

Essays on Economic Growth and China's Urbanization

A thesis submitted to The University of Manchester for the Degree of

Doctor of Philosophy

in the Faculty of Humanities

2015

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Abstract

This thesis studies the impact of labor markets on economic growth in both developed and developing countries and China's urbanization, by formalizing dual labor market characteristics and China's Hukou system in two theoretical models.

The first is a unified growth model in an open economy environment that captures dual labor market characteristics. The mechanism involves economic growth driven by capital accumulation in the country with Lewisian labor market leading to increasing labor participation at a near constant wage. The model shows that surplus labor plays a critical role in explaining different economic growth paths and structural changes in developing and developed countries, such as China and the US.

The second is a dynamic general equilibrium model with endogenous rural-urban migration to analyze the provision of rural and urban government services in China, with special emphasis on the role of the household registration (Hukou) system in shaping its urbanization process. It argues that China's urban bias policy, which is enabled by the Hukou system restricting rural-urban migration, did not necessarily reduce economic efficiency, rather it might have only raised urban welfare at the expense of rural residents. As the Hukou system also ties people to particular geographical locations, our model argues that China's continuous bias towards coastal and big cities has started to cause economic inefficiency as well as inequality. It suggests that progressive Hukou reform reducing barriers to cross-region migration would improve economic efficiency and welfare.

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Acknowledgments

I would like to express my great appreciation to my supervisor Dr. Xiaobing Wang for his guidance and insightful suggestions in shaping the overall theme of my research. He has given me a lot of generous support and encouragement during my research. I thank my second supervisor Professor Anne Villamil for her helpful comments and suggestions on the early draft of this thesis.

The Department of Economics at Manchester has provided a happy and stimulating environment for the completion of the thesis. I would like to thank the leaders of the PhD programme, Professor Paul Madden, Professor Horst Zank, Dr. Kyriakos Neanidis and Dr. Alejandro Saporiti for their support and professional facilitation throughout my PhD study. I would like to thank Professor Keith Blackburn for evaluating my PhD progression and support. In addition, many staffs and fellow students at the department have helped me in various ways throughout the programme.

I would also like to acknowledge the financial support provided by the North West Doctoral Training Centre and the University of Manchester in the form of scholarship awards of ESRC and ORSA allowing me to pursue the doctoral programme in Economics at the University of Manchester.

Last but not least, a very special thanks to my parents, whose trust and encouragement have enabled me to do my work.

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Chapter 1

Introduction

There are a number of studies addressing economic growth in both developed and developing countries each looking at a different aspect, from work examining the role of capital (Antony, 2009), work looking at the question about the efficiency of human capital (Hanushek and Kimko, 2000; Lucas, 2015), work discussing the impact of innovation and technology diffusion (Kumar and Russell, 2002; Benhabib *et al.*, 2014) and work on the effect of governance, institutions and public policies (Acemoglu *et al.*, 2005; Beck and Laeven, 2006). However, the differences in labor markets between developed and developing countries like the US and China have been largely neglected. Unlike most developed countries with a neoclassical labor market, many developing countries have a large number of under-utilized laborers in the agricultural sector. For example, there were around 170 million surplus laborers in China's agricultural sector in 2007. Countries having surplus labor can enjoy growth superior to other countries in terms of lower labor costs for the period before their surplus labor is exhausted.

Along with its significant economic growth, China has also undergone an enormous increase in urbanization over the past 35 years. The number of people living in urban areas has grown from less than 18 percent of total population in 1978 to 54 percent in 2013. That is, about 560 million more people are now living in urban areas in China. Although the level of urbanization is still below that of many developed countries which have more than 80 percent

urban population, the scale and the speed of Chinese urbanization are astonishing. China's urbanization process encompasses diverse regional economies that range from extreme poverty to relative prosperity. More precisely, rural peasants still struggle on the margins of subsistence while, with an urban bias, urban households enjoy various benefits including state-subsidized food and housing and, for many, access to permanent jobs. In China, the divide exists not only between rural and urban sectors but also between big cities and smaller ones and between Eastern coastal cities, such as Beijing, Shanghai and Guangzhou, and Western inland cities, such as Wuhan, Xi'an and Guilin. There has been a wide range of literature on China's urbanization, Chen and Song (2014) find that China's urbanization accounts for 80.4% of the total urban population growth. Chan (2010) shows the administrative and economic structures and policy play the fundamentals of China's urbanization in the last two decades. Pannell (2002) analyzes several driving factors behind China's rapid urbanization such as foreign trade and foreign investment, especially in coastal areas; restructuring of state-owned enterprises and growth of private enterprises and activities; migration of rural people, as regulations on rural and urban household registration change. However, there is a lack of theoretical understanding of China's urban bias policies and the urbanization process, given the division between sectors and between cities and given that China has so much surplus labor and China's migration is strictly controlled by the government with its unique household registration (Hukou) system.

This thesis contributes to the existing literature on economic growth and China's urban bias. In Chapter 2, we capture dual labor market characteristics into a unified growth model in an open economy environment. The mechanism involves economic growth driven by capital accumulation in the country with Lewisian labor market leading to increasing labor participation at a near constant wage. The model shows that surplus labor plays a critical role in explaining different economic growth paths and structural changes in developing countries such as China and developed countries like the US.

In Chapter 3, we develop a dynamic general equilibrium model with endogenous rural-urban migration to analyze the provision of rural and urban government services in China, with special emphasis on the role of the household registration (Hukou) system in shaping its urbanization process. It argues that China's urban bias policy, which is enabled by the Hukou system restricting rural-urban migration, did not necessarily reduce economic efficiency, rather it might have only raised urban welfare at the expense of rural residents. As the Hukou system also ties people to particular geographical locations, this chapter argues that China's continuous bias towards coastal and big cities has started to cause economic inefficiency as well as inequality. It suggests that progressive Hukou reform reducing barriers to cross-region migration would improve economic efficiency and welfare.

1.1 Economic Growth with and without Dual Labor Markets

Countries vary significantly not only in their wage levels but also in labor endowments and labor market structures. Existing growth theories consider capital, labor and technology, but do not fully consider an economy's labor-market structure. While the labor market tends to be relatively competitive in many developed countries, there is severe labor-market segmentation and a large number of surplus laborers in many developing countries.

Lewis proposed a dual economy framework characterized by the separation of the modern industrial sector from the traditional agricultural sector. Labor in the traditional agricultural sector is plentiful, frequently having low or even zero marginal product while, in the modern industrial sector, labor has a positive marginal product. The modern industrial sector's wage is determined by the marginal product but in the traditional agricultural sector, people's income level is determined by their average product which is at subsistence level. The population in the traditional sector is sufficiently large to provide an unlimited supply of labor capable of moving

to the modern sector at a subsistence wage in a given period without lowering agricultural output. This unlimited supply of labor from the traditional sector keeps the wage rate in the modern sector low, ensures that capital accumulation in the modern sector is sustained over time and thus leads to economic transformation.

The characteristics of traditional agricultural economy are different from those of modern commercialized agriculture. Many laborers in poor countries are under-utilized in the agricultural sector and willing to work in the industrial sector but there is only a limited number of jobs available to them. It is impossible for the industrial sector to absorb these surplus laborers by lowering the wage as this is set at subsistence level. As a result, many laborers capable of work are effectively stuck in the agricultural sector with low or zero marginal product, unable to participate in meaningful production.

In a dual economy with a small industrial sector and a large agricultural sector, the traditional agricultural sector consists mainly of family units engaged in agricultural production, where all family members share the work and the subsequent output, either as wages or profits. Thus, no family member is technically unemployed, each earns the average product of labor in the agricultural sector.

In Chapter 2 we compare the outcomes of economies with and without Lewis-style labor markets. In particular, this chapter provides microfoundations to the Lewis dual economy model and combines dual labor market characteristics into a growth model in an open economy environment. As our model considers the existence of surplus labor in developing countries, it is able to derive different growth paths and structural changes in developed and developing countries. In addition, our model demonstrates the effects of surplus labor on economic growth and economic welfare in developed and developing countries, such as the US and China.

1.2 Urbanization in China

In China, rural-urban migration is strictly controlled by the government through the household registration (Hukou) system. Given the scale and speed of its urbanization process, many questions need to be answered regarding China's urban bias policies and their implications for efficiency and welfare in the urbanization process.

Urban bias is very evident in China as it explicitly controls population movement. Consequently, its rural-urban income gap is now among the biggest in the world. It is not only income that is affected: the rural-urban divide is multi-dimensional in areas such as consumption, education, health care and access to public goods. Measured by most of these dimensions, China's rural-urban divide and inequality have risen between regions and over time.

China's urbanization process has been subject to very heavy distortionary government policies. China's unique household registration (Hukou) system works as a *de-facto* internal passport and visa mechanism, ties people to particular geographical locations and assigns an urban or rural Hukou status to every individual. When this system is strictly enforced, no unauthorized labor movement across regions or from rural areas to urban areas is legal. This means that rural-urban and cross-region migration have been less. The Hukou system created invisible walls and administrative barriers that divided China into two: those with urban Hukou who have access to certain government subsidies and those with rural Hukou who are guaranteed land-use rights and access to subsistence.

There is a wide range of literature on urbanization, from work examining why economic activity is so geographically concentrated, work looking at the question about the efficiency of rural to urban migration, work discussing the way cities interact with each other and work on the effect of governance, institutions and public policies on urbanization. In spite of this, there is a lack of theoretical understanding of China's urban bias policies and the urbanization

process.

Chapter 3 provides an integrated analytical framework for a comprehensive account of the economic and welfare implications of China's urban bias policy and its household registration system. This chapter formalizes China's urban bias under the Hukou system, and observes the impact on efficiency and the welfare implications of government fiscal policy. It extends to formalize China's mega-city bias and shows that this type of bias does not improve efficiency but creates inefficient labor-market segmentation and increase inequality. Furthermore, our model demonstrates the effects of these two types of bias on economic growth and welfare.

This thesis is organized as follows. Chapter 2 demonstrates economic growth with dual labor markets in an open economy; Chapter 3 shows China's efficient urban bias with the Hukou system; Chapter 4 concludes with some policy implications and suggestions for further research.

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Chapter 2

Growth with Dual Labor Markets in an Open Economy

2.1 Introduction

This chapter develops a simple formal model in which the dual labor market characteristic is taken into consideration. Unlike most developed countries with a neoclassical labor market, many developing countries have a large number of under-utilized laborers in the agricultural sector, where industrial development does not drive up wage level. (Lewis, 1954). Thus countries having surplus labor can continuously enjoy trade advantages over other countries in terms of lower labor costs for the period before their surplus labor is exhausted.

It has long been argued that the concepts of surplus labor and dual economies are crucial to understanding economic development (Lewis, 1954; Fei and Ranis, 1964), and dual economy models have become deeply embedded in contemporary thinking about development and growth (Gollin, 2014). However, although the general framework of the Lewis dual economy model is insightful, its lack of formal micro-foundations has been a barrier to the further development of the model and has prevented its being used rigorously in empirical research. It is only recently that some attempts have been made to formally incorporate dual economy features into models of development (Banerjee and Duflo, 2005; Temple, 2005; Vollrath, 2011; Wang and Piesse, 2013), growth (Temple and Wößmann, 2006; Vollrath, 2009), and trade (Barbier

and Rauscher, 2007).

There has been a large number of studies trying to address economic growth issues each looking at different aspects, but the differences in labor markets between developed and developing countries have been largely neglected. Furthermore, conventional growth models tend to focus on one country's growth experience in autarky, there is increasing need to study the dynamics in an open economy setting.

This chapter develops a unified endogenous growth model in an open economy environment that captures dual labor market characteristics, which enables us to compare different growth paths in developed and developing countries with different labor market structures, such as the US and China. In the development process initialized by capital accumulation, an expansion in the industrial sector allows surplus laborers in the agricultural sector to enter this sector, the impact on wages in this process is quite different from the situation when laborers change sectors in a competitive labor market. When the economy opens to trade, an increase in the foreign demand for industrial goods will cause the industrial sector to expand and induce economic growth.

This chapter contributes to the literature as follows. Firstly, this chapter provides micro-foundations to the Lewis dual economy model and combines dual labor market characteristics into a growth model in an open economy environment. Secondly, as our model considers the existence of surplus labor in developing countries, it is able to derive different growth paths and structural changes in developed and developing countries. Finally, the model demonstrates the effects of surplus labor on economic growth and economic welfare in both developed and developing countries.

This chapter is organized as follows. Section 2.2 introduces the concept of surplus labor and discusses the structural differences in labor markets between developed and developing countries; section 2.3 develops a unified growth model in an open economy environment, and

formalizes the concept of surplus labor; section 2.4 discusses economic growth under two different labor market structures, and demonstrates the effects of surplus labor on economic growth; section 2.5 concludes.

2.2 The Labor Market Structure in Developing Countries

Countries vary significantly not only in their wage levels but also in labor endowments and labor market structures. Existing growth theories consider capital, labor and technology, but do not fully consider an economy's labor market structure. While the labor market tends to be relatively competitive in many developed countries, there is severe labor market segmentation and a large number of surplus laborers in many developing countries.

Lewis (1954) proposed a dual economy framework characterized by the separation of the modern industrial sector from the traditional agricultural sector. Labor in the traditional agricultural sector is plentiful, frequently having low or even zero marginal product, while in the modern industrial sector labor has a positive marginal product. The modern industrial sector's wage is determined by their marginal product but in the traditional agricultural sector, people's income level is determined by their average product which is at the subsistence level. The population in the traditional sector is sufficiently large to provide an unlimited supply of labor capable of moving to the modern sector at a subsistence wage in a given period without lowering agricultural output. This unlimited supply of labor from the traditional sector keeps the wage rate in the modern sector low, ensures that capital accumulation in the modern sector is sustained over time and thus leads to economic transformation.

The characteristics of the traditional agricultural economy are different from those of the modern commercialized agriculture. Many laborers in poor countries are under-utilized in the agricultural sector and willing to work in the industrial sector but there is only a limited

number of jobs available to them. It is impossible for the industrial sector to absorb these surplus laborers by lowering the wage as this is set at subsistence level. As a result, many laborers capable of work are effectively stuck in the agricultural sector with low or zero marginal product, unable to participate in meaningful production.

In a dual economy with a small industrial sector and a large agricultural sector, the traditional agricultural sector mainly consists of family units engaged in agricultural production, where all family members share the work and the subsequent output, either as wages or profits. Thus, no family member is technically unemployed, each earns the average product of labor in the agricultural sector, as noted by Lewis (1954), Fei and Ranis (1964, 1997), Sen (1966) and Fields (2004).

Because of diminishing returns to labor, when land is fixed, the long run population level adjusts as a function of available food. This pushes the wage, which equals the average product of labor, to subsistence level. In other words, in the equilibrium, the subsistence wage in the agricultural sector equals the subsistence level of output per head. (Lewis, 1954; Wang and Piesse, 2013).

Surplus labor can exist in one country even when it engages in trade with another country under the following scenarios: 1). the elasticity of technical substitution between production factors is greater than one but has an upper limit;¹ 2). when the ratio of capital to labor endowment is over a certain level, the wage will be driven down to a value that equals subsistence level; 3). the total population is larger than the critical number where the population is supported by the agricultural sector based on the average product of labor². When capital can not be technically substituted by labor and when the amount of surplus labor is constant or

¹For example, when there is a large amount of surplus labor relative to capital, it is impossible for labor to substitute capital in production because of the technical limit.

²The average product of labor defines the total number of population that can be supported by the agricultural sector, i.e., there is enough food for everyone.

increasing, the wage will not increase, and the industrial sector will have an unlimited supply of labor from the agricultural sector at a constant wage level.

Figure 2.2.1: Employment and Wage Determination in Developing Countries

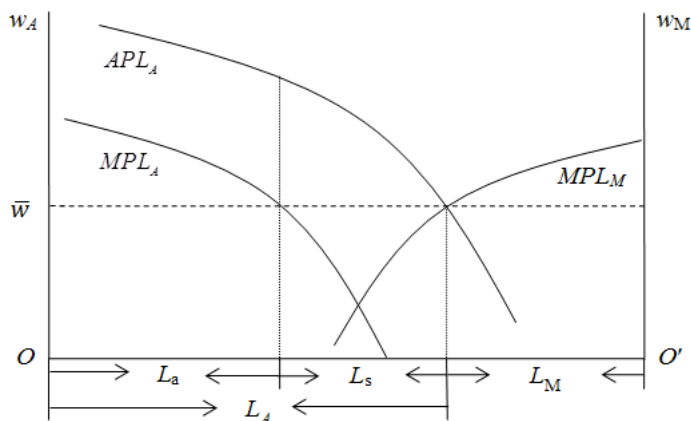


Figure 1 may help to clarify these issues as it illustrates the determination of employment and wage in a Lewisian labor market. The horizontal axis, OO' , shows the total amount of labor force in the economy, which can be assumed to be fixed when there is no population or labor force growth. The agricultural sector's labor is measured rightwards from the origin O . The MPL_A and APL_A curves are the marginal and average product of labor in the agricultural sector respectively. Industrial employment is measured leftwards from O' . The MPL_M curve is the marginal product of labor in the industrial sector.

The intersection point between the APL_A and the MPL_M determines the wage, \bar{w} , which is at subsistence level. This intersection point divides total labor force into the two sectors as industrial laborers, L_M , and agricultural laborers, L_A . On the other hand, the intersection point of \bar{w} , and the MPL_A determines the total amount of effective labor in the agricultural sector, L_a . Because their marginal product is higher than the subsistence wage level, and they make contributions to agricultural production, those people are referred to as agricultural effective

labor. The distance between these two equilibria determines the total number of surplus laborers in the agricultural sector, L_s .³ The agricultural sector absorbs all surplus labor, otherwise, they would not have been able to survive. As a result, everybody in the agricultural sector is paid the average product, which equals the subsistence wage level. Therefore, the total number of agricultural laborers is the sum of effective laborers and surplus laborers, that is $L_A = L_a + L_s$.⁴

In essence, surplus labor is defined as laborers whose marginal product is less than the actual wage received. By definition, surplus laborers would not have been able to survive if they were paid only their marginal product, which is less than subsistence level. While the neoclassical wage determination principle that the wage equals the marginal product of labor is true for competitive markets, it is not necessarily the case for the traditional agricultural sector.

Labor markets evolve in three stages: in the first stage the agricultural sector has absolute surplus labor whose marginal product is zero; in the second stage their marginal product is positive but lower than what they are paid; in the third, and neoclassical, stage all labor is paid according to their marginal product (Fei and Ranis, 1964, 1997; Wang and Piesse, 2013). In this chapter, we assume that the labor market in the developed home country has already reached a neoclassical stage while the developing foreign country still has a large pool of surplus labor in the agricultural sector.

In many developing countries, in terms of employment, there is a small industrial sector

³For simplicity, we do not distinguish two types of surplus labor, those whose marginal product equals zero and those bigger than zero but lower than their income. See Wang and Piesse (2013) for a detailed discussion of the wage determination mechanisms and the two types of surplus labor in dual economy models. Those surplus laborers with $0 < MPL < \bar{w}$ actually have contribution to production but it is very small. So, in order to simplify calculations, we only take the type of surplus labor with $MPL = 0$ into consideration in the following model.

⁴This figure is an illustration of statics of surplus labor in the two sectors, and is unable to show the dynamics of labor movement. i.e., it is inappropriate to show industrial employment expansion just by moving the MPL_M towards the left, as in this figure, a movement of L_s towards the industrial sector would mean a higher APL_A .

and a big agricultural sector with a large number of surplus laborers. The wage in the agricultural sector is low but laborers can not move to the industrial sector for a higher wage rate because of its low absorptive capacity. It is only when the industrial sector expands that it can absorb surplus laborers from the agricultural sector. The industrial sector's expansion will cause the number of employed workers in the economy to increase but will not cause the wage in the industrial sector to rise. This means that economic growth has translated into widening labor participation but not into increasing the wage level. With the existence of surplus labor, the labor supply is unlimited at a fixed subsistence wage level, no matter how much the labor demand increases. That is, the labor supply curve is horizontal until surplus labor is exhausted.

2.3 The Model

In an open economy, there are two countries, home and foreign (*), where the home country is developed and the foreign country is a developing one. We assume everything is the same in both countries except their factor endowments and labor market structures. More precisely, we assume that the home country has a larger capital endowment but the foreign country has a larger labor endowment: $K > K^*$, $L < L^*$. The labor market in the home country has already entered a neoclassical stage while the foreign country has a Lewisian labor market.

There are two sectors in both countries: an agricultural sector and a manufacturing sector. The agricultural sector produces a homogenous agricultural good, which is taken as the numeraire with unit price.⁵ The manufacturing sector produces a wide range of variety of differentiated goods that are close substitutes for each other, and all varieties are symmetric.⁶

⁵Our model works whether the agricultural good is internationally traded or not.

⁶“Variety” in this chapter can be understood as output or consumption. In our model, as in most of the New Trade Theory literature (for example, Krugman, 1979, 1980), the economy has n number of firms, where one firm only produces one variety. It is assumed that the quantity of each variety is a constant and equals across all firms in both countries. The aggregate output is the quantity of each variety times the total number of varieties (i.e., the total number of firms). In this framework, output increase can then be modeled as an

The price of manufactured goods is measured in terms of the numeraire. In the foreign country, its large amount of surplus labor exists in the agricultural sector.

There are three factor inputs, labor L , land N and capital K . The agricultural sector uses labor and land, and the manufacturing sector uses labor and capital to produce. The total amounts of labor and land are assumed to be exogenously given and fixed, but capital can be accumulated. There is free labor mobility between sectors but not across countries, and there is no capital mobility across countries⁷. We also assume there are no trade costs.

In this section, we focus on the discussion of the home country, with the understanding that analogous equations hold for the foreign country.

2.3.1 Preferences

The set-up of the basic model takes elements from Dixit and Stiglitz (1977), Krugman (1979, 1980), Markusen and Venables (2000) and Barbier and Rauscher (2007). Households are homogenous within a country, and generate utility from the consumption of the agricultural good and manufactured goods. The utility function $U(A, V)$ represents preferences for A and V , where A is an individual's consumption of the agricultural good and V is the sub-utility function of manufactured goods' consumption. We assume the agricultural product is a good satisfying basic needs (food) and has low income elasticity, and manufactured goods satisfy non-basic needs and have higher income elasticity. When income increases, the major share of additional expenditure is on manufactured goods.⁸ For simplicity, we assume each individual's consumption of the agricultural good, A , is fixed. Therefore, the utility function can be written as the

increase in the number of varieties. On the consumer side, as the utility function exhibits agents' love of variety, an increase in variety will mean an increase in utility.

⁷We take this assumption only for simplicity. It can be relaxed but that would require more complex conditions on production function.

⁸Low income elasticity for agricultural goods and high income elasticity for manufactured goods is well documented in the literature. This, Engel's law, has been nicely modeled by Kansamont, Rebelo and Xie (2001).

following, where the consumption of the agricultural good is of the CRRA (constant relative risk aversion) form:

$$U(A, V) = \frac{A^{1-\delta} - 1}{1-\delta} + V, \quad \delta > 0 \quad (2.3.1)$$

When $\delta = 1$, the first component of the utility function becomes $\ln A$.

Let manufactured goods be modeled as a continuum of varieties, the sub-utility function is of the Dixit-Stiglitz type:

$$V[c(i), m(j)] = \left[\int_0^n c(i)^\theta di + \int_0^{n^*} m(j)^\theta dj \right]^{\frac{1}{\theta}}, \quad 0 < \theta < 1 \quad (2.3.2)$$

where $c(i)$ denotes the home country's consumption of domestically produced variety i , $m(j)$ denotes the home country's consumption of imported foreign produced variety j . n and n^* are the total numbers of varieties produced in the home and the foreign country respectively. θ is the consumer's willingness to substitute between domestically and foreign produced varieties, and the elasticity of substitution equals $\frac{1}{1-\theta}$.

The budget constraint of a domestic representative household is:

$$e = A + \int_0^n p(i) c(i)^\theta di + \int_0^{n^*} p^*(j) m(j)^\theta dj \quad (2.3.3)$$

where $p(i)$ and $p^*(j)$ are the prices of domestically produced variety i and foreign produced variety j , and e is the consumption income per capita⁹.

When we maximize the utility function (2.3.1) with respect to A , $c(i)$ and $m(j)$ subject to the budget constraint (2.3.3), we get demand functions for domestically produced variety i

⁹It should be noted that e is consumption income per capita, not income per capita. In later discussion, we will allow capital to be accumulated by σ savings rate, thus only $1 - \sigma$ of manufacturing output can be consumed.

and for imported foreign produced variety j conditional on A as follows:

$$c(i) = \frac{e - A}{P^{\frac{\theta}{\theta-1}}} p(i)^{\frac{1}{\theta-1}} \quad (2.3.4)$$

$$m(j) = \frac{e - A}{P^{\frac{\theta}{\theta-1}}} p^*(j)^{\frac{1}{\theta-1}} \quad (2.3.5)$$

where P is a CES price index with the following form:

$$P = \left[\int_0^n p(i)^{\frac{\theta}{\theta-1}} di + \int_0^{n^*} p^*(j)^{\frac{\theta}{\theta-1}} dj \right]^{\frac{\theta-1}{\theta}} \quad (2.3.6)$$

Because both countries have the same production technology and cost structures, they have the same price index.

Each consumer's choice between A and V is governed by the following standard condition that the marginal rate of substitution equals the relative price:

$$\frac{U_V}{U_A} = P \quad (2.3.7)$$

where U_V and U_A denote the partial derivatives of the utilities from the consumption of manufactured goods and the agricultural good.

Note that the total demand for a domestically produced variety i , $x(i)$, is composed of the domestic consumption, $c(i)$, and the foreign consumption, $m^*(i)$. That is,

$$x(i) = c(i) + m^*(i) = \frac{e - A + e^* - A^*}{P^{\frac{\theta}{\theta-1}}} p(i)^{\frac{1}{\theta-1}} \quad (2.3.8)$$

The income levels, the demands for the agricultural product and the price index in both countries are taken as given by an individual producer, who is infinitely small compared to the

size of the market. Thus, it follows that the inverse demand function can be expressed as the following:

$$p(i) = \mu x(i)^{\theta-1} \quad (2.3.9)$$

where μ is a constant parameter.

Since all varieties are assumed to be produced with the same technology, the index i can be dropped and the inverse market demand function for a representative variety becomes:

$$p = \mu x^{\theta-1} \quad (2.3.10)$$

2.3.2 The Manufacturing Sector

We assume all firms in the manufacturing sector operate under monopolistic competition. There are increasing returns to scale at the firm level and each firm produces only one variety. Each firm differentiates its variety from all other varieties offered by other firms. The production function for a representative firm in the manufacturing sector is as follows:

$$x(k, l_M) = \frac{1}{\nu} (k^\alpha l_M^{1-\alpha} - \phi), \quad 0 < \alpha < 1 \quad (2.3.11)$$

where x is each firm's output, k and l_M are capital and manufacturing labor inputs at the firm level respectively. $\frac{1}{\nu}$ is the production technology, and the value of it is constant. The parameter ϕ is the necessarily fixed factor inputs required to produce output x . α is the output elasticity of capital at the firm level.

Each firm minimizes its total cost $rk + w_M l_M$ for producing output x , which derives the demand function for each factor input per firm as follows:

$$k = \left(\frac{\alpha}{1-\alpha} \frac{w_M}{r} \right)^{1-\alpha} (\nu x + \phi) \quad (2.3.12)$$

$$l_M = \left(\frac{1-\alpha}{\alpha} \frac{r}{w_M} \right)^\alpha (\nu x + \phi) \quad (2.3.13)$$

Therefore, the total cost per firm can be expressed as the following:

$$TC(r, w_M, x) = \frac{r^\alpha w_M^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}} (\nu x + \phi) \quad (2.3.14)$$

Equation (2.3.14) exhibits internal increasing returns to scale because it implies the average cost, $\frac{r^\alpha w_M^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}} (\nu + \frac{\phi}{x})$, is decreasing with output x .

Given the inverse demand function (2.3.10) and the total cost function (2.3.14), we get the representative firm's profit function as:

$$\pi = \mu x^\theta - \frac{r^\alpha w_M^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}} (\nu x + \phi) \quad (2.3.15)$$

Firm's profit maximization implies the following price level as:

$$p = \frac{v}{\theta} \frac{r^\alpha w_M^{1-\alpha}}{\alpha^\alpha (1-\alpha)^{1-\alpha}} \quad (2.3.16)$$

where $p = \mu x^{\theta-1}$, from the inverse demand function (2.3.10) above. This yields the standard result that each firm charges a monopoly mark-up over marginal cost.

The mark-up pricing equation (2.3.16) determines the rental price and the wage in this sector as follows:

$$r = \left[\frac{\alpha^\alpha (1-\alpha)^{1-\alpha} p \theta}{w_M^{1-\alpha} \nu} \right]^{\frac{1}{\alpha}} \quad (2.3.17)$$

$$w_M = \left[\frac{\alpha^\alpha (1 - \alpha)^{1-\alpha} p\theta}{r^\alpha \nu} \right]^{\frac{1}{1-\alpha}} \quad (2.3.18)$$

Free entry and exit lead to zero profit, $\pi = 0$. This derives the output per firm as:

$$x = \frac{\theta}{1 - \theta} \frac{\phi}{\nu} \quad (2.3.19)$$

Equation (2.3.19) shows the output per firm is constant. It does not depend on the price or other variables that might be affected by changes in factor endowments, but depends on the parameters of the model that do not change.

When we substitute equations (2.3.18) and (2.3.19) into equation (2.3.12) for k , and substitute equations (2.3.17) and (2.3.19) into equation (2.3.13) for l_M , we obtain each firm's demand functions for factor inputs respectively as follows:

$$k = \frac{\alpha}{r} \frac{\theta}{1 - \theta} \frac{p\phi}{\nu} \quad (2.3.20)$$

$$l_M = \frac{1 - \alpha}{w_M} \frac{\theta}{1 - \theta} \frac{p\phi}{\nu} \quad (2.3.21)$$

These two equations say that the demand for each factor input is determined by its factor price and the price level rather than by the ratio of factor prices as shown in equations (2.3.12) and (2.3.13).

We include analysis with increasing returns to scale at the firm level in order to exhibit certain patterns of trade that we are interested in, such as trade of varieties of differentiated goods between countries. However, in order to ease subsequent calculation to derive growth rates of variables in the following section, we have to have sector level production function in addition to that of the firm level. Let the whole sector's production function be written as:

$$X = \frac{1}{\nu} K^\eta L_M^{1-\eta}, \quad 0 < \eta < 1 \quad (2.3.22)$$

where X represents the total manufacturing output, K and L_M are aggregate capital and total manufacturing labor inputs at the industry level respectively. η is the output elasticity of capital at the industry level.

Since varieties in the manufacturing sector are symmetric, the total output is the sum of each firm's output, that is $X = nx$, where n is the total number of varieties. Analogously, we have aggregate capital is the sum of each firm's capital, $K = nk$, and total manufacturing labor is the sum of each firm's labor, $L_M = nl_M$. When we substitute equations (2.3.20) for k into $K = nk$ and (2.3.21) for l_M into $L_M = nl_M$, we get the demand functions for factor inputs at the industry level respectively as the following:

$$K = \frac{n\alpha}{r} \frac{\theta}{1-\theta} \frac{p\phi}{\nu} \quad (2.3.23)$$

$$L_M = \frac{n(1-\alpha)}{w_M} \frac{\theta}{1-\theta} \frac{p\phi}{\nu} \quad (2.3.24)$$

2.3.3 The Agricultural Sector in the Home Country

The production of the agricultural good requires land N and agricultural labor L_A to be combined via a constant returns to scale Cobb-Douglas production function to yield the aggregate level of output. This production function can be written as:

$$Y = N^\beta L_A^{1-\beta}, \quad 0 < \beta < 1 \quad (2.3.25)$$

where Y is the total output in the agricultural sector, and β is the output elasticity of land.

Since the total amount of land is exogenously given and fixed, hereafter we normalize it to one, that is $N = 1$. Thus, the production function can be re-written as:

$$Y = L_A^{1-\beta} \quad (2.3.26)$$

Given the production function, the income of a rural household is determined by the marginal product of labor as follows:

$$w_A = MPL_A = (1 - \beta) \frac{Y}{L_A} \quad (2.3.27)$$

Perfect intersectoral labor mobility equates the wages in the two sectors, i.e., $w_M = w_A = w$. Thus the indices M and A on the wages can be dropped.

2.3.4 *The Agricultural Sector in the Foreign Country*

The difference between the foreign and the home country is that the foreign country has a Lewisian labor market, where there exists a large amount of surplus labor in the agricultural sector. The agricultural production function in the foreign country is as follows:

$$Y^* = L_a^{*1-\beta} \quad (2.3.28)$$

where Y^* is the total agricultural output, L_a^* is the amount of effective agricultural labor. Those effective agricultural laborers contribute to the production of the agricultural good with $MPL_a^* \geq \bar{w}^*$ ¹⁰ that their marginal product is higher than or equal to the subsistence wage level, \bar{w}^* .

In the foreign country with a Lewisian labor market, people living in rural areas own

¹⁰In fact, those surplus laborers with $0 < MPL < \bar{w}^*$ also contribute to agricultural production, but their contributions are very small. For simplicity, we do not take those surplus laborers into the production function.

the land and obtain all the output from their work on this land. Thus the income of a rural household measured in units of the agricultural good, equals the average product of labor (APL_A^*), which is at subsistence level (\bar{w}^*), as follows:

$$\bar{w}^* = APL_A^* = \frac{Y^*}{L_A^*} \quad (2.3.29)$$

where the total number of agricultural laborers, L_A^* , is the sum of effective laborers, L_a^* , and surplus laborers, L_s^* , that is $L_A^* = L_a^* + L_s^*$. Although the marginal product of surplus labor equals zero, $MPL_s^* = 0$ ¹¹, the agricultural sector absorbs all surplus labor, otherwise, they would not have been able to survive.

2.3.5 *Different Kinds of Laborers in the Foreign Country*

Many existing studies claim to have formally captured the characteristics of surplus labor often abandoned the key features of the dual economy models of Lewis (1954) and Fei and Ranis (1964). They either assume a competitively labor market in the traditional sector (e.g., Acemoglu, 2009), or fail to consider the linkage between the subsistence wage and the average product of labor in the agricultural sector or its close connection with the industrial sector. (e.g., Barbier and Rauscher, 2007) An example of this approach is Barbier and Rauscher's (2007) model which yields the result that an increase in land endowment or in agricultural productivity can have negative welfare implications for countries. This result is contrary to the empirical observations. We argue that considering only the agricultural average product is not enough to formalize surplus labor as it does not take the relationship between the agricultural average product and the manufacturing marginal product into consideration, and often implicitly assumes a much higher average product in the agricultural sector. Nor does it allow us to obtain the amount of surplus labor in the agricultural sector. We argue that the concept of

¹¹To be precise, it should be $0 \leq MPL_s^* < \bar{w}^*$. But for simplicity without loss of generality, we do not distinguish the two types of surplus labor.

surplus labor should be formalized by the following equation as:

$$APL_A^* = MPL_a^* = MPL_M^* = \bar{w}^* \quad (2.3.30)$$

Equation (2.3.30) not only considers the average product of the agricultural sector, but also concerns the marginal product of effective agricultural labor and the marginal product of the manufacturing sector. When they are equal to the subsistence wage level \bar{w}^* simultaneously, surplus labor exists in the agricultural sector. Referring back to Figure 1, the distance between the two equilibria determines the total amount of surplus labor in the agricultural sector in the foreign country.

From equation (2.3.30), $APL_A^* = MPL_a^*$ implies $\frac{Y^*}{L_A^*} = (1 - \beta)\frac{Y^*}{L_a^*}$, which describes a relationship between L_a^* and L_A^* : $L_a^* = (1 - \beta)L_A^*$. $L_a^* + L_s^* = L_A^*$ gives $L_s^* = \beta L_A^*$. $APL_A^* = MPL_M^*$ implies $\frac{Y^*}{L_A^*} = \frac{1-\eta}{\nu} \left(\frac{K^*}{L_M^*}\right)^\eta$, plugging $K^{*\eta} = \frac{\nu X^*}{L_M^{*1-\eta}}$ into it we obtain $L_M^* = \frac{(1-\eta)X^*}{Y^*}L_A^*$. Based on the above results and the fact that the total number of laborers (the initial labor endowment) is the sum of each kind of labor in the economy such that $L^* = L_a^* + L_s^* + L_M^*$, the total amount of agricultural labor is:

$$L_A^* = \frac{L^*}{1 + \frac{n^*(1-\eta)}{L^*A^*} \frac{\theta}{1-\theta} \frac{\phi}{\nu}} \quad (2.3.31)$$

the total number of effective agricultural laborers is :

$$L_a^* = \frac{(1 - \beta) L^*}{1 + \frac{n^*(1-\eta)}{L^*A^*} \frac{\theta}{1-\theta} \frac{\phi}{\nu}} \quad (2.3.32)$$

and the total amount of surplus labor in the agricultural sector is:

$$L_s^* = \frac{\beta L^*}{1 + \frac{n^*(1-\eta)}{L^*A^*} \frac{\theta}{1-\theta} \frac{\phi}{\nu}} \quad (2.3.33)$$

and the total number of manufacturing laborers is :

$$L_M^* = \frac{\frac{n^*(1-\eta)}{A^*} \frac{\theta}{1-\theta} \frac{\phi}{\nu}}{1 + \frac{n^*(1-\eta)}{L^* A^*} \frac{\theta}{1-\theta} \frac{\phi}{\nu}} \quad (2.3.34)$$

where in the equilibrium, the total output equals the total consumption of the agricultural good that $Y^* = L^* A^*$.

Those equations show that the total amount of each kind of labor depends on the labor endowment, L^* , individual's consumption of the agricultural good, A^* , and the total number of varieties, n^* . It is worth noting that in our model, L^* is assumed to be fixed and each individual's consumption of the agricultural good, A^* , is also assumed to be unchanged, thus the total consumption of the agricultural good, $L^* A^*$, is fixed. With unchanged L^* and A^* , when n^* increases, L_M^* goes up, L_A^* goes down as well as L_a^* and L_s^* .

2.3.6 The Static Equilibrium

When there is no capital accumulation, each country's equilibrium is static. In the home country, the market clearing conditions in capital and labor markets can be expressed as follows respectively:

$$nk = K \quad (2.3.35)$$

$$L_M + L_A = L \quad (2.3.36)$$

Based on those equilibrium conditions, we derive the equilibrium rental price and wage as follows:

$$r = \frac{n\alpha \frac{\theta}{1-\theta} \frac{p\phi}{v}}{K} \quad (2.3.37)$$

$$w = \frac{n(1-\alpha) \frac{\theta}{1-\theta} \frac{p\phi}{v}}{L} + (1-\beta)A \quad (2.3.38)$$

On the other hand, in the foreign country, the capital market clearing condition is the same as that in the home country. Hence, the equilibrium rental price is:

$$r^* = \frac{n^*\alpha \frac{\theta}{1-\theta} \frac{p\phi}{v}}{K^*} \quad (2.3.39)$$

However, in a Lewisian labor market, surplus labor exists in the agricultural sector, the standard labor market clearing condition can not be applied, instead, we use equation (2.3.30) that $APL_A^* = MPL_a^* = MPL_M^*$ to determine the equilibrium wage, which is at subsistence level, as:

$$\bar{w}^* = \frac{n^*(1-\eta) \frac{\theta}{1-\theta} \frac{\phi}{v}}{L^*} + A^* \quad (2.3.40)$$

Equations (2.3.38) and (2.3.40) show that the equilibrium wage levels would increase when the total numbers of varieties, n and n^* , become larger in each country respectively.

This is the case for the foreign country even though it has a large pool of surplus labor in the agricultural sector. One may argue that this is because industrial employment expansion absorbs surplus labor from the agricultural sector and, consequently, the total amount of surplus labor become less which would lead the wage in the agricultural sector to increase. However, there exist various scenarios in which the total amount of surplus labor may not reduce when

laborers are drawn out from the agricultural sector. As a result, the wage in the agricultural sector may be kept constant. See Appendix for detailed discussion of the various scenarios where the wage rate is kept constant. Based on the analysis in the Appendix, although our model does not take population growth and agricultural total factor productivity growth into consideration, we can reasonably assume that the equilibrium wage is constant in the foreign country that has a Lewisian labor market.

2.4 Economic Growth

Now, let us consider economic growth driven by capital accumulation in the two countries. Assuming there is no capital depreciation, we may set the rate of aggregate capital accumulation equal to a share σ of manufacturing output X_t , that is $\dot{K}_t = \sigma X_t$ ¹², where t represents continuous time and $t \in (0, \infty)$.^{13 14}

2.4.1 Growth in the Home Country

Recall in section 2.3, we define k_t and $l_{M,t}$ as capital and manufacturing labor inputs per firm; K_t and $L_{M,t}$ as aggregate capital and total manufacturing labor inputs at the industry level respectively. Therefore, capital per manufacturing worker can be expressed as aggregate capital

¹²In our previous discussion, without capital accumulation we assume all manufacturing output to have been consumed, see equation (2.3.8). In the case of capital accumulation, because σX have been saved, only $(1 - \sigma) X$ have been consumed. However, adding this item, $1 - \sigma$, into equation (2.3.8), only complicates calculations, it will not alter our results. For simplicity, we do not include this term in our subsequent calculations.

¹³As we only consider comparative statics with K , we assume constant growth in K .

¹⁴It is not possible to tell our story with only a simple industrial level growth model with exogenous productivity growth. Much empirical literature, such as Krugman (1994) and Young (2003), argues that growth in Total Factor Productivity was very small in many emerging economies, and mainly driven by increased levels of factor inputs. Although Holz (2008) argues that there was significant growth in productivity in some developing countries like China, it did not match that in many developed countries such as the US. Thus a one-sector production function and exogenous productivity growth would not be able to capture what our model can. Thus, we have to have capital accumulation driven economic growth.

divided by the total number of manufacturing workers: $k_{M,t} = \frac{K_t}{L_{M,t}}$ ¹⁵. Substituting equations (2.3.23) for K_t and (2.3.24) for $L_{M,t}$ into the expression of $k_{M,t}$ we get $k_{M,t} = \frac{\alpha}{1-\alpha}\omega_t$, where we set $\omega_t = \frac{w_t}{r_t}$. Therefore, the rate of $k_{M,t}$ accumulation is as follows:

$$\dot{k}_{M,t} = \frac{\partial \left(\frac{K_t}{L_{M,t}} \right)}{\partial t} = \frac{\dot{K}_t}{L_{M,t}} - \frac{\dot{L}_{M,t}}{L_{M,t}} k_{M,t} \quad (2.4.1)$$

Dividing both sides of $\dot{K}_t = \sigma X_t$ by $L_{M,t}$ we get $\frac{\dot{K}_t}{L_{M,t}} = \sigma \frac{X_t}{L_{M,t}}$, then using equation (2.3.22) to replace X_t in this expression we get $\frac{\dot{K}_t}{L_{M,t}} = \frac{\sigma}{\nu} \left(\frac{K_t}{L_{M,t}} \right)^\eta = \frac{\sigma}{\nu} k_{M,t}^\eta$; equation (2.3.24) shows $\frac{\dot{L}_{M,t}}{L_{M,t}} = \frac{\dot{n}_t}{n_t} - \frac{\dot{w}_t}{w_t}$. Substituting $\frac{\dot{K}_t}{L_{M,t}}$ and $\frac{\dot{L}_{M,t}}{L_{M,t}}$ into equation (2.4.1), and then dividing both sides by $k_{M,t}$ we get the growth rate of capital per manufacturing worker as:

$$\frac{\dot{k}_{M,t}}{k_{M,t}} = \frac{\sigma}{\nu} k_{M,t}^{\eta-1} + \frac{\dot{w}_t}{w_t} - \frac{\dot{n}_t}{n_t} \quad (2.4.2)$$

The growth rate of aggregate capital equals the growth rate of capital per manufacturing worker plus the growth rate of manufacturing labor, which can be expressed as:

$$\frac{\dot{K}_t}{K_t} = \frac{\dot{k}_{M,t}}{k_{M,t}} + \frac{\dot{L}_{M,t}}{L_{M,t}} = \frac{\sigma}{\nu} k_{M,t}^{\eta-1} = \frac{\sigma}{\nu} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t} \right)^{1-\eta} \quad (2.4.3)$$

where $k_{M,t} = \frac{\alpha}{1-\alpha}\omega_t$.

Substituting equation (2.3.12) for k_t into $n_t k_t = K_t$ gives us $n_t \left(\frac{\alpha}{1-\alpha}\omega_t \right)^{1-\alpha} \frac{\phi}{1-\theta} = K_t$, from which we obtain an alternative equation of the growth rate of aggregate capital as:

$$\frac{\dot{K}_t}{K_t} = \frac{\dot{n}_t}{n_t} + (1-\alpha) \frac{\dot{\omega}_t}{\omega_t} \quad (2.4.4)$$

Since $\omega_t = \frac{w_t}{r_t}$, $\frac{\dot{\omega}_t}{\omega_t} = \frac{\dot{w}_t}{w_t} - \frac{\dot{r}_t}{r_t}$. From equation (2.3.37) we get $\frac{\dot{r}_t}{r_t} = \frac{\dot{n}_t}{n_t} - \frac{\dot{K}_t}{K_t}$. Equation

¹⁵Since all firms are assumed to be symmetric, $K_t = n_t k_t$ and $L_{M,t} = n_t l_{M,t}$. Thus capital per manufacturing worker also can be expressed as capital per firm divided by the number of manufacturing workers per firm: $k_{M,t} = \frac{k_t}{l_{M,t}}$.

(2.3.38) implies $\frac{\dot{w}_t}{w_t} = \frac{z\dot{n}_t}{zn_t+(1-\beta)A}$, where z is a function of p and L that is $z = \frac{(1-\alpha)^{\frac{\theta}{1-\theta}} p^{\frac{\phi}{v}}}{L}$. As we have a fixed international price of manufactured goods, p , and fixed labor endowment, L , we can treat z as a constant parameter. Therefore, $\frac{\dot{w}_t}{w_t} = \frac{z\dot{n}_t}{zn_t+(1-\beta)A} - \frac{\dot{n}_t}{n_t} + \frac{\dot{K}_t}{K_t}$. Substituting this result into equation (2.4.4) and using equation (2.4.3) to replace $\frac{\dot{K}_t}{K_t}$ in equation (2.4.4) we have the growth rates of variety and manufacturing output as follows respectively:

$$\frac{\dot{n}_t}{n_t} = \frac{1}{1 + \frac{1-\alpha}{\alpha} f_t} \frac{\dot{K}_t}{K_t} = \frac{\sigma}{\nu \left(1 + \frac{1-\alpha}{\alpha} f_t\right)} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t}\right)^{1-\eta} \quad (2.4.5)$$

$$\frac{\dot{X}_t}{X_t} = \frac{1}{1 + \frac{1-\alpha}{\alpha} f_t} \frac{\dot{K}_t}{K_t} = \frac{\sigma}{\nu \left(1 + \frac{1-\alpha}{\alpha} f_t\right)} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t}\right)^{1-\eta} \quad (2.4.6)$$

where f_t is a function of z , A , and n_t , shown as $f_t = \frac{z}{z+(1-\beta)\frac{A}{n_t}}$. It is obvious that f_t is positively related with n_t because both z and A are fixed. Equations (2.4.5) and (2.4.6) show that the relationships between f_t and the growth rates of variety and manufacturing output are negative, which means when n_t becomes larger, the growth rates of variety and manufacturing output will be slower over time. In addition, the growth rates of variety and manufacturing output negatively depend on the wage and rental price ratio as well. That is, bigger ω_t will induce smaller $\frac{\dot{n}_t}{n_t}$ and $\frac{\dot{X}_t}{X_t}$ over time.

Substituting $\frac{\dot{w}_t}{w_t} = \frac{z\dot{n}_t}{zn_t+(1-\beta)A}$ into $\frac{\dot{L}_{M,t}}{L_{M,t}} = \frac{\dot{n}_t}{n_t} - \frac{\dot{w}_t}{w_t}$, the growth rate of manufacturing labor is:

$$\frac{\dot{L}_{M,t}}{L_{M,t}} = \frac{1-f_t}{1 + \frac{1-\alpha}{\alpha} f_t} \frac{\dot{K}_t}{K_t} = \frac{\sigma(1-f_t)}{\nu \left(1 + \frac{1-\alpha}{\alpha} f_t\right)} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t}\right)^{1-\eta} \quad (2.4.7)$$

Furthermore, substituting $\frac{\dot{w}_t}{w_t} = \frac{z\dot{n}_t}{zn_t+(1-\beta)A}$ into equation (2.4.2), the growth rate of capital per manufacturing worker is:

$$\frac{\dot{k}_{M,t}}{k_{M,t}} = \left(1 - \frac{1 - f_t}{1 + \frac{1-\alpha}{\alpha} f_t}\right) \frac{\sigma}{\nu} \left(\frac{1 - \alpha}{\alpha} \frac{1}{\omega_t}\right)^{1-\eta} \quad (2.4.8)$$

Equation (2.4.7) shows that because $1 - f_t < 1 + \frac{1-\alpha}{\alpha} f_t$, the growth rate of manufacturing labor is a fraction of the growth rate of aggregate capital. In other words, the growth rate of capital is faster than the growth rate of labor in the manufacturing sector; that is, $\frac{\dot{K}_t}{K_t} > \frac{\dot{L}_{M,t}}{L_{M,t}}$. This means that with capital accumulation, the manufacturing sector would use more capital rather than labor to expand its production. The production technology in the manufacturing sector would become more capital intensive. The consequence of this unequal growth would lead to an increase in wage level if all other things are held constant; that is $\frac{\dot{w}_t}{w_t} > 0$. On the other hand, the rental rate decreases with capital deepening, $\frac{\dot{r}_t}{r_t} < 0$. Thus $\frac{\dot{\omega}_t}{\omega_t} = \frac{\dot{w}_t}{w_t} - \frac{\dot{r}_t}{r_t} > 0$, ω_t increases over time. Hence we have $\frac{\dot{L}_{M,t}}{L_{M,t}} > 0$, which means there is labor movement from the agricultural sector to the manufacturing sector for a higher wage.

Our model derives $\frac{\dot{w}_t}{w_t} = \frac{z}{z+(1-\beta)\frac{A}{n_t}} \frac{\dot{n}_t}{n_t}$, so $\frac{\dot{n}_t}{n_t} > \frac{\dot{w}_t}{w_t}$ implies the wage does not rise fast enough to offset capital deepening-induced expansion in the manufacturing sector. Because A is assumed to be fixed, and there is no additional demand for the agricultural good, any increase in variety induces higher demand for manufactured goods, in this case, the wage increase has to be muted enough to ensure that supply equals demand for manufactured goods.

Since, in the neoclassical world capital deepening leads to an increase in wage rate and this prevents the effect of capital accumulation from mapping onto an equivalent expansion of the size of output in the manufacturing sector, the growth rate of output is only a proportion of the growth rate of aggregate capital, as shown in equation (2.4.6).

2.4.2 Growth in the Foreign Country

Calculations based on equation (2.3.30) imply $L_{M,t}^* = \frac{X_t^*}{k_{M,t}^{*\eta}}$, the growth rate of manufacturing labor in the foreign country therefore can be written as follows:

$$\frac{\dot{L}_{M,t}^*}{L_{M,t}^*} = \frac{\dot{n}_t^*}{n_t^*} - \eta \frac{\dot{k}_{M,t}^*}{k_{M,t}^*} \quad (2.4.9)$$

Equation (2.4.3) shows $\frac{\dot{K}_t^*}{K_t^*} = \frac{\dot{k}_{M,t}^*}{k_{M,t}^*} + \frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$, substituting equation (2.4.9) into it, the growth rate of capital per manufacturing worker is:

$$\frac{\dot{k}_{M,t}^*}{k_{M,t}^*} = \frac{1}{1-\eta} \left(\frac{\dot{K}_t^*}{K_t^*} - \frac{\dot{n}_t^*}{n_t^*} \right) \quad (2.4.10)$$

Equation (2.3.22) gives us $\frac{\dot{n}_t^*}{n_t^*} = \eta \frac{\dot{K}_t^*}{K_t^*} + (1-\eta) \frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$, substituting equation (2.4.9) for $\frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$ into it we get the following equation:

$$\frac{\dot{n}_t^*}{n_t^*} = \eta \frac{\dot{K}_t^*}{K_t^*} + (1-\eta) \left(\frac{\dot{n}_t^*}{n_t^*} - \eta \frac{\dot{k}_{M,t}^*}{k_{M,t}^*} \right) \quad (2.4.11)$$

Substituting equation (2.4.10) for $\frac{\dot{k}_{M,t}^*}{k_{M,t}^*}$ into equation (2.4.11) we have the following result as:

$$\frac{\dot{n}_t^*}{n_t^*} = \frac{\dot{K}_t^*}{K_t^*} \quad (2.4.12)$$

Equation (2.4.12) shows that the growth rate of variety equals the growth rate of aggregate capital in the foreign country.

When we substitute equation (2.4.12) into equation (2.4.10) we get $\frac{\dot{k}_{M,t}^*}{k_{M,t}^*} = 0$, which implies capital per manufacturing worker stays constant in the foreign country. Substituting this result into equation (2.4.9) gives $\frac{\dot{L}_{M,t}^*}{L_{M,t}^*} = \frac{\dot{n}_t^*}{n_t^*}$. Equation (2.4.2) implies $\frac{\dot{k}_{M,t}^*}{k_{M,t}^*} = \frac{\sigma}{\nu} k_{M,t}^{*\eta-1} - \frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$, plugging $\frac{\dot{k}_{M,t}^*}{k_{M,t}^*} = 0$ and $\frac{\dot{L}_{M,t}^*}{L_{M,t}^*} = \frac{\dot{n}_t^*}{n_t^*}$ into it, the growth rate of variety as follows:

$$\frac{\dot{n}_t^*}{n_t^*} = \frac{\sigma}{\nu} k_{M,t}^{*\eta-1} = \frac{\sigma}{\nu} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t^*} \right)^{1-\eta} \quad (2.4.13)$$

where $k_{M,t}^* = \frac{\alpha}{1-\alpha} \omega_t^*$.

Therefore, the growth rates of aggregate capital, manufacturing labor, variety, and manufacturing output are the same as:

$$\frac{\dot{K}_t^*}{K_t^*} = \frac{\dot{L}_{M,t}^*}{L_{M,t}^*} = \frac{\dot{n}_t^*}{n_t^*} = \frac{\dot{X}_t^*}{X_t^*} = \frac{\sigma}{\nu} \left(\frac{1-\alpha}{\alpha} \frac{1}{\omega_t^*} \right)^{1-\eta} \quad (2.4.14)$$

Equation (2.4.14) shows $\frac{\dot{K}_t^*}{K_t^*} = \frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$, this equality in growth rates leads to an unchanged wage level, that is $\frac{\dot{w}_t^*}{w_t^*} = 0$ assuming all other things constant. It is worth noting that this result is consistent with the discussion in Appendix: industrial expansion induces laborers to draw out of the agricultural sector. However, the average product of labor and hence the wage in the agricultural sector will not increase. On the other hand, equation (2.3.39) shows the growth rate of rental price as: $\frac{\dot{r}_t^*}{r_t^*} = \frac{\dot{n}_t^*}{n_t^*} - \frac{\dot{K}_t^*}{K_t^*}$. As a result of equal growth of variety and aggregate capital we have $\frac{\dot{r}_t^*}{r_t^*} = 0$. Therefore, $\frac{\dot{w}_t^*}{w_t^*} = 0$ and $\frac{\dot{r}_t^*}{r_t^*} = 0$ imply the growth rate of the wage and rental price ratio is also zero that $\frac{\dot{\omega}_t^*}{\omega_t^*} = 0$, it means ω_t^* is a constant over time.

Capital accumulation causes an industrial expansion which uses both more capital and labor in production, and the increase of labor is from surplus labor in the agricultural sector. Thus in the foreign country, we observe structural change in terms of a shift of employment from the agricultural sector to the industrial sector¹⁶. Because of the existence of surplus labor, capital accumulation increases labor participation but not the wage level.

Because capital accumulation does not lead to a wage-rise, the effect of capital accumula-

¹⁶Structural change can be induced by other factors such as total factor productivity (TFP) growth (Ngai, and Pissarides, 2007), capital deepening (Acemoglu and Guerrieri, 2008) or higher income elasticity of manufactured goods as compared to the agricultural good (Kongsamut, Rebelo and Xie, 2001).

tion maps onto an equivalent expansion in the manufacturing sector, that is, the growth rates of output and the number of varieties equal the growth rate of aggregate capital, as shown in equation (2.4.14).

It is worth noting that the methods of our model to derive growth in these two countries are significantly different. In the home country, the growth rate of each variable is an inverse function of ω_t , and except the growth rate of aggregate capital, all other growth rates also depend on f_t , where f_t is a function of z , A , and n_t . On the other hand, the growth rate of each variable in the foreign country is determined only by ω_t^* , in which z , A , and n_t are unable to affect the growth rate. The reason behind that is their different labor market structures. More precisely, with the existence of surplus labor in the foreign country, economic growth derives from $L_{M,t}^* = \frac{X_t^*}{k_{M,t}^{*\eta}}$, induced by equation (2.3.30) that the equalities between the average product of total agricultural labor, the marginal product of effective agricultural labor and the marginal product of manufacturing labor. However, it is inappropriate to apply the result of $L_{M,t}^* = \frac{X_t^*}{k_{M,t}^{*\eta}}$ to the home country as it does not have dual economy. Our model derives growth in the home country from the equilibrium rental price and wage (see equations (2.3.37) and (2.3.38)). This leads to the growth rate affected by z , A , and n_t .

Although the growth rate in the foreign country is not affected by z , A , and n_t , with an increasing wage in the home country and surplus labor-induced constant wage in the foreign country, ω_t becomes larger than ω_t^* over time, it is clear that the growth rate of each variable would be relatively higher in the foreign country than in the home country over time. For example, the comparison of the growth rate of manufacturing labor between countries shows that

$$\frac{\dot{L}_{M,t}}{L_{M,t}} - \frac{\dot{L}_{M,t}^*}{L_{M,t}^*} = \frac{\sigma}{\nu} \left(\frac{1-\alpha}{\alpha} \right)^{1-\eta} \left[\frac{1-f_t}{1+\frac{1-\alpha}{\alpha}f_t} \left(\frac{1}{\omega_t} \right)^{1-\eta} - \left(\frac{1}{\omega_t^*} \right)^{1-\eta} \right] \quad (2.4.15)$$

Equation (2.4.15) demonstrates that with the presence of $0 < \frac{1-f_t}{1+\frac{1-\alpha}{\alpha}f_t} < 1$ and $\omega_t^* < \omega_t$, we have $\frac{\dot{L}_{M,t}}{L_{M,t}} < \frac{\dot{L}_{M,t}^*}{L_{M,t}^*}$, which means labor migration from the agricultural sector to the industrial sector is faster in the foreign country than that in the home country.

2.4.3 The Effects of Surplus Labor on Economic Growth

In our model, economic growth in both countries is driven by capital accumulation. Different labor market characteristics lead to different growth paths. Therefore, we arrive at the following propositions:

Proposition When the home country has a neoclassical labor market and the foreign country has a Lewisian labor market,

- (a) Aggregate capital, manufacturing labor, variety, and manufacturing output change at different growth rates in the home country, but change at the same growth rate in the foreign country.
- (b) Structural change in terms of a shift of employment from the agricultural to the manufacturing sector occurs in both countries, and this transition process is faster in the foreign country.
- (c) Manufacturing production becomes more capital intensive in the home country, but it stays the same in the foreign country.
- (d) The wage level increases in the home country, but remains constant in the foreign country.
- (e) The growth rates of aggregate capital, variety, and manufacturing output would become relatively higher in the foreign country than those in the home country over time.

Proof Proposition (a) follows from equations (2.4.3), (2.4.5), (2.4.6) and (2.4.7) that in the home country the growth rates of variety and manufacturing output are a proportion

$\frac{1}{1+\frac{1-\alpha}{\alpha}f_t}$ of the growth rate of aggregate capital, and the growth rate of manufacturing labor is a share $\frac{1-f_t}{1+\frac{1-\alpha}{\alpha}f_t}$ of the growth rate of aggregate capital; from equation (2.4.14) that in the foreign country with the existence of surplus labor, aggregate capital, manufacturing labor, variety, and manufacturing output grow at the same rate. Proposition (b) comes from equation (2.4.15), which shows the growth rate of manufacturing labor is larger in the foreign country than that in the home country over time. Proposition (c) and (d) follow from the fact that in the home country capital deepening leads capital to grow faster than manufacturing labor, this unequal growth would cause the wage level to increase, thus the manufacturing sector would use more capital rather than labor to expand its production. In the foreign country, capital accumulation and surplus labor mobility induce an equal growth rate of capital and manufacturing labor, this equality leads to a constant wage level, hence industrial expansion would use both more capital and more labor in production. Proposition (e) follows from equations (2.4.3) and (2.4.14) that with an increasing wage in the home country and a constant wage in the foreign country, the growth rate of aggregate capital is relatively higher in the foreign country than that in the home country. Equations (2.4.5) and (2.4.13) show the growth rate of variety and equations (2.4.6) and (2.4.14) show the growth rate of manufacturing output to be relatively higher in the foreign country than in the home country.

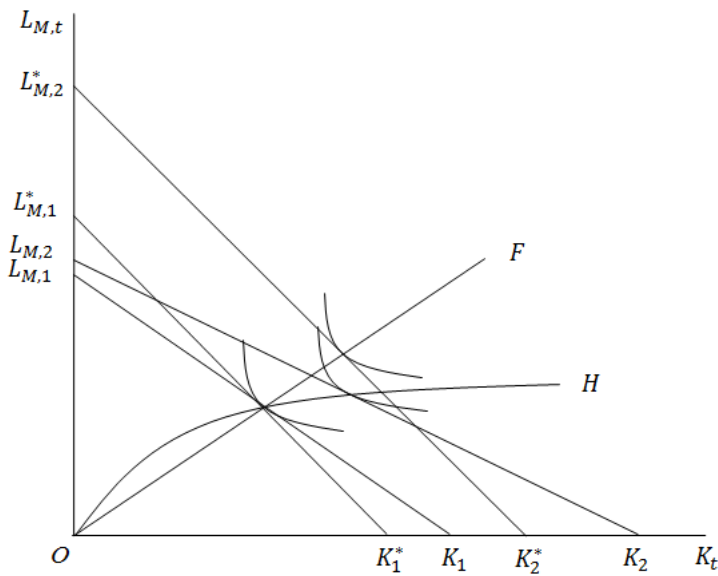
The above propositions can be illustrated by Figure 2. For each country, the isoquant curve and the isocost line determine the optimal production point at a given level of output and a given level of factor prices.

In the home country with a neoclassical labor market, the economy expands with capital deepening, the total amount of aggregate capital significantly increases from K_1 to K_2 , while with smaller growth rate, the total quantity of manufacturing labor increases from $L_{M,1}$ to $L_{M,2}$.

Higher growth rate of aggregate capital than that of manufacturing labor causes the wage to increase, which prevents the effect of capital accumulation from mapping onto an equivalent expansion of the size of manufacturing output. Therefore, manufacturing production becomes more capital intensive, and its production scale expands following the curve OH .

In the foreign country with a Lewisian labor market, the economy expands with capital accumulation and the immigration of surplus labor from the agricultural sector to the manufacturing sector. The total amount of aggregate capital increases from K_1^* to K_2^* , and the total amount of manufacturing labor rises from $L_{M,1}^*$ to $L_{M,2}^*$. Equal growth rate of aggregate capital and manufacturing labor leads to an unchanged wage, which makes the effect of capital accumulation map onto an equivalent expansion of manufacturing output. Thus the manufacturing sector uses the same input proportion to produce, and its production scale increases following the straight line OF .

Figure 2.4.1: Growth Paths in the Two Countries



2.5 Conclusions

Labor endowments and labor market structures have profound impact on economic growth and structural change but have received little attention in formal growth and development theories. This chapter develops a unified growth model in which dual labor market characteristics and comparative advantages have been taken into consideration.

One of the significant components of the model is that it shows the effects of surplus labor on economic growth and structural change. Our model uses the equalities between the average product of total agricultural labor, the marginal product of effective agricultural labor and the marginal product of manufacturing labor to formalize the concept of surplus labor and determine the total amount of surplus labor in the agricultural sector in the developing foreign country.

A model incorporating surplus labor is able to produce more realistic results. For a developed country with a neoclassical labor market and a developing country with a Lewisian labor market, with capital accumulation, the wage level increases in the developed country, but keeps constant in the developing country. In this case, the developed country uses more capital rather than labor to expand its industrial production. Its industrial production becomes more capital intensive. However, in the developing country, surplus labor in the agricultural sector is sufficiently large to give an unlimited supply of labor for industrial expansion, thus labor migration from the agricultural sector to the industrial sector induces more significant structural change in this country than in the developed country. The industrial sector uses both more capital and more labor to increase its production. The developing country with surplus labor enjoys faster capital accumulation while capital per manufacturing worker stays constant. It enjoys faster growth of variety and manufacturing output for a given growth rate of capital per manufacturing worker. These two effects of surplus labor are magnified when the

developing country opens to trade with the developed country, as it allows a bigger market for the goods produced in the developing country and thus allows the country to utilize more of its surplus labor than when it was closed.

This chapter shows that capital accumulation in a labor-surplus developing country leads to increasing labor participation at a near constant wage which in turn leads to an expansion in the industrial sector. We argue that surplus labor plays a significant role in shaping different growth paths and structural changes in developed and developing countries. We have shown that a country's labor surplus can be translated into faster growth rates of aggregate capital, manufacturing labor, and manufacturing output, which is largely consistent with the process of development in developing countries.

2.6 Appendix: Scenarios of Constant Wage

There are many explanations for the fact that the number of laborers drawn from the agricultural sector does not cause a reduction in the total amount of surplus labor (L_s) or a change in the wage rate in the agricultural sector. These can be expressed as follows:

1) This may be as a result of higher population growth that matches the speed of migration from the agricultural sector to the manufacturing sector. That is, if the rate of migration and the rate of population growth are the same, Malthusian population growth will replace all surplus labor that has moved to the manufacturing sector and the average product of labor in the agricultural sector (APL_A) will not change. 2) A second scenario involves technical change improving efficiency in the agricultural sector and this leads to increases in surplus labor. 3) Another scenario may be one where the agricultural sector is so big and the manufacturing sector so small that there is hardly any impact on the APL_A when small-scale migration takes place. 4) If land is not owned by farmers, when they move out of the agricultural sector, the APL_A is likely to go up, but the landlord may increase the land rent so that the APL_A stays the same. 5) The wage in the agricultural sector can also be defined as the social acceptable wage, which is not connected to the APL_A , so the increase of the APL_A will not induce an increase in the agricultural sector's wage.

If population growth is allowed, and we assume it grows at a constant and exogenous rate γ , that is $\frac{\dot{L}}{L} = \gamma$. In this case, when both sectors have the same population growth rate, i.e., $\gamma_M = \gamma_A > 0$, or there is no population growth in the manufacturing sector and all population growth are in the agricultural sector, i.e., $\gamma_M = 0, \gamma_A > 0$, it means that the expansion of manufacturing labor (L_M) is from net increase of surplus labor caused by population growth in the agricultural sector. Therefore, when the number of emigrants is equal to or less than net population growth (i.e., industrial employment expansion is equal to or less than net growth

of workers), the expansion of manufacturing labor is satisfied by population growth, and the total amount of agricultural labor (L_A) does not change. Consequently, the APL_A and hence the wage will stay constant.

If we assume there is a positive technological shock in the agricultural sector, $T_A > 0$, this increase of total factor productivity (TFP) in this sector will release some effective agricultural laborers (L_a) from production, and create more surplus labor in the agricultural sector. Kwan *et al.* (2013) argue that relatively higher labor productivity implies potentially more surplus labor. When the rate of emigration is in line with the growth rate of TFP in the agricultural sector, the total amount of surplus labor will be constant in the agricultural sector. Thus, if the expansion of manufacturing labor is less than the reduction of effective agricultural labor or the increase of surplus labor, the wage will also be constant.

In China during the reform period, the average population growth rate was about 5% from 1978 to 2010, net population increased from 1 billion in 1978 to 1.3 billion in 2010 (National Bureau of Statistics of China, 2010). In the same period, since China underwent significant economic transformation, the total number of rural to urban migrant laborers continued to grow and reached 136 million in 2007 (Cai *et al.*, 2009) and the annual growth rate of agricultural TFP on average was 1.5% resulting in an overall 21.2% increase from 1990 to 2003 (Chen *et al.*, 2008). However, Cai and Wang (2010) show that the average monthly wage for migrants increased very slightly from 608 RMB in 1997 to 1339 RMB in 2008. The increase in the wage was so small that we can ignore it, thus there was a constant wage level for unskilled workers in urban areas for a period of around 20 years before the early 2000s (Wang and Weaver, 2013).

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Chapter 3

China's Efficient Urban Bias

3.1 Introduction

Along with its significant economic growth, China has undergone an enormous increase in urbanization over the past 35 years. The number of people living in urban areas has grown from less than 18 percent of total population in 1978 to 54 percent in 2013 (NBS, 2014). That is, about 560 million more people now living in urban areas in China. Although the level of urbanization is still below that of many developed countries which have more than 80 percent urban population, the scale and the speed of Chinese urbanization are astonishing.

Given the scale and speed of its urbanization process and given that China's rural-urban migration is strictly controlled by the government through the household registration (Hukou) system, many questions need to be answered regarding China's urban bias policies and their implications for efficiency and welfare in the urbanization process.

Many countries have pursued an urban bias policy. In many of these countries, public infrastructure investments in cities are enormous compared to rural areas and government policies concerning land markets and migration often favor urban areas. Urban bias is evident in China as it explicitly controls population movement. As a result, the rural-urban income gap in China is now among the biggest in the world (Sicular *et al.*, 2007; Wang and Piesse,

2010). This is apparent in more than income: the rural-urban divide is multi-dimensional in areas such as consumption, education, health-care and access to public goods. Measured in most of these dimensions, China's rural-urban divide and inequality have risen across regions and over time.

A big rural-urban divide in many countries has led to mass rural-urban migration. However, China's urbanization process has been subject to very heavy distortionary government policies. China's unique household registration (Hukou) system works as a *de-facto* internal passport and visa mechanism, ties people to particular geographical locations and assigns an urban or rural Hukou status to every individual. When this system is strictly enforced, no unauthorized movement across regions or from rural areas to urban areas is legal. This means that rural-urban and cross-region migration have been less. The Hukou system created invisible walls and administrative barriers that divided China into two: those with urban Hukou who have access to certain government subsidies, such as unemployment support and retirement pensions, and those with rural Hukou who are guaranteed land-use rights and access to subsistence.

Since the reforms began, there has been a continuous loosening of controls and restrictions on rural labor moving to cities. Although it remains extremely difficult for a rural person to become a permanent urban dweller (that is, to obtain an urban Hukou), many of them live in cities on a temporary basis without urban Hukou status. As of 2013, it is estimated that roughly 250 million people with rural Hukou status were resident¹ in urban areas (NBS, 2014).

Despite continuing government efforts aimed at improving rural development, the rural-urban divide is still increasing. This has led many researchers to place the blame for this on the Hukou system.² Some local governments, such as Chongqing municipal provincial government,

¹Residency here is defined by the Chinese State Council as "at least three months" in the particular urban area.

² Many researchers argue that China's growth performance has been hindered by the Hukou system, so they

began to encourage some farmers to give up their land rights in exchange for urban Hukou status. However, this chapter puts those questions into a theoretical framework and argues that the Hukou system was not the cause of the divide and did not lead to economic inefficiency.

There has been a wide range of literature on urbanization, from work examining why economic activity is so geographically concentrated, work looking at the question of the efficiency of rural to urban migration, work discussing the way cities interact with each other and work on the effect of governance, institutions and public policies on urbanization (Henderson, 2005), but there is a lack of theoretical understanding of China's urban bias policies and the urbanization process.

Based on Mourmouras and Rangazas' (2013) dynamic general equilibrium model with endogenous rural-urban migration, we develop a model that captures China's unique Hukou system. By differentiating the provision of rural and urban public services, and by imposing costs on rural-urban migration, the Chinese government was able to increase economic efficiency at the cost of rural residents' welfare and rural-urban equality.

Conventional literature argues that urban-biased policy and/or labor-market segmentation is inefficient. (Lipton, 1977; Henderson, 2005) However, given its labor-market conditions, China's systematic urban bias policy did not necessarily create inefficiencies associated with

have added their voices to calls for the abolition of the system. A prominent example is the development of a thriving informal sector by rural migrants that has yielded value-added to urban sectors and that might have contributed much more in the absence of the Hukou system. However, we want to emphasize that our story is only about the case of how the Hukou system affects China's urban bias policy and the whole economy's efficiency and welfare, we are not focusing on splitting the whole economy into formal and informal sectors, nor on a specific analysis of the effect of Hukou on the development of the informal sector, which could be another topic in my future research but is not the story of this chapter.

the restriction of labor-market segmentation. In addition, as the Chinese government is able to intervene in migration costs through the Hukou system to control the flow of rural-urban migration, it might well have contributed to China's relatively orderly urbanization process. In other words, China's urban bias may have led to inequality, but it is not inefficient.

The Hukou system restricted internal migration between urban and rural areas and between regions. With China's rapid economic growth, continuous regional controls have caused significant loss of efficiency as well as increased inequality. A progressive Hukou reform that reduces barriers to cross-region migration would improve economic efficiency and welfare.

By applying a dynamic general equilibrium model with endogenous rural-urban migration, this chapter is able to provide an integrated analytical framework for a comprehensive understanding of the economic and welfare implications of China's urban bias policy and its household registration system. This chapter contributes to the literature as follows. Firstly, this chapter formalizes China's urban bias under the Hukou system, and studies the impact on efficiency and the welfare implications of government fiscal policy. Secondly, it extends to formalize China's mega-city bias and shows that this type of bias does not bring improved efficiency but creates inefficient labor-market segmentation and increases inequality. Finally, our model demonstrates the effects of these two types of bias on economic growth and economic welfare.

The rest of this chapter is structured as follows. Section 3.2 introduces China's Hukou system and discusses its impact on China's rural-urban and inland-coastal migration; section 3.3 develops a simple baseline model of urban bias that takes efficiency into consideration; section 3.4 extends the model to the case of China with special emphasis on the role of the Hukou system in shaping urbanization; section 3.5 further extends the model to discuss the geographical division between regions and between coastal and inland cities; the final section concludes and suggests some policy implications.

3.2 China's Hukou System and Urban Bias

In many countries, explicit migration restrictions are not possible as this would be regarded as open discrimination. There are many implicit ones. For example, cities can refuse to provide legal housing development or basic public services for immigrants or the neighborhoods where they settle. Despite this, many such cities still attract many migrants which leads to the development of slums, shanty-towns or squatter settlements. (Henderson, 2005)

In China, explicit migration restrictions have existed for about two thousand years since the Han dynasty (such a restriction was known as Bianhu) and historically there has been little resistance to this. An early version of the current system, known as Household Registration or the Hukou system, was introduced shortly after the establishment of the People's Republic of China, for monitoring population movement. However, as influxes of peasants into cities escalated and began to be a serious burden, the central government tried to stop what it called "blind flows" of rural labor with the implementation of formal controls. As a result, the Hukou Registration Act of the People's Republic of China came into force in 1958, granting state agencies much greater powers for controlling citizens' geographical mobility through a system of migration permits and recruitment and enrollment certificates.³

Under the 1958 Hukou system, every Chinese citizen was registered as resident in a specific place with a category of either agricultural (rural) or non-agriculture (urban). Residents with rural Hukou were assigned rights to land for farming, while those with urban Hukou were provided with various benefits, including state-subsidized food and housing and, for many, access to permanent jobs.

The Hukou system functions as a *de-facto* internal passport and visa mechanism that confined the population to their place of birth and created two separate entities, a rural and an

³See Chan and Zhang (1999), Knight and Song (1999) and Wang and Piesse (2010) for detailed description of the Hukou system.

urban China, where migration between the two only occurred on an extremely small scale and under strict state control. Under this system, employment restrictions and state distribution policies created a highly segmented system, which still remains in many areas of the economy.

The rural-urban divide at a general level has been well documented but what is less discussed are the location-specific features of the Hukou system and its policy implications. Every citizen is required to register in one, and only one, place of residence whether it be rural or urban. Almost all the entitlements, regardless of rural or urban status, have a specified locality. Thus the system restricted internal migration of its population not only between urban and rural areas, but also within the urban sector, between big and small cities, and between regions (Au and Henderson, 2006). For example, a Shanghai urban Hukou status is substantially different from a Chongqing urban Hukou status, in the way that people often attach much higher value to the former.

Reforms over the past decades have seen many controls being loosened. However, it still remains extremely difficult for an individual or a household with rural Hukou to establish a household in an urban area and obtain urban Hukou. Although temporary migration is now permitted, city governments impose restrictions on the employment of migrants in enterprises under their jurisdiction in order to minimize unemployment and maintain social order (Knight and Song, 2005, p184). When in cities, migrants have little access to the benefits available to urban Hukou holders – these include unemployment support, health-care, retirement pensions, or the Minimum Living Allowance scheme. It is even the case that migrants' children are often denied access to urban public schools (Meng, 2012).

Governments used the Hukou system as an explicit tool of control of migration flow: allowing more migration when it thought more was needed and reducing it when it thought it was not. These tools include direct quotas, job and wage discrimination (Knight and Song 2005), temporary Hukou registration of origin and place of work, increased application fees

for required documents, adjusting the level of implementation of measure and intensity of temporary Hukou inspection or level of enforcement, all of which affect the “cost” of migration to migrants.

In fact, the political and institutional arrangements gave urban residents privileged access to secure employment at above market-clearing wages and controlled the flow of peasants to cities, allowing rural migrants to fill only the jobs that urban-dwellers did not want (Knight and Song, 1999; Meng, 2012).

The system of taxes and subsidies has long favored the privileged urban class and exploited impoverished rural residents. Before 2006, China had a regressive tax regime, by which poor rural people paid more direct tax and relatively rich urban people got more subsidies. Rural households were required to pay an agricultural tax according to their Hukou status, whereas urban residents did not pay these taxes, not being involved in agricultural production. The national average burden of agricultural taxes and fees for rural household were about 20 percent of the value of the yield in a normal year. (Wang and Piesse, 2010)

In addition to this regressive tax system, large amounts of government revenue are invested in urban development projects, while there is far less per capita in rural areas (Wang, Piesse and Weaver, 2013). What is defined as a public service in a city may not be considered so in the countryside as much of the public sector infrastructure that does exist in rural areas is provided by the rural population themselves. In cities, local governments typically build schools and roads whereas in some villages, the villagers themselves are responsible for financing and constructing these.

A regressive taxation system and skewed allocation of subsidies make the urban sector better off at the cost of rural households’ welfare. (Wang and Piesse, 2010) In particular, taxes and subsidies are based on individual Hukou status determined largely by place of birth. Even when rural laborers migrate to urban areas, they still face rural tax and fee liabilities simply

because of their rural Hukou status. This situation was exacerbated by huge discrimination in terms of occupational attainment and wages for migrant workers.

The rationale of the Hukou system was an attempt to ensure the success of an industrialization strategy which needed a stable food supply and a flow of capital from the agriculture sector to the industrial sector, through the application of the well known “price scissors” and agricultural taxes (Wang and Piesse, 2010). Generally, in the early stages of development, rural residents have large incentives to migrate to urban areas, but in urban areas job creation is restricted by the speed of growth of its absorptive capacity. In order to fulfill the development strategy and prevent open urban unemployment, the Chinese government controlled rural-urban migration. Hence it can be argued that Hukou made possible a faster capital accumulation and industrialization. Without it, rural people would migrate from rural to urban areas to escape from rural hardship.

As the rural-urban divide become a serious social and political issue with an average urban income more than three times that of a rural resident, the Chinese government started to explicitly address this issue in 2002 but the real impact of these policies has been very limited. Many people advocate the abolition of the Hukou system but this alone might not have a significant impact on reducing inequality, because it would not help if the rural poor moved and added to the stock of urban poor.

Much literature (Knight and Song, 1999; Knight, Deng and Li, 2011; Wang and Piesse, 2013; Wang and Weaver, 2013a) argue that there was surplus labor in both rural areas (where it was disguised as underemployment in the communes) and in urban areas (where it was disguised as underemployment in state-owned enterprises). When this is the case, simply moving people from rural areas to urban areas will only mean a move of rural surplus laborers to become urban surplus laborers and this kind of urbanization, without industrialization, will not improve economic efficiency. Gollin and Vollrath (2013) argue that urbanization and industrialization

do not necessarily happen together. They demonstrate that there are two different paths to high rates of urbanization. The first involves the movement of labor from agriculture into industry; the second is driven by the income effect of natural resource endowments: resource rents are spent on urban goods and services.

Only the urbanization driven by industrial employment opportunities is meaningful to economic efficiency. When other forms of rural-urban migration contribute to urbanization, huge urban unemployment may result and rural-urban migration means that rural surplus labor become urban surplus labor. Such causes of urbanization may be deterioration of conditions in rural areas or government policies which are biased in favor of urban areas or migration to cities based on false expectations.

With China's rapid economic growth and urbanization, with reduction in subsidies for urban Hukou holders and the removal of the agriculture tax in 2006, the difference in terms of treatment between rural Hukou and urban Hukou in small towns became smaller; the boundary blurred between a county level urban Hukou and rural Hukou. There has been a shift in inequality away from the urban-rural divide to the difference between big cities and smaller ones, and between Eastern coastal and Western inland cities.⁴ A coastal-city urban bias induced by Hukou restrictions on inland-to-coastal migration reflects coastal-city priorities rather than equity and efficiency considerations.

3.3 The Basic Model

The set-up and the discussion of the basic model in this section largely follow Mourmouras and Rangazas (2013). The model describes a small open economy where both final goods

⁴This is partly a result of the spatial concentration of industries in coastal areas, and partly a result of some wealth concentration programs are favoring different regions. For example, China's uneven development strategy since 1978 led to income inequalities between the coastal and inland regions.

and physical capital flow freely across borders. There are two sectors of production of fixed geographic size, urban and rural, that produce the same consumption goods. Production in each sector is carried out by perfectly competitive firms.

Urban and rural sectors are different in the technology used in production. Firms in the rural sector use traditional technology in that land is combined with labor to produce output, while modern technology is used in the urban sector where physical capital and labor are combined to produce output.

Households can only work in the sector in which they reside, but households make a decision about where to live and work when they are young before work begins. When there is a wage gap between urban and rural sectors, the young household takes this into consideration but rural to urban migration takes time.

The productivity of each sector is affected by government investment and government services. Because both sectors produce the same goods, the rural sector may be viewed as redundant. Government may favor the urban sector and provide only limited government services to the rural sector.

3.3.1 Production

3.3.1.1 Urban Sector

Firms in the urban sector engaged in final goods production use capital and labor according to the following technology,

$$Y_t = K_t^\alpha (D_t M_t)^{1-\alpha} \tag{3.3.1}$$

where Y_t is output, K_t is the capital stock, M_t is the number of workers employed, D_t is a labor productivity index and α is the constant capital share parameter with $0 < \alpha < 1$. The productivity index is a function of effective productive government services per worker,

$g_t = G_t/M_t$, and an exogenous technology index, E_t ,

$$D_t = (g_t)^\mu E_t^{1-\mu} \quad (3.3.2)$$

where μ is a constant parameter with $0 < \mu < 1$. The technology index, E_t , grows at a constant rate q .

Profit maximization and competition generate the standard equations relating factor prices to the marginal productivity of the factors

$$r + \delta = (1 - \tau) \alpha k_t^{\alpha-1} \quad (3.3.3)$$

$$W_t = (1 - \alpha) D_t k_t^\alpha \quad (3.3.4)$$

where $k_t = K_t/D_t M_t$.

The return to capital is taxed at the constant rate τ . Capital depreciates at the constant rate δ . For simplicity, we take the rate of depreciation to be one. The internationally determined after-tax rate of return on capital is r . Wage income is also taxed at the constant rate τ , but tax is collected at household level. The before-tax wage rate paid to a worker is W_t .

3.3.1.2 Rural Sector

The rural sector produces the same good⁵ with the technology that uses land (L) instead of physical capital. For simplicity, we assume that rural firms and households face the same

⁵ The output in the rural sector is denoted by O_t only for the purpose of helping to keep the two sectors distinct.

tax rate as the urban sector.

The rural technology is

$$O_t = L_t^\alpha (A_t F_t)^{1-\alpha} \quad (3.3.5)$$

where F_t is the labor employed in production and A_t is the labor productivity index in the rural sector. We assume the land share to be the same as the capital share in the urban sector, α . Similar to the urban sector, the labor productivity index in the traditional sector is determined by

$$A_t = (g_t^O)^\mu (e_t E_t)^{1-\mu} \quad (3.3.6)$$

where $g_t^O = G_t^O/F_t$ and where e_t is the relative state of technology in rural production. Note that an increase in E_t , holding e_t constant, represents a balanced technological improvement across sectors.

The competitive factor price equations for the rental rate of land and the rural wage rate are as follows:

$$r_t^L = (1 - \tau) \alpha \left(\frac{L_t}{A_t F_t} \right)^{\alpha-1} \quad (3.3.7)$$

$$W_t^O = (1 - \alpha) A_t \left(\frac{L_t}{A_t F_t} \right)^\alpha \quad (3.3.8)$$

Available land is fixed in the economy, so in the equilibrium we must have $L_t = L$ in each period. Given the equilibrium rural wage rate and the fixed amount of land, the allocation of

labor to the rural sector, F_t , and the rental rate on land, r_t^L , are given by the competitive factor price equations (3.3.7) and (3.3.8).

3.3.2 Households

Households are life-cycle planners that populate the standard overlapping generation model. Households live for two periods; they work only in the first period and then retire in the second period. All households have the same preferences. Household welfare is determined by the consumption of the common good produced in the two sectors, c_{it} , where i denotes the period of life in which the goods are consumed. Households save by purchasing physical capital (s_t) and land (l_t), and then renting them to firms for production. Households can only work in the sector in which they reside.

3.3.2.1 Urban Sector

Household preferences, regardless of location, are given by the following lifetime utility function

$$U_t = u(c_{1t}) + \beta u(c_{2t+1}) \quad (3.3.9)$$

where u is a strictly concave and differentiable, single-period utility function and β is the time discount factor.

The single-period budget constraints for the two periods of life of an urban household are as follows:

$$c_{1t} + s_t + p_t^L l_t = (1 - \tau) W_t \quad (3.3.10)$$

$$c_{2t+1} = (1 + r) s_t + (r_{t+1}^L + p_{t+1}^L) l_t \quad (3.3.11)$$

where p_t^L is the competitive relative price of land. The two single-period constraints generate the following lifetime budget constraint

$$c_{1t} + \frac{c_{2t+1}}{1 + r} = (1 - \tau) W_t \quad (3.3.12)$$

with the no-arbitrage condition that determines the equilibrium price of land

$$p_t^L = \frac{r_{t+1}^L + p_{t+1}^L}{1 + r} \quad (3.3.13)$$

Given the competitive factor prices, urban households make life-cycle consumption choices to maximize utility.

3.3.2.2 Rural Sector

There are two types of rural household. One type chooses to remain in the rural sector and the second type migrates to the urban sector. Migration is costly. It requires a loss of consumption equal to θ (transportation costs, goods left behind and other moving expenses) and a lost fraction of work-time, ω , spent in transit and in looking for work in the city. The decision to migrate occurs at the beginning of a household's working life and is based on the relative wage opportunities in the two sectors that determine the household's lifetime welfare.

Households that remain in the rural sector maximize utility subject to a lifetime budget constraint (based on the after-tax rural wage)

$$c_{1t}^O + \frac{c_{2t+1}^O}{1 + r} = (1 - \tau) W_t^O \quad (3.3.14)$$

The rural households that choose to migrate to the urban sector must bear the time and goods costs associated with migration. They maximize utility subject to a lifetime budget constraint based on the urban wage net of migration costs

$$\bar{c}_{1t}^O + \frac{\bar{c}_{2t+1}^O}{1+r} = (1-\tau)(1-\omega)W_t^U - \theta_t \quad (3.3.15)$$

In an open economy, the interest rate is determined exogenously by the international market for capital. We assume the international return to capital is constant, so that maximum utility will vary because of variation in the market wage rate alone. The value function is defined to be $V(X)$, where X stands for the net wage of the different household types. In some cases, we will resort to the special case of log preferences where $u(c) = \ln c$. In this case, the value function of a household with net wage X takes the form, $V(X) = (1+\beta)\ln\left(\frac{1}{1+\beta}\right) + \beta\ln\beta + (1+\beta)\ln(X) + \beta\ln(1+r)$.

3.3.3 Demographics

In each period there will be young and old households of each of the three types. The population of young urban households in each period, N_t , is composed of the children of the previous period's urban-sector natives and those young rural households who choose to migrate

$$N_t = (1+n)N_{t-1} + m_t(1+n)N_{t-1}^O \quad (3.3.16)$$

where n is the common rate of population growth for all households, m_t is the fraction of young rural households that choose to migrate and N_{t-1}^O is the number of rural households in the previous period. The number of rural households in the current period is

$$N_t^O = (1 - m_t) (1 + n) N_{t-1}^O \quad (3.3.17)$$

The labor supply in each sector equals the number of young households in that sector, $M_t = N_t$ and $F_t = N_t^O$. Assuming a common population growth rate in each sector implies the country's total population size $P_t = N_t + N_t^O$ is exogenous, i.e., independent of the endogenous allocation of the population across the sectors that occurs each period.

3.3.4 Migration in Equilibrium

We primarily consider equilibria where both sectors operate and some movement to the city occurs each period. For these equilibria, the rural households must be indifferent about staying in the rural sector or migrating to the urban sector. For a household to be indifferent about migrating, the value functions must be equal whether the household migrates or not, i.e., $V_t [(1 - \tau) W_t^O] = V_t [(1 - \tau) (1 - \omega) W_t - \theta_t]$ or equivalently

$$W_t^O = (1 - \omega) W_t - \frac{\theta_t}{1 - \tau} \quad (3.3.18)$$

Positive migration to the city is needed to satisfy equation (3.3.18) when, in the absence of migration, W_t^O is strictly less than $(1 - \omega) W_t - \frac{\theta_t}{1 - \tau}$.

3.3.5 Government

We assume the allocation of public services across the two sectors is determined by urban households. ⁶ Given that all urban households in a given age cohort are identical, the choice

⁶This is a reasonable assumption, especially in China, due to the facts that 1) industrial sector and urban workers are the backbone of the communist regime. Agriculture and farmers are perceived to be less important. 2) concentrated minor interests of the urban residents is likely to be overrepresented and diffuse majority interests trumped, as a result of a free-rider problem in collective action that is stronger when a

of government service allocation can be made by a representative household from the cohort of young households in each period. Only young households care about the allocation of government services because these services affect welfare only by affecting the productivity of labor and wages. The welfare of old households in each period is predetermined by the previous period's wage and the exogenously determined world interest rate.

The government budget constraint confronting the representative urban household in making its fiscal choice is given by

$$G_t + G_t^O = B_t \tag{3.3.19}$$

where B_t is the proportion of the total government budget that is allocated to fund government services, and the value of B_t depends on the tax revenues from both the return to capital and wage income at the constant rate τ . We assume that B_t rises proportionately with the state of technology and the country's population, to capture the effects of a rising tax base.

The representative urban household chooses the allocation of public services to maximize a social welfare function of the form $V_t [(1 - \tau) W_t] + \gamma V_t [(1 - \tau) W_t^O]$, subject to equation (3.3.19), where γ is a nonnegative weight placed on the welfare of the rural household by the policymaker. We assume the policy is urban bias thus $0 \leq \gamma \leq 1$.

3.3.6 Characterizing the Equilibrium

Defining the de-trended per worker values of G_t^O , G_t , and B_t as $\tilde{g}_t^O = G_t^O/F_t E_t$, $\tilde{g}_t = G_t/M_t E_t$, and $\tilde{b}_t = B_t/P_t E_t$, that is government services per worker in each sector and the budget available per household, all de-trended by the state of technology. For equilibria where partial migration occurs, $0 < m_t < 1$, the equilibrium values of \tilde{g}_t^O , \tilde{g}_t , m_t and W_t^O/W_t , must satisfy the following equations⁷

group becomes larger (Olson, 1965).

⁷For the details of the derivation of these equations see the Appendix, which is extended from the Appendix

$$\tilde{g}_t^O = \frac{\mu(1-\alpha)}{\alpha + \mu(1-\alpha)} \tilde{g}_t \quad (3.3.20)$$

$$\tilde{g}_t M_t + \tilde{g}_t^O F_t = \tilde{b}_t P_t \quad (3.3.21)$$

$$1 - m_t = \left\{ \frac{\left[(e_t^R)^{1-\mu} (\tilde{g}_t^O)^\mu \right]^{1-\alpha}}{k_t^\alpha (\tilde{g}_t)^\mu (W_t^O/W_t)} \right\}^{\frac{1}{\alpha}} \frac{L}{(1+n) N_{t-1}^O E_t} \quad (3.3.22)$$

$$\frac{W_t^O}{W_t} = 1 - \omega - \frac{\theta_t}{(1-\tau)(1-\alpha) k_t^\alpha (\tilde{g}_t)^\mu E_t} \quad (3.3.23)$$

Equation (3.3.20) determines the optimal mix of government services across sectors. Note that the expression is independent of γ , so politics plays no role in determining the allocation of government services across sectors. There is an unambiguous urban bias because government services per capita are smaller in the rural sector, but this is for efficiency reasons. The fundamental logic for the efficient urban bias starts with the idea that urban wages are solely a function of urban public services per capita, see equation (3.3.4), and not the absolute value of labor as in the rural sector where land is an input.

An attempt is made to limit migration from rural areas by offering some public services. The purpose of rural public services provision is to control urban crowding which would overstretch urban public services for a given fiscal budget.

The role of rural public services in controlling urban crowding can be seen directly by

A in Mourmouras and Rangazas (2013).

rewriting equation (3.3.19) as

$$\tilde{g}_t \rho_t + \tilde{g}_t^O (1 - \rho_t) = \tilde{b}_t \quad (3.3.24)$$

Given the size of the government budget per person, an increase in the fraction of the urban population (ρ_t) will strain resources when there is urban bias. The value of ρ_t is indirectly determined by equation (3.3.22) which derives from equation (3.3.8) and expresses the demand for labor in the rural sector as a fraction of the stable rural population ($1 - m_t$). Equation (3.3.22) indicates that the lower the provision of government services in the rural sector, the weaker the demand for rural workers and the higher m_t and ρ_t . Thus, it is optimal to provide some government services to the rural sector in order to manage the value of ρ_t in the face of urban bias in government services provision.

The degree of urban bias depends on how much rural government services affect the rural population; the larger the effect, the weaker the urban bias. The effectiveness of government services in controlling migration depends on the production parameters, μ and α , as can be seen in equation (3.3.22). The larger the expression $\mu(1 - \alpha)$, the greater the effect of government services on the marginal product of labor, and labor demand, in the rural sector. A low value of α , not only increases the size of the shift in the demand for labor, as government services increase, but also reduces the slope of the demand for labor. When the demand for labor has a flatter slope, more workers must be hired in order to derive the marginal product of labor back down to the equilibrium wage rate.

As argued by Mourmouras and Rangazas (2013), in this model, a redistributive urban bias designed to increase urban welfare must take the form of restricted migration to the city. To redistribute income, the government needs to reduce migration by imposing direct administrative measures, such as migration quotas and other restrictions that raise the costs

of migration.

3.4 China's Efficient Urban Bias with the Hukou System

This section analyzes China's urbanization and urban bias policies, in the presence of the Hukou system. As discussed in section 3.2, China was practicing urban bias policies that invested much more public goods in urban areas and provided more jobs and welfare to support urban residents. When these policies stimulate rural households to migrate, the government uses the Hukou system to control rural-urban migration by administrative measures and by affecting the costs of migration from rural to urban areas. In this section, migration is restricted by the Hukou system, and the government is assumed to allocate urban and rural government services and to have the ability to impose deliberate migration costs that can affect rural-urban migration.⁸

Note that in the baseline model we assume land can be purchased for households' savings. However, in China, land belongs to government, rural households only have the rights to use land and any transaction of land is not allowed. Therefore, when we apply the baseline model to the case of China, it is more appropriate to assume that land is deleted from the budget constraints (see equations (3.3.10) and (3.3.11)), but this does not have any effect on characterizing the new equilibrium in China.

3.4.1 China's Migration Model

Supposing everything to be the same as the baseline economy, and the Chinese government is able to intervene in the reallocation of rural and urban government services with a redistributive urban bias in setting policy $G_t + Z_t$ and $G_t^O - Z_t$, where Z_t is the realloca-

⁸Chinese government is able to affect migration costs does not mean it has the ability to directly allocate households across sectors with no cost.

tion of public services from the rural to the urban sector with $0 \leq Z_t \leq G_t^O$.⁹ Government services per worker in both sectors can be expressed as $\hat{g}_t = (G_t + Z_t)/M_t = g_t + z_t$ and $\hat{g}_t^O = (G_t^O - Z_t)/F_t = g_t^O - z_t^O$, where z_t and z_t^O are reallocated urban and rural government services per capita respectively, which satisfy $z_t M_t = z_t^O F_t = Z_t$. In this case, equations (3.3.2) and (3.3.6) become the following form

$$\hat{D}_t = (\hat{g}_t)^\mu E_t^{1-\mu} \quad (3.4.1)$$

$$\hat{A}_t = (\hat{g}_t^O)^\mu (e_t E_t)^{1-\mu} \quad (3.4.2)$$

and equations (3.3.4) and (3.3.8) of urban and rural wages become as follows

$$\hat{W}_t = (1 - \alpha) \hat{D}_t k_t^\alpha \quad (3.4.3)$$

$$\hat{W}_t^O = (1 - \alpha) \hat{A}_t \left(\frac{L_t}{\hat{A}_t F_t} \right)^\alpha \quad (3.4.4)$$

For a prolonged period from the late 1980s, Chinese rural migrants needed temporary Hukou when looking for and taking jobs in the city. Temporary Hukou application is controlled

⁹The existence of Z_t , can be understood as China's regressive tax and subsidy regime discussed in section 3.2. If we define the effective tax rate equals the tax rate minus government services per capita, that is $\tau_t^* = \tau - g_t$. In our model, τ is the same in both rural and urban sectors, and $g_t > g_t^O$, hence we have a larger effective tax rate in the rural sector that $\tau_t^* < \tau_t^{O*}$. That means Chinese government taxes the rural sector more to get revenue, and then transfers the revenue to the urban sector, which is equivalent to the reallocation of public services from the rural to the urban sector, Z_t .

by the government through the adjustment of application time and fees and the strictness of implementation. Chinese local governments have the ability to artificially increase the costs of migration to $\omega + h_t^1$ and $\theta_t + h_t^2$, where ω and θ_t are the natural losses of work-time and consumption respectively as shown in the baseline model. h_t^1 is extra lost fraction of work-time induced by the Hukou system, and Hukou also generates extra loss of consumption, h_t^2 , such as application fees for the required documents for temporary Hukou. Hence equation (3.3.18) can be rewritten as follows:

$$\hat{W}_t^O = (1 - \omega - h_t^1) \hat{W}_t - \frac{\theta_t + h_t^2}{1 - \tau} \quad (3.4.5)$$

3.4.2 Characterizing the New Equilibrium with the Hukou System

Defining the de-trended per worker values of reallocated $G_t^O - Z_t$, $G_t + Z_t$, and B_t as $\hat{g}_t^O = (G_t^O - Z_t) / F_t E_t = \tilde{g}_t^O - \tilde{z}_t^O$, $\hat{g}_t = (G_t + Z_t) / M_t E_t = \tilde{g}_t + \tilde{z}_t$, and $\tilde{b}_t = B_t / P_t E_t$, that is the reallocation of government services per worker in each sector and the budget available per household, all de-trended by the state of technology. Through adjusting the values of Z_t , h_t^1 and h_t^2 , Chinese economy can achieve a new equilibrium associated with labor-market segmentation generated by the Hukou system.

Proposition 1 When the Chinese government is able to directly reallocate the provision of government services differently to rural and urban areas and so affect the costs of migration, the new equilibrium values of \hat{g}_t , \hat{g}_t^O , \hat{m}_t and \hat{W}_t^O / \hat{W}_t must satisfy the following equations

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¹⁰The details of the derivation of these equations follow the baseline model.

$$\hat{g}_t^O = \frac{\mu(1-\alpha)}{\alpha + \mu(1-\alpha)} \hat{g}_t \quad (3.4.6)$$

$$\hat{g}_t M_t + \hat{g}_t^O F_t = \tilde{b}_t P_t \quad (3.4.7)$$

$$1 - \hat{m}_t = \left\{ \frac{[(e_t)^{1-\mu} (\hat{g}_t^O)^\mu]^{1-\alpha}}{k_t^\alpha (\hat{g}_t)^\mu (\hat{W}_t^O / \hat{W}_t)} \right\}^{\frac{1}{\alpha}} \frac{L}{(1+n) N_{t-1}^O E_t} \quad (3.4.8)$$

$$\frac{\hat{W}_t^O}{\hat{W}_t} = 1 - \omega - h_t^1 - \frac{\theta_t + h_t^2}{(1-\tau)(1-\alpha) k_t^\alpha (\hat{g}_t)^\mu E_t} \quad (3.4.9)$$

3.4.3 Analysis

Equation (3.4.6) shows that, since government services per capita are higher in the urban sector, there exists a redistributive urban bias in China. China's redistributive urban bias improves productive efficiency in the urban sector and accelerates the urbanization process. This is achieved by the reallocation of government services from the rural to the urban sector. In other words, because urban wages are only determined by urban government services per capita, as shown in equation (3.4.3), and $G_t + Z_t$ induces more extensive urban government services per worker, $\hat{g}_t = g_t + z_t$, the urban sector will have greater productivity and higher wages.

However, with natural migration costs ω and θ_t , higher urban wages would stimulate rural migration. In the equilibrium, larger rural migrants \hat{m}_t would increase M_t in the city. According to $\hat{g}_t = (G_t + Z_t)/M_t E_t$, a bigger M_t leads to smaller reallocated urban government services per capita. On the other hand, more migrants would cause a heavier strain on the government budget, which has a negative effect on urban government services per capita. Therefore, if the crowding effects from migration can not be limited, the increase in efficiency generated by Z_t will be eliminated in the urban sector by the inflow of rural migrants. Instead, the efficient policy – the one that maximizes urban government services provision per capita and wages in both sectors – is to increase the costs of migration in order to limit migration.

In China, as discussed above, because of the existence of the Hukou system, rural-urban migration is restricted by the government. Thus, on one hand redistributive urban bias gives rise to an increase in urban wages but, on the other hand, in the rural sector, migration is limited by Hukou-induced migration costs, h_t^1 and h_t^2 . For example, when these Hukou migration costs are larger than the increase in urban wages, the incentives for rural households to migrate to the urban sector are eliminated. In this case, urban crowding is controlled by limited migration. Consequently, efficiency generated by Z_t in the urban sector will be maintained by Hukou migration costs. In other words, China's Hukou system controls the crowding effects of migration leading to efficient redistributive urban bias. Thus Hukou has helped with an efficient urban bias.

Equation (3.4.7) indicates that Z_t , h_t^1 and h_t^2 will not change the fiscal constraint. Equation (3.4.8) implies that the higher Z_t , the lower the provision of government services in the rural sector, so the weaker the demand for rural workers and the higher \hat{m}_t . In the extreme case of $Z_t = G_t^O$, where the government reallocates all rural public services to cities and the entire government budget is devoted to urban public services, almost all rural households are eager to migrate to the urban sector for significant welfare even when Hukou imposes higher migration

costs on migrants. It is optimal to provide some government services to the rural sector in order to maintain rural wages and to limit migration. This case reflects urban priorities rather than equity considerations.

China's wage inequality across sectors is given in equation (3.4.9). The baseline model shows natural migration costs, ω and θ_t , would affect rural-urban inequalities, but in China, endogenous Hukou migration costs would also influence inequalities, that is, higher h_t^1 and h_t^2 lead to a smaller fraction of \hat{W}_t^O over \hat{W}_t . Therefore, China's Hukou system helped redistributive urban bias to trade off rural households welfare for efficiency in the urban sector but, at the same time, exacerbated rural-urban inequalities.

Proposition 2 Under the Hukou system which has restricted rural-urban migration, China's redistributive urban bias did not necessarily reduce economic efficiency but did raise urban welfare at the expense of rural welfare. The Hukou costs of migration played a significant role in increasing China's rural-urban inequalities.

What we argue here is that the urban bias policy enabled by the Hukou system is more like a lump-sum transfer to the urban sector financed by a lump-sum tax on the rural sector. As households cannot affect the level of tax by changing their behavior, this kind of tax does not lead to any distortions in choice. No resources are lost due to the imposition of the lump-sum tax. As a result, the economy's total endowment and efficiency are not reduced by the application of these lump-sum taxes and transfers. When redistribution is achieved with no efficiency cost, it actually increases economic efficiency in the way that the transfer enhances production efficiency of the urban sector. In turn, as a result of the general equilibrium effect, it will also benefit the rural sector dynamically.

3.5 New Development and Inefficient Geographic Bias

As discussed above, the Hukou system has contributed to China's growth by ensuring a relatively orderly and smooth urbanization but it has also reduced rural households' welfare by impeding their migration and this has led to possible welfare losses for rural residents.

However, the boundary between a county level urban Hukou and rural Hukou has been blurring because the difference in terms of treatment between rural Hukou and urban Hukou in small cities became smaller with reduction in subsidies for urban Hukou holders and the removal of the agriculture tax in 2006.

There has been a shift in inequality away from the urban-rural divide to a divide between big cities and smaller ones and between Eastern coastal cities, such as Beijing, Shanghai and Guangzhou and middle and Western inland cities, such as Wuhan, Xi'an and Guilin. At present, the eastern provinces have a much higher real income than the central and western provinces, despite the fact that the income difference between the three regions was relatively small in 1978. The rural-urban divide becomes more of a geographical divide between regions and between core and peripheral cities. This section considers the provision of urban government services across cities and the question of the efficiency of coastal-city urban bias.

3.5.1 *Production*

Supposing the Chinese government has the ability to allocate urban public services to coastal and inland cities it might give a share ϕ of urban government services G_t to coastal cities and $1 - \phi$ to inland cities. As the production technology in coastal and inland cities is the same in that they use physical capital and labor to produce output, we assume the production function as

$$Y_t^j = (K_t^j)^\alpha (D_t^j M_t^j)^{1-\alpha} \quad j = C, I \quad (3.5.1)$$

where coastal and inland cities are labeled C and I respectively, and city-specific variable is superscript $j = C, I$. Y_t^j is output, K_t^j is the capital stock, M_t^j is the number of employed workers, and D_t^j is a labor productivity index, and it takes the following form

$$D_t^j = (g_t^j)^\mu E_t^{1-\mu} \quad j = C, I \quad (3.5.2)$$

where $g_t^C = \phi G_t/M_t^C$ represents urban government services per worker in coastal cities, and $g_t^I = (1 - \phi) G_t/M_t^I$ is inland-city urban government services per worker. Coastal and inland cities have the same technology index E_t , which is exogenous in the model.

Profit maximization and competition generate wages as

$$W_t^j = (1 - \alpha) D_t^j (k_t^j)^\alpha \quad j = C, I \quad (3.5.3)$$

where $k_t^j = K_t^j/D_t^j M_t^j$.

Note that $Y_t^C + Y_t^I = Y_t$, $K_t^C + K_t^I = K_t$ and $M_t^C + M_t^I = M_t$.

3.5.2 Migration between Cities with the Hukou System

To simplify calculation, we assume there are no natural costs of migration, ω and θ_t , on inland-to-coastal migrants. However, inland-to-coastal migrants are burdened with migration costs h_t^1 and h_t^2 , which are imposed by the government to limit migration from peripheral inland cities to core coastal cities and other geographical migration.¹¹ h_t^1 and h_t^2 can be interpreted as Hukou migration costs of losses of working-time and consumption respectively. In the equilibrium,

¹¹An implicit assumption here is that there are no Hukou migration costs for migrants from coastal to inland as people would not want to migrate that way in general.

taking h_t^1 and h_t^2 into consideration, inland-city households must be indifferent about staying in inland cities or migrating to coastal cities, i.e., the following equilibrium condition of inland-city and coastal-city wages must be satisfied

$$W_t^I = (1 - h_t^1) W_t^C - \frac{h_t^2}{1 - \tau} \quad (3.5.4)$$

When W_t^I is strictly less than $(1 - h_t^1) W_t^C - \frac{h_t^2}{1 - \tau}$, there will be no inland-coastal migration.

We also assume the fraction \bar{m}_t of young inland-city households have the incentive to migrate when they achieve equation (3.5.4). In the equilibrium, the numbers of coastal-city and inland-city workers in the current period are as follows respectively

$$M_t^C = (1 + n) M_{t-1}^C + \bar{m}_t (1 + n) M_{t-1}^I \quad (3.5.5)$$

$$M_t^I = (1 - \bar{m}_t) (1 + n) M_{t-1}^I \quad (3.5.6)$$

where n is the population growth rate in the economy.

3.5.3 Government

We allow coastal-city households to determine the allocation of urban government services between coastal and inland cities, and the representative coastal-city household making its fiscal choice is constrained by the given government services in the urban sector that $\phi G_t + (1 - \phi) G_t = G_t$.¹² When we take into consideration the role of inland-city urban public services in controlling coastal-city crowding, the government budget can be rewritten as $\varphi_t g_t^C +$

¹²Referring back to the baseline model, the given urban government services G_t are financed by the government budget B_t .

$(1 - \varphi_t) g_t^I = g_t$, where φ_t is the proportion of the urban population in coastal cities.

The social welfare function faced by the policymaker takes the form: $V_t [(1 - \tau) W_t^C] + \delta V_t [(1 - \tau) W_t^I]$, subject to government budget constraint, where δ is a nonnegative weight placed on the welfare of inland-city households. We assume $0 \leq \delta \leq 1$ to examine the consequences of coastal-city urban bias in politics.

3.5.4 The Geographical Equilibrium with the Hukou System

Define the de-trended coastal-city and inland-city urban government services per worker by the state of technology as $\tilde{g}_t^I = (1 - \phi) G_t / M_t^I E_t$ and $\tilde{g}_t^C = \phi G_t / M_t^C E_t$. Equation (3.5.3) shows that

$$\frac{W_t^I}{W_t^C} = \left(\frac{\tilde{g}_t^I}{\tilde{g}_t^C} \right)^{\mu(1-\alpha)} \left(\frac{K_t^I M_t^C}{K_t^C M_t^I} \right)^\alpha \quad (3.5.7)$$

The equilibrium condition of inland-city and coastal-city wages derives

$$\frac{W_t^I}{W_t^C} = 1 - h_t^1 - \frac{h_t^2}{(1 - \tau) W_t^C} \quad (3.5.8)$$

The equality of equations (3.5.7) and (3.5.8) gets the following result as

$$\tilde{g}_t^I = \left[1 - h_t^1 - \frac{h_t^2}{(1 - \tau) W_t^C} \right]^{\frac{1}{\mu(1-\alpha)}} \left(\frac{K_t^C M_t^I}{K_t^I M_t^C} \right)^{\frac{\alpha}{\mu(1-\alpha)}} \tilde{g}_t^C \quad (3.5.9)$$

Equation (3.5.9) shows that the degree of bias depends on both Hukou costs of migration and the distribution of capital and workers across cities. In our model, the government only is allowed to affect the provision of urban government services between coastal and inland cities

although the allocation of capital and workers across cities is determined by market forces.

To focus on the consequences of bias in the form of allocating coastal and inland cities' urban government services, we assume present capital and workers are equally allocated across cities. Hence equation (3.5.9) can be reduced to the following form

$$\tilde{g}_t^I = \left[1 - h_t^1 - \frac{h_t^2}{(1 - \tau) W_t^C} \right]^{\frac{1}{\mu(1-\alpha)}} \tilde{g}_t^C \quad (3.5.10)$$

Equation (3.5.10) determines the provision of urban government services between coastal and inland cities. Since urban government services per capita in inland cities are a fraction of those provided in coastal cities, there is urban bias towards coastal cities. Because the production technology is the same in coastal and inland cities in that they use physical capital and labor to produce output, equal allocation of capital and labor in coastal and inland cities causes a natural equilibrium, in which $MPK^C = MPK^I$ and $MPL^C = MPL^I$ lead to $W^C = W^I$. However, China's coastal-city urban bias gives rise to greater productivity and higher wages in coastal cities, which makes the Chinese economy deviate from the natural equilibrium that $W^C = W^I$. Consequently, through adjusting the values of h_t^1 and h_t^2 , coastal-city urban bias leads the economy to a new geographical equilibrium, in which any deviation from the original natural equilibrium would generate possible deadweight loss to the economy. Therefore, China's coastal-city urban bias is inefficient.

In a competitive labor market, the deviation from the natural equilibrium wage rate will be corrected by the market itself but, because China's Hukou system generates segmentation in the labor market, the deviation can not be fixed by the market. This results in inefficient urban bias with continuous deadweight loss to the economy.

The degree of coastal-city urban bias depends on how much the Hukou system affects the costs of migration from inland. The larger the effect, the bigger the potential for coastal-city

urban bias is possible. With no Hukou migration costs, equation (3.5.10) shows coastal-city urban bias would not exist, $\tilde{g}_t^I = \tilde{g}_t^C$. An equal allocation of urban government services across coastal and inland cities returns the economy to the natural equilibrium with no deadweight loss.

Substituting equation (3.5.3) of W_t^C and equation (3.5.5) of M_t^C into equation (3.5.10), we derive the equilibrium fraction of inland-to-coastal migration as follows

$$\bar{m}_t = \frac{K_t^C \left\{ (1 - \tau) (1 - \alpha) E_t^{1-\alpha} (\tilde{g}_t^C)^{\mu(1-\alpha)} \left[1 - h_t^1 - \left(\frac{\tilde{g}_t^I}{\tilde{g}_t^C} \right)^{\mu(1-\alpha)} \right] \right\}^{\frac{1}{\alpha}}}{(1 + n) M_{t-1}^I (h_t^2)^{\frac{1}{\alpha}}} - \frac{M_{t-1}^C}{M_{t-1}^I} \quad (3.5.11)$$

In the case of coastal-city bias, the effectiveness of urban government services in controlling inland-to-coastal migration also depends on the production parameters μ and α , as shown in equation (3.5.11).¹³ The larger the expression $\mu(1 - \alpha)$, the greater the impact of government services on migration across cities.¹⁴

The amount of wage inequality that inland-city households will suffer is determined by Hukou-induced costs of migration, as given in equation (3.5.8). With no Hukou migration costs, wage inequality between coastal and inland cities would no longer be an issue. Thus we derive the following proposition.

Proposition 3 Under the Hukou system that has restricted inland-coastal migration, China's coastal-city bias distorts the allocation of urban government services, generating loss of economic efficiency and exacerbating a geographical divide between regions and between

¹³If we allow the government to have the ability to allocate capital and workers across cities, the government must also take into account K_t^C , M_{t-1}^C and M_{t-1}^I .

¹⁴The details of the analysis of the equilibrium migration can be seen in section 3.3.

core and peripheral cities.

3.6 Conclusion

This chapter has built a dynamic general equilibrium model to analyze urban bias policy and has shown that, with the presence of the Hukou system, China's redistributive urban bias across rural and urban sectors was efficient in that it traded off rural-urban inequality for urban efficiency. However, China's coastal-city bias between cities was inefficient in that it generated deadweight loss in the economy and enlarged inland-coastal inequality.

China's Hukou system restricting labor migration from rural to urban areas, is part of a systematic urban bias in the policy. However, because of the co-existence of surplus labor in both rural and urban sectors, transferring excessive rural surplus labor to urban areas artificially will not improve output or efficiency.¹⁵ Urbanization without industrialization (i.e., without sufficient employment creation in the urban sector) might have no economic benefits as it only involves surplus labor in rural areas becoming urban surplus labor. (Gollin and Vollrath, 2013; Wang and Weaver, 2013a) In other words, without the expansion of absorptive capacity in the urban sector, any relocation of labor from the rural to the urban sector will not bring about real improvement in terms of welfare or economic efficiency. Therefore we argue that the Hukou system controlling migration-flow from rural to urban areas did not necessarily create large inefficiencies. Indeed, it might well have contributed to China's relatively orderly urbanization process.

With China's geographically uneven growth across regions, especially in coastal and inland

¹⁵It is argued that China's urban surplus has been decreasing, and China is moving towards a unified neoclassical labor market with no surplus labor, especially when the second Lewis turning point is reached in the next two decades or so. (Wang and Piesse, 2013; Wang and Weaver, 2013b)

areas, the problem with the Hukou system now is less that of rural-urban divide and more of a regional barrier, which also restricts labor migration from inland to coastal cities. The main barriers to migration are not the rural-urban side of Hukou but the implications in terms of regional restrictions. While Hukou had helped with an efficient urban bias, the system now leads to regional inequity rather than efficiency. Migrants are unable to get settlement rights even after a very long period of work and residence.

For China to become a fairer society, this geographic barrier has to be recognized and removed, as has happened in rural and urban Hukou in many inland areas. China should follow international practice giving people the right to settle after a certain period of work or residence. This will also help the establishment of a functioning social system. However, there is huge opposition from local government in areas with a large number of migrants. These governments are not willing to allow migrants to “share” their public services and social security entitlements. Resistance can only be tackled by central government acting across regions, as many local governments are the seat of resistance to progressive Hukou reforms.

3.7 Appendix

Equation (3.3.21) comes from the de-trended per worker values of G_t^R , G_t^U , and B_t . Equation (3.3.22) is derived from equations (3.3.4), (3.3.8) and (3.3.17) as follows:

In the equilibrium, the labor supply in the rural sector equals the number of young households in that sector, $F_t = N_t^R$. Substituting equation (3.3.6) for A_t and equation (3.3.17) for N_t^R into equation (3.3.8) for the rural wage rate we obtain

$$W_t^R = (1 - \alpha) (g_t^R)^\mu (e_t^R E_t)^{1-\mu} \left[\frac{L}{(g_t^R)^\mu (e_t^R E_t)^{1-\mu} (1 - m_t) (1 + n) N_{t-1}^R} \right]^\alpha$$

$$(1 - m_t)^\alpha W_t^R = (1 - \alpha) \left[(g_t^R)^\mu (e_t^R)^{1-\mu} \right]^{1-\alpha} \left[\frac{L}{(1 + n) N_{t-1}^R} \right]^\alpha E_t^{(1-\mu)(1-\alpha)}$$

Equations (3.3.2) and (4) show $E_t^{1-\mu} = \frac{W_t^U}{(1-\alpha)(g_t^U)^\mu k_t^\alpha}$. Substituting this result into the above equation we get

$$(1 - m_t)^\alpha = \left[(g_t^R)^\mu (e_t^R)^{1-\mu} \right]^{1-\alpha} \left[\frac{L}{(1 + n) N_{t-1}^R} \right]^\alpha \frac{W_t^U E_t^{1-\alpha}}{(g_t^U)^\mu k_t^\alpha W_t^R}$$

de-trended the above equation by the state of technology generates the result of equation (3.3.22).

Equation (3.3.23) comes from the equilibrium condition for migration, equation (3.3.18).

Dividing W_t^U on both sides of equation (3.3.18) we generate

$$\frac{W_t^R}{W_t^U} = (1 - \omega) - \frac{\theta_t}{(1 - \tau) W_t^U}$$

Substituting equation (3.3.4) for W_t^U into the above equation and de-trended by the state of

technology enable us to get equation (3.3.23).

To derive equation (3.3.20), we start by differentiating equation (3.3.22) with respect to \tilde{g}_t^U and \tilde{g}_t^R respectively, yielding

$$\frac{\partial m_t}{\partial \tilde{g}_t^U} = -\frac{\mu}{\alpha} \frac{1 - m_t}{\tilde{g}_t^U}$$

$$\frac{\partial m_t}{\partial \tilde{g}_t^R} = -\frac{\mu(1 - \alpha)}{\alpha} \frac{1 - m_t}{\tilde{g}_t^R}$$

This information is needed by the government to solve the allocation problem. With this information, the government chooses the country's allocation of productive government services to solve the following maximization problem

$$\max V_t(W_t^U) + \gamma V_t(W_t^R) + \lambda_t \left[\tilde{b}_t - \tilde{g}_t^U (\rho_{t-1} + m_t(1 - \rho_{t-1})) - \tilde{g}_t^R ((1 - m_t)(1 - \rho_{t-1})) \right] E_t$$

where λ_t is the Lagrange multiplier.

Equation $\frac{\partial m_t}{\partial \tilde{g}_t^U} = -\frac{\mu}{\alpha} \frac{1 - m_t}{\tilde{g}_t^U}$ gives us $1 - m_t = -\frac{\alpha}{\mu} \frac{\partial m_t}{\partial \tilde{g}_t^U} \tilde{g}_t^U$ and $m_t = 1 + \frac{\alpha}{\mu} \frac{\partial m_t}{\partial \tilde{g}_t^U} \tilde{g}_t^U$. When we derive the first-order condition for maximization with respect to urban government services per capita, the government must take into account the equilibrium conditions for urban and rural wages, equations (3.3.4) and (3.3.18). Therefore, the government's objective function can be rewritten as follows

$$\begin{aligned} & \max V_t \left((1 - \alpha) k_t^\alpha (\tilde{g}_t^U)^\mu E_t \right) + \gamma V_t \left((1 - \omega) (1 - \alpha) k_t^\alpha (\tilde{g}_t^U)^\mu E_t - \frac{\theta_t}{1 - \tau} \right) + \\ & \lambda_t \left[\tilde{b}_t - \tilde{g}_t^U \left(\rho_{t-1} + \left(1 + \frac{\alpha}{\mu} \frac{\partial m_t}{\partial \tilde{g}_t^U} \tilde{g}_t^U \right) (1 - \rho_{t-1}) \right) - \tilde{g}_t^R \left(-\frac{\alpha}{\mu} \frac{\partial m_t}{\partial \tilde{g}_t^U} \tilde{g}_t^U (1 - \rho_{t-1}) \right) \right] E_t \end{aligned}$$

Differentiating the above government's objective function with respect to \tilde{g}_t^U gives the following first-order condition for maximization in the urban sector

$$\begin{aligned} & \left[V_t' (W_t^U) + \gamma V_t' (W_t^R) (1 - \omega) \right] \mu (1 - \alpha) k_t^\alpha (\tilde{g}_t^U)^{\mu-1} E_t = \\ & \lambda_t \left[\rho_{t-1} + m_t (1 - \rho_{t-1}) + \frac{\partial m_t}{\partial \tilde{g}_t^U} (1 - \rho_{t-1}) (\tilde{g}_t^U - \tilde{g}_t^R) \right] \end{aligned}$$

Equation $\frac{\partial m_t}{\partial \tilde{g}_t^R} = -\frac{\mu(1-\alpha)}{\alpha} \frac{1-m_t}{\tilde{g}_t^R}$ shows $1 - m_t = -\frac{\alpha}{\mu(1-\alpha)} \frac{\partial m_t}{\partial \tilde{g}_t^R} \tilde{g}_t^R$ and $m_t = 1 + \frac{\alpha}{\mu(1-\alpha)} \frac{\partial m_t}{\partial \tilde{g}_t^R} \tilde{g}_t^R$.

Hence the government's objective function becomes

$$\begin{aligned} & \max V_t (W_t^U) + \gamma V_t (W_t^R) + \\ & \lambda_t \left[\tilde{b}_t - \tilde{g}_t^U \left(\rho_{t-1} + \left(1 + \frac{\alpha}{\mu(1-\alpha)} \frac{\partial m_t}{\partial \tilde{g}_t^R} \tilde{g}_t^R \right) (1 - \rho_{t-1}) \right) - \tilde{g}_t^R \left(-\frac{\alpha}{\mu(1-\alpha)} \frac{\partial m_t}{\partial \tilde{g}_t^R} \tilde{g}_t^R (1 - \rho_{t-1}) \right) \right] E_t \end{aligned}$$

Differentiating the above government's objective function with respect to \tilde{g}_t^R gets the following first-order condition for maximization in the rural sector

$$- (\tilde{g}_t^U - \tilde{g}_t^R) (1 - \rho_{t-1}) \frac{\partial m_t}{\partial \tilde{g}_t^R} = (1 - m_t) (1 - \rho_{t-1})$$

Substituting $\frac{\partial m_t}{\partial \tilde{g}_t^R} = -\frac{\mu(1-\alpha)}{\alpha} \frac{1-m_t}{\tilde{g}_t^R}$ into the above equation and solving for \tilde{g}_t^R produce the result in equation (3.3.20).

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Chapter 4

Conclusion

This thesis relates economic growth and China's urbanization, specifically, it demonstrates economic growth in both developed and developing countries without and with Lewis-style labor markets and China's urbanization process with the presence of the Hukou system. In Chapter 2, we find that surplus labor plays a critical role in explaining different economic growth paths and structural changes in developing and developed countries. In Chapter 3, our model shows China's urban bias policy did not necessarily reduce economic efficiency but might have raised urban welfare at the expense of rural residents. However, China's continuous bias towards coastal and big cities has started to cause economic inefficiency as well as inequality.

4.1 Main Findings of Current Research

Labor endowments and labor market structures have profound impact on economic growth and structural change but have received little attention in formal growth and development theories. Chapter 2 develops a unified growth model in which dual labor market characteristics and comparative advantages have been taken into consideration.

One of the significant components of the model is that it shows the effects of surplus labor on economic growth and structural change. Our model uses the equalities between the

average product of total agricultural labor, the marginal product of effective agricultural labor and the marginal product of manufacturing labor to formalize the concept of surplus labor and determine the total amount of surplus labor in the agricultural sector in the developing foreign country.

For a developed country like the US with a neoclassical labor market and a developing country such as China with a Lewisian labor market, with capital accumulation, the wage level increases in the developed country, but is constant in the developing country. In this case, the developed country uses more capital rather than more labor to expand its industrial production. Its industrial production becomes more capital intensive. However, in the developing country, surplus labor in the agricultural sector is sufficiently large to give an unlimited supply of labor for industrial expansion, thus labor migration from the agricultural sector to the industrial sector induces more significant structural change in this country than in the developed country. The industrial sector uses both more capital and more labor to increase production. The developing country with surplus labor enjoys faster capital accumulation while capital per manufacturing worker stays constant. It enjoys faster growth of variety and manufacturing output for a given growth rate of capital per manufacturing worker. These two effects of surplus labor are magnified when the developing country opens to trade with the developed country, as it allows a bigger market for the goods produced in the developing country and thus allows the country to utilize more of its surplus labor than when it was closed.

Chapter 2 shows that capital accumulation in a labor surplus developing country leads to increasing labor participation at a near constant wage which in turn leads to an expansion in the industrial sector. We argue that surplus labor plays a significant role in shaping different growth paths and structural changes in developed and developing countries. We have shown that a country's labor surplus can be translated into faster growth rates of aggregate capital, manufacturing labor, and manufacturing output, which is largely consistent with the process

of development in developing countries.

Chapter 3 builds a dynamic general equilibrium model to analyze urban bias policy and has shown that, with the presence of the Hukou system, China's redistributive urban bias across rural and urban sectors was efficient in that it traded off rural-urban inequality for urban efficiency. However, China's coastal-city bias between cities was inefficient in that it generated deadweight loss in the economy and enlarged inland-coastal inequality.

China's Hukou system restricting labor migration from rural to urban areas, is part of a systematic urban bias in policy. However, because of the co-existence of surplus labor in both rural and urban sectors, transferring excessive rural surplus labor to urban areas artificially will not improve output or efficiency. Urbanization without industrialization (i.e., without sufficient employment creation in the urban sector) might have no economic benefits as it only involves surplus labor in rural areas becoming urban surplus labor. In other words, without the expansion of absorptive capacity in the urban sector, any relocation of labor from the rural to the urban sector will not bring about real improvement in terms of welfare or economic efficiency. Therefore we argue that the Hukou system controlling migration-flow from rural to urban areas did not necessarily create large inefficiencies. Indeed, it might well have contributed to China's relatively orderly urbanization process.

With China's geographically uneven growth across regions, especially in coastal and inland areas, the problem with the Hukou system now is less that of rural-urban divide and more of a regional barrier, which also restricts labor migration from inland to coastal cities. The main barriers to migration are not the rural urban side of Hukou but the implications in terms of regional restrictions. While Hukou had helped with an efficient urban bias, the system now leads to regional inequity rather than efficiency. Migrants are unable to get settlement rights even after a very long period of work and residence.

For China to become a fairer society, this geographic barrier has to be recognized and

removed, as has happened in rural and urban Hukou in many inland areas. China should follow international practice giving people the right to settle after a certain period of work or residence. This will also help the establishment of a functioning social system. However, there is huge opposition from local government in areas with a large number of migrants. These governments are not willing to allow migrants to “share” their public services and social security entitlements. These can only be tackled by central government acting across regions, as many local governments are the seat of resistance to progressive Hukou reforms.

4.2 Further Research

There are several potential topics for further research. First, China has been running huge trade and current account surpluses, and the US trade deficit with China continues to widen over time. Conventional literature argues that this is because China has deliberately under-valued its currency. However, we can develop a computable general equilibrium (CGE) model which enables us to show that the existence of surplus labor in China plays a more significant role in explaining the Chinese trade surplus with the US, especially when processing trade is taken into consideration.

Second, there is an evident global imbalance puzzle: capital-scarce developing countries like China are accumulating huge foreign exchange reserves while the capital-abundant developed countries, such as the US, are running huge deficits. Debt level in the US is continuing to expand despite its huge size; meanwhile, the size of foreign exchange reserves in the form of US dollar assets, principally US Treasuries held by China, continues to grow. Conventional literature argues that the accumulation of foreign exchange reserves is due to policies of deliberate under-valuation of China’s currency. But China’s foreign exchange reserves increased significantly during the period of significant appreciation. We can develop a CGE model by

taking into consideration the existence of surplus labor in China, to argue that, in order to have more rural surplus labor employed in the industrial sector, China is forced to keep foreign exchange reserves rather than change it back to domestic currency.