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China

Trade, foreign direct investment, and development strategies

Yanqing Jiang

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List of abbreviations

ASEAN	Association of Southeast Asian Networks
COD	Chemical Oxygen Demand
CV	Coefficient of Variation
DEA	Data Envelopment Analysis
FD	First Differencing
FD 2SLS	First Differenced Two Stage Least Squares
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GRP	Gross Regional Product
HCS	Hoover's Coefficient of Specialization
KSI	Krugman Specialization Index
NBS	National Bureau of Statistics of China
NCEE	National College Entrance Examination
OLS	Ordinary Least Squares
PIM	Perpetual Inventory Method
PRD	Pearl River Delta
PUBL	PUBLications per worker
RE	Random Effects
RD	Relative Demand
RS	Relative Supply
TFP	Total Factor Productivity

About the author

Yanqing Jiang is associate professor at Shanghai International Studies University in Shanghai, China. His recent research is mainly on China's opening up, growth and development. He started his research in this area in 2004 when he was affiliated to the Hanken School of Economics and the Helsinki Centre of Economic Research as a doctoral researcher in Helsinki, Finland. He has published many articles on China in various refereed journals.

Introduction

Abstract: Openness to foreign trade and foreign direct investment plays an important role in shaping China's development strategies. This book explores how openness to foreign trade and foreign direct investment affects development strategies regarding China's processes and patterns of economic restructuring. This introductory chapter introduces the topics, and subsequent chapters enter into theoretical discussions and empirical analyses addressing the many facets of the central theme of the book.

Key words: trade, foreign direct investment, development strategies, China, opening up, regional disparity.

Openness to foreign trade and foreign direct investment (FDI) plays an important role in shaping China's development strategies. It is the development process in China that drives the strong pressure for continuous restructuring of the Chinese economy. This book, *China: Trade, Foreign Direct Investment, and Development Strategies*, explores how openness to foreign trade and FDI affects China's development strategies as they relate to the processes and patterns of economic restructuring. The book aims to provide the reader with insight and findings that shed new light on related issues and problems. This introductory chapter introduces the topics, and subsequent chapters enter into the theoretical discussions and empirical analyses that address the many facets of the central theme of the book. Despite cross-referencing between chapters from time to time, each chapter is sufficiently self-contained and can thus be read on its own, a feature that hopefully improves the usefulness of the book as a text.

Along with China's rapid economic growth in the past few decades, substantial disparities have emerged in productivity and per capita income across different regions in China. In Chapter 2, in preparation for subsequent examinations of regional development and spatial inequality in China, we construct a theoretical framework within which regional growth in total output can be broken down into the growth of its various contributors. As unbalanced growth and development in China can be seen to be a result of the uneven regional growth of productivity and production factors, we then propose a coherent framework, not only to investigate the potential forces shaping the pattern of China's spatial disparities, but also to evaluate their relative importance by quantitatively breaking the imbalance down into its various contributory factors. In sum, the discussions in this chapter constitute an analytic foundation on which our analyses in subsequent chapters can be built.

Different phases in development strategies have generated different forces that affect China's unbalanced development. In Chapter 3, we present facts and trends about the interregional inequality in China, and attempt to establish a linkage between the various forces generated by policy regime switching and the changing pattern of interregionally unbalanced economic development in China. Among other findings, our empirical results suggest that the sharp increase in overall interregional inequality in the early 1990s can largely be attributed to the between-zone contribution of physical capital. Besides the coastal–inland disparity, the variation between coastal regions appears at times to be the dominant factor behind overall interregional inequality in China. Moreover, it can be shown that the process underlying the opening up of China to trade and FDI does account for a substantial share of China's interregional inequality, and the share rises over time.

Chapter 4 is devoted to preliminary discussion of the potential effects of foreign trade on economic development as it relates to the Chinese economy, with a focus on the possible mechanisms through which foreign trade can exert its various impacts on economic development. One such mechanism is technology diffusion. Openness to foreign trade promotes total factor productivity (TFP) growth in China by facilitating technological spillovers from technologically advanced countries. Our preliminary empirical analysis in this chapter is based on a hypothesis positing that, given the level of TFP at the world technology frontier, China's regional TFP growth is a positive function of regional openness to foreign trade and a negative function of the current level of regional TFP. Our regression results show that there exists a significantly positive effect of regional openness on regional TFP growth, and that there is evidence for conditional convergence in TFP across China's regions.

Symmetrical to the preceding chapter, Chapter 5 is devoted to preliminary discussion of the potential effects of openness to FDI on China's economic development. Our focus in this chapter is on potential mechanisms through which openness to FDI can exert its various impacts on China's economic development. FDI inflows not only enhance capital accumulation in China, which in itself is crucial to China's development, but also exert several spillover effects through different channels. The regression results of our preliminary empirical analysis in Chapter 5 suggest that regional openness to FDI tends to promote regional TFP growth and hence regional income growth. Motivated by the preliminary discussions in Chapters 4 and 5, we then proceed to investigate the impacts of openness to foreign trade and FDI on China's economic development from different perspectives in the subsequent chapters of this book.

In Chapter 6 we investigate the effects of international openness, domestic coastal–inland market integration, and human capital accumulation on TFP growth in inland regions in China. By using a variety of panel data regression techniques, we show that human capital accumulation plays an important role in promoting TFP growth in China's inland provinces. Our results support the argument that the most important contribution of human capital to income growth lies not in its static direct effect as an accumulable factor in the production function, but rather in its dynamic role in promoting TFP growth. Our results also provide evidence of the positive role coastal–inland market integration plays in promoting TFP growth in inland regions of China.

Openness to foreign trade and FDI increases the efficiency in the way production factors are allocated by lifting barriers to the mobility of resources across different sectors. In Chapter 7 we empirically analyze the relationship between openness to foreign trade and FDI and China's structural change. Our regression results show just how useful the Lewis model can be at analyzing China's process of industrialization. Our empirical analyses also show that openness to foreign trade and FDI plays an important role in China's structural transformation. The results suggest that regional openness promotes regional structural transformation in terms of labor share shifts from the agricultural to the manufacturing sector, and that structural transformation in poorer regions tends to be faster, demonstrating convergence in per-worker income across the different regions of China.

Chapter 8 focuses on the linkage between change in the pattern of China's comparative advantage and the continuous transformation in economic structure of the country. After formalizing the processes of structural transformation and the shift of comparative advantage across sectors, we use the specialization index to proxy for the intensity of comparative advantage in our empirical analysis. Results show that the specialization index of primary goods has been declining while that of manufactured goods has been climbing over time. They further show that, of the various subdivisions of primary goods, the specialization index of mineral fuels and non-edible raw materials has been falling whereas, of the various subdivisions of manufactured goods, the specialization index of machinery and transport equipment has been rising. To a large degree, the empirical results support the hypothesis of the theoretical model presented in Chapter 8.

Chapter 9 contains a theoretical study concerning transaction efficiency and the patterns of specialization, which has important implications for empirical analysis and policy evaluation with respect to a large developing country such as China. In this theoretical study, we revisit the old Ricardian model of comparative advantage. Following an inframarginal methodology, we build an extended theoretical model based on the concepts of comparative advantage and transaction efficiency to explain development and inequality in developing economies. According to our model, an increase in domestic transaction efficiency reduces inequality within a developing economy while an increase in international transaction efficiency enhances the overall welfare level in a developing economy. The results of our model have important implications for China in its policy-making.

In Chapter 10 we explore issues related to economies of scale and industrial agglomeration, and their linkages to regional development and interregional disparity in China. We focus specifically on an empirical examination of the spatial distribution of manufacturing activity in China in the 2000s, a time of increasing opening up to foreign trade and FDI. We set up our regression model and carry out a regression exercise to empirically examine the effects of openness to foreign trade and FDI on industrial distribution and agglomeration across China's provinces. Our regression results support our claim that openness to foreign trade and FDI indeed plays an important role in shaping the spatial pattern and distribution of industries across China's provinces.

Knowledge as an intangible production input not only promotes economic growth but also facilitates structural change of a developing economy. Education is the major means of knowledge accumulation. Higher education in China plays an important role not only in promoting knowledge accumulation, but also in facilitating human capital mobility in China. Chapter 11 empirically investigates the issue of the relationship between regional disparities, college preferences, and admissions under the National College Entrance Examination (NCEE) system and potential interregional human capital mobility in China.

Our empirical results show that examinees from western provinces tend to have a strong preference for coastal universities, compared with examinees from central provinces. In this sense, we expect college admissions in China under the NCEE system to exert a stronger impact on potential human capital movement from western to coastal regions than from central to coastal regions.

Chapter 12 aims to empirically examine the linkages between pollution emission, output growth, and openness to foreign trade and FDI. Our regression results suggest that the 'gains from openness' hypothesis, which posits that openness to foreign trade and FDI has a positive impact on the environment, dominates the 'race to the bottom' hypothesis as far as China's regions are concerned. Our regressions do not provide evidence to support the 'race to the bottom' hypothesis. As openness to foreign trade and FDI is likely to contribute to a better environment for China, policy-makers should remove barriers to foreign trade and FDI for environmental technology, goods, and services to allow further gains from openness.

Finally, Chapter 13 provides a tentative discussion of the knowledge economy and knowledge-based development in China. Despite its long tradition of respect for knowledge, China's development is still based much more heavily on the advantages of low-cost labor. For China, one central challenge posed by the global knowledge economy is to develop an industrial structure that could better exploit rapidly growing global knowledge to accelerate its own economic development and facilitate its transition toward a knowledge-based economy. For this purpose, China should further leverage its FDI inflows, focusing more on attracting FDI with a higher degree of knowledge content. Foreign trade is another channel through which Chinese enterprises can tap global knowledge and technology. While importing capital goods is a major way of acquiring foreign technology, the management and knowledge support that comes with it are necessary to maximize productivity from technology investment.

2

Regional growth and its decomposition

Abstract: Along with China's rapid economic growth in the past few decades, substantial disparities have emerged in productivity and per-capita income across the different regions of China. In this chapter, in preparation for subsequent examinations of regional development and spatial inequality in China, we construct a theoretical framework within which regional growth in total output can be broken down into the growth of its various contributors. As unbalanced growth and development in China can be seen to be a result of the uneven regional growth of productivity and production factors, we propose a coherent framework, not only to investigate the potential forces shaping the pattern of China's spatial disparities, but also to evaluate their relative importance by quantitatively breaking the inequality down into its constituent parts. In sum, our discussion in this chapter constitutes an analytic foundation on which our analyses in subsequent chapters can be built.

Key words: economic growth, productivity, inequality, growth decomposition, intensive growth, extensive growth.

JEL classification codes: O47; O57.[1]

Introduction

Before 1978, China had a centrally planned economy, characterized by low productivity, widespread poverty, and very low inequality in income. Thanks to the post-1978 reforms, China has achieved spectacular economic growth in the ensuing 35 years. However, great disparities have emerged in productivity and per-capita income across the different regions of China. The Gini coefficient, for example, which measures economic inequality in society, rose by about 40 percent in total from 0.33 in 1980 to 0.46 in the early 2000s (Sisci, 2005; WB, 2005; Fan and Sun, 2008; Knight, 2008). Such a rate of increase, according to the

World Bank, was the fastest in the world. Spatial income disparities, especially those between urban and rural areas and between coastal and inland regions, have been on the rise and became a prominent issue in China during the country's transition and development (Yin, 2011). By the end of the 1990s, interregional income inequality had exceeded that in any other country, and by 2005 the average per-capita income of the richer coastal regions was at least 2.5 times higher than that of inland regions (Yang, 1999; Zhu et al., 2008). Some researchers claim that the growing inequality may 'threaten the social compact and thus the political basis for economic growth and social development' (Fan et al., 2009).

Why have some regions in China become so much richer than others? In spite of regional preferential policies, there are a number of other factors that may also play a role in shaping interregional income inequality. These factors, often interrelated, may include geographical differences (Demurger et al., 2002), regional infrastructure development (Demurger, 2001), regional openness and the process of globalization (Zhang and Zhang, 2003; Kanbur and Zhang, 2005; Wan et al., 2007), development of the regional industrial mix (Huang et al., 2003), openness and development of regional township and village enterprises (Yao, 1997; DaCosta and Carroll, 2001), the process of marketization (Jian et al., 1996), effects of regional structural shocks and structural transformation (Jiang, 2010), and investment in and accumulation of regional human capital (Fleisher et al., 2010), to name a few.

The influencing factors just listed may contribute to interregional income inequality through their impacts either on regional growth of productivity or on regional accumulation of physical and human capital. Differential rates of regional productivity growth and regional physical and human capital accumulation will lead to different rates of regional output growth and ultimately shape the pattern of the evolution of interregional income inequality across China's different regions. Therefore, in order to empirically examine regional development and interregional inequality in China, we first need to construct a theoretical framework within which regional growth in total output can be broken down into growth of its constituent parts.

A theoretical framework for output decomposition

In this section we apply the Solow growth model and break output growth down theoretically. We can use this framework to empirically examine interregional inequality in China. Moreover, we augment the traditional Solow model by incorporating human capital into the aggregate production function. Specifically, we assume that, at any given point in time, output is produced according to the following function

$$Y = F(K, AH) \tag{2.1}$$

where Y denotes the level of output, K denotes the level of physical capital stock, H denotes the level of human capital–augmented labor used in production, and A denotes the level of productivity (technology), which is, for convenience, assumed to be labor augmenting (Harrod neutral). As A and H enter the production function 2.1 multiplicatively, we refer to AH as effective labor. We further assume that each unit of labor (each worker) is identical within the economy and is trained with E years of education. That is, human capital intensity is determined by

$$h = \exp[\phi(E)] \tag{2.2}$$

where human capital intensity h is defined as per-worker human capital (i.e., $h \equiv H/L$). By assuming $\phi(0) = 0$, the function $\phi(E)$ reflects the relative efficiency of a worker with E years of education compared with one who receives no education (see, for example, Hall and Jones, 1999).

In order to make the model workable, we have to assume that the production function 2.1 exhibits constant returns to scale in its two arguments: physical capital and effective labor.[2] This assumption allows us to work conveniently with the production function in intensive form. We therefore define $\hat{k} \equiv K/(AH)$ and $\hat{y} \equiv Y/(AH)$, and under the assumption of constant returns to scale we have

$$F\left(\frac{K}{AH}, 1\right) = \frac{1}{AH} F(K, AH) \tag{2.3}$$

which can be rewritten in the intensive form as

$$\hat{y} = f(\hat{k}) \tag{2.4}$$

where we define $f(\hat{k}) \equiv F(\hat{k}, 1)$. Thus we can write output per unit effective labor as a function of physical capital per unit effective labor. We assume that $f(\hat{k})$ satisfies $f(0) = 0, f'(\hat{k}) > 0$, and $f''(\hat{k}) < 0$, which implies that the marginal product of physical capital is positive, but that it declines as capital (per unit effective labor) rises.

The model distinguishes three sources of variation in per-worker output Y/L: differences in per-worker physical capital K/L, differences in technology A, and differences in per-worker human capital h. It follows directly from Eq. 2.1 that

$$y = F(k, Ah) \tag{2.5}$$

where $y \equiv Y/L$ and $k \equiv K/L$, which are defined as per-worker output and per-worker physical capital, respectively. An accounting approach can thus be applied to account for variation in per-worker output y in terms of per-worker physical capital k, technology A, and per-worker human capital h, provided that the functional form of Eq. 2.1 is specified. If we adopt the well-known Cobb–Douglas functional form $Y = F(K, AH) = K^{\alpha}(AH)^{1-\alpha}$, then

$$y = F(k, Ah) = k^{\alpha}(Ah)^{1-\alpha} \tag{2.6}$$

Taking logs then yields

$$\ln y = \alpha \ln k + (1-\alpha) \ln h + (1-\alpha) \ln A \tag{2.7}$$

In terms of growth rates, we have

$$\frac{\dot{y}}{y} = \alpha \frac{\dot{k}}{k} + (1-\alpha) \frac{\dot{h}}{h} + (1-\alpha) \frac{\dot{A}}{A} \tag{2.8}$$

where a dot over a variable indicates the first-order derivative with respect to time. Thus the growth rate (or level) of per-worker output can be accounted for by the growth rates (or levels) of technology, per-worker physical capital, and per-worker human capital. However, the growth accounting framework has a serious shortcoming. It ignores the causal linkage between the growth (or level) of technology (or per-worker human capital) and the growth (or level) of per-worker physical capital.

To understand this point, we need to consider the dynamics of the Solow model. We further assume that technology A and human capital–augmented labor H grow exogenously at constant rates

$$\dot{A}/A = g \tag{2.9}$$

$$\dot{H}/H = \rho \tag{2.10}$$

Output can be divided between consumption and investment, where the fraction of output devoted to investment s is assumed to be exogenous and constant, with one unit of output devoted to investment yielding one unit of new physical capital. In addition, existing physical capital depreciates at rate δ. To keep our analysis simple, education is taken not as investment in human capital, but rather as part of consumption. At any given point in time, we have

$$\dot{K} = sY - \delta K \tag{2.11}$$

It follows that

$$\dot{\hat{k}} = \frac{\dot{K}}{AH} - \frac{K}{(AH)^2}(A\dot{H} + \dot{A}H) \tag{2.12}$$

Inserting Eqs. 2.9, 2.10, and 2.11 into Eq. 2.12, we obtain

$$\dot{\hat{k}} = sf(\hat{k}) - (\rho + g + \delta)\hat{k} \tag{2.13}$$

The steady-state value of physical capital per unit effective labor, denoted by $\hat{k}^*$, is determined by

$$sf(\hat{k}^*) = (\rho + g + \delta)\hat{k}^* \tag{2.14}$$

Therefore,

$$\hat{k}^*/f(\hat{k}^*) = s/(\rho + g + \delta) \tag{2.15}$$

Let us define a new function $\chi(\hat{k}) \equiv \hat{k}/f(\hat{k})$, where $\chi(\hat{k})$ is increasing in $\hat{k}$ as $f'(\hat{k}) > 0$ and $f''(\hat{k}) < 0$. Thus $\hat{k}^*$, which is ultimately a function of the four parameters, s, ρ, g, and δ, can be written as

$$\hat{k}^* = \chi^{-1}(s/(\rho + g + \delta)) \tag{2.16}$$

The steady-state value of output per unit effective labor, denoted by $\hat{y}^*$, is then given by

$$\hat{y}^* = f(\hat{k}^*) = f[\chi^{-1}(s/(\rho + g + \delta))] \tag{2.17}$$

Eqs. 2.16 and 2.17 describe a balanced growth path along which the values of $\hat{k}^*$ and $\hat{y}^*$ are determined by the four exogenous parameters s, ρ, g, and δ.

Of the four parameters, investment rate s is the one that policy is most likely to affect. The long-term effect on output of a change in the investment rate allows us to obtain the following partial derivative of $\hat{y}^*$ with respect to s

$$\frac{\partial \hat{y}^*}{\partial s} = f'(\hat{k}^*)\frac{\partial \hat{k}^*}{\partial s} \tag{2.18}$$

As $\hat{k}^*$ is the steady-state value of $\hat{k}$, it must satisfy

$$sf(\hat{k}^*) = (\rho + g + \delta)\hat{k}^* \tag{2.19}$$

As Eq. 2.19 holds for all values of s, we take the derivative on both sides with respect to s, which yields

$$sf'(\hat{k}^*)\frac{\partial \hat{k}^*}{\partial s} + f(\hat{k}^*) = (\rho + g + \delta)\frac{\partial \hat{k}^*}{\partial s} \tag{2.20}$$

Rearranging Eq. 2.20 gives

$$\frac{\partial \hat{k}^*}{\partial s} = \frac{f(\hat{k}^*)}{(\rho + g + \delta) - sf'(\hat{k}^*)} \tag{2.21}$$

Inserting Eq. 2.21 back into Eq. 2.18, we obtain

$$\frac{\partial \hat{y}^*}{\partial s} = \frac{f'(\hat{k}^*)f(\hat{k}^*)}{(\rho + g + \delta) - sf'(\hat{k}^*)} \tag{2.22}$$

Using Eq. 2.19 to substitute for s in Eq. 2.22, we end up with the following elasticity form

$$\frac{s}{\hat{y}^*}\frac{\partial \hat{y}^*}{\partial s} = \frac{\hat{k}^* f'(\hat{k}^*)/f(\hat{k}^*)}{1 - \hat{k}^* f'(\hat{k}^*)/f(\hat{k}^*)} = \frac{\chi(\hat{k}^*)f'(\hat{k}^*)}{1 - \chi(\hat{k}^*)f'(\hat{k}^*)} \tag{2.23}$$

where $\hat{k}^* f'(\hat{k}^*)/f(\hat{k}^*)$ is the elasticity of output with respect to physical capital at $\hat{k} = \hat{k}^*$.

However, though a change in investment rate s changes an economy's balanced growth path and thus the level of output per worker at any point in time, it does not affect the growth rate of output per worker as far as the balanced growth rate is concerned. This becomes clear when we consider Eq. 2.5, according to which output per worker (at a given point in time) on the balanced growth path is determined by

$$y^* = F(k^*, Ah) = F[Ah \cdot \chi^{-1}(s/(\rho + g + \delta)), Ah] \tag{2.24}$$

where $k^* = \hat{k}^* Ah = Ah \cdot \chi^{-1}(s/(\rho + g + \delta))$, which shows that investment rate s has only a level effect – not a long-term growth effect on k^*, as the long-term (balanced path) growth of k^* depends only on the growth of Ah over time. We further assume that labor L grows exogenously at a constant rate n, that is

$$\dot{L}/L = n \tag{2.25}$$

Using Eqs. 2.10 and 2.25, we see that human capital intensity h grows at a constant rate $(\rho - n)$, that is

$$\dot{h}/h = \rho - n \tag{2.26}$$

Since by construction $k = \hat{k}Ah$, we have the following decomposition

$$\frac{\dot{k}}{k} = \frac{\dot{\hat{k}}}{\hat{k}} + \frac{\dot{A}}{A} + \frac{\dot{h}}{h} \tag{2.27}$$

Inserting Eqs. 2.9, 2.13, and 2.26 into Eq. 2.27 yields

$$\frac{\dot{k}}{k} = s\frac{f(\hat{k})}{\hat{k}} - (n + \delta) \tag{2.28}$$

Using Eq. 2.14 to substitute for s in Eq. 2.28, coupled with a little rearrangement, we obtain

$$\frac{\dot{k}}{k} = \left(\frac{\chi(\hat{k}^*)}{\chi(\hat{k})} - 1\right)(n + \delta) + \frac{\chi(\hat{k}^*)}{\chi(\hat{k})}(g + \rho - n) \tag{2.29}$$

where we remember that $\chi(\hat{k}) \equiv \hat{k}/f(\hat{k})$, a function that is increasing in $\hat{k}$. It is clear from Eq. 2.29 that a change in investment rate s affects the growth dynamics of physical capital per worker (and hence output per worker) by shifting the steady-state level of physical capital per unit effective labor $\hat{k}^*$. Since Eq. 2.29 shows investment rate s having no more than a level effect – not a long-run growth effect on per worker physical capital (or hence on per-worker output) because in the long run (i.e., on the balanced growth path), where $\hat{k} = \hat{k}^*$, physical capital per worker would grow at a rate equal to $(g + \rho - n)$, which is obviously independent of investment rate s.

The important point to note from all this is that Eq. 2.24 reveals that per-worker output on a balanced growth path is dependent on A and h through two different channels. As seen from Eq. 2.24, A and h affect y^* not only directly, but also indirectly through (per-worker) physical capital accumulation (i.e., k^* is dependent on A and h). This means the growth accounting decomposition in Eq. 2.8 failed to take this into account and would thus mistakenly attribute (a part of) contributions of A and h to physical capital accumulation.

For growth accounting decomposition to be properly carried out in this chapter, we need to apply the Cobb–Douglas functional form to the aggregate production function, so that $Y = K^{\alpha}(AH)^{1-\alpha}$ or, equivalently, $y = k^{\alpha}(Ah)^{1-\alpha}$ as in Eq. 2.6. Using this Cobb–Douglas functional form and rearranging the mathematics, we obtain the following equation

$$y = \left(\frac{K}{Y}\right)^{\alpha/(1-\alpha)} Ah = \left(\frac{k}{y}\right)^{\alpha/(1-\alpha)} Ah \tag{2.30}$$

On a balanced growth path, where K and Y (or k and y) grow at the same rate, per-worker output (at a given point in time) can be written specifically as

$$y^* = \left(\frac{s}{\rho + g + \delta}\right)^{\alpha/(1-\alpha)} Ah \tag{2.31}$$

where $K^*/Y^* = k^*/y^* = \hat{k}^*/\hat{y}^* = s/(\rho + g + \delta)$ has been applied.

In order to study interregional disparities in China, we are now in a position to perform an output decomposition exercise for China's different regions, based on the idea expressed by Eqs. 2.30 and 2.31. We assume that for any region (province) i in China, its aggregate production function