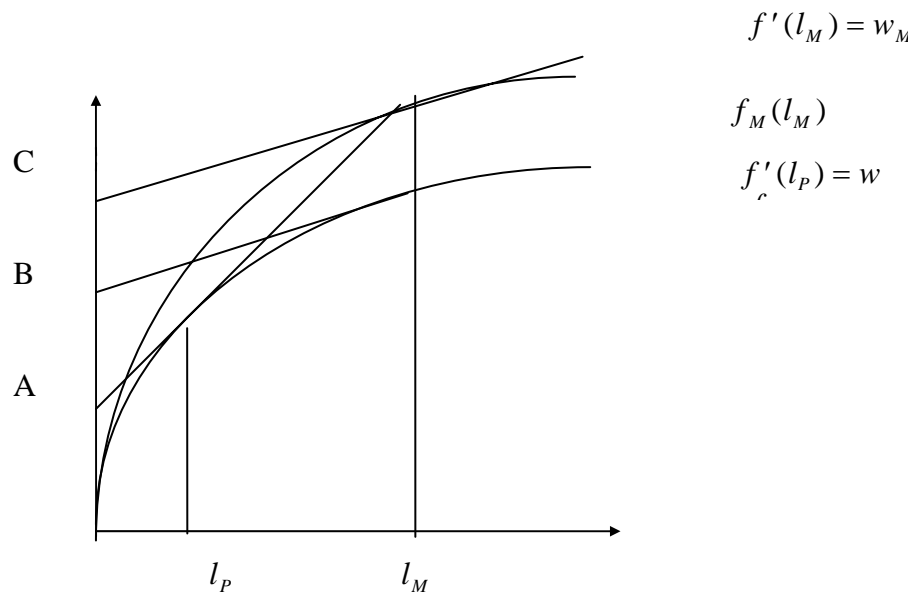
$$f'(l_M) = w_M / P_M$$



**Graph 3.4** Production and labour intensity with same technology

The curve is the production function  $f(l)$ . From the cost minimising behaviour of the producers we have:  $f'(l) = w/P$ . Owing to the fact, that the wage rate in the market segment is lower than that in the planned segment, the labour intensity in the market segment must be higher than that in the planned segment. Graphically the slope at  $l_p$  must be steeper than that at  $l_M$ . Therefore,  $l_p$  is smaller than  $l_M$ , because this slope is decreasing. The intercept can be expressed as:  $f - f'l$ , which is equal to  $g(l)$  by definition. The difference between the intercepts A-B expresses the difference in growth of the capital stock due to the difference in labour intensity (see **Graph 3.4**).

If the production in the market segment is more efficient, this difference will be even bigger. It is expressed through A-C, that is the sum of the difference due to the labour intensity A-B and that due to the production function itself B-C.



**Graph 3.5** Production and labour Intensity with different technologies

During the process of the transition, the productive capacity of the market segment will grow and the behaviour in the planned segment will change. Thus the relative advantages of the market segment become increasingly weaker over time. It all depends on whether the planned segment has the same performance as the market segment.

### 5.8 Industrialisation and Labour Distribution

All the previous discussion was conducted under the assumption of labour surplus. The urban minimum wage exceeds the competitive level and draws rural labour into the industrial sector. The industrial sector faces an „unlimited supply of labour“ and the minimum wage can prevail. Labourers are engaged in three groups of employment: industrial production of the planned segment, industrial production of the market segment, and agricultural production. During the transition from plan to market, the industrialisation process is going on. The labour movement from the agricultural sector into the industrial sector proceeds continuously. Consequently, the agricultural wage rate will rise and approach the industrial wage rate. The living standard in the rural areas will improve with the raising labour income in agriculture. As soon as the wage rate in the agricultural sector reaches the level in the industrial sector, a qualitative change in the labour market will take place. There will be no more labour surplus. The unified real wage rate will not be fix on the minimum level but will be determined endogenously on the competitive level.

In the equation (7me), this ratio can be determined. The question of the existence of the solution is, whether or not a positive  $r_M$  exists, that can meet the equation (7me). To answer this question, we first show that the left hand side of (7me) is an increasing function of the rental wage ratio  $r_M / w_M$ . We denote the left side of (7me) by  $G(r_M / w_M)$ .

$$dG\left(\frac{r_M}{w_M}\right) = d(u_1 l_1 + u_2 l_2) = ((1 - u_1) l_2' + u_1 (1 - f_1' (l_1 - l_2) / f_1) l_1') d\left(\frac{r_M}{w_M}\right) > 0$$

Hence,  $G(r_M / w_M)$  is a rising function of  $r_M / w_M$ . Because  $\lim_{r_M \rightarrow \infty} G(r_M / w_M) = \infty$  and  $\lim_{r_M \rightarrow 0} G(r_M / w_M) = 0$ , a positive  $(r_M / w_M)^*$  exists for which  $G(r_M / w_M)^* = l_M$ .

As the growth of capital stock is much faster than the growth of labour (we have assumed a constant labour supply), the overall labour intensity decreases with time and so does the rental-wage ratio. From the equation (5me) we know, that the price of industrial products will also decrease. This process will go on until the market price falls below the planned price. At least from this point on, the planned segment will be forced to follow the market price, otherwise no one would buy the products at the planned price. In this case, the planned segment obviously could not survive in the system, if it would not adjust itself to the market situation.

The consideration above suggests the conclusion, that the industrialisation might be crucial to the transition from plan to market. As soon as the industrialisation is completed, the thorough removal of the planned segment will be inevitable, with only one exception that the planned segment behaves just like the market segment.

The degree of industrialisation can be expressed through the share of industrial product in the whole economy. We have constructed the growth process in our model through the accumulation of capital stock. The whole production will grow with time. The industrialisation becomes a straight forward result of the assumption concerning the dualistic structure of the economy.

### 3.9 Welfare effect of transition

The consumption possibility expressed through real income is taken here as the indicator of welfare. It is well known that welfare concept is much more comprehensive than just a single object of real income<sup>43</sup>. Constrained by the model structure, the welfare effect will be only examined in this partial aspect. The participants of the economy during the transition process can be roughly divided into 4 groups: farmers, who are engaged in the agricultural production, farmer-workers, who were farmers and became industrial workers during the industrialisation process, workers of the state-owned enterprises, and capitalists, who own the capital stocks. The impact of the transition from plan to market on the welfare is different among the four groups, because they are engaged differently in the economy.

At the early stage of the economic reform, farmers had benefited from the rural reform through rising price of agricultural products and freeing up of the market for agricultural products and side line products. During the transition process accompanied by the industrialisation process, labourers moved continuously from agricultural sector into industrial sector. The marginal productivity increased in agriculture, thus, farmers' income rose continuously. Although farmers' income was the lowest among the four groups, farmers

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<sup>43</sup> Sen, Amartya (1988): in Hand Book of Development Economics Vol. 1, P.12 ff.

were facing improving living standards. Hence, they are happy with of the reform policies, as long as the improvement continues.

Farmer-workers improved their living standard through moving into the industrial employment. They earn more than their former colleagues, who remained in the countryside. In this sense, they are grateful to the reform policy. However, they have to lead a rather hard live in the urban area. Owing to the excess supply of labour, their real income will be fix on the minimum level. They faced the fact, that although they earned more and they had to spend more for living. Hence, their opinion to the reform is twofold. On the one hand, they are grateful to the reform policy, that got the chance to work in industry and could improve their living standards in comparison to the situation before the reform. On the other hand, they will always complain about that the reform can not give them further improvement of living standard.

Workers of the state-owned enterprises can not profit directly from the transition process, because their wage rate was determined through the planning. They might suffer from a loss of welfare due to the rising prices, which is caused by the higher prices in the market segment. However, with the progress of reform in the state-owned enterprises, the enterprises have gained comprehensive autonomy. The managers of the enterprises raised the income of the workers through rising the share of premium in the total wage. From 1987 to 1993 the share of tariff wage fell from 85.8% to 50%. According to this fact, the central planning did not play the decisive role any more in the wage determination. It raises naturally the question, how is the wage rate determined in the state-owned enterprises during the economic reform. Neither the theory of marginal productivity nor the efficiency wage model can provide a sufficient explanation to the phenomena, because statistics show that the increase of wage rate in the state-owned enterprises is larger than the increase of productivity. Obviously, the managers of the state-owned enterprises have taken the growth of real income of the workers of their enterprises into their object function<sup>44</sup>. These wage increases in the state-owned enterprises are partly responsible for the fall of profit rate in the state-owned enterprises during the transition process. Due to the increased real wage, workers of the state-owned enterprises experienced welfare gain during the transition. However, it is questionable whether the improvement can last throughout the transition process. The profit fall will threaten the existence of the state-owned enterprises and thus the existence of the workers. Without significant technical progress, the improvement of the living standard of the workers of the state-owned enterprises can not continue during the transition process.

The capitalists have profited the most through the transition process. At the early stage of the reform the capital rental rate was very high. With the expansion of the market segment and the capital stocks, the rental rate will go down. A new entrepreneur class is slowly forming during the transition process. This class is naturally the support of reform policy. The role of small savers, who just put their money in the bank, is total different from the capitalists, who invest money direct in the production process. Due to the monopoly position of the bank, the interest rate is always set at the level not higher than the inflation rate, such that small savers can get no profit from their capital - savings.

Summing up, the 4 groups can all profit from the economic reform. Farmers, who earn at least among the four groups, can get improvement of living standard, as long as the industrialisation process continues. Farmer-workers, whose income is between farmers and

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<sup>44</sup> Wing Thye Woo has argued for this behaviour in Wing Thye Woo (1994), P. 286.

the other, improve their living standard through moving from the agricultural into industrial sector. A further improvement will not be possible, before farmers' income reach the level of the farmer-workers. From then on their real wage will rise continuously. Workers of the state-owned enterprises, who earn the most among the working class, get real wage increases, because the managers of the enterprises act partly as agency of the workers. However, these increases of real wage are not economically founded. They can only last in the long run, if the technical progress in the state-owned enterprises can guarantee enough growth in the productivity. The newly emerged capitalists profit the most during the transition process.

### 3.10 Timing of the Reform

The evolution path of the model, as a series of the temporal equilibrium in the system, depends on the initial condition and the functioning mechanism in each period respectively. Any reform policy, that is designed to change the functioning in the planned segment can affect the state of the temporal equilibrium in each period, and thus the process of the transition from plan to market. It is worthy to discuss, whether a certain policy aimed at accelerating the transition from plan to market can really have this expected effect. It is crucial, whether the ratio of the production capacity of the market segment to that of the planned segment has reached a certain level at the time, when the policy is carried out. Because the ratio of production capacity between the two segments alters with time, the timing of a reform policy may be crucial, whether the policy can have the intended effect.

We know from the discussion in chapter 4, whether the overall economic situation in the system has still CPE-specific features depends on, whether the market segment can correct the disequilibrium situation produced by the planned segment. The critical point is whether the equilibrium rental rate in the market segment is larger than the rate of disequilibrium expressed by  $E / K_M$ . If it holds:  $r_M^* > \frac{E}{K_M}$ , the market segment can absorb the disequilibrium.

If  $r_M^* < \frac{E}{K_M}$ , the disequilibrium situation persists and there exists forced saving. If forced

savings are used for investment in the planned segment, the transition may be stopped. Recalling the conclusion of the discussion about the dual price in the state-owned enterprises (see section 5.6.2), we know the equilibrium rental rate becomes smaller than without the dual price policy. If this policy was introduced at an early stage of the reform, when the market production capacity was still very small, the market rental rate might possibly become smaller than the disequilibrium rate. This might lead to disequilibrium in the whole economy. Even worse, it might cease the transition process, if the growth of planned segment supported by the forced saving might be faster than that in the market segment. Thus a policy, which is designed to accelerate the transition process, may result in opposite effect. Similar conclusion holds also for the policy of freeing up of the price control. However, when the production capacity in the market segment is so far expanded, that the disequilibrium rate is far smaller than the market rental rate, the price reform can have its intended effect - enforcing the transition process.

From the above example, we can conclude, that in the evaluation of a reform policy, we must always consider the interaction of planned segment and market segment, even if the policy may be only designed for the planned segment. The correct timing plays an important role in achieving the expected effect.

### 3.11 Feasible Transition Path

From the previous discussion we have seen that, whether the transition from plan to market can proceed successfully, depends on the constellation of the planned segment and the market segment, on the one hand, and the policy intervention, on the other. The evolution process driven by the laissez-faire market force may not always lead to a successful transition from plan to market (section 4.5). Besides the production technology and the practice in the planned segment, the ratio of the initial production capacity in the market segment to that in the planned segment is crucial for the transition process. To promote the transition, the policy makers are asked to create a sound initial condition for the transition through political measures. The reform policy aimed at transforming the planned segment into market segment, such as price reform and wage and labour market reform, will not always lead to acceleration of the transition process. Under certain circumstances, it will obstacle the transition process, if these policies were not carried out with an appropriate timing. However, numerous political options exist, which will lead to a successful end of the transition.

Although the evolution path depends on the initial condition and the political intervention and is hence not unique, the development of the economic system will go through several similar stages along each feasible successful transition path.

At the early stage, when the market segment comes into existence, the capital stock of the market segment is rather small. Its production is restricted at first to the consumption sector, the unsatisfied demand for consumer goods provides a ready market for the products. The production of consumer goods is technically less complicated than the production for investment goods, so that the new producers can get an easy start in the consumer sector. Moreover, the production of consumer products is desired by the reform policy makers, who are anxious to improve the supply situation in the consumption market.

Through the appearance of the market segment in the economy, the supply situation will be improved. More of the labour force is employed in the industrial production. The whole economy grows faster and becomes more flexible in production and resource allocation. Owing to the insufficient production capacity in the market segment, not all the deficit in supply of consumer goods can be covered. The unsatisfied consumer demand becomes forced saving. The planned segment is still dominant in the economy. The main features of the CPE in the economy, such as shortage of supply, fixed prices and rigid factor allocation, are only quantitatively reduced. However, the large difference between the demand and the supply due to the insufficient production capacity drives the market price to its highest level. The price advantage of the market segment is at its greatest. Hence, the market segment grows the fastest at this stage. In general the market segment plays a complimentary role in the economy. We call this stage the complimentary stage.

The second stage begins, when the production of the market segment expands into the investment sector. During the first stage a certain production capacity was established in the market segment. It can cover all the supply deficit of the planned segment. Moreover, the enterprises of market segment are also involved in the production of investment goods. The market segment becomes more and more of an independent economic sub-system. While during the first stage the market segment has to rely on the investment products from the planned segment, it can now at least in part cover the demand for investment production through its own production.

During this stage, the growth rate in the market segment is larger than that in the planned segment. The price advantage, the wage advantage and the production advantage support faster growth in the market segment. Of course, with the expansion of the market segment the price advantage will be reduced stepwise. But, the price advantage continues to be significant at this stage. The overall economic situation is much more market-like. The features of CPE exist only within the planned segment and are not significant for the whole economy anymore. In this stage, both the planned segment and the market segment show development. The transition is taking place. We call this stage the development stage.

Facing faster growth in the market segment and shrinking share of the planned segment in the economy, the policy makers are motivated to carry out reform to adjust the planned segment to the new economic situation. We have discussed the various reform policies in the previous sections. All the policies are aimed at accelerating the growth in the planned segment through making it more market-like. These adjustments imply the reduction of planning step by step and even abandoning planning completely. These adjustments can lower the price advantage, the production advantage and the wage advantage of the market segment. However, these advantages will only be completely neutralised, if all the planning decisions in the planned segment will coincide with that in the market segment. This implies, however, that the planned segment would become itself a market segment. The policy making in this stage of the transition concentrates on the adjustment of the planned segment to catch up the advantage of the market segment. We call this stage, the voluntary adjustment stage

Parallel to the transition process, the industrialisation process is going on. The labour movement takes place continuously. With the increasing productivity in agriculture, the wage difference between industry and agriculture is getting smaller. The labour surplus reduces with time. The fourth stage begins, when the labour surplus disappears. In the further development, the real wage in the market segment will rise. As soon as the real wage in the market segment reaches that in the planned segment, the competition from the market segment will really threaten the existence of the planned segment. The planned segment can only survive in the system, if it performs just the same as the market segment. This implies, that the planned segment has to become itself a market segment, otherwise it will not survive in the system. Hence, we call this stage forced adjustment.

## Concluding Remark

Complicated economic phenomena during the transition from plan to market can be classified into intrinsic and extrinsic transition according to the cause of the transition phenomena. The global behaviour of an economy in the transition process depends on, which kind of transition plays the dominant role during the transition process. While the intrinsic transition touched off generally by some reform policies is always accompanied by „shocks“ and thus produces disturbances in the economy, the extrinsic transition driven by the growth of the market activities is a more smooth process. The approach of this classification makes it possible to model the complex transition process with conventional methods of neo-classic theory. The extrinsic transition can be well captured in the framework of a growth theory. The intrinsic transition can be modelled as the impact of the political instrument on the planned economic activities and so on the whole economy. This twofold modelling of the transition process works well, if the extrinsic transition plays the governing role in the transition process.

The transition from plan to market in China characterised by „growing out of plan“ is typically dominated by the extrinsic transition, where the growth, especially the faster growth of the market segment, is the most important driving force of the transition. This particular Chinese way of transition is marked by a decentralised industrialisation process during the reform era.

Before the economic reform, Chinese industrialisation followed the Soviet-type way. In this mode of industrialisation, the central planning controlled the whole economic activities. Because the agriculture should provide „surplus“ for the industrialisation, the price of agricultural product was kept at a very low level. Since consumption should give way for the „productive accumulation“, the wage rate in industry was also controlled at very low level. (Because the price for agricultural product determined the income of farmers, the planning authority was able to control the income of farmers through controlling the price.) Consequently, although the economy had grown at a rather high level, the living standard was rarely improved. The economic reform led by the rural reform has changed significantly the mechanism of the industrialisation. It freed the economic force from the bureaucratic administration. The improved income on the rural area, the existing technological condition, the liberalised economic environment and the established incentive stimulated and enforced a decentralised industrialisation process. A market economic segment emerged during this process. The market segment took advantage of the existing planned segment and could get a faster development than the planned segment. This formed the particular Chinese way of transition.

The faster growth of the market segment can be traced back to three economic reasons rooted in the existing Chinese economic condition and history. 1. The huge reservoir of the labour force in China, i.e. the existing labour surplus, made it possible to use labour at a lower wage rate in the market segment than in the planned segment. Taking advantage of the lower price in planned segment, the market segment can even work with marginal labour productivity lower than minimum consumption level. This advantage in the labour using will prevail, as long as the industrialisation process still goes on and the wage difference between rural area and urban area exists significantly. In this context, the industrialisation process plays a key role during the transition from plan to market. 2. Owing to the price mechanism of the market, producers in the market segment can always sell its product at a higher(or not lower to be precisely) price level than those in the planned segment, in which the price was set by the

planning authority. The price difference was legitimated by the reform policy of „two tiers“-system, that was historically founded by Chinese economic development. The different wages and the different prices lead to that the capital income in the market segment is much higher than that in the planned segment. This leads to, in turn, that the production capacity will grow much faster in the market than in the planned segment. However, the price advantage will disappear, as soon as the price reform in the planned segment is completed. The wage advantage will exist, until the industrialisation process is finished. 3. The flexible allocation of the market is another reason, why the market segment can grow faster. The investors of the market segment can choose activities selectively in the most profitable branches, while the planned segment has to provide some products and services, which are not profitable and hence no investors of the market segment are ready to produce. At this point, we touch the field of market failure and public economy, whose dimension reaches far beyond the scope of this manuscript. However, we know, in this context, that the value of the planned segment can not be judged only by the growth.

The intrinsic transition in China can be viewed as the adjustment process of the planned segment to the continuously changing economic situation, driven by the market force. The price reform could reduce the price disadvantage of the planned segment against the market segment and accelerate the growth in the planned segment. The reform on the labour market would reduce the disadvantage in the labour using in the long run. However, with these reform policies, the planned segment loses his planned economic nature. The disadvantages can only be totally removed, if the planned segment can perform identically as the market segment, which implies that the planned segment would become itself a market segment.

We have concluded that the reform of the financial market is key to the transition process. If the financial market is still administratively controlled and a „favour-planned-segment“ policy is pursued, the transition process will be ended at a certain constant mixture with planned segment on the one side and the market segment on the other. The planned economic activities may dominate in this situation. If the financial market is run somehow competitively, then the market segment will dominate in the long run. The price reform and the reform of the labour market influence only the short run economic situation, and hence are important for contemporary economic policy. They have no significance in the long run.

The impact of the transition on common welfare expressed by consumption is in general positive owing to the overall growth process. However, the average gain in the welfare should be viewed differentially. The owners of the capital stocks profit the most from the transition process through high capital income. The farmer-workers moved from agriculture into industry get more real income owing to the higher wage rate in the industrial sector. The farmers gain more income through rising wage due to rising price of agriculture product. The workers in the state-owned enterprises could not benefit from the transition process. By contrast, they would have to suffer from the loss of real income due to the rising price. In this sense, the transition has a negative redistribution effect for the workers of the state-owned enterprises. But, this loss could be compensated, if the planned wage rate would be set to guarantee a constant level of real income. However, this guarantee is done on the cost of the capital income in the planned segment, which will weaken the growth of the planned segment. Hence, this guarantee can only be founded by a technical progress in the long run.

Therefore, the transition will promise a golden future, only if the technical progress enforced by the transition can outweigh the negative redistribution effect of the transition.



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Appendix 2  
**Summary of the Model**

In summary the whole model consists of 31 variables with 26 independent equations and 5 exogenous variables. The following is a list of the variables:

*List of variables*

1	$P_{2P}$	the planned price for industrial goods	Exogenous
2	$w_P$	the planned wage rate	Exogenous
3	$K_{2P}$	the capital stock in the industrial sector of the planned segment	Exogenous
4	$L_{2P}$	the employed labour in the industrial sector of the planned segment	Endogenous
5	$I_{2P}$	the amount of the produced investment goods	Endogenous
6	$C_{2P}$	the amount of the produced consumer goods	Endogenous
7	$Y_{2P}$	the amount of the industrial products	Endogenous
8	$r_P$	the rental rate in the planned economic segment	Endogenous
9	$NC_P^d$	the demand for consumption from the planned segment	Endogenous
10	$NI_P^d$	the demand for investment from the planned segment	Endogenous
11	$E$	the shortage of supply for consumer goods in planned segment	Endogenous
12	$K_{1M}$	the capital stock in the agricultural sector	Endogenous
13	$K_{2M}$	the capital stock in the industrial sector of the market segment	Endogenous
14	$P_{1M}$	the market price for the agricultural goods	Endogenous
15	$P_{2M}$	the market price for the industrial goods	Endogenous
16	$L_{1M}$	the labour employed in the agricultural sector	Endogenous
17	$L_{2M}$	the labour employed in the industrial sector of the market segment	Endogenous
18	$L_M$	the total labour employed in the market segment	Endogenous
19	$Y_{1M}$	the amount of agricultural goods produced in the market segment	Endogenous
20	$Y_{2M}$	the amount of industrial goods produced in the market segment	Endogenous
21	$r_{1M}$	the rental rate of capital in the agricultural sector	Endogenous
22	$r_{2M}$	the rental rate of capital in the industrial sector	Endogenous
23	$K_M$	the total capital stock in the market segment	Exogenous
24	$w_{2M}$	the market wage rate in the industrial sector	Endogenous
25	$w_{1M}$	the market wage rate in the agricultural sector	Endogenous
26	$I_{2M}$	the produced investment goods in the market segment	Endogenous
27	$C_{2M}$	the produced consumer goods in the market segment	Endogenous
28	$Y_1^d$	the demand for the agricultural products	Endogenous
29	$NC_M^d$	the nominal demand for consumption from the market segment	Endogenous
30	$NI_M^d$	the nominal demand for investment from the market segment	Endogenous
31	$L_G$	total labour force	Exogenous

**Summary of equations:**

1) Equations for the planned segment:

$$Y_{2P} = F^2(K_{iP}, L_{iP}) \quad (1p)$$

$$Y_{2P} = I_{2P} + C_{2P} \quad (2p)$$

$$\frac{\partial F_{2P}}{\partial L_{2P}} = \frac{w_P}{P_{2P}} \quad (3p)$$

$$r_P = \frac{P_{2P}Y_{2P} - w_P L_{2P}}{K_{2P}} \quad (4p)$$

$$NC_P^d = w_P L_P + (1 - s_r)r_P K_P, \quad (5p)$$

$$NI_P^d = s_r r_P K_P. \quad (6p)$$

$$\frac{I_{2P}}{C_{2P}} = \mu \quad (7p)$$

$$E = NC_P^d - P_{2P}C_{2P} \quad (8p)$$

2) Equations for the market segment:

$$Y_{iM} = F^i(K_{iM}, L_{iM}) \quad (1m-2m)$$

$$Y_{2M} = I_{2M} + C_{2M} \quad (3m)$$

$$K_M(t) = K_{1M}(t) + K_{2M}(t) \quad (4m)$$

$$\frac{\partial F_{iM}}{\partial K_{iM}} = \frac{r_{iM}}{P_{iM}} \quad (5m-6m)$$

$$\frac{\partial F_{iM}}{\partial L_{iM}} = \frac{w_{iM}}{P_{iM}} \quad (7m-8m)$$

$$L_M = L_{1M} + L_{2M} \quad (9m)$$

$$L_M + L_{2P} = L_G \quad (10m)$$

$$r_{1M} = r_{2M} = r_M \quad (11m)$$

$$w_{2M} = v_E w_P \quad (12m)$$

$$w_{2M} = \delta_E (\lambda P_{2P} + (1 - \lambda) P_{2M}). \quad (13m)$$

$$Y_{1M}^d = \varepsilon L_G. \quad (14m)$$

$$NC_M^d = w_{1M}L_{1M} + w_{2M}L_{2M} + (1 - s_r)r_M K_M \quad (15m)$$

$$NI_M^d = s_r r_M K_M \quad (16m)$$

$$Y_{1M}^d = Y_{1M} \quad (17m)$$

$$P_{2M}I_{2M} = NI_M^d + NI_P^d - P_{2P}I_{2P} \quad (18m)$$

$$P_{2M}C_{2M} = NC_M^d + NC_P^d - P_{2P}C_{2P} - P_{1M}Y_{1M} \quad (19m)$$

3) Equations for the dynamic properties of the system:

$$K_{2P}(t) = K_{2P}(t-1) + I_P^p(t) - \delta K_{2P}(t-1) \quad (A)$$

$$K_M(t) = K_M(t-1) + I_M^m(t) - \delta K_M(t-1) \quad (B)$$

$I_M^m(t), I_P^p(t)$ : real investment in the market segment and planned segment.

## Proof of Existence and Uniqueness of the Equilibrium and the Dynamic of the System

### A3.1 Restatement of the Model

The model constructed in the section2 consists of two segments. In solving for equilibrium we only have to consider the market segment, because the variables in the planned segment are determined through planning decision and hence can be treated as independently from the market. Owing to the constant returns to scale technology, we can restate the sub-model of the market segment in intensive form. For this purpose, we define the following new variables:

$$f_i = \frac{F^i(K_{iM}, L_{iM})}{K_{iM}} \quad \text{capital productivity of the } i\text{-th sector in the market segment}$$

$$l_i = \frac{L_{iM}}{K_{iM}} \quad \text{the labour intensity of the } i\text{-th sector in the market segment}$$

$$u_i = \frac{K_{iM}}{K_M} \quad \text{the share of the capital in } i\text{-th sector in the market segment}$$

With the newly defined variables, the production function can be restated in terms of labour intensity as follows:

$$F^i(K_{iM}, L_{iL}) = K_{iM} F^i(1, L_{iM}/K_{iM}) = K_{iM} F_{iM}(1, l_i) = K_{iM} f_i(l_i)$$

The differential of the above equation is:

$$F_{L_{iM}}^i = K_{iM} f_i'(l_i) / K_{iM} = f_i'(l_i)$$

For the linear homogenous production function, the Eule-Theorem holds (for convenience we have omitted the subscript):

$$F = F_K' K + F_L' L \quad \text{or} \quad f(l) = F_K + l f'(l)$$

Dividing both sides by  $f$  and using the relation  $f' = F_L$  and  $F_K/f' = F_K/F_L = r/w$ , we get the following relations, respectively, for agricultural production:

$$f_1 / f_1' - l_1 = \frac{r_M}{w_{1M}} \quad (1ma)$$

and for industrial production:

$$f_2 / f_2' - l_2 = \frac{r_M}{w_{2M}}. \quad (2ma)$$

The equation for market balance on the agriculture market (17m) can be written as follows:

$$u_1 f_1 = \varepsilon L_G / K_M = \varepsilon l_G \quad (3ma)$$

$$\text{with } u_1 = \frac{K_{1M}}{K_M} \quad \text{and} \quad l_G = \frac{L_G}{K_M}.$$

$u_1$  is the share of the capital stock used in the agricultural sector.  $u_2$  is the share of the capital stock used in the industrial sector. The shares in both sectors add up to one.

$$u_1 + u_2 = 1. \quad (4ma)$$

Using  $E = -(NI_P^d - P_{2P}I_{2P})$  and  $I_{2M} = \eta_1 Y_{2M} = \eta_1 K_{2M} f_2 = \eta_1 u_2 K_M f_2$ , we can rewrite the market balance for investment product (18m) as follows (here we assume  $s_r = 1$ ):

$$\eta_1 u_2 f_2 P_{2M} = r_M - e \quad (5ma)$$

$$\text{with } \eta_1 = \frac{I_{2M}}{Y_{2M}} \quad \text{and} \quad e = \frac{E}{K_M}$$

$\eta_1$  is the share of the investment products in the whole industrial production.  $\eta_2$  is the share of the consumption products in the whole industrial production. For the shares of production of investment goods and consumption goods, the following equation holds:

$$\eta_1 + \eta_2 = 1 \quad (6ma)$$

From equations (7m) and (8m) we get

$$P_{1M} = \frac{w_{1M}}{f_1'} \quad (7ma)$$

and

$$P_{2M} = \frac{w_{2M}}{f_2'}. \quad (8ma)$$

We can put the full employment condition as follows:

$$l_1 u_1 + l_2 u_2 = l_M = L_M / K_M. \quad (9ma)$$

The minimum-wage condition (13m) can be restated with the new variables:

$$u_2 f_2 (P_{2M} - \frac{w_{2M}}{\delta_E}) = \frac{Y_{2P}}{K_M} (\frac{w_{2M}}{\delta_E} - P_{2P}) \quad (10ma)$$

For the nominal wage we restate just the equation (12m):

$$w_{2M} = v_E w_P \quad (11ma)$$

In this restated system there are 11 independent equations and 11 endogenous variables:  $l_1, l_2, u_1, u_2, \delta_1, \delta_2, P_{1M}, P_{2M}, w_{1M}, w_{2M}$  and  $r_M$ . Obviously, the solution for this restated system is the equilibrium solution of the original system. In next section, we will give an answer to the question, whether there exists a solution for this restated system.

### A3.2 Existence and Uniqueness

The existence of a solution for the system is demonstrated in the following way. First we show, that all the endogenous variables except  $r_M$  and  $w_{2M}$  can be uniquely expressed as functions of the rental wage ratio  $r_M / w_{2M}$  through the equations from (1ma) to (9ma). In the equation (10ma) an equilibrium rental wage ratio can be uniquely determined.

It is easy to show, that in equations (1ma) and (2ma) a monotone relation prevails between  $l_1$  and  $r_M/w_{1M}$ ,  $l_2$  and  $r_M/w_{2M}$ , respectively, if we take derivatives of both sides of the two equations with respect to  $r_M/w_{1M}$  and  $r_M/w_{2M}$  separately:

$$(f_1/f_1' - l_1)' = \left(\frac{f_1'^2 - f_1' f_1}{f_1'^2} - 1\right)l_1' = -\frac{f_1'' f_1}{f_1'^2} l_1' = 1$$

$$(f_2/f_2' - l_2)' = \left(\frac{f_2'^2 - f_2' f_2}{f_2'^2} - 1\right)l_2' = -\frac{f_2'' f_2}{f_2'^2} l_2' = 1$$

$$\text{with } l_1' = \frac{\partial l_1}{\partial \omega_1}, l_2' = \frac{\partial l_2}{\partial \omega_2}, \omega_1 = \frac{r_M}{w_{1M}} \text{ and } \omega_2 = \frac{r_M}{w_{2M}}$$

Therefore, for a given ratio of rental rate to wage rate, the labour intensity will be uniquely determined. Moreover, the prices can also be determined, because they are functions of the labour intensity. From equations (3ma), (5ma) and (1ma), we can put  $u_1$  as a function of  $r_M$ .

$$u_1 = \frac{\mathcal{E}l_G}{f(l_1)} \text{ and } u_2 = \frac{f(l_1) - \mathcal{E}l_G}{f(l_1)}.$$

From equation (4ma) we can determine the  $\eta_1$  as:

$$\eta_1 = \frac{r_M - e}{u_2 f_2 P_2} \quad \text{and} \quad \eta_2 = \frac{u_2 f_2 P_2 - r_M + e}{u_2 f_2 P_2}$$

From the equation of full employment we can get:

$$l_2 + u_1(l_1 - l_2) = l_M$$

We differentiate both sides of the equation and find:

$$l_2' d\omega_2 = \frac{\mathcal{E}l_G}{f_1^2} (f_1(l_1' d\omega_1 - l_2' d\omega_2) - (l_1 - l_2) f_1' l_1' d\omega_1)$$

$$\left(1 - \frac{\mathcal{E}l_G}{f_1}\right) l_2' d\omega_2 + \frac{\mathcal{E}l_G}{f_1^2} (f_1 - (l_1 - l_2) f_1') l_1' d\omega_1 = 0, \quad (12ma)$$

Thus we get a relation between  $\omega_1$  and  $\omega_2$ .

$$\frac{d\omega_1}{d\omega_2} = -\frac{\left(1 - \frac{\mathcal{E}l_G}{f_1}\right) l_2'}{\frac{\mathcal{E}l_G}{f_1^2} (f_1 - (l_1 - l_2) f_1') l_1'} < 0$$

Therefore, we can view  $\omega_1$  as a function of  $\omega_2$ . Because  $\omega_2$  is a function of  $r_M$ ,  $\omega_1$  is also a function of  $r_M$ , noting that  $w_{2M}$  is determined independently from  $r_M$  in (11ma). All the variables  $l_1, l_2, u_1, u_2, \delta_1, \delta_2, P_{1M}, P_{2M}, w_{1M}$  can be uniquely determined, if  $r_M$  is given.

The minimum-wage condition is restated as follows:

$$u_2 f_2 P_{2M} \left(1 - \frac{f_2'(l_2)}{\delta_E}\right) = \frac{Y_{2P}}{K_M} \left(\frac{w_{2M}}{\delta_E} - P_{2P}\right). \quad (10m-b)$$

The right side of (10m-b) is a constant, while the left hand side is a function of  $r_M$ . We denote the left hand side as  $D(r_M)$  and show that the derivative of  $D(r_M)$  is positive.

$$d(D(r_M)) = \left(1 - \frac{f_2'(l_2)}{\delta_E}\right) d(u_2 f_2 P_{2M}) + u_2 f_2 P_{2M} d\left(1 - \frac{f_2'(l_2)}{\delta_E}\right) \quad (13ma)$$

We begin by picking out the first part of the derivation and insert the equation (12ma) into it. Using the relation  $f_2 P_{2M} = w_{2M} l_2 + r_M$ ,  $du_1 = -du_2$  and  $d\omega_2 = w_{2M} dr_M$  we get:

$$\begin{aligned} d(u_2 f_2 P_{2M}) &= (w_{2M} l_2 + r_M) d(u_2) + u_2 d(w_{2M} l_2 + r_M) \\ &= \frac{f_1' f_1 - f_1'(f_1 - \varepsilon l_G)}{f_1^2} (w_{2M} l_2 + r_M) l_1' d\omega_1 + \frac{f_1 - \varepsilon l_G}{f_1} (w_{2M} l_2' + w_{2M}) d\omega_2 \\ &= \frac{f_1' \varepsilon l_G}{f_1^2} (w_{2M} l_2 + r_M) l_1' d\omega_1 - w_{2M} \frac{\varepsilon l_G}{f_1} \left(1 - \frac{f_1'(l_1 - l_2)}{f_1}\right) l_1' d\omega_1 + u_2 w_{2M} d\omega_2 \\ &= \frac{w_{2M} \varepsilon l_G}{f_1} \left( \frac{f_1'(l_2 + \frac{r_M}{w_{2M}})}{f_1} - \frac{f_1 - f_1'(l_1 - l_2)}{f_1} \right) l_1' d\omega_1 + u_2 w_{2M} d\omega_2 \\ &= \frac{w_{2M} \varepsilon l_G}{f_1} 2 \left( \frac{1}{f_1} \left( -f_1 + f_1' \left( l_2 + \frac{r_M}{w_{2M}} + l_1 - l_2 \right) \right) \right) l_1' d\omega_1 + u_2 w_{2M} d\omega_2 \\ &= \frac{w_{2M} \varepsilon l_G}{f_1} 2 \left( \frac{1}{f_1} \left( -f_1 + f_1' \left( \frac{r_M}{w_{2M}} + l_1 \right) \right) \right) l_1' d\omega_1 + u_2 w_{2M} d\omega_2 \\ &= u_2 w_{2M} d\omega_2 \end{aligned}$$

Now we can put this result into the equation (13ma):

$$\begin{aligned} d(D(r_M)) &= \left(1 - \frac{f_2'(l_2)}{\delta_E}\right) (u_2 w_2 d\omega_2) - u_2 f_2 d\omega_2 \frac{f_2''(l_2)}{\delta_E} l_2' d\omega_2 \\ &= \left(1 - \frac{f_2'(l_2)}{\delta_E}\right) (u_2 w_2 d\omega_2) - u_2 f_2 P_{2M} \frac{f_2''(l_2)}{f_2(l_2) \delta_E} d\omega_2 \\ &= \left(1 - \frac{f_2'(l_2)}{\delta_E}\right) (u_2 w_2 d\omega_2) - u_2 w_{2M} \frac{f_2''(l_2)}{\delta_E} d\omega_2 \\ &= u_2 w_2 d\omega_2 \\ &= u_2 dr_M \end{aligned}$$

We get:

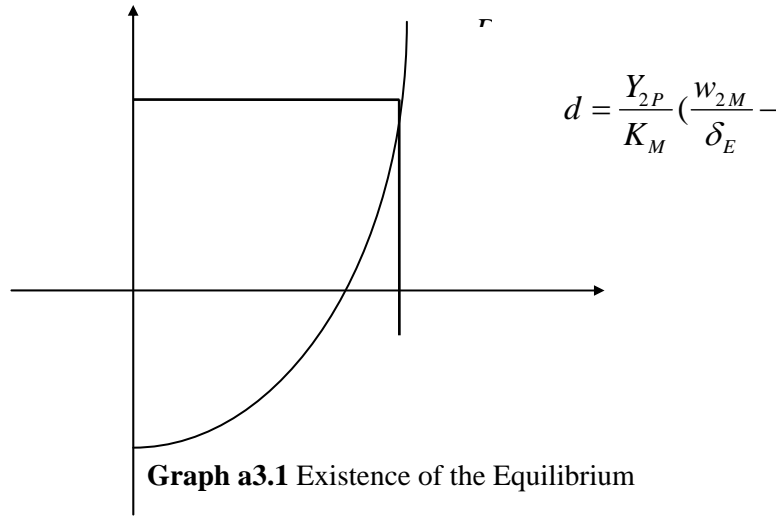
$$D(r_M)' = u_2 > 0$$

and

$$D(r_M)'' = u_2' = -u_1' = -\frac{\varepsilon l_G f_1'(l_1)}{f_1(l_1)^2} l_1' \frac{d\omega_1}{d\omega_2} \frac{d\omega_2}{dr_M} > 0.$$

As the first and second derivatives of  $D(r_M)$  are all positive,  $D(r_M)$  will rise with rising  $r_M$  and  $\lim_{r_M \rightarrow +\infty} D(r_M) = +\infty$ . As  $r_M$  decreases to a certain point, it holds then  $f_2' = \delta_E$ , or  $D(r_M) = 0$ . Because  $D(r_M)$  is a continuous monotone increasing function, there must be a unique positive  $r_M^*$  for which the equation (8ma) holds. That is to say, that there exists a unique equilibrium solution.

We can illustrate the equilibrium solution graphically in **Graph a3.1**.  $D(r_M)$  is a rising function of  $r_M$ . For a given level of  $d = \frac{Y_{2P}}{K_M} (\frac{w_{2M}}{\delta_E} - P_{2P})$ , there is an  $r_M^*$ , so that  $D(r_M^*) = d$ .



**Graph a3.1** Existence of the Equilibrium

### A3.3 Stability of the Equilibrium

To examine the stability of the equilibrium we have to consider the reaction of the system to a disturbance away from equilibrium. We adopt the idea of Walrasian tâtonnement process. We specify the reactions of the prices to excess demand on the agricultural market and the industrial market, respectively.

The excess demand for agricultural products is the difference between the demand and the supply of these products.

$$E_{1M} = \varepsilon L_G - Y_{1M}$$

The total demand for industrial products is the total income minus the expenditure for agricultural products. It can be expressed as follows:

$$\begin{aligned} & w_P L_P + w_{2M} L_{2M} + w_{1M} L_{1M} + r_M K_M + r_P K_P - P_{1M} Y_{1M} \\ &= w_P L_P + w_{2M} L_{2M} + r_P K_P + r_M K_{2M} \\ &= P_{2M} Y_{2M} + P_{2P} Y_{2P} \end{aligned}$$

The real demand for industrial products in the market segment can be written as the residual demand, because the price of the planned segment is lower than that in the market segment. Hence, the real demand must satisfy the following condition:

$$Y_{2M} = \frac{P_{2M} Y_{2M} + P_{2P} Y_{2P}}{\bar{P}_2} - Y_{2P}.$$

Then we find the real demand:

$$Y_{2M}^d = \frac{Y_{2P}(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)}$$

The excess demand can therefore be written as the difference between the real demand and the supply:

$$E_{2M} = Y_{2M}^d - Y_{2M}$$

We rewrite the excess demand in relation to capital stock of the market segment as follows.

$$e_{1M} = \varepsilon l_G - u_1 f_1$$

$$\text{with: } e_{1M} = \frac{E_{1M}}{K_M},$$

and

$$e_{2M} = \frac{k f_P (\bar{P} - P_{2P})}{(P_{2M} - \bar{P}_2)} - u_2 f_2$$

$$\text{with: } e_{2M} = \frac{E_{2M}}{K_M}, k = \frac{K_P}{K_M}, f_P = \frac{Y_P}{K_P}.$$

We assume an instantaneous adjustment process, so that the short run dynamic process can be expressed as:

$$\frac{\partial \mathcal{P}_{1M}}{\partial t} = h_1(e_{1M}) \quad \text{with } h_1(0) = 0 \quad \text{and} \quad h_1' > 0,$$

$$\frac{\partial \mathcal{P}_{2M}}{\partial t} = h_2(e_{2M}) \quad \text{with } h_2(0) = 0 \quad \text{and} \quad h_2' > 0.$$

Without loss of generality, we assume  $h_1'(0) = h_2'(0) = 1$ . In the neighbourhood of an equilibrium the following linear differential equation system holds:

$$\frac{\partial \mathcal{P}_{1M}}{\partial t} = \frac{\hat{\partial} e_{1M}}{\partial \mathcal{P}_{1M}} (P_{1M} - P_{1M}^*) + \frac{\hat{\partial} e_{1M}}{\partial \mathcal{P}_{2M}} (P_{2M} - P_{2M}^*)$$

$$\frac{\partial \mathcal{P}_{2M}}{\partial t} = \frac{\hat{\partial} e_{2M}}{\partial \mathcal{P}_{1M}} (P_{1M} - P_{1M}^*) + \frac{\hat{\partial} e_{2M}}{\partial \mathcal{P}_{2M}} (P_{2M} - P_{2M}^*)$$

The condition for a stable solution of the system is:

$$\frac{\hat{\partial} e_{1M}}{\partial \mathcal{P}_{1M}} + \frac{\hat{\partial} e_{2M}}{\partial \mathcal{P}_{2M}} < 0$$

and

$$\frac{\hat{\partial} e_{1M}}{\partial \mathcal{P}_{1M}} \frac{\hat{\partial} e_{2M}}{\partial \mathcal{P}_{2M}} - \frac{\hat{\partial} e_{1M}}{\partial \mathcal{P}_{2M}} \frac{\hat{\partial} e_{2M}}{\partial \mathcal{P}_{1M}} > 0.$$

To check the stability, we calculate at first the four partial derivatives for the labour intensities. Rewriting equation (1ma) we get:

$$f_1 - f_1'(l_1)l_1 = \frac{r_M}{P_{1M}}.$$

Deriving both sides of the equation above with respect to  $P_{1M}$ , we get:

$$f_1'(l_1) \frac{\partial_1}{\partial P_{1M}} - f_1'(l_1) \frac{\partial_1}{\partial P_{1M}} - l_1 f_1''(l_1) \frac{\partial_1}{\partial P_{1M}} = -\frac{r_M}{P_{1M}^2},$$

or

$$l_{11}' = \frac{\partial_1}{\partial P_{1M}} = \frac{r_M}{l_1 f_1'(l_1) P_{1M}^2} < 0.$$

To calculate the partial derivatives with respect to  $P_{1M}$ , we take  $P_{2M}$  as constant. Considering equation (8ma),  $l_2$  does not change with  $P_{1M}$ . We get:

$$l_{21}' = \frac{\partial_2}{\partial P_{1M}} = 0.$$

From equation (8ma) we get:

$$l_{22}' = \frac{\partial l_2}{\partial P_{2M}} = \frac{-w_{2M}}{f_2''(l_2) P_{2M}^2} > 0.$$

From equation (2ma) we get:

$$f_2'(l_2) \frac{\partial_2}{\partial P_{2M}} - f_2'(l_2) \frac{\partial_2}{\partial P_{2M}} - l_2 f_2''(l_2) \frac{\partial_2}{\partial P_{2M}} = -\frac{r_M' P_{2M} - r_{2M}}{P_{2M}^2},$$

thus:

$$r_M' = -P_{2M}^2 l_2 f_2''(l_2) l_{22}' + P_{2M} r_M > 0.$$

We multiply both sides of (1ma) by  $f_1'(l_1)$  and derive it with respect to  $P_{2M}$ . We get then:

$$l_{12}' = \frac{\partial_1}{\partial P_{2M}} = \frac{r_M'}{l_1 f_1''(l_1) P_{1M}} > 0.$$

Now we calculate the partial derivatives for the stability condition. Because the production function has a decreasing marginal productivity,  $f_1 - f_1'(l_1)(l_1 - l_2)$  are always positive. We get:

$$\begin{aligned} \frac{\partial_{1M}}{\partial P_{1M}} &= -\frac{\partial(u_1 f_1)}{\partial P_{1M}} = -\frac{\partial}{\partial P_{1M}} \left( \frac{l_M - l_2}{l_1 - l_2} f_1(l_1) \right) \\ &= \frac{-1}{(l_1 - l_2)^2} [f_1'(l_1)(l_M - l_2)(l_1 - l_2)l_{11}' - l_{11}'(l_M - l_2)f_1] \\ &= \frac{l_{11}'}{(l_1 - l_2)^2} (l_M - l_2)(f_1 - f_1'(l_1)(l_1 - l_2)) < 0, \end{aligned}$$

We use the relation:  $l_1 > l_m > l_2$ , because the agricultural production is more labour intensive than the industrial production.

$$\begin{aligned} \frac{\partial e_{2M}}{\partial P_{2M}} &= -\frac{kf_P(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)^2} - \frac{\partial(u_2 f_2)}{\partial P_{2M}} = -\frac{kf_P(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)^2} - \frac{\partial}{\partial P_{2M}} \left( \frac{l_1 - l_M}{l_1 - l_2} f_2(l_2) \right) \\ &= -\frac{kf_P(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)^2} - \frac{1}{(l_1 - l_2)^2} [l_{12}' f_2(l_2)(l_M - l_2) + l_{22}'(l_1 - l_M)(f_2(l_2) + f_2'(l_2)(l_1 - l_2))] < 0, \\ \frac{\partial e_{1M}}{\partial P_{2M}} &= -\frac{\partial(u_1 f_1)}{\partial P_{2M}} = -\frac{\partial}{\partial P_{2M}} \left( \frac{l_M - l_2}{l_1 - l_2} f_1(l_1) \right) \\ &= \frac{1}{(l_1 - l_2)^2} [l_{22}' f_1(l_2)(l_1 - l_M) + l_{12}'(l_M - l_2)(f_1(l_1) - f_1'(l_1)(l_1 - l_2))] > 0, \end{aligned}$$

and

$$\begin{aligned} \frac{\partial e_{2M}}{\partial P_{1M}} &= \frac{\partial}{\partial P_{1M}} \left( \frac{kf_P(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)} - u_2 f_2 \right) = -\frac{\partial(u_2 f_2)}{\partial P_{1M}} = \frac{\partial}{\partial P_{1M}} \left( \frac{l_1 - l_M}{l_1 - l_2} f_2(l_2) \right) \\ &= \frac{-l_{11}'}{(l_1 - l_2)^2} (l_M - l_2) f_2(l_2) > 0. \end{aligned}$$

Obviously it holds that:

$$\frac{\partial e_{1M}}{\partial P_{1M}} + \frac{\partial e_{2M}}{\partial P_{2M}} < 0.$$

$$\frac{\partial e_{1M}}{\partial P_{1M}} \frac{\partial e_{2M}}{\partial P_{2M}} - \frac{\partial e_{1M}}{\partial P_{2M}} \frac{\partial e_{2M}}{\partial P_{1M}} = \frac{\partial e_{1M}}{\partial P_{1M}} \left( -\frac{kf_P(\bar{P}_2 - P_{2P})}{(P_{2M} - \bar{P}_2)^2} \right) + \frac{\partial u_1 f_1}{\partial P_{1M}} \frac{\partial u_2 f_2}{\partial P_{2M}} - \frac{\partial u_1 f_1}{\partial P_{2M}} \frac{\partial u_2 f_2}{\partial P_{1M}}$$

We insert the above results into the following expression and get:

$$\begin{aligned} &\frac{\partial u_1 f_1}{\partial P_{1M}} \frac{\partial u_2 f_2}{\partial P_{2M}} - \frac{\partial u_1 f_1}{\partial P_{2M}} \frac{\partial u_2 f_2}{\partial P_{1M}} \\ &= \frac{1}{(l_1 - l_2)^4} [(-l_{11}' l_{22}') (l_1 - l_2)^2 (l_M - l_2) (f_1(l_1) f_2'(l_2) - f_1'(l_1) f_2(l_2) - f_1'(l_1) f_2'(l_2) (l_1 - l_2))] \\ &= \frac{1}{(l_1 - l_2)^2} \left[ (-l_{11}' l_{22}') (l_M - l_2) f_1'(l_1) f_2'(l_2) \left( \frac{f_1}{f_1'} - \frac{f_2}{f_2'} - (l_1 - l_2) \right) \right] \\ &= \frac{1}{(l_1 - l_2)^2} \left[ (-l_{11}' l_{22}') (l_M - l_2) f_1'(l_1) f_2'(l_2) \left( \frac{r_M}{w_{1M}} - \frac{r_M}{w_{2M}} \right) \right]. \end{aligned}$$

Under the assumption, that the wage rate is lower in the agriculture than in the industry, we get:

$$\frac{\partial u_1 f_1}{\partial P_{1M}} \frac{\partial u_2 f_2}{\partial P_{2M}} - \frac{\partial u_1 f_1}{\partial P_{2M}} \frac{\partial u_2 f_2}{\partial P_{1M}} > 0.$$

Therefore the stability condition is satisfied.

## Appendix 4 Tables

**Table 1.1** Agricultural Production

Year	Index of Value Added <sup>45</sup>	Index of Value Added <sup>46</sup>	Population	Per Capita Production
1952	100	100,00	57482	1,00
1953	101,9	101,90	58796	1,00
1954	101,7	103,63	60266	0,99
1955	107,9	111,82	61465	1,05
1956	104,7	117,07	62828	1,07
1957	103,1	120,70	64653	1,07
1958	100,4	121,19	65994	1,06
1959	84,1	101,92	67207	0,87
1960	83,6	85,20	66207	0,74
1961	101,4	86,40	65859	0,75
1962	104,5	90,28	67295	0,77
1963	111,3	100,49	69172	0,84
1964	112,9	113,45	70499	0,93
1965	109,7	124,45	72538	0,99
1966	107,2	133,41	74542	1,03
1967	101,9	135,95	76368	1,02
1968	98,4	133,77	78534	0,98
1969	100,8	134,84	80671	0,96
1970	107,7	145,23	82992	1,01
1971	101,9	147,99	85229	1,00
1972	99,1	146,65	87177	0,97
1973	109,0	159,85	89211	1,03
1974	104,1	166,41	90859	1,05
1975	102,0	169,74	92420	1,06
1976	98,2	166,68	93717	1,02
1977	97,8	163,01	94974	0,99
1978	104,1	169,70	96259	1,01
1979	106,1	180,05	97542	1,06
1980	98,5	177,35	98705	1,03
1981	107,0	189,76	100072	1,09
1982	111,5	211,58	101590	1,20
1983	108,3	229,15	102764	1,28
1984	112,9	258,71	103876	1,43
1985	101,8	263,36	105851	1,43

<sup>45</sup> This Index is calculated based on comparable prices with preceding year=100.

<sup>46</sup> This Index is calculated based on comparable prices the value in 1952 as 100.

1986	103,3	272,05	107507	1,45
1987	104,7	284,84	109300	1,50
1988	102,5	291,96	111026	1,51
1989	103,1	301,01	112704	1,54
1990	107,3	322,99	114333	1,62
1991	102,4	330,74	115823	1,64
1992	104,7	346,28	117171	1,70
1993	104,7	362,56	118517	1,76
1994	104,0	377,06	119850	1,81
1995	105,0	395,91	121121	1,88
1996	105,1	416,10	122389	1,95
1997	103,5	430,67	123626	2,00
1998	103,5	445,74	124761	2,05
1999	102,8	458,22	125786	2,09
2000	102,4	469,22	126743	2,13
2001	102,8	482,36	127627	2,17

Source: Chinese Statistic Year Book 2002 p.53 p.93  
Chinese Statistic Year Book 1995 p.59

**Table 1.3** The Composition of the total social products in rural area

Year	Total (100Mio.)	Agr. (100Mio.)	Ind. (100Mio.)	Constr. (100Mio.)	Transp. (100Mio.)	Trade (100Mio.)
1980	2792,12	1922,6	543,96	179,97	47,14	98,45
1983	4123,78	2750	826,49	320,88	82,63	143,78
1984	5067,55	3214,13	1161,31	370,58	132,55	188,98
1985	6340,04	3619,49	1750,08	510,49	190,42	269,56
1986	7554,23	4013,01	2380,79	591,93	245,4	323,1
1987	9431,61	4675,7	3284,86	723,31	334,47	413,27
1988	12534,69	5865,27	4781,16	895,33	434,44	558,49
1989	14480,17	6534,73	5886,02	919,17	515,5	624,75
1990	16619,21	7662,09	6719,13	978,47	579,62	679,3
1991	19004,09	8057,03	8266,5	1142,32	660,76	777,48
1992	25386,28	9084,71	12717,09	1570,01	906,04	1108,43
Share of each Sectors						
Year	Total	Agr.	Ind.	Constr.	Transp	Trade
1980	100	68,86	19,48	6,45	1,69	3,53
1983	100	66,69	20,04	7,78	2,00	3,49
1984	100	63,43	22,92	7,31	2,62	3,73
1985	100	57,09	27,60	8,05	3,00	4,25
1986	100	53,12	31,52	7,84	3,25	4,28
1987	100	49,57	34,83	7,67	3,55	4,38
1988	100	46,79	38,14	7,14	3,47	4,46
1989	100	45,13	40,65	6,35	3,56	4,31
1990	100	46,10	40,43	5,89	3,49	4,09
1991	100	42,40	43,50	6,01	3,48	4,09
1992	100	35,79	50,09	6,18	3,57	4,37

Source: Chinese Statistic Year Book 1993, p.333

**Table 1.4** Gross output value of industry ( 100 Mio.)

Year	State-owned enterprises	Township- and village enterprises	Ratio
1978	3289	358	0,11
1979	3673	423	0,12
1980	3915	509	0,13
1981	4037	579	0,14
1982	4326	646	0,15
1983	4739	757	0,16
1984	5262	1245	0,24
1985	6302	1827	0,29
1986	6971	2413	0,35
1987	8250	3243	0,39
1988	10351	4529	0,44
1989	12342	5244	0,42
1990	13063	6050	0,46
1991	14954	8780	0,59
1992	17824	13635	0,76
1993	22724	23446	1,03
1994	26200	32336	1,23

Source<sup>47</sup>: Chinese Statistic Year Book 1993 p.396 and p.412  
Chinese Statistic Year Book 1995 p.365 and p.379

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<sup>47</sup> Although it is questionable, whether the sudden changes in the figures of 1984 and 1992 are reliable, there is no doubt that the TVEs are playing an increasingly important role in the economy.

**Table 1.5** Growth rates in state-owned industry and in the agriculture (nominal)

Year	Output of state-owned enterprises (100Mio.)	Output of agriculture (100Mio.)	Growth rate of output in agriculture	Growth rate of output in state-owned enterprises
1978	3289	1379		
1979	3673	1698	0,23	0,12
1980	3915	1923	0,13	0,07
1981	4037	2181	0,13	0,03
1982	4326	2486	0,14	0,07
1983	4739	2750	0,11	0,10
1984	5262	3214	0,17	0,11
1985	6302	3620	0,13	0,20
1986	6971	4013	0,11	0,11
1987	8250	4676	0,17	0,18

Source: Chinese Statistic Year Book 1988 p. 37 and Chinese Statistic Year Book 1993 p. 412.

**Table 1.6** Composition of investment

year	1981	1982	1983	1984	1985	1986	1987
state allocated	269,7	279,2	339,71	421	407,8	440,6	475,5
bank credit	122	176,1	175,5	258,4	510,27	638,3	835,9
self financing	532,8	714,5	848,3	1082	1533,6	1808	2154,
foreign investment	36,36	60,51	66,55	70,66	91,48	132,1	175,3
total	961,0	1230	1430,0	1832,	2543,1	3019,	3640,
<u>Shares of the Investment</u>							
state allocated	0,28	0,23	0,24	0,23	0,16	0,15	0,13
bank credit	0,13	0,14	0,12	0,14	0,20	0,21	0,23
self financing	0,55	0,58	0,59	0,59	0,60	0,60	0,59
foreign invstment	0,04	0,05	0,05	0,04	0,04	0,04	0,05

year	1988	1989	1990	1991	1992	1993	1994
state allocated	410	342	388	373	334	463	529
bank credit	927	716	871	1292	2152	2925	3703
self financing	2901	2356	2329	2879	4025	6218	8001
foreign investment	259	274	278	316	457	907	1768
share of investment							
total	4497	4137	4449	5509	7855	12457	16370
state allocated	0,09	0,08	0,09	0,07	0,04	0,03	0,03
bank credit	0,21	0,17	0,20	0,23	0,27	0,23	0,22
self financing	0,65	0,57	0,52	0,52	0,51	0,49	0,49
foreign investment	0,06	0,07	0,06	0,06	0,06	0,07	0,10

Source: Chinese Statistic Year Book 1988 p.559  
Chinese Statistic Year Book 1993 p.145  
Chinese Statistic Year Book 1995 p.137

**Table 1.6b** Composition of investment

Year	Grouped by Source of Funds				Grouped by Use of Funds		
	State Budgetary Appropriation	Domestic Loan	Foreign Investment	Fundraising and others	Construction and Installation	Purchase of Equipments	Others
1981	269,76	122,00	36,36	532,89	689,83	223,64	47,54
1982	279,26	176,12	60,51	714,51	871,12	291,41	67,87
1983	339,71	175,50	66,55	848,30	993,32	358,31	78,43
1984	421,00	258,47	70,66	1082,74	1217,58	509,23	106,06
1985	407,80	510,27	91,48	1533,64	1655,46	718,08	169,65
1986	455,62	658,46	137,31	1869,19	2059,66	851,95	208,99
1987	496,64	871,98	181,97	2241,11	2475,65	1038,78	277,26
1988	431,96	977,84	275,31	2968,69	3099,66	1305,37	348,77
1989	366,05	762,98	291,08	2990,28	2994,59	1115,81	300,00
1990	393,03	885,45	284,61	2954,41	3008,72	1165,54	342,74
1991	380,43	1314,73	318,89	3580,44	3647,68	1460,19	486,63
1992	347,46	2214,03	468,66	5049,95	5163,37	2125,14	791,58
1993	483,67	3071,99	954,28	8562,36	8201,21	3315,92	1555,18
1994	529,57	3997,64	1768,95	11530,96	10786,52	4328,26	1928,08
1995	621,05	4198,73	2295,89	13409,19	13173,33	4262,46	2583,48
1996	(629,72)	(4576,53)	(2747,41)	(15465,35)	(15153,41)	(4940,79)	(2879,83)
	625,88	4573,69	2746,60	15412,40	15109,29	4925,98	2878,28
1997	696,74	4782,55	2683,89	17096,49	15614,03	6044,84	3282,25
1998	1197,39	5542,89	2617,03	19359,61	17874,53	6528,53	4003,10
1999	1852,14	5725,93	2006,78	20169,80	18795,93	7053,04	4005,74
2000	2109,45	6727,27	1696,24	22577,14	20536,26	7785,62	4595,85
2001	2546,42	7239,79	1730,73	26470,04	22954,88	8833,79	5424,83
<b>Percentage</b>							
1981	28,1	12,7	3,8	55,4	71,8	23,3	4,9
1982	22,7	14,3	4,9	58,1	70,8	23,7	5,5
1983	23,8	12,3	4,7	59,2	69,5	25,1	5,4
1984	23,0	14,1	3,9	59,0	66,4	27,8	5,8
1985	16,0	20,1	3,6	60,3	65,1	28,2	6,7
1986	14,6	21,1	4,4	59,9	66,0	27,3	6,7
1987	13,1	23,0	4,8	59,1	65,3	27,4	7,3
1988	9,3	21,0	5,9	63,8	65,2	27,5	7,3

1989	8,3	17,3	6,6	67,8	67,9	25,3	6,8
1990	8,7	19,6	6,3	65,4	66,6	25,8	7,6
1991	6,8	23,5	5,7	64,0	65,2	26,1	8,7
1992	4,3	27,4	5,8	62,5	63,9	26,3	9,8
1993	3,7	23,5	7,3	65,5	62,7	25,4	11,9
1994	3,0	22,4	9,9	64,7	63,3	25,4	11,3
1995	3,0	20,5	11,2	65,3	65,8	21,3	12,9
1996	2,7	19,6	11,8	66,0	66,0	21,5	12,5
1997	2,8	18,9	10,6	67,7	62,6	24,2	13,2
1998	4,2	19,3	9,1	67,4	62,9	23,0	14,1
1999	6,2	19,2	6,7	67,8	63,0	23,6	13,4
2000	6,4	20,3	5,1	68,2	62,4	23,7	13,9
2001	6,7	19,1	4,6	69,6	61,7	23,7	14,6

Source Chinese Statistic Year Book 2002 p.

**Table 1.7** Cost and profit of the state-owned enterprises

Year	Profit+tax (100Mio.)	Costs (100Mio.)	Growth rate of profit+tax	Growth rate of costs
1978	790,7	2208,39		
1979	846,4	2474,96	0,07	0,12
1980	907,1	2681,11	0,07	0,08
1981	923,3	2771,02	0,02	0,03
1982	972,2	3020,61	0,05	0,09
1983	1032,8	3301,54	0,06	0,09
1984	1152,8	3717,48	0,12	0,13
1985	1334,1	4585,06	0,16	0,23
1986	1341,4	5242,43	0,01	0,14
1987	1514,1	6246,95	0,13	0,19
1988	1774,9	7893,28	0,17	0,26
1989	1773,14	9682,25	0,00	0,23
1990	1503,14	10430,8	-0,15	0,08
1991	1661,15	11887,9	0,11	0,14
1992	1944,12	14804,29	0,17	0,25
1993	2454,70	17278,22	0,26	0,16
1994	2876,25	17601,06	0,17	0,018

Source: Chinese Statistic Year Book 1993 p.430  
Chinese Statistic Year Book 1994 p.399  
Chinese Statistic Year Book 1995 p.402

**Table 3.1** Index of real wage and the annual growth rate of national income

Year	Growth rate of national income (%)	Index of average real wage
1952	14(1953)	100
1957	4.5	127.9
1962	-6.5	92.1
1965	17	110.1
1970	23	105.6
1975	8.3	107.9
1980	6.4	124.7
1981	4.9	123.4
1982	8.3	124.9
1983	9.8	126.7
1984	13.5	145.6

Source: Chinese Statistic Year Book 1988 p.52 and p.190.

**Table 3.2.** Planned price index for agricultural products

Year	Planned price index
1952	121,6
1957	146,2
1962	200,1
1965	187,9
1970	195,1
1975	208,7
1978	217,4
1980	284,4
1985	362,9
1990	595,8
1991	583,9
1992	603,8
1993	684,7
1994	844,9

Source: Chinese Statistic Year Book 1993 p.238  
Chinese Statistic Year Book 1995 p.233