Accounting for Sources of China's Growth from a Regional Economy Perspective—A Preliminary Attempt

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Abstract

This study incorporates regions into the entire analytical framework to explore the regional origins of China's overall economy and TFP growth. In addition, by incorporating the regional productivity accounts into the national framework, this study also examines the reallocation effect of resources across industries and regions and its impacts on the growth rate of China's TFP. During 1992-2014, the average annual growth rate of Chinese economy is 8.73%, and the coastal district plays an important role in promoting the growth of Chinese economy, followed by the central district, while the contribution from the northeast and western districts are relatively small, especially that from the western district. The coastal district also plays a dominant role in promoting the growth of most of sectors, while the central district plays the leading role in promoting the growth of the rest sectors. Capital input is the most important contributor to the Chinese economic growth, followed by the TFP and labor input. The coastal district makes the dominant contribution to the growth of capital and labor inputs. The average annual growth rate of China's TFP is 0.62% and keeps a growing trend over sub-periods. The main source of growth of China's TFP is mainly from the labor reallocation given that both the Domar-weighted TFP and capital reallocation are negative. The TFP of two industrial sectors, i.e., commodity and primary materials, and finished and semi-finished goods, is the main contributors of the Domar-weighted TFP growth in China in which the coastal district plays the dominant role, followed by the central and northeast districts, while the contribution from the western district is nearly zero. The TFP growth performance of the western district in energy and services is relatively better than other districts although it is still negative. Finally, the net reallocation effect of capital and labor inputs is 1.42%, of which 1.79% comes from labor reallocation and -0.37% comes from capital reallocation, and completely covers the growth of China's TFP.

Key words: Regional origins; TFP; KLEMS approach; Resource reallocation

JEL classification: C82, O11, O41, O47

1. Introduction

After 40 years of rapid economic growth, the Chinese economy is now facing the challenge of transforming economic growth momentum. What kind of measures should be taken to gradually change the way that relied on factor inputs to promote economic growth into a way that relies on efficiency to lead the Chinese economy on the path of high-quality development is a topic worthy of research. In theory, total factor productivity (TFP) has been regarded as a sign of high-quality economic development. At present, a large number of studies have analyzed the growth of China's TFP. Early literature often regarded China's economy as a whole based on the aggregate production function and measured China's overall TFP (World Bank, 1997; Hu and Khan, 1997). Such analysis assumes that China's economy has no industry or regional differences, which is inappropriate. In recent years, more and more studies have studied Chinese TFP from disaggregate levels, such as an industry perspective (Cai and Fu, 2017; Hu et al., 2015; Li and Tao, 2012), or a regional perspective (Yu, 2017; Ma and Hao, 2018; Wang and Wang, 2017). However, the existing research only measures the TFP of individual industries or regions, and cannot further calculate the overall TFP of China's economy from the region or industry perspective, that is, it is unable to maintain the logical consistency between the constituent parts with the national total. If the logical relationship between the individual components and the total cannot be established, the result is bound to produce serious deviations that are difficult to explain. Moreover, compared with the KLEMS method widely used internationally (Jorgenson et al., 2005; O'Mahony and Timmer, 2009), the data envelopment analysis (DEA) and stochastic frontier analysis (SFA) methods used in existing researches cannot reflect the impacts of resource reallocation on TFP results. However, a large number of studies have shown that there exists serious resource misallocation in the Chinese economy (such as Hsieh and Klenow, 2009; Wei and Li, 2017; Wu and Zhang, 2016; Brandt et al., 2013). Therefore, ignoring the resource misallocation effects is bound to cause serious biases in TFP results.

The accuracy of TFP result also depends on data quality. Most of the existing studies ignore intermediate inputs, replace capital input with capital stock, and replace labor input with the number of persons employed, which bring biases in the measurement of both output and inputs and further biases in TFP results. With the deepening of industry division, the production activities of an industry often use a variety of outputs from other industries as intermediate inputs, making the links among industries closer. The efficiency improvement of an industry will affect the efficiency improvement of other industries through the transmission of intermediate inputs, and ultimately affect the economy-wide TFP growth (Hulten, 1978). Furthermore, the adoption of capital stock instead of capital input and the number of persons employed instead of labor input, that is, replacing factor inputs' services with their stocks, often underestimates the quality improvement of capital and labor inputs (OECD, 2001), and ultimately overestimates TFP. In order to match the KLEMS method, Wu (2018) constructs China's KLEMS data strictly in accordance with the KLEMS standard so that the TFP analysis of China's economy at industry level can strictly combine

productivity theory, growth accounting, and date measurement together. His results show that the TFP growth rate of the Chinese economy dropped from 1.2% in 1992-2001 to 0.9% in 2002-2007, and further to -2.0% in 2008-2016. During the entire period, the average annual growth rate of TFP was almost zero. Only did the capital misallocation among industries cause a 0.4% annual decline in TFP. This challenges the results of TFP growth rate estimated in the existing literatures that work on the overall economy.

There is still room to improve Wu (2018)'s research. His research concentrates on industry level, without considering the regional origins of the industry's economic activities. Under the regional decentralized authoritarian regime, growth-driven competition among local governments in a large part explains China's rapid growth in the past few decades (Xu, 2011). Due to the growth performance of the regional economy is set by the central government as an important indicator for measuring the performance of local government officials, in order to promote rapid economic growth in the area under its jurisdiction, local governments often adopt industry policies to guide the flow of resources among industries to achieve rapid growth of certain industries, and further the rapid growth of the regional economy to win the growth competition with their peers. Due to the differences in geographical location and resource endowments among regions, the industrial structure and the industrial policies adopted by local governments are also different, which not only brings about differences in the growth of economy and TFP among regions, but also affects the regional distribution of development and TFP growth of the industry. Moreover, compared with the market mechanism, the intervention of local governments and regional protection due to the growth competition among regions have also caused serious resource misallocation.

Therefore, when analyzing a large economy like China where is undergoing economic transition, we need to be aware of the differences in growth potentials among regions. In order to provide a complete blueprint for understanding China's economy and TFP growth, it is necessary for us to incorporate regions into the entire analytical framework to explore the regional origins of China's overall economy and TFP growth. At the same time, by incorporating the regional productivity accounts into the national framework, we also further examine the reallocation effect of resources across industries and regions.

The contribution of this paper to literature is that we for the first time adopt the KLEMS approach to extend the research of China's TFP to the regional level, and analyze the growth performance of China's economy and TFP from the two dimensions of region and industry. We also investigate the resource reallocation effects across two dimensions of region and industry and further its impacts on the growth of China's TFP. In order to meet the data requirements of the KLEMS method, we strictly follow the KLEMS standard to construct the regional KLEMS data. This can not only fill the gaps in the research of KLEMS-TFP at the regional level in China, and unify the existing research perspectives on the analysis of industries and regions, but also maintain the logical consistency between the total and the constituent parts, so that the analysis of TFP at regional level in China can combine theory, growth accounting, and data

measurement together. The rest of this paper is organized as follows: section 2 introduces the growth accounting framework, section 3 illustrates how to construct regional KLEMS data, section 4 analyzes the results, and finally section 5 concludes this paper.

2. Growth Accounting Framework

The gross output production function is a function of capital input, labor input, intermediate input, and TFP, that is,

$$Y_{i,j} = F_{i,j}(K_{i,j}, L_{i,j}, X_{i,j}, T_{i,j}) \tag{1}$$

where $Y_{i,j}$, $K_{i,j}$, $L_{i,j}$, $X_{i,j}$, and $T_{i,j}$ are gross output, capital input, labor input, intermediate input, and the TFP of industry i in region j, respectively.

Assuming that the gross output production function is separable, sufficiently smooth, and constant returns to scale, firms engage in cost minimization given factor prices in factor markets, the growth rate of gross output can be approximated as:

$$\Delta lnY_{i,j} = \bar{v}_{i,j}^{K}\Delta lnK_{i,j} + \bar{v}_{i,j}^{L}\Delta lnL_{i,j} + \bar{v}_{i,j}^{X}\Delta lnX_{i,j} + v_{i,j}^{T} \tag{2}$$

where $v_{i,j}^{T}$ is the TFP of industry i in region j, $\bar{v}_{i,j}^{K}$, $\bar{v}_{i,j}^{L}$, and $\bar{v}_{i,j}^{X}$ are income shares of capital input, labor input, and intermediate input in gross output of industry i in region j, respectively, and $\bar{v}_{i,j}^{K} + \bar{v}_{i,j}^{L} + \bar{v}_{i,j}^{X} = 1$. "-" denotes two-period average.

From the perspective of value added, gross output is a function of value added and intermediate input, that is,

$$Y_{i,j} = G_{i,j}(V_{i,j}, X_{i,j}) \tag{3}$$

Under the above assumptions, the growth rate of gross output can be expressed as:

$$\Delta lnY_{i,j} = \bar{v}_{i,j}^{V}\Delta lnV_{i,j} + \bar{v}_{i,j}^{X}\Delta lnX_{i,j} \tag{4}$$

where $\bar{v}_{i,j}^{V}$ and $\bar{v}_{i,j}^{X}$ are shares of value added and intermediate input in gross output of industry i in region j, respectively, and $\bar{v}_{i,j}^{V} + \bar{v}_{i,j}^{X} = 1$.

Combining Equations (2) and (4), the growth rate of value added of industry i in region j can be expressed as:

$$\Delta lnV_{i,j} = \frac{\bar{v}_{i,j}^{K}}{\bar{v}_{i,j}^{V}}\Delta lnK_{i,j} + \frac{\bar{v}_{i,j}^{L}}{\bar{v}_{i,j}^{V}}\Delta lnL_{i,j} + \frac{1}{\bar{v}_{i,j}^{V}}v_{i,j}^{T} \tag{5}$$

The growth rate of value added of region j, ΔlnV_j, can be defined as a Tornqvist index of the growth rates of industry value added, that is,

$$\Delta lnV_j = \sum_i \bar{w}_{i,j}\Delta lnV_{i,j} \tag{6}$$

where $\bar{w}_{i,j}$ is value added share of industry i in region j.

Further, the growth rate of value added of the Chinese economy, ΔlnV, can be defined as a Tornqvist index of the growth rates of regional value added, that is,

$$\Delta lnV = \sum_j \bar{w}_j \Delta lnV_j = \sum_j \sum_i \bar{w}_j \bar{w}_{i,j} \Delta lnV_{i,j} \tag{7}$$

where $\bar{w}_j$ is value added share of region j in the whole economy.

Inserting Equation (5) into (7), we get:

$$\Delta lnV = \sum_j \sum_i \left(\frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} \bar{v}_{i,j}^K \Delta lnK_{i,j} + \frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} \bar{v}_{i,j}^L \Delta lnL_{i,j} + \frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} v_{i,j}^T \right) \tag{8}$$

The growth rate of the economy-wide TFP is defined as:

$$v^T = \Delta lnV - \bar{u}^K \Delta lnK - \bar{u}^L \Delta lnL \tag{9}$$

where K and L are capital input and labor input of the Chinese economy, respectively. $\bar{u}^K$ and $\bar{u}^L$ are income shares of capital input and labor input in aggregate value added.

Inserting Equation (8) into (9), we get:

$$v^T = \sum_j \sum_i \frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} v_{i,j}^T + \left(\sum_j \sum_i \frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} \bar{v}_{i,j}^K \Delta lnK_{i,j} - \bar{u}^K \Delta lnK \right)$$

$$+ \left(\sum_j \sum_i \frac{\bar{w}_j \bar{w}_{i,j}}{\bar{v}_{i,j}^V} \bar{v}_{i,j}^L \Delta lnL_{i,j} - \bar{u}^L \Delta lnL \right) \tag{10}$$

where the first term on the right-hand side is the Domar-weighted TFP. The terms in the first bracket represent the difference between the contribution from the weighted average of growth rates of capital input across sectors and regions to China's economic growth and that by assuming capital input increases at the same rate across sectors and regions, reflecting efficiency gains as a result of the reallocation of capital across sectors and regions. The terms in the second bracket reflect efficiency improvements as a result of the reallocation of labor across sectors and regions.

3. Construction of Regional KLEMS Dataset

In order to meet the data requirements of KLEMS method, this paper constructs regional productivity accounts that include output accounts, price deflator, capital input, and labor input, which are illustrated in the followings.

3.1 Construction of Output and Price Deflators by Regions

As for output, double deflation is adopted in the KLEMS method to measure real value added and its growth rate. The ideal way to conduct double deflation is to work at a very detailed sectoral level, deflating each component by a strictly appropriate price index. Regional input and output table (RIOT) is the ideal data tool to construct nominal output data. The regional official statistics publish both detailed RIOTs and reduced RIOTs every five years from 1987.[1] During 1992-2014, we have five benchmarks, i.e.,

[1] In detailed RIOTs, the number of industries is over 100 while in reduces RIOTs, the number of industries is increasing from 1987. The number is 33 in 1987 and 1992, 40 in 1997, and 42 from 2002 onwards.

1992, 1997, 2002, 2007, and 2012.

The first step to construct regional output data is to regroup detailed sectors into our standard 37 sectors.[2] For several regions, we use the reduced RIOTs because we do not have the detailed RIOTs. In this case, we use the information from the *China Industry Economy Statistical Yearbook* to split the broad industrial sectors in the reduced RIOTs. Regarding service sectors, we assume that the sector structures are the same as in the adjacent detailed RIOTs and use those sector shares to split the broad service sectors in the reduced RIOTs. Consequently, we construct 37 sectors for the five benchmark years.

After the first step, we calculate four kinds of ratios: labor compensation-value added ratio (LC-VA ratio), value added-gross output ratio (VA-GO ratio), the VA share of each industrial sector in the total industry, and the VA share of each service sector in the total services in the five benchmark years. For middle years between two adjacent benchmarks, we interpolate the industrial structure by linear projection. The key assumption behind this is that every sector develops along a linear trend. This assumption is valid when there is no major industrial structure change or external shock between two adjacent benchmark years. For the last two years, that is, 2013 and 2014, we assume that the industry structure is the same as it was in 2012.

By completing the above two steps, we obtain time series of the industry structure during 1992-2014 for four panels in each region, that is, LC-VA ratio, VA-GO ratio, the VA share of each industrial sector in the total industry, and the VA share of each service sector in the total services. Next, we take the gross value added of three broad industries from regional accounts, that is, primary industry, secondary industry (including industry and construction), and tertiary industry as control totals. By multiplying time series of the VA shares, we can first obtain time series of the VA for both industrial and service sectors. With the VA of primary industry and construction from the regional accounts, we get nominal VA for each sector. By further using the LC-VA ratio and VA-GO ratio, we obtain time series of LC and GO.

Thus, we obtain time series of VA, LC, and GO for every region, and capital compensation is derived as the residual of VA minus LC; intermediate input is derived as the residual of GO minus VA. For national totals, we use the data from the China Industrial Productivity database project, which at present covers 37 sectors in total that exhaust all sectors of the economy at this level of sectoral classification.

In order to insert regions into the whole accounting framework and keep the accounting identity consistent between the national total and the summation of all regions, we integrate regional accounts with the national account by redistributing the discrepancy between the national account and the summation of all regional accounts based on the sector structure of newly constructed regional accounts.

As for sector-specific producer price index (PPI), with the limitations of official regional data availability, two approaches are mainly adopted to construct sector-specific PPIs in each region. One is for agriculture and industrial sectors, in which the data of official PPIs are used. The other is for service sectors, which is the most difficult

[2] The regional KLEMS data can be regarded as the extension of China KLEMS data to regional level so that we keep the industry classification the same as it at the national level. See Table A1 in Appendix for the classification of 37 sectors.

because the officials do not report any related PPI information. The data of the relevant components of the regional consumer price index (CPI) and other price information are employed to construct PPIs for most service sectors. We follow the approach used to construct sectoral PPIs at the national level to construct regional PPIs, and the approaches and data used to construct regional PPIs are summarized in Table 3.1.

Table 3.1 Approaches Used in Constructing Regional Sector-specific PPIs

Sector by CIP Code	**Approach**
Agriculture (1)	Aggregate PPI for all agricultural products, assumed to move with national total before 2004
Mining (2-5)	Sector-specific PPIs, not adjusted
Manufacturing (6-24)	Sector-specific PPIs, geometric average of sub-sectors for each standard sector
Utilities (25)	Aggregate, geometric average of sub-sectors
Construction (26)	Investment price index of construction and installation
Wholesale and retail (27)	Implicit value added deflator
Hotels and catering (28)	Regional CPI for 1991-1993; price index of "dining out" (a component of CPI) for 1993 onwards
Transportation and storage (29)	Transportation expense for 1991-2000; transportation component of CPI, excluding the price of equipment (vehicles) for 2000 onwards
Post and telecommunication (30)	Postage for 1991-2000; communication services for 2000 onwards
Financial services (31)	Geometric average of transportation and storage (29), post and telecommunication (30), real estate (32), and other services (37)
Real estate services (32)	Relation between PPI and national CPI is applied at regional level
Leasing, business services (33)	As financial services (31)
Public management (34)	Regional CPI; adjusted to nominal wage index of urban staff from 2002 onwards
Education (35)	Tuition and childcare charges before 2000; adjusted to nominal wage index of urban staff from 2002 onwards
Healthcare, social welfare (36)	Medical care service; adjusted to nominal wage index of urban staff from 2002 onwards
Other services (37)	Geometric average of cosmetic beauty fees, culture and entertainment expense, repair and other service fees before 2000; geometric average of culture and entertainment expense, tourism from 2001 onwards

Source: Constructed by author based on official PPIs and regional CPIs. See also Table A1 for sector classification.

Generally, the data of official producer prices are mainly used to construct PPIs for non-service sectors. For industrial sectors, the official statistics of some regions do not report PPIs at detailed sectoral level in certain years; instead, they report another

two types of PPIs: one is grouped by production and living materials, and the other is grouped by department of industry; see Table 3.2 for detailed categories of these two standards. For some regions where the official statistics do not report PPIs at detailed sectoral level while report PPIs based on these two types of PPIs, the latter is used as corresponding aggregate PPIs for some relevant industrial sectors at the detailed sectoral level by assuming that the price changes of detailed industrial sectors move with those of corresponding aggregate PPIs. Furthermore, some regions are missing PPIs data for the first few years of the 1990s, or for the last few years. In this case, we first assume that the price changes of regional aggregate PPIs move with that of the national aggregate PPI, and then assume that the trend of detailed industrial sectors to regional aggregate PPIs reported in regional official statistics continues for the years without PPIs for detailed industrial sectors. Finally, we construct PPIs for the industrial sectors with the classification reported in regional official statistics, and then derive the PPIs for the standard industrial sectors by taking the geometric average of PPIs of the corresponding sub-sectors.

Table 3.2 Two Additional Standards of Industrial Sectors

Type I: Grouped by production and living materials	**Type II: Grouped by department of industry**
Production Materials	Metallurgical Industry
Mining and Quarrying Industry	Power Industry
Raw Materials Industry	Coal Industry
Processing Industry	Petroleum Industry
Living Materials	Chemical Industry
Food	Machine Manufacturing Industry
Clothing	Building Materials Industry
Articles for Daily Use	Timber Industry
Durable Consumer Goods	Food Industry
	Textile Industry
	Tailoring Industry
	Leather Industry
	Paper-Making Industry
	Cultural, Educational, and Art Supplies Industry
	Others

Source: Author's collection.

As can be seen in Table 3.1, in most cases, we use the relevant components of regional CPI to construct PPIs for service sectors.[3] Specifically, the price index of a component of regional CPI, dining out, is used as the proxy PPI for hotels and catering services (standard sector 28) from 1994. For transportation and storage (29), we use the price of transportation expenses for 1991-2000 and the transportation component of CPI from 2001, which includes four ingredients, that is, fuels and parts, fees for vehicle

[3] The present work is preliminary and welcomes suggestions for improvement.

use and maintenance, in-city traffic fare, and intercity traffic fare. We use the price index of postage for the period of 1991-2000 and communication services for the period of 2001-2014 for post and telecommunications (30). It is difficult to appropriately construct PPIs for both financial services (31) and leasing and business services (33). For these two sectors, we take a geometric average of the price indices of transportation and storage (29), post and telecommunication (30), real estate services (32) and other services (37). For education (35), the price changes of tuition and childcare charges are used before 2000, and from 2002, we change it to the nominal wage index of urban staff, which is also used for public management (34) and healthcare and social welfare (36) during this period. For healthcare and social welfare (36), the price index of medical care service is adopted. For the last service sector, other services (37), we take the geometric average of price changes of cosmetic beauty fees, culture and entertainment expenses, repairs, and other service fees before 2000, and of culture and entertainment expenses and tourism from 2001.

For those service sectors that cannot be related to the concrete components of regional CPI, we directly use regional CPI as a proxy for their PPIs. Such sectors include hotel and catering services (28) for the period of 1991-1993 and public management (34) for the period of 1991-2001.

In addition, for some service sectors whose PPIs cannot be constructed by using the components of regional CPI, i.e., construction (26), wholesale and retail (27), and real estate services (32), we rely on other information to construct their PPIs. For construction (26), we use the IPI of construction and installation. For wholesale and retail (27), the implicit value added deflator is adopted. For real estate services (32), Wu and Ito (2015) first calculate the service margin of per square meter housing based on housing statistics reported in the chapter of "Real Estate" of the *China Statistical Yearbooks*;[4] next, they construct the service margin index that is used as the PPI of real estate services (32) starting in 1993. For the time period before 1993, they assume that the PPI follows the housing component of the national CPI. It is difficult, however, to repeat this procedure to construct PPI for real estate services at the regional level. Therefore, we apply the relation between the PPI of national real estate services and the national CPI to the regional level.

3.2 Construction of Capital Input by Regions

We follow the perpetual inventory method to construct capital stock for each region. The core indicators are constructed as follows: (1) We use the two-period difference of original value of fixed assets as the investment flow for industrial sectors, remove residential investments, and add back productive assets not covered by the official industry investment statistics and scrapings. We use the newly increased fixed assets as the investment flow for non-industrial sectors. (2) The share of equipment and structure in the total investment of industrial sectors at the national level is applied for regions to construct these two types of capital assets at the regional level. For service sectors, we use data from the *China Statistical Yearbook of The Tertiary Industry* to

[4] Before 2014, the chapter "Real Estate" was contained in the chapter "Investment in Fixed Assets".

divide investment flows into equipment and structure. For agriculture and construction, the share of equipment and structure is set at 5:5 since there are no systematic data about asset decompositions of these two sectors by region. (3) The time period of newly constructed regional capital data starts from 1980, we take the 1980 values of equipment and structure by sector from the national totals to construct the initial capital stock for regions. That is, based on the regional distribution from the newly constructed regional capital data, we divide the two national sectoral totals into 31 regions. (4) The depreciation rates for all sectors at the national level are used for regions. (5) To construct investment price index (IPI) of equipment at regional level, we first collect the data of the aggregate IPI of the "purchase of equipment and instruments" from regional statistical yearbooks for the period from 1990, and for the period before 1990, we assume that the price change of regional aggregate IPI follows that of national aggregate IPI. Then, we apply the ratio of the IPI of every industrial sector to the aggregate IPI at the national level to regions to construct the industrial sector-specific IPI of equipment. The IPI of the equipment of non-industrial sectors is the same as the geometric average of that of industrial sectors. We use the data of the regional IPI of "construction and installation" to construct the IPI of structure of each region. After finishing the construction of capital stock, we estimate capital user cost, and finally measure capital input in each region.

3.3 Construction of Labor Input by Regions

In order to sufficiently reflect the heterogeneity of different types of labor, we also aim to construct labor employment, hours worked, and compensation matrices cross-classified by four dimensions at regional level, that is, gender/sex ($g = 2$), age ($a = 7$ groups), education level ($e = 5$ levels), and sector ($s = 37$). We first construct control totals of employment of 37 sectors in each region. We collect the employment data for three broad industries, that is, primary, secondary, and tertiary industries, from regional statistical yearbooks and take the primary industry as our first standard sector, i.e., agriculture. Then, we split the secondary industry into industry and construction by using the time series of the employment share of construction in the total secondary industry, which is constructed by interpolating and extrapolating the employment share based on three benchmarks of regional population census, i.e., 1990, 2000, and 2010.

To construct employment data for detailed industrial sectors, we use data from the *China Industry Economy Statistical Yearbook* (CIESY)[5] and regional population census to derive employment data for "below designated size" industrial sectors by the difference between these two data sources, and then construct the share of employment of individual industrial sectors in the total "below designated size" industrial sectors. Together with the control totals for "below designated size" industrial sectors, derived by the control total of industry constructed earlier minus the total of "above designated size" industrial sectors from the CIESY, and the time series of the employment share of "below designated size" industrial sectors, constructed by interpolating and

[5] The data coverage of CIESY is only for "above designated size" industrial sectors, while that of the regional population census should be considered as covering all industrial sectors, which also includes "below designated size" industrial sectors.

extrapolating the employment share based on three benchmarks, we obtain the time series of employment data for "below designated size" industrial sectors. The whole employment data of industrial sectors are obtained by summing up the employment data of "above and below designated size" industrial sectors.

To construct employment data for detailed service sectors, we use data from the *China Labor Statistical Yearbook* (CLSY)[6] and regional population census to derive employment data for non-urban service sectors by the difference between these two data sources, and then construct the share of employment of individual service sectors in the total non-urban service sectors. Together with the control totals for non-urban service sectors, derived by the control totals of service sectors constructed earlier minus the total of urban service sectors from the CLSY, and the time series of the employment share of non-urban service sectors, constructed by interpolating and extrapolating the employment share based on three benchmarks, we obtain the time series of employment data for non-urban service sectors. The whole employment data of service sectors are obtained by summing up the employment data of service sectors located in both urban and non-urban areas.

After finishing the construction of control totals of employment of 37 sectors, we move to construct full-dimensioned employment matrices. We first collect available marginal matrices, which includes partial dimensions, from regional population census and integrate them into the full-dimensioned employment matrices at three benchmarks by using the iterative proportional fitting approach. Then, we derive the total employment of each sector by summing all its components and calculate the share of employment of each component in the total employment of each sector. By using the control totals of employment of 37 sectors and the time series of the share of employment of each component in the total employment of each sector at three benchmarks, we estimate the time series of full-dimensioned employment matrices for each region over 1990-2014.

For the hours worked in accordance with each type of labor, given that the data limitations about hours at regional level, we use national hour matrices data to construct regional full-dimensioned hours worked matrices by assuming that the average hours worked of each type of labor at the national level are as same as in regions. By employing the time series of full-dimensioned employment matrices of each region constructed above, we can construct the time series of the full-dimensioned hours worked matrices for each region.

As for the hourly compensation of each type of labor, we first calculate the ratio of the per hour compensation of each type of labor to the average wage of its corresponding sector at the national level. Then with the average wage of each sector at the regional level, which is derived by the total labor compensation divided by total employment of each sector, we obtain the per hour compensation for each type of labor in each region for the time period of 1992-2014 by applying the relation of per hour compensation of each type of labor to its sectoral average rate at the national level to regions.

[6] The data coverage of the CLSY is only for sectors in urban areas, and that of the regional population census should be considered as covering all service sectors, which also includes service sectors located in non-urban areas.

4. Results

Table 1 shows the contribution of sectors and inputs to regional growth rate.[7] During 1992-2014, the average annual growth rate of coastal district is 9.69%, followed by the central district (7.85%), the western district (6.93%), and the northeast district (6.69%). Among these four districts, the growth rate of coastal district is the highest, which is mainly benefited from many factors, such as policy support, geographic location, and so on. China had started reform and opening up policy since 1978. Considering heterogeneous growth potentials among different regions, the central government supported some regions to develop first. Also benefiting from geographic location, the coastal regions are greatly involved in international market via international trade, which promotes economic growth in these regions. In addition, the rapid economic growth in coastal regions further attracts a large amount of resources to inflow into these regions, which becomes the important sources of economic growth. On the other hand, the growth rate of northeast district is the lowest, which may be due to the difficult transition of industry structure from heavy industries and the depletion of natural resources. Moreover, with the slowdown economic growth in northeast district, more and more resources flow into other districts.

From the perspective of sectors, industry is the main source of growth in coastal, northeast, and central districts. Due to the base of industry is weak in western district, the contribution of industry is lower than that of services. The western district has the comparative advantage of agriculture and energy, especially the agriculture whose growth rate is the highest among four districts. From the inside of the industry, the growth rate of finished and semi-finished goods is the highest, followed by commodity and primary materials, and energy. The positions in industry chain may affect the growth performance of three industrial sectors. From the perspective of vertical industry division, the manufacturing of finished and semi-finished goods locates at the downstream of industry chain, which participates in market competition and is less affected by government intervention. The energy sector on the other hand locates at the upstream of industry chain, which is far away from market competition and vulnerable to governmental intervention. The manufacturing of commodity and primary materials locates in the middle of the industry chain. From the inside of the service industry, the growth rate of first two service sectors is obviously higher than that of non-market service.

Considering the sources of regional economic growth, it is clear that capital is the main source of growth in all four districts. In coastal district, the TFP growth rate is over than that of labor input, while in other three districts it is negative. The TFP of coastal district exhibits a growing trend, while it shows a declining trend in other districts, particularly, the TFP of western district declines from 0.83% in 1992-2001 to -1.72% in 2008-2014. This indicates that the regional economic growth in China is still heavily replying on factor inputs, especially capital input, other than TFP.

In order to explore the sources of growth of TFP in each district, the growth rate of TFP is further decomposed into three terms: the Domar-weighted TFP, the capital

[7] See Table A2 in Appendix for classification of provinces.

reallocation effect, and the labor reallocation effect, which are shown in Table 2. As stated above, during 1992-2014, the TFP growth rate of coastal district is the highest, 0.64% per annum, and shows a growing trend, while it is negative in other districts and shows a declining trend over three sub-periods, especially in western district.

From the perspective of Domar-weighted TFP, the TFP of industry is the main source of growth of the overall TFP in coastal, northeast, and central districts. Due to the industry development is relatively stagnating in western district, the growth rate of TFP of industry is negative. The western district has the highest of TFP growth rate in agricultural sector, although it is negative in other districts. From the inside of the industry, the market competition is conducive to the improvement of TFP, thus, the TFP of the sector of finished and semi-finished goods is the highest. However, the energy sector is far away from market competition, and it is in a large part affected by governmental intervention, causing its TFP is negative in all districts. The TFP of service sectors is almost negative in all districts, while that of "service 1" is relatively better than the rest two service sectors.

The last two rows of Table 2 show the reallocation effects of capital and labor. In China, capital is mainly controlled by government, and a large amount of capital tends to flow into state-owned enterprises in spite of efficiency is relatively low in these enterprises. The small and medium enterprises whose efficiency is relatively high are difficult to be approved to get the capital resource. Thus, there exists capital misallocation in Chinese economy, which is shown as the negative capital reallocation effect in all districts. A phenomenon that should be paid attention is that capital reallocation is improved in 2008-2014 compared to it is in 2002-2007. One possible reason for the improvement in capital reallocation is that the government learned from the performance of capital reallocation in 2002-2007 that interventions on capital allocation is not helpful to improve the allocation efficiency of capital, thus gradually reducing interventions and letting the market make a decisive role in allocating resources. On the other hand, the labor market is less affected by governmental interventions compared to capital market. Thus, labors can relatively freely flow from industries with low efficiency into industries with high efficiency by following the market mechanism. The comprehensive effect of capital and labor reallocation in each district is the dominant source of growth of the overall TFP, which covers the growth of the latter.

Table 1 Contribution of Sectors and Inputs to Regional Growth

	Coastal District					Northeast District			
	1992-2001	2002-2007	2008-2014	1992-2014		1992-2001	2002-2007	2008-2014	1992-2014
Regional growth rate	8.63	11.59	9.42	9.69		5.73	6.98	7.68	6.69
	Contribution from Sectors					Contribution from Sectors			
Agriculture	0.79	0.15	0.16	0.41		0.07	0.02	0.33	0.14
Construction	0.14	0.39	0.27	0.25		0.24	0.44	0.61	0.42
Energy	0.36	0.09	-0.26	0.09		-0.18	-0.70	-1.69	-0.80
Commodity and primary materials	2.27	1.51	1.55	1.83		1.68	0.42	1.95	1.42
Finished and semi-finished goods	3.40	4.61	3.37	3.72		2.47	2.55	3.24	2.74
Service 1	0.49	1.78	1.57	1.19		0.20	1.36	1.15	0.82
Service 2	1.38	2.72	2.71	2.17		1.27	2.58	2.00	1.86
Non-market services	-0.20	0.32	0.06	0.02		-0.03	0.30	0.09	0.10
	Contribution from Inputs					Contribution from Inputs			
Capital input	8.02	9.37	8.23	8.46		5.18	6.61	8.78	6.71
Labor input	0.90	0.82	0.00	0.59		0.62	0.52	-0.28	0.31
TFP	-0.30	1.40	1.19	0.64		-0.07	-0.16	-0.82	-0.33

Source: Author’s calculation.

Table 1 Contribution of Sectors and Inputs to Regional Growth (continued)

	Central District					Western District			
	1992-2001	2002-2007	2008-2014	1992-2014		1992-2001	2002-2007	2008-2014	1992-2014
Regional growth rate	6.49	8.54	9.02	7.85		7.47	7.51	5.74	6.93
	Contribution from Sectors					Contribution from Sectors			
Agriculture	-0.16	-0.24	0.45	0.01		3.66	2.04	0.40	2.18
Construction	0.58	0.84	0.64	0.67		-0.06	1.18	0.26	0.38
Energy	0.75	0.05	0.39	0.44		1.86	-0.06	-0.26	0.66
Commodity and primary materials	1.70	1.25	1.78	1.60		0.97	0.73	0.68	0.81
Finished and semi-finished goods	2.25	2.44	2.25	2.30		-0.07	0.13	0.83	0.27
Service 1	0.35	1.44	1.50	1.02		0.57	1.24	1.88	1.17
Service 2	1.01	2.38	1.86	1.66		0.54	1.75	1.27	1.10
Non-market services	0.01	0.36	0.15	0.15		0.01	0.49	0.70	0.36
	Contribution from Inputs					Contribution from Inputs			
Capital input	5.90	8.17	9.67	7.72		5.85	6.30	7.84	6.61
Labor input	0.80	0.40	-0.47	0.29		0.78	0.50	-0.38	0.34
TFP	-0.21	-0.03	-0.18	-0.15		0.83	0.71	-1.72	-0.01

Source: Author's calculation.

Table 2 Decomposition of Growth of Regional TFP

	Coastal District					Northeast District			
	1992-2001	2002-2007	2008-2014	1992-2014		1992-2001	2002-2007	2008-2014	1992-2014
Growth rate of regional TFP	-0.30	1.40	1.19	0.64		-0.07	-0.16	-0.82	-0.33
1. Domar-weighted TFP	-0.86	1.38	-1.08	-0.32		-1.16	0.33	-3.05	-1.36
Agriculture	0.53	0.11	-0.08	0.22		-0.54	-0.26	0.07	-0.27
Construction	-0.48	0.12	-0.13	-0.21		-0.12	0.24	-0.17	-0.04
Energy	-0.18	-0.51	-0.73	-0.45		-1.47	-2.02	-2.72	-2.02
Commodity and primary materials	1.14	-0.14	0.28	0.52		1.43	-0.05	0.62	0.77
Finished and semi-finished goods	1.36	1.48	0.89	1.24		1.79	1.47	1.03	1.46
Service 1	-1.25	0.59	0.05	-0.34		-0.93	0.58	0.14	-0.18
Service 2	-1.24	0.15	-0.76	-0.71		-0.55	0.69	-1.37	-0.47
Non-market services	-0.73	-0.41	-0.59	-0.60		-0.76	-0.33	-0.64	-0.60
2. Reallocation of capital	-0.61	-1.20	-0.10	-0.61		-0.07	-0.92	0.27	-0.19
3. Reallocation of labor	1.17	1.21	2.37	1.56		1.16	0.44	1.96	1.22

Source: Author’s calculation.

Table 2 Decomposition of Growth of Regional TFP (continued)

	Central District					Western District			
	1992-2001	2002-2007	2008-2014	1992-2014		1992-2001	2002-2007	2008-2014	1992-2014
Growth rate of regional TFP	-0.21	-0.03	-0.18	-0.15		0.83	0.71	-1.72	-0.01
1. Domar-weighted TFP	-1.06	-0.44	-2.69	-1.41		0.68	-0.42	-4.55	-1.28
Agriculture	-0.93	-0.51	-0.30	-0.61		2.71	1.49	-0.13	1.47
Construction	-0.11	0.24	-0.13	-0.02		-0.63	0.66	-1.00	-0.39
Energy	0.27	-1.05	-0.59	-0.36		0.79	-2.34	-2.80	-1.20
Commodity and primary materials	1.16	0.07	-0.08	0.47		0.55	-0.16	-1.02	-0.14
Finished and semi-finished goods	1.22	1.27	-0.25	0.77		-0.44	-0.07	0.40	-0.07
Service 1	-1.11	0.27	0.49	-0.22		-0.51	0.47	1.21	0.30
Service 2	-1.06	0.03	-1.10	-0.77		-1.42	0.01	-0.62	-0.77
Non-market services	-0.52	-0.76	-0.71	-0.65		-0.38	-0.48	-0.59	-0.48
2. Reallocation of capital	-0.20	-1.21	-0.08	-0.44		-0.44	-0.82	-0.88	-0.68
3. Reallocation of labor	1.05	1.62	2.59	1.70		0.60	1.94	3.71	1.95

Source: Author’s calculation.

Table 3 shows the contribution of region-industry growth to the growth of the whole Chinese economy. During 1992-2014, the average annual growth rate of the whole economy is 8.73%, peaks in 2002-2007, and slightly declines in 2008-2014. The coastal district is the main regional source of China's economic growth, followed by the central district, northeast district, and western district. From the growth performance of each district over three sub-periods, the growth of coastal and western districts declines slightly in 2008-2014 while that of the rest two districts keeps growing.

From the perspective of industry, industry contributes 4.90% to the growth of the whole economy, followed by 3.12% from services, 0.40% from construction, and 0.31% from agriculture. Considering the regional sources of growth of each industry, the coastal district plays a dominant role in promoting growth in agriculture, commodity and primary materials, finished and semi-finished goods, service 1, and service 2, while the central district plays a dominant role in promoting growth in construction, energy, and non-market services. The contributions of northeast and western districts are relatively small, especially the western district.

From the perspective of factor inputs, capital input contributes 7.85% to the growth of the whole economy, followed by 0.62% from TFP, and 0.25% from labor input. Furthermore, the growth of capital input and TFP is growing over three sub-periods, while that of labor input obviously declines in 2008-2014. A reason for decrease in labor input is because of the supply of labor forces is declining. Many studies find that the demographic dividend of China has disappeared around 2010. Considering the regional sources of growth of capital input, the coastal district makes the dominant contribution, followed by the central, northeast, and western districts. In addition, in 2008-2014, the growth of capital input is growing in northeast, central, and western districts, especially in the central district, while it is declining in the coastal district. As for labor input, a large amount of labor forces flow from the central and western districts into the coastal district, and this phenomenon is more obvious in 2002-2007. Finally, despite the growth rate of TFP keeps growing over three sub-periods, it only contributes around 7% of China's economic growth.

Table 3 Contribution of Region-Industry Growth to China's GDP

	1992-2001	2002-2007	2008-2014	1992-2014
GDP growth rate	7.57	10.10	9.04	8.73
—Coastal district	4.69	6.58	5.19	5.36
—Northeast district	0.59	0.62	0.66	0.62
—Central district	2.09	2.69	3.04	2.56
—Western district	0.21	0.21	0.16	0.19
	Contribution from region-industry			
1. Agriculture	0.49	0.07	0.28	0.31
—Coastal district	0.43	0.09	0.09	0.23
—Northeast district	0.00	0.00	0.03	0.01
—Central district	-0.05	-0.07	0.15	0.01
—Western district	0.10	0.06	0.01	0.06
2. Construction	0.29	0.56	0.42	0.40
—Coastal district	0.07	0.22	0.15	0.14
—Northeast district	0.03	0.04	0.05	0.04
—Central district	0.19	0.26	0.22	0.22
—Western district	0.00	0.03	0.01	0.01

3. Energy	0.46	0.00	-0.16	0.14
—Coastal district	0.19	0.05	-0.14	0.05
—Northeast district	-0.03	-0.06	-0.14	-0.07
—Central district	0.24	0.02	0.13	0.14
—Western district	0.05	0.00	-0.01	0.02
4. Commodity and primary materials	1.99	1.31	1.63	1.69
—Coastal district	1.24	0.86	0.85	1.01
—Northeast district	0.17	0.04	0.17	0.13
—Central district	0.54	0.40	0.60	0.52
—Western district	0.03	0.02	0.02	0.02
5. Finished and semi-finished goods	2.82	3.62	2.91	3.07
—Coastal district	1.84	2.62	1.85	2.06
—Northeast district	0.26	0.23	0.28	0.26
—Central district	0.73	0.77	0.76	0.75
—Western district	0.00	0.00	0.02	0.01
6. Service 1	0.42	1.63	1.52	1.10
—Coastal district	0.27	1.01	0.86	0.66
—Northeast district	0.02	0.12	0.10	0.07
—Central district	0.11	0.46	0.51	0.33
—Western district	0.02	0.03	0.05	0.03
7. Service 2	1.22	2.57	2.33	1.94
—Coastal district	0.75	1.54	1.50	1.20
—Northeast district	0.13	0.23	0.17	0.17
—Central district	0.32	0.75	0.63	0.54
—Western district	0.01	0.05	0.03	0.03
8. Non-market services	-0.11	0.34	0.11	0.08
—Coastal district	-0.11	0.18	0.03	0.02
—Northeast district	0.00	0.03	0.01	0.01
—Central district	0.00	0.11	0.05	0.05
—Western district	0.00	0.01	0.02	0.01
	Contribution from inputs			
Capital input	6.65	8.53	8.81	7.85
—Coastal district	3.64	4.65	4.04	4.04
—Northeast district	0.72	0.69	0.83	0.75
—Central district	2.00	2.88	3.57	2.74
—Western district	0.29	0.32	0.37	0.32
Labor input	0.40	0.90	-0.49	0.25
—Coastal district	0.16	2.57	-0.30	0.67
—Northeast district	0.02	0.14	-0.04	0.04
—Central district	0.20	-1.55	-0.13	-0.38
—Western district	0.02	-0.27	-0.02	-0.07
TFP	0.52	0.67	0.72	0.62

Source: Author's calculation.

Table 4 further decomposes the growth rate of aggregate TFP to investigate its growth sources. The average annual growth rate of Domar-weighted TFP during 1992-2014 is -0.8%, peaks in 2002-2007, and declines significantly in 2008-2014. Throughout the whole period, the growth rate of TFP in all districts is declining, especially in the central district. In three sub-periods, only in the coastal district does TFP achieve obvious growth in 2002-2007.

From the perspective of industry, the sectors of commodity and primary materials and finished and semi-finished goods are the main contributors of the aggregate TFP growth in China. The coastal district plays the dominant role in promoting TFP growth in these two industrial sectors, followed by the central and northeast districts, while the

contribution from the western district is nearly zero. In addition, the coastal district also plays the dominant role in promoting TFP growth in agriculture, which is benefited from the TFP growth during 1992-2001. The negative growth of TFP of construction is mainly due to the decline in TFP in the coastal district. In the rest energy and services, the TFP growth performance of the western district is relatively better than other districts although it is still negative.

As like in regions, the capital reallocation effect is also negative for the whole economy during 1992-2014 while labor reallocation effect is significantly positive. In addition, the capital reallocation effect is improved in the last period. The comprehensive effect of capital and labor reallocation throughout the whole period is 1.42%, completely contributing the aggregate TFP growth in China.

Table 4 Decomposition of Growth of China's TFP

	1992-2001	2002-2007	2008-2014	1992-2014
TFP growth rate	0.52	0.67	0.72	0.62
(I) Domar-weighted TFP	-0.94	0.67	-1.88	-0.80
—Coastal district	-0.46	0.78	-0.61	-0.17
—Northeast district	-0.14	0.03	-0.26	-0.13
—Central district	-0.36	-0.14	-0.89	-0.47
—Western district	0.02	-0.01	-0.12	-0.04
	Contribution from region-industry			
1. Agriculture	0.01	-0.08	-0.14	-0.06
—Coastal district	0.29	0.07	-0.04	0.12
—Northeast district	-0.06	-0.03	0.01	-0.03
—Central district	-0.30	-0.16	-0.10	-0.20
—Western district	0.08	0.04	0.00	0.04
2. Construction	-0.33	0.18	-0.16	-0.14
—Coastal district	-0.27	0.07	-0.07	-0.11
—Northeast district	-0.01	0.02	-0.01	0.00
—Central district	-0.03	0.07	-0.04	-0.01
—Western district	-0.02	0.02	-0.03	-0.01
3. Energy	-0.15	-0.87	-0.91	-0.59
—Coastal district	-0.10	-0.29	-0.41	-0.25
—Northeast district	-0.16	-0.18	-0.23	-0.19
—Central district	0.09	-0.33	-0.20	-0.12
—Western district	0.02	-0.06	-0.07	-0.03
4. Commodity and primary materials	1.15	-0.07	0.15	0.50
—Coastal district	0.63	-0.08	0.15	0.28
—Northeast district	0.14	0.00	0.05	0.07
—Central district	0.37	0.02	-0.02	0.15
—Western district	0.02	0.00	-0.03	0.00
5. Finished and semi-finished goods	1.31	1.37	0.50	1.07
—Coastal district	0.74	0.84	0.48	0.69
—Northeast district	0.19	0.13	0.09	0.14
—Central district	0.39	0.40	-0.08	0.24
—Western district	-0.01	0.00	0.01	0.00
6. Service 1	-1.16	0.49	0.24	-0.27
—Coastal district	-0.69	0.34	0.03	-0.18
—Northeast district	-0.10	0.05	0.01	-0.02
—Central district	-0.36	0.09	0.16	-0.07
—Western district	-0.01	0.01	0.03	0.01
7. Service 2	-1.11	0.16	-0.92	-0.71
—Coastal district	-0.67	0.08	-0.41	-0.38
—Northeast district	-0.06	0.06	-0.12	-0.04

—Central district	-0.34	0.01	-0.37	-0.26
—Western district	-0.04	0.00	-0.02	-0.02
8. Non-market services	-0.65	-0.51	-0.64	-0.61
—Coastal district	-0.40	-0.23	-0.33	-0.33
—Northeast district	-0.08	-0.03	-0.05	-0.06
—Central district	-0.17	-0.24	-0.24	-0.21
—Western district	-0.01	-0.01	-0.02	-0.01
	Contribution from resource reallocation			
(II) Reallocation of capital	-0.10	-1.04	-0.14	-0.37
(III) Reallocation of labor	1.55	1.04	2.74	1.79

Source: Author's calculation.

5. Conclusions

Although Chinese economy has achieved rapid growth at the national level, there still exists obvious growth disparity among regional economies. Furthermore, under the regional decentralized authoritarian regime, the local governments spare no efforts to promote regional economic growth to win the growth competition among their peers. The industry policies adopted by local governments not only have important influences on the industry development among regions, but also affect the resource allocation, which in turn affects the efficiency improvement of regional economies. Therefore, it is worth incorporating regions into the entire analytical framework to explore the regional origins of China's overall economy and TFP growth. At the same time, by incorporating the regional productivity accounts into the national framework, we also further examine the reallocation effect of resources across industries and regions. In order to meet the data requirement of KLEMS approach, this study strictly follows the KLEMS standards to construct regional KLEMS dataset, which includes output, price deflators, capital and labor input data.

During 1992-2014, the average annual growth rate of coastal district is the highest, followed by the central district and the western district, while that of the northeast district is the slowest. From the perspective of sectors, industry is the main source of growth in coastal, northeast, and central districts. Due to the base of industry is weak in western district, the contribution of industry is lower than that of services. The western district has the comparative advantage of agriculture and energy, especially the agriculture whose growth rate is the highest among four districts. From the inside of the industry, the growth rate of finished and semi-finished goods is the highest, followed by commodity and primary materials, and energy. From the inside of the service industry, the growth rate of market services is obviously higher than that of non-market service. Capital input is the main source of growth in all four districts, followed by labor input. The growth rate of TFP in coastal district is over than that of labor input, while in other three districts it is negative.

The TFP of industry is the main source of growth of the overall TFP in coastal, northeast, and central districts while it is negative in western district. However, the western district has the highest of TFP growth rate in agricultural sector, although it is negative in other districts. The TFP of service sectors in all districts is almost negative. Another important source of growth of TFP in each district is labor reallocation while capital reallocation effect is negative.

The coastal district plays an important role in promoting the growth of Chinese economy, followed by the central district, while the contribution from the northeast and western districts are relatively small, especially that from the western district. The coastal district also plays a dominant role in promoting the growth of most of sectors, while the central district plays the leading role in promoting the growth of the rest sectors. From the perspective of factor inputs, capital input is the most important contributor to the Chinese economic growth, followed by the TFP and labor input. The coastal district makes the dominant contribution to the growth of factor inputs, especially for the labor input which shows that a large amount of labor forces flows from the central and western districts into the coastal district.

The growth rate of the aggregate TFP keeps a growing trend, which is mainly benefited from the labor reallocation given that both the Domar-weighted TFP and capital reallocation are negative. The contribution of each district to the Domar-weighted TFP of Chinese economy is negative. From the perspective of sectors, the TFP of two industrial sectors, i.e., commodity and primary materials, and finished and semi-finished goods, is the main contributors of the Domar-weighted TFP growth in China in which the coastal district plays the dominant role, followed by the central and northeast districts, while the contribution from the western district is nearly zero. However, the TFP growth performance of the western district in energy and services is relatively better than other districts although it is still negative. Finally, the governmental interventions in allocation of capital cause the capital reallocation effect to be negative, while the positive labor reallocation effect is mainly benefited from the relaxation of various restrictions on labor mobility so that labors can relatively freely flow from industries/regions with low efficiency into industries/regions with high efficiency by following the market mechanism.

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Appendix

Table A1 CIP Industry Classification and Codes

Code	Industry Description	Classification
1	Agriculture, Forestry, Animal Husbandry and Fishery	Agriculture
2	Mining and Washing of Coal	Energy
3	Extraction of Petroleum and Natural Gas	Energy
4	Mining of Metal Ores	C&P
5	Mining of Nonmetallic Ores and Other Ores	C&P
6	Manufacturing of Foods	F&SF
7	Manufacturing of Cigarettes and Tobacco	F&SF
8	Manufacturing of Textile	C&P
9	Manufacturing of Textile Wearing Apparel and Ornament	F&SF
10	Manufacturing of Leather, Fur, Feather and Their Products, and Footwear	F&SF
11	Processing of Timbers, Furniture	F&SF
12	Manufacturing of Paper, Printing	C&P
13	Processing of Petroleum, Coking	Energy
14	Manufacturing of Chemical Raw Materials and Chemical Products	C&P
15	Manufacturing of Rubber and Plastics Products	F&SF
16	Manufacturing of Non-metallic Mineral Products	C&P
17	Manufacturing and Pressing of Metals	C&P
18	Manufacturing of Fabricated Metal Products	F&SF
19	Manufacturing of General and Special Equipment	F&SF
20	Manufacturing of Electrical Machinery and Equipment	F&SF
21	Manufacturing of Computers, Communication Equipment and Other Electronic Equipment	F&SF
22	Manufacturing of Instrumentation, and Culture, Office Machinery	F&SF
23	Manufacturing of Transportation Equipment	F&SF
24	Other Manufacturing	F&SF
25	Production and Distribution of Electricity, Heating Power, Gas and Water	Energy
26	Construction	Construction
27	Wholesale and Retail Trades	Service 2
28	Hotel and Catering Services	Service 2
29	Transportation and Storage	Service 1
30	Post and Telecommunication	Service 1
31	Finance Intermediation	Service 1
32	Real Estate	Service 2
33	Leasing, Technical, Science and Business Services	Service 2
34	Public Management and Social Organizations	Non-market Service
35	Education	Non-market Service
36	Health and Social Welfare Services	Non-market Service
37	Other Services	Service 2

Source: From China Industry Productivity (CIP) database. “C&P” stands for commodity and primary materials, “F&SF” stands for finished and semi-finished goods.

Table A2 Classification of Provinces

Districts	**Provinces**
Coastal district	Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, Hainan
Northeast district	Liaoning, Jilin, Heilongjiang
Central district	Shanxi, Inner Mongolia, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Ningxia
Western district	Tibet, Gansu, Qinghai, Xinjiang

Source: Author's collection.