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Abstract

Attempts to understand China's role in global value chains have often noted the case of Apple's iPhone production, in particular the fact that the value added during the Chinese portion of the iPhone's supply chain is no more than 4%. However, when we examine the Chinese economy as a whole in global production networks, China's share in total induced value added by China's exports of final products to the USA is about 75% in 2005. This leads us to investigate how Chinese value added is created and distributed not only internationally but also domestically. To elucidate the increasing complexity of China's domestic production networks, this paper focuses on the measure of Domestic Value Chains (DVCs) across regions and their linkages with global markets. By using China's 1997 and 2007 interregional input-output tables, we can understand in detail the structural changes in domestic trade in terms of value added, as well as the position and degree of participation of different regions within the DVCs.

Keywords: Trade in value added, value chain, vertical specialization, comparative advantage
JEL classification: C6, F4, O18

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Abstract

Since the launch of the Reform and Open-Door Policy in 1978, China has registered a high level of economic growth. Its accession to the WTO in 2001 brought a dramatic change to the global trade structure. Attempts to understand China's role in global value chains have often noted the case of Apple's iPhone production, in particular the fact that the value added during the Chinese portion of the iPhone's supply chain is no more than 4%. However, when we examine the Chinese economy as a whole in global production networks, China's share in total induced value added by China's exports of final products to the USA is about 75% in 2005. This leads us to investigate how Chinese value added is created and distributed not only internationally but also domestically. To elucidate the increasing complexity of China's domestic production networks, this paper focuses on the measure of Domestic Value Chains (DVCs) across regions and their linkages with global markets. By using China's 1997 and 2007 interregional input-output tables, we can understand in detail the structural changes in domestic trade in terms of value added, as well as the position and degree of participation of different regions within the DVCs. We can also use our measurements to discuss China's regional economic performance and policy orientation.

Keyword: Trade in value added, input-output, value chain, vertical specialization, comparative advantage

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1 Introduction

China has registered a high rate of economic growth during the last three decades. Its economic scale in real terms expanded almost 2.6-fold from 1987 to 1997, and did so again from 1997 to 2007[1]. In 2010, China's nominal GDP surpassed that of Japan, becoming the second largest in the world. The most important factors that enabled China to achieve such high economic growth are generally considered to be its domestic market-oriented economic reforms, ongoing urbanization, industrialization, and active participation in global value chains (GVCs). At the same time, the interactions between these four forces provide a powerful engine to support the so-called "China Miracle."

A number of studies have used different approaches to investigate China's role in the increasingly globalized world economy. Recently, case studies examining China's role in Apple's global supply chain (e.g., Linden et al., 2009; Dedrick et al., 2010) have received a great amount of attention. In the case of the iPhone, "China just contributed only 3.6% of US$2.0 billion export to the US, the rest was simply a transfer from Germany, Japan, Korea, the US, and other countries" (Xing and Detert, 2010). However, when we examine the Chinese economy as a whole in global production networks, China's share in total induced value added by China's exports of final products to the USA is about 75% in 2005.[2] This clearly indicates that case studies of iPhone production focus on only the supply chain of a specific firm and its products, rather than the role of China's domestic production networks and inter-industrial linkages in the value creation process. As a response to this issue and related topics, some national and international input-output (I/O)-based analyses have been done, such as Hummels et al. (2001), Kuroiwa, (2006), Escaith (2008), Koopman et al. (2008, 2010), Uchida and Inoamata (2009), Yang et al. (2009), Degain and Maurer (2010), Timmer (2010), Fukasaku et al. (2011), Johnson and Noguera (2011), Meng et al. (2011), Abdul et al. (2011), Los et al. (2012), and Stehrer (2012). However, all of them treat China as a whole rather than considering the expansion of GVCs inside China at the regional level. Since there is large variation in economic size, industrial structure, and overseas dependency across regions within China, we need regional level perspectives in order to understand the value added creation and distribution mechanisms in detail. This paper applies the concepts of vertical specialization (VS), trade in value added (TiVA) and TiVA-based revealed comparative advantage (RCA) to China's regional economies. This can serve not only to elucidate the features and evolution of China's domestic value chains (DVCs), but also to provide a way to understand the relationship between China's DVCs and GVCs at the regional level.

The rest of the paper is organized as follows. Section 2 shows how we apply the conventional trade indicators such as the VS, TiVA, and RCA to domestic-regional dimensions. Section 3 gives a brief explanation of the database used. Section 4 shows the results of an analysis of China's DVCs and its linkages to the global market. Concluding remarks are given in Section 5.

2 I/O-based measurement of value chains

In this section, we propose new I/O-based indicators for measuring DVCs and their linkages with

[1] Based on the IMF statistics, China's GDP at constant price (1990 base) are respectively 1.609 trillion yuan for 1987, 4.149 trillion yuan for 1997, and 10.691 trillion yuan for 2007.

[2] This result is based on author's calculation by using the OECD input-output and bilateral trade database.

overseas markets. These indicators include the domestic versions of conventional VS indictors, a measurement of domestic TiVA, and indicators of value added linkages in regard to the contribution of exports to the regional economy. Most ideas in this section can be traced back to the traditional I/O-based measurement of GVCs in the existing literature.

2.1 Regional VS indicators

To investigate the degree of participation of a region in both domestic and global production networks, we first expand the widely converted VS indicator (import contents of export) proposed by Hummels et al. (2001) into a domestic version. The conventional I/O-based VS indicator can be written as

$$\text{VS share} = \frac{\mathbf{u}\cdot\mathbf{M}\cdot(\mathbf{I}-\mathbf{A})^{-1}\cdot\mathbf{ex}}{\mathbf{u}\cdot\mathbf{ex}}, \quad (1)$$

where $\mathbf{u}$ is a $1 \times n$ row vector of 1's, $\mathbf{M}$ is the $n \times n$ matrix constructed by using import coefficients (the share of imported intermediate goods in total input), $\mathbf{A}$ is the $n \times n$ domestic input coefficient matrix, $\mathbf{I}$ is an $n \times n$ identity matrix, $(\mathbf{I}-\mathbf{A})^{-1}$ is the domestic Leontief inverse, and $\mathbf{ex}$ is the $n \times 1$ column vector of exports. The above VS indicator represents the intermediate imports directly and indirectly induced by export demand, which can also be explained as the value of imported intermediates embodied in a country's exports. This indicator has been widely used as a proxy to represent the degree of participation of a country in global supply chains.

If a single regional I/O table with separate import/export data (foreign trade with the rest of the world) and inflow/outflow data (domestic trade with the rest of the nation) is available, the above national VS indicator can be expanded to the following four types of regional indicators: (1) regional import contents of export (RIMCE); (2) regional import contents of outflow (RIMCO); (3) regional inflow contents of export (RINCE); (4) regional inflow contents of outflow (RINCO). In addition, indicators (2) and (4) can yield further four indicators if the inflow/outflow information can be separated into trade in intermediate and final products respectively.

The advantages of the above regional VS indicators include (1) the degree of participation of a region in domestic and global supply chains can be evaluated; (2) the economic interdependency or interaction between domestic and international supply chains can be measured at regional level; (3) the relative position of a region in both domestic and international supply chains can be identified by focusing on intermediate and final products separately.

2.2 Measuring domestic TiVA

To investigate DVCs and their evolution in detail, we apply the concept of global TiVA (Johnson and Noguera, 2009) to a domestic interregional I/O framework. The domestic TiVA at the regional level can be simply defined as "one region's value added induced by the other region's final demand."

To explain the concept of domestic TiVA, we model a closed economy with just two regions (r and s) and n sectors for each region. Based on the traditional interregional I/O model, the total value added can be written as the following form:

$$\mathbf{va} = \mathrm{diag}(\mathbf{v}) \cdot \mathbf{L} \cdot \mathbf{fd}, \tag{2}$$
$$\mathbf{va} = \begin{pmatrix} \mathbf{va}^{r} \\ \mathbf{va}^{s} \end{pmatrix},\ \mathbf{v} = (\mathbf{v}^{r}, \mathbf{v}^{s}),\ \mathbf{L} = \begin{pmatrix} \mathbf{L}^{rr} & \mathbf{L}^{rs} \\ \mathbf{L}^{sr} & \mathbf{L}^{ss} \end{pmatrix} = \left[\mathbf{I} - \begin{pmatrix} \mathbf{A}^{rr} & \mathbf{A}^{rs} \\ \mathbf{A}^{sr} & \mathbf{A}^{ss} \end{pmatrix}\right]^{-1},\ \mathbf{fd} = \begin{pmatrix} \mathbf{fd}^{rr} \\ \mathbf{fd}^{sr} \end{pmatrix} + \begin{pmatrix} \mathbf{fd}^{rs} \\ \mathbf{fd}^{ss} \end{pmatrix}.$$

Here, $\mathbf{va}^{r}$ is the (n × 1) column vector representing region r's value added by sector, $\mathbf{v}^{r}$ is the (1 × n) row vector of value added ratio (value added share in total input) by sector for region r, $\mathbf{L}$ is the interregional Leontief inverse constructed by the sub-matrix $\mathbf{L}^{rs}$. $\mathbf{A}^{rs}$ represents the (n × n) matrix of interregional input coefficients from region r to region s, and $\mathbf{fd}^{rs}$ is the (n × 1) column vector representing region s's final demand for goods and services produced in region r. Following the definition of global TiVA, we can formulate region r's value added exported to region s as follows:

$$\begin{aligned} \mathrm{TiVAD}^{rs} &= (\mathbf{u}, \mathbf{u}) \cdot \mathrm{diag}(\mathbf{v}^{r}, \mathbf{0}) \cdot \begin{pmatrix} \mathbf{L}^{rr} & \mathbf{L}^{rs} \\ \mathbf{L}^{sr} & \mathbf{L}^{ss} \end{pmatrix} \cdot \begin{pmatrix} \mathbf{fd}^{rs} \\ \mathbf{fd}^{ss} \end{pmatrix}, \\ &= \mathbf{v}^{r} \cdot \mathbf{L}^{rr} \cdot \mathbf{fd}^{rs} + \mathbf{v}^{r} \cdot \mathbf{L}^{rs} \cdot \mathbf{fd}^{ss}, \\ &= \mathrm{TiVADF}^{rs} + \mathrm{TiVADH}^{rs}. \end{aligned} \tag{3}$$

TiVAD^{rs} represents region r's value added induced by region s's final demands on products produced in both the foreign region ($\mathbf{fd}^{rs}$) and the home region ($\mathbf{fd}^{ss}$). Therefore, this type of TiVA can be considered demand-based TiVA from the viewpoint of region s (demander). TiVAD^{rs} can be further separated into two parts, TiVADF^{rs} and TiVADH^{rs}, concerning different types of final demands, namely, $\mathbf{fd}^{rs}$ and $\mathbf{fd}^{ss}$.

At the product (sector) level, we can regard the induced value added in a specific sector j of region r by a specific final demand for product i in region s as "an individual TiVA linkage," which is defined as follows:

$$\mathrm{TiVAD}_{ij}^{rs} = \mathbf{v}_{j}^{r}(\mathbf{L}^{rr} \cdot \mathbf{fd}_{i}^{rs} + \mathbf{L}^{rs} \cdot \mathbf{fd}_{i}^{ss}). \tag{4}$$

Based on the above definition, region r's export of sector j's value added to region s ($\mathrm{TiVAD}_{\cdot j}^{rs}$) can be expressed as

$$\mathrm{TiVAD}_{\cdot j}^{rs} = \sum_{i} \mathrm{TiVAD}_{ij}^{rs}. \tag{5}$$

In addition, from the viewpoint of the supplier (region s) of final products, region r's export of value added to region s (the supply-based TiVA) can be defined as follows:

$$\begin{aligned} \mathrm{TiVAS}^{rs} &= (\mathbf{u}, \mathbf{u}) \cdot \mathrm{diag}(\mathbf{v}^{r}, \mathbf{0}) \cdot \begin{pmatrix} \mathbf{L}^{rr} & \mathbf{L}^{rs} \\ \mathbf{L}^{sr} & \mathbf{L}^{ss} \end{pmatrix} \cdot \begin{pmatrix} \mathbf{0} \\ \mathbf{fd}^{sr} + \mathbf{fd}^{ss} \end{pmatrix}, \\ &= \mathbf{v}^{r} \cdot \mathbf{L}^{rs} \cdot \mathbf{fd}^{sr} + \mathbf{v}^{r} \cdot \mathbf{L}^{rs} \cdot \mathbf{fd}^{ss}, \\ &= \mathrm{TiVASF}^{rs} + \mathrm{TiVASH}^{rs}. \end{aligned} \tag{6}$$

The above TiVAS^{rs} represents the induced value added in region r when region s provides (produces) final products to the entire nation. As shown in the above equation, TiVAS^{rs} can also be separated into two parts for two different types of final demand ($\mathrm{TiVASH}^{rs} = \mathrm{TiVADH}^{rs}$). In addition, by using the same method shown in equations (4) and (5), the individual supply-based TiVA can be written as follows:

$$\mathrm{TiVAS}_{ij}^{rs} = \mathbf{v}_j^r \cdot \mathbf{L}^{rs}(\mathbf{fd}_i^{sr} + \mathbf{fd}_i^{ss}), \quad (7)$$

$$\mathrm{TiVAS}_{\cdot j}^{rs} = \sum_i \mathrm{TiVAS}_{ij}^{rs}. \quad (8)$$

In the framework of an interregional trade system, a region's products shipped to a partner region may embody a third region's parts and components. Thus, when we consider the net trade among regions, the conventional interregional trade model cannot provide a reasonable measure because of double counting. This is why we propose to use the concept of TiVA to examine DVCs.

In addition, if we replace the final demand item in equation (6) with regional exports, the share of a region's value added that is incorporated into a partner region's exports can be also measured. This can facilitate understanding of how a certain region participates in GVCs by acting as a provider of intermediate products in DVCs.

2.3 Alternative measure of regional comparative advantage

To evaluate a region's comparative advantage at value creation in DVCs, we can apply the concept of domestic TiVA to the measure of regional RCA at the sector level. The concept of RCA is mainly based on the theory of Ricardian comparative advantage. The most widely used indicator of RCA is given as follows (Béla Balassa, 1965):

$$\mathrm{RCA}_i^R = \frac{\mathrm{EX}_i^R / \sum_i \mathrm{EX}_i^R}{\sum_R \mathrm{EX}_i^R / \sum_R \sum_i \mathrm{EX}_i^R}, \quad (9)$$

where EX_i^R represents country r's exports of product i. This indicator represents the relative advantage or disadvantage of a country in international trade for a certain class of goods or services. However, as mentioned above, when intermediate imports are used in the production of exports, this indicator may lose its original meaning. Since a region's value added in a specific sector as exported to other regions can be measured by $\mathrm{TiVAD}_{\cdot j}^{rs}$ and $\mathrm{TiVAS}_{\cdot j}^{rs}$, we can use these concepts to measure a region's comparative advantage at value creation in DVCs in two ways[3]:

$$\mathrm{RCAD}_{\cdot j}^r = \frac{\mathrm{TiVAD}_{\cdot j}^r / \sum_j \mathrm{TiVAD}_{\cdot j}^r}{\sum_r \mathrm{TiVAD}_{\cdot j}^r / \sum_r \sum_j \mathrm{TiVAD}_{\cdot j}^r} \quad (10)$$

$$\mathrm{RCAS}_{\cdot j}^r = \frac{\mathrm{TiVAS}_{\cdot j}^r / \sum_j \mathrm{TiVAS}_{\cdot j}^r}{\sum_r \mathrm{TiVAS}_{\cdot j}^r / \sum_r \sum_j \mathrm{TiVAS}_{\cdot j}^r} \quad (11)$$

3 Data sources

The main data sources used in this paper for the calculation of domestic TiVA are the 1997 and 2007 Chinese multiregional I/O (CMRIO) tables. The 1997 CMRIO table was the main product of an international joint research project conducted by the Institute of Developing Economies - Japan External

[3] In addition, the bilateral RCA considering a specific target region can also be defined as the following form: $\mathrm{RCAD}_{\cdot j}^{rs} = \frac{\mathrm{TiVAD}_{\cdot j}^{rs} / \sum_j \mathrm{TiVAD}_{\cdot j}^{rs}}{\sum_r \mathrm{TiVAD}_{\cdot j}^{rs} / \sum_r \sum_j \mathrm{TiVAD}_{\cdot j}^{rs}}$ and $\mathrm{RCAS}_{\cdot j}^{rs} = \frac{\mathrm{TiVAS}_{\cdot j}^{rs} / \sum_j \mathrm{TiVAS}_{\cdot j}^{rs}}{\sum_r \mathrm{TiVAS}_{\cdot j}^{rs} / \sum_r \sum_j \mathrm{TiVAS}_{\cdot j}^{rs}}$.The bilateral RCA provides us with more views for the evaluation of region's comparative advantage.

Trade Organization (IDE-JETRO) and the China State Information Center (SIC) in 2003 (IDE SDS, 2003). The 2007 CMRIO was compiled solely by SIC in 2012 (Zhang and Qi, 2012). Both tables use the same region (Appendix 1) and sector classifications (Table 1). It should be noted that the import item is a stand-alone vector in both CMRIO tables rather than a separate matrix. To calculate the regional VS as mentioned in the previous section, we use the so-called "same proportion assumption" to transfer the import vector to the import matrix. In addition, both tables are constructed using a hybrid method (survey based + non-survey based). Although the non-survey based method applies different types of gravity models in the estimation of interregional trade flows, the calibration of the parameters and the original data sources are very similar.

4 Empirical analyses

In this section, we first examine the general state of China's regional economies by using the regional value added and interregional trade information obtained from 1997 and 2007 CMRIO data. Second, we present the region-level VS indicators to show the degree of participation and position of a certain region in both domestic and international supply chains. Third, we calculate the results of domestic TiVA for 1997 and 2007 in order to illustrate the evolution of regional give-out and gain potentials for value added within China's multi-regional value chains. We also use the sector-level results of TiVA to evaluate the comparative advantage of different sectors across regions. Finally, the regional value added induced by foreign trade is presented to show the linkages between China's DVCs and GVCs.

4.1 China's regional economies and interregional trade

To give an overall view of the evolution of China's regional economies between 1997 and 2007, we calculate the regional value added and its real growth rate by sector. Table 1 shows the results. At the national level, total value added increased 190% over 10 years. This is not surprising and coincides with the general image of China's economic performance since the officially published average annual GDP growth rate is about 11%[4]. However, when looking at the growth rate of value added at the region and sector levels, a large variation can be noted. At the regional level, the North Municipalities, one of the quickly expanding urban agglomeration areas, shows the highest growth rate at 237%, followed by the largest energy-base region, the Northwest at 213% and the two developed coastal regions the East Coast with 205% and the South Coast with 202%. The growth rate of the Central region (193%) and the North Coast (186%) is close to the national average. The remote inland regions, which include the Northeast (155%) and Southwest (144%), show relatively low performance in value added growth.

By comparing regions to the national average as shown in Table 1, we can identify the leading regions for value added growth by sector. For example, the coastal regions (North Coast, East Coast, and South Coast) can be considered leading regions since their growth rates for most sectors are higher than the national average. In addition, the bottom part of Table 1 shows which sectors are most important for regional economic growth. Heavy industry and service sectors play a leading role in most regions. This implies that there is a similar economic growth pattern across regions. However, for the primary and light

[4] If the annual growth rate of GDP is 11.2% across 10 years and the GDP of the first year is given as 100, the tenth year GDP can be calculated as $100*(1+11.2\%)^{10}=289$. This means the 10-year GDP growth rate is (289-100)/100=189%.

industry sectors, a relatively clear tendency toward specialization appears. For example, the mining sector in the inland regions, wood products in the Coastal regions, and the chemical sector in the Central and Southwest regions all show high rates of growth relative to that in the corresponding sector in other regions.

The dynamics and diversity of regional and sectoral economic growth depend not only on changes in intra-regional production technology but also on interregional production networks (including linkages to overseas markets). Figure 1 shows the share of bilateral trade in total interregional trade for 1997 and 2007, with the bubble size representing the share. To focus on the magnitude of interregional trade, in this figure intra-regional trade is excluded. In addition, the rest of the world (ROW) is considered to be one region. There are no significant structural changes in interregional trade pattern during this 10 year period. The exports and imports of the coastal regions account for a relatively large share. Interaction among the coastal regions and between the coastal regions and the Central region is the most important part of domestic interregional trade. However, when comparing the results from1997 and 2007 carefully, we can still find a number of interesting differences. For example, the East Coast replaces the South Coast as the leading region in export and import markets in 2007. In addition, the interaction between the North Municipalities and its neighbor region, the North Coast, shows a dramatic increase during the decade. There is also a clear increase in the magnitude of transactions between inland regions and between the inland and coastal regions. This makes the overall transaction between regions much flatter in general.

To investigate the degree of dispersion or concentration of interregional trade at the sector level, we calculate the coefficient of variation (CV) for intermediate and final products by sector respectively. In statistics, CV is defined as the ratio of the standard deviation to the mean of a dataset. CV is a normalized measure of the dispersion of data points in a data series around the mean. It is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different. A higher CV indicates a higher concentration of trade. According to the results shown in Table 2, some features of the changing patterns of interregional trade can be summarized as follows: (1) the concentration of total trade in intermediate products across regions decreased (CV changes from 1.23 to 0.97). However, at the sector level, we can confirm a wide variation in the change of the concentration degrees. This reflects the increasing complexity of interregional production networks in China. (2) For most final products, the concentration of interregional flows increased rapidly. This implies that more regions tend to specialize in production or procurement of final products within the domestic supply chains.

4.2 Region-level VS trade

Figure 2 shows the regional VS indicators for 1997 and 2007. At the absolute level, the North Municipalities, the East Coast and the South Coast have higher (more than 20% in 2007) regional import contents of export (RIMCE) compared with the inland regions and the North Coast. The East Coast and the South Coast are foreign export oriented economies with large scale export processing zones in which the manufacture of export products supposedly uses more imports as parts and components. This is why these two coastal regions have higher figures. For the North Municipalities, given its low economic self-sufficiency rate and high dependency on external markets, it comes as no surprise that this region has a higher RIMCE. The North Coast is a coastal region, but its main products are concentrated in primary sectors such as agriculture, which require fewer imported inputs for production. Therefore, the North

Coast shows a level similar to that of the other inland regions. When looking at the evolution of RIMCE between 1997 and 2007, the North Municipalities and the South Coast show only a small increase, but the East Coast's figure almost doubles. This is mainly due to the high rate of economic growth led by the development plan of the Yangtze River Delta Region and Shanghai's Pudong New Area, in which the export processing trade plays an important role. Another point to note is that the RIMCE figures for all inland regions show significant increases. This implies that the inland regions have been increasingly involved in international supply chains. The most probable explanations for this phenomenon include (1) most inland regions come to realize the importance and possibilities of the export-oriented economic growth pattern that has been so successful in the coastal regions; (2) the accession to the WTO provides opportunities not only to coastal regions but also to inland regions to access the world market and (3) the continuous improvement of China's domestic transportation and logistical systems has increased the accessibility of the inland regions to foreign markets.

The figures for the regional import content of outflow (RIMCO) for most regions are only slightly lower than the figures for RIMCE and show similar patterns of change. This indicates that the import of intermediate products gains importance not only when regions produce products for export, but also when regions produce goods and services for domestic regions. In addition, we can see that producing intermediate products for outflow requires more import content in most regions when compared to the figure of RIMCO for final products. This provides evidence that the rapid increase of RIMCO for the East Coast is mainly due to the contribution of RIMCO for intermediate products, and the decline of RIMCO for the North Municipalities can be attributed to the decrease of RIMCO for final products.

When looking at the figures for the regional inflow contents of export (RINCE), we can confirm that there is no great variation across regions in 1997, but in 2007 some regions, namely, the North Municipalities, North Coast, South Coast, Central, and Southwest, show large increases. This implies that most regions expanded their domestic downstream production linkages as they increased their participation in global supply chains. A similar change can be found in the figures for regional inflow contents of outflow (RINCO). Namely, most regions also increased their participation in domestic supply chains. However, if we compare the figures in RINCE and RINCO with the figures in RIMCE and RIMCO for the Northeast and the East Coast, we find that these two regions tend to be more involved in global rather than domestic supply chains through replacement of domestic input with foreign imports.

When examining the differences between RINCO for intermediate products and final products, we see that the increasing participation in domestic supply chains for the North Municipalities, the North Coast and the Central regions is mainly due to their growing presence in the production networks of intermediate products. However, for the South Coast, the Northwest and the Southwest, the main contribution is from the increasing production of final products.

4.3 Domestic TiVA

In the previous section, we calculated the regional VS indicator to measure the participation of a specific region in China's domestic supply chains. This indicator can be estimated if the regional I/O table is available. However, it is difficult to show the structure of DVCs in detail, since the interregional spillover and feedback effects in the production networks cannot be explicitly captured when using only a single regional I/O table. In this section, we applied the concept of domestic TiVA as defined in equation (3) to

China's MRIO tables for 1997 and 2007. The results of the TiVA related indicators can shed light on how the value added is created and distributed across regions through interregional production networks.

To first check the differences in interregional flow of value between the traditional gross term measure (interregional trade) and net term measure (TiVA), we show both results in Table 3 for 1997 and 2007.We can see that the TiVA (middle part of Table 3) is smaller than the figure for traditional trade statistics. This reflects the problem of double counting that occurs in traditional trade statistics when measuring the trans-regional flow of value. For the ease of comparison, we can calculate the share of interregional TiVA in interregional trade. We note a large variation across regions. For example, the Northeast region's export of value added to the Central region accounts for 96.52% of its exports. This means that only a small amount of value added of other regions is embodied in the Northeast region's exports to the Central region in 1997. However, the East Coast's export of value added to the South Coast accounts for just 33.99% of its real flow of products. This suggests that the products produced in the East Coast and then shipped to the South Coast include a large share of other region's parts and components. If we compare these shares between 1997 and 2007, we see that almost all figures decreased as the national total dropped from 57.03% to 44.85%. This means that most regions have been involved in DVCs and the level of China's domestic market integration has increased.

As described in the previous section, the total TiVA can be separated into two types. Table 4 presents the matrix of demand-based TiVA induced by regional final demand for its locally produced products ($\mathrm{TiVADH}^{\mathrm{rs}} = \mathrm{TiVASH}^{\mathrm{rs}}$). For the ease of comparison between different years, we use China's national GDP deflator to make the 2007 figure reflect constant prices (base year: 1997)[5]. For example, in 1997, the value in the cell at the intersection of the North Municipalities' row and the Northeast's column is 3.99, which indicates that the Northeast's final demand for products produced in its own region created about 3.99 billion Chinese yuan value added in North Municipalities in 1997. Moving down the column we see that the sum of about 88.77 billion Chinese yuan represents the total value creation effect that Northeast exerts on other regions as a whole. We divide the column sum of the Northeast by the average of each region's column sum to produce an index for the Northeast. We call this index the "value added give-out potential" of the Northeast region. Similarly, the row total of the Northeast (54.7) represents the total value added that the Northeast receives from the other regions as a whole. Again, we use the row sum to define the "value added gain potential" of the Northeast from other regions.

To illustrate the development of the TiVA structure from 1997 through 2007, the above two potentials of each region are plotted in Figure 3. The position of the East Coast demands immediate attention. The East Coast, with its large economic scale and highest per capita GDP in China, purchases a massive amount of goods and services from its home market, generating a significant value added in other regions, especially in its neighbor, the Central region (see Table 3). In other words, the East Coast has relatively strong backward linkages of value creation with the Central region. The Central region has both higher give-out and gain potentials. This is related to both the large economy and final demand scale of the Central region as well as the geographic centrality and developed infrastructure of the region. This centrality places it in a prime position to be a supplier of intermediate products to other regions, especially those on the coast. In general, the position of region in Figure 3 mainly depends on the economic scale of each region. However, when looking at the changes in each region, the regions with

[5] The national GDP deflator is calculated by using IMF's national currency-based GDP statistics.

the larger economies enhanced their give-out potentials as a value added provider but in turn lost their gain potential. On the contrary, the remote regions with relatively small economies moved in the opposite direction as they increased their value added gain potentials. This implies that large regions' final demand for their locally made products tends to create backward linkages of value creation with remote and smaller regions located in the downstream of supply chains who provide more intermediate products. On the other hand, the movement of the North Municipalities is particularly interesting that it enhanced both potentials. This is not so surprising, since the North Municipalities experienced the fastest GDP growth as it acted as a provider of service products to other regions.

In addition, when looking at the bottom part of Table 4, we see that for almost all regions, the transfer of TiVA across regions increased. The total growth rate is about 140%, which is lower than the growth rate of national value added, 190% (see Table 1). This implies that the regional final demand for locally made products is not the leading force in the evolution of trans-regional value creation system. This conclusion is further supported by the results in Table 5 and 6.

Table 5 shows the trans-regional value added induced by regional final demand of inflow products ($TiVASF^{rs}$) for both 1997 and 2007. In other words, the values in Table 5 represent how much one region's interregional demand (demand for final products produced in other domestic regions) creates another region's value added through interregional supply chains. In the same manner as shown in Table 4, we can calculate the give-out and gain potentials for each region and plot them in Figure 4. We see that in 1997 the Central region is both the largest provider and beneficiary of trans-regional value added caused by the other regions' interregional demand. This is primarily due to the Central region's position as the second largest economy with the best accessibility to the domestic market. The North Coast and the East Coast have relatively high gain potentials in 1997. This reflects the fact that these two coastal regions have larger production capacities to match other regions' needs for final products. The gain and give-out potentials in 1997 for the North Municipalities and the inland regions (Northeast, Northwest and Southwest) are quite low. The low figure for the North Municipalities is mainly due to its relatively small economic scale (both for interregional demand and production capacity); the low figure for the inland regions reflects their relatively low participation in DVCs. However, this situation was changed significantly in 2007. Namely, the variation of gain potential across regions decreased rapidly. This implies that the distribution structure of benefits or value created by interregional trade in final products has been getting flatter across regions. However, there are still large differences in the give-out potential across regions. The Central and North Coast regions enhanced their give-out potential rapidly between 1997 and 2007. If we look at the detailed trans-regional figures, especially the growth rate shown in Table 5, we can confirm that the main contributors to this movement have been the increasing linkages between the Central, North Coast, and North Municipalities and the inland regions in the trans-regional value creation system. This is also a reason for the rapid growth in the gain potential of the North Municipalities and inland regions.

In addition, when looking at the bottom part of Table 5, we can see that the national (row sum or column sum) growth rate of trans-regional value added between 1997 and 2007 is 524%, which is much larger than the value shown in Table 4. This supports our previous conclusion that the regional final demand for products produced in other regions can be regarded as the main source of the increasing presence of trans-regional value added.

As mentioned in the previous section, from the viewpoint of a supplier of final products, we can also estimate the "supply-based" trans-regional value added (see Table 6 and Figure 5). Focusing on the evolution of gain and give-out potentials as shown in Figure 5, we see that the variation of both potentials across regions decreased rapidly between 1997 and 2007. Inland regions enhanced both potentials, while the coastal regions excluding the South Coast saw a decrease in both potentials. This also reflects the fact that the inland regions increased their participation in DVCs by providing not only more final products to other regions (the source of give-out potential), but also more intermediate products to other regions (the source of gain potential).

4.4 Evolution of regional comparative advantage in terms of domestic TiVA

There is no guarantee that providing more products equals more value added in a supply chain with high vertical specialization, as in the case of the iPhone. This becomes crucial when considering regional comparative advantage from the view of value creation within the domestic market. This is why we propose to use the TiVA concept to measure regional comparative advantage.

Table 7 shows the TiVA based domestic RCA indicator and its changing pattern between 1997 and 2007. The main findings can be summarized as follows: (1) there is a large variation of RCA by sector across regions. Namely, the coastal regions have relatively more sectors with top ranking RCA, especially in the manufacturing sector; inland regions mainly specialize in primary sectors; (2) the ranking of a region in RCA by sector changes significantly between 1997 and 2007. For example, in 1997, the North Municipalities ranks first for transport equipment, but in 2007 the Northeast region has taken over the top position. This is mainly because the Northeast has experienced rapid development of motor vehicles and car parts production over the 10-year period; 3) when looking at the standard deviation of RCA by region and sector and its positive rate of change, we see that for all regions, the increasing tendency toward specialization in value creation across both region and sector becomes apparent. This implies that most regions tend to enhance their specialization in value creation as characterized by the increasing sector RCA when taking part in DVCs.

4.5 Participation degree of regional economy in GVCs

As shown in the previous section, using the interregional I/O framework, we can also estimate how much of a region's value added is created by another region's exports. This can help us understand the position of a specific region in other region's global supply chains.

Figure 6 shows the give-out potential of induced value added by regional exports. In 1997, the exports of the South Coast region had the largest impact on the value creation of other regions, followed by the East Coast. When looking at the components of the bars for these two coastal regions' give-out potential, we find that the Central and other coastal regions are the main beneficiaries. This implies that around 1997, the benefits of the export oriented development strategy applied in the coastal regions were limited with relatively small spillover effects to the inland regions. However, in 2007, more inland regions were able to enjoy the benefit of the coastal regions' exports. At the same time, the inland region themselves also showed an increasing give-out potential to other regions. When looking at the gain potential of induced value added by regional exports (Figure 7), we see that the Central region with its large economy and centralized location maintains the position as the largest beneficiary of value added spillover from other

regions' exports. In addition, as seen in Figure 6, more inland regions can enjoy the benefits of their partner region's exports, especially from the South Coast and East Coast. Taken together, this means that the inland regions in China have been increasing their participation in the GVCs by exporting more products to the world market directly, but also by joining the domestic supply chains of some leading coastal regions' global supply chains indirectly.

5 Concluding remarks

China has experienced rapid economic growth since the launch of the Reform and Open-Door Policy in 1978. With the accession to the WTO in 2001, China has become deeply involved in the world economy. China's participation in global supply chains has had dramatic impacts on not only its domestic economies but also the global trade structure. To elucidate the increasing complexity of China's domestic production networks, this paper focused on the measure of DVCs across regions and their linkages with global markets. Using China's 1997 and 2007 interregional Input-Output tables, the detailed structural changes in domestic TiVA, and the position and degree of participation of different regions in both DVCs and GVCs have been measured. The main conclusions can be summarized as follows: (1) the creation and distribution of value added across regions has became much flatter. This has been caused primarily by the expansion of interregional trade with high vertical specialization trade in intermediate products. (2) The regional final demand for goods and services produced in other regions has played a large role in the development of trans-regional value added trade. (3) Most of the inland regions successfully enhanced their gain potential for value added by increasing their participation in DVCs. (4) China's increased participation in GVCs between 1997 and 2007 can mainly be attributed to the increasing presence of the inland regions in the production chains. (5) The inland regions tend to be able to get much more value added not only by increasing direct exports to the world market, but also by joining the domestic supply chains of some of the leading coastal regions' global supply chains (6) The sector TiVA-based comparative advantage across regions and the regional TiVA-based comparative advantage across sectors shows a more apparent tendency toward concentration. This indirectly reflects the improved efficiency of China's DVCs.

Reference

Balassa, B. (1965), “Trade liberalization and revealed comparative advantage”, *The Manchester School*, 33, pp.99-123.

Dedrick, J., K.L. Kraemer and G. Linden (2010), "Who profits from innovation in global value chains?: A study of the iPod and notebook PCs", *Industrial and Corporate Change*, 19 (1), pp. 81-116.

Degain, C. and A. Maurer (2010), “Globalization and trade flows: what you see is not what you get!”, *WTO Staff Working Paper*.

Escaith, H. (2008), “Measuring trade in value added in the new industrial economy: statistical implications”, *MPRA Paper* No. 14454.

Foster, N., R. Stehrer and G. Vries (2012), “Trade in value added and factors: A comprehensive approach”, *WIOD Working Paper*, 1-22.

Fukasaku, K., B. Meng and N. Yamano (2011), “Recent development in Asian economic integration: Measuring trade integration and fragmentation”, *OECD STI Working Paper*, 2011/3.

Hummels, D., J. Ishii and K.M. Yi (2001), “The nature and growth of vertical specialization in world trade”, *Journal of International Economics*, 54(1), pp. 75 - 96.

IDE-SDS (2003), “Multi-regional Input-Output Model for China 2000”, IDE-JETRO, *Statistical Data Series*, 86.

Johnson R.C. and G. Noguera (2011) “Accounting for intermediates: Production sharing and trade in value added,” *Journal of International Economics*, 86(2), pp. 224-236.

Kuroiwa, I. (2006), “Rules of origin and local content in East Asia”, IDE Discussion Paper, 78.

Koopman, R., Z. Wang and S.J. Wei (2008), “How much of Chinese exports is really made in China? Assessing domestic value-added when processing trade is pervasive”, *NBER Working Paper*, 14109:

Koopman, R., W. Powers, Z. Wang and S.J. Wei (2010), “Give credit where credit is due: Tracing value added in global production chains”, *NBER Working Paper*, 16426.

Linden, G., J. Dedrick, and K.L. Kraemer (2009), “Innovation and job creation in a global economy: The case of Apple's iPod”, *Working Paper*, Personal Computing Industry Center, UC Irvine.

Los, B., E. Dietzenbacher, R. Stehrer, M.P. Timmer and G. de Vries (2012), “Trade performance in internationally fragmented production networks: Concepts and measures”, *WIOD Working Paper*, 11.

Meng, B., N. Yamano and C. Webb (2011), "Application of factor decomposition techniques to vertical specialisation measurements", *Journal of Applied Input-Output Analysis*, 16.

Stehrer, R., (2012), "Trade in value added and value added in trade", *WIIW working paper*, 81.

Uchida, Y. and S. Inomata (2009), "Vertical specialization in the time of the Economic Crisis", in Inomata, S. and Y. Uchida (eds.), Asia Beyond the Crisis: Visions from International Input-Output Analyses, *IDE Spot Survey*, 31, pp. 70-83.

Xing, Y., and N., Detert (2010), "How the iPhone widens the United States trade deficit with the People's Republic of China", Asian Development Bank, *ADBI Working paper*, 257.

Yang, C.H., E. Dietzenbacher, J.S. Pei and X.K. Chen (2009), "The bias in measuring vertical specialization", Paper presented at the 17th International Input-Output Association Conference.

Zhang, Y.X. and S.C. Qi (2012), *China's Interregional Input-Output Tables for 2002 and 2007*, China Statistics Press (in Chinese).

Table 1 Value added by sector and region and its growth rate

		Agriculture	Mining and quarrying	Food products and tobacco	Textile and garment	Wood products and furniture	Pulp, paper, and printing	Chemical	Non-metallic mineral products	Metal products	General machinary	Transport equipment	Electric applicances and electronics	Other manufacturing products	Electricity, gas, and water supply	Construction	Trade and transportation	Other services	Total
1997	Northeast	143	72	31	14	9	7	57	27	28	22	17	11	12	16	47	88	84	685
	North Municipalities	17	6	9	10	2	6	17	5	13	9	7	16	7	8	24	33	128	317
	North Coast	210	62	57	41	6	21	79	42	43	46	9	22	17	22	67	101	177	1,022
	East Coast	173	14	51	118	9	27	129	43	62	67	31	68	43	35	97	158	253	1,378
	South Coast	182	24	34	74	8	24	60	24	24	10	14	57	35	31	80	117	195	993
	Central	359	82	75	46	15	19	61	65	46	33	17	14	30	35	85	129	216	1,327
	Northwest	120	37	18	12	2	3	24	14	17	7	3	8	6	15	38	54	89	467
	Southwest	264	27	74	11	6	9	34	25	24	15	18	15	12	18	61	87	147	847
	Total	1,468	324	349	326	57	116	461	245	257	209	116	211	162	180	499	767	1,289	7,036
2007	Northeast	219	195	56	21	16	9	143	29	80	63	89	25	34	54	97	229	392	1,750
	North Municipalities	16	42	15	8	2	6	47	7	44	31	26	61	22	31	53	152	506	1,070
	North Coast	328	224	145	112	50	43	210	116	194	127	69	67	47	89	143	314	645	2,922
	East Coast	226	21	103	259	37	64	307	66	265	229	124	311	167	116	206	514	1,194	4,206
	South Coast	237	54	74	162	34	73	172	76	116	69	59	284	91	127	124	364	887	3,002
	Central	590	214	192	92	49	53	220	127	271	118	57	79	75	151	243	451	910	3,891
	Northwest	189	238	53	13	4	7	65	25	104	18	15	12	5	73	104	182	353	1,461
	Southwest	390	69	142	19	10	18	88	34	122	44	54	35	25	94	140	240	544	2,069
	Total	2,194	1,057	779	684	201	273	1,252	479	1,196	700	492	874	467	734	1,111	2,447	5,430	20,370
Real growth rate (%)	Northeast	53	171	80	48	79	31	151	8	184	185	422	130	181	235	107	160	367	155
	North Municipalities	-5	602	62	-23	-23	2	175	38	242	249	272	283	217	292	120	362	295	237
	North Coast	56	262	154	173	729	104	166	175	352	176	666	203	179	304	114	211	265	186
	East Coast	31	48	101	119	308	138	138	53	327	242	300	357	288	230	112	225	372	205
	South Coast	30	126	118	118	321	203	187	216	382	589	321	398	160	310	55	211	355	202
	Central	64	160	156	100	227	178	260	96	489	257	233	463	150	331	186	250	321	193
	Northwest	58	544	193	8	91	130	171	80	512	162	385	53	-11	385	174	237	297	213
	Southwest	48	155	91	74	66	96	159	35	407	196	202	135	111	423	130	176	270	144
	Total	49	226	123	110	252	135	172	96	365	235	324	314	188	308	123	219	321	190
Relative to regional average	Northeast	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-
	North Municipalities	-	+	-	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+
	North Coast	+	+	+	+	+	-	-	+	-	-	+	-	-	-	-	-	-	-
	East Coast	-	-	-	+	+	+	-	-	-	+	-	+	+	-	-	+	+	+
	South Coast	-	-	-	+	+	+	+	+	+	+	-	+	-	+	-	-	+	+
	Central	+	-	+	-	-	+	+	-	+	+	-	+	-	+	+	+	+	+
	Northwest	+	+	+	-	-	-	-	-	+	-	+	-	-	+	+	+	-	+
	Southwest	-	-	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-
Relative to sectoral average	Northeast	-	+	-	-	-	-	-	-	+	+	+	-	+	+	-	+	+	
	North Municipalities	-	+	-	-	-	-	-	-	+	+	+	+	-	+	-	+	+	
	North Coast	-	+	-	-	+	-	-	-	+	-	+	+	-	+	-	+	+	
	East Coast	-	-	-	-	+	-	-	-	+	+	+	+	+	+	-	+	+	
	South Coast	-	-	-	-	+	+	-	+	+	+	+	+	-	+	-	+	+	
	Central	-	-	-	-	+	-	+	-	+	+	+	+	-	+	-	+	+	
	Northwest	-	+	-	-	-	-	-	-	+	-	+	-	-	+	-	+	+	
	Southwest	-	+	-	-	-	-	+	-	+	+	+	-	-	+	-	+	+	
	Total	-	+	-	-	+	-	-	-	+	+	+	+	-	+	-	+	+	

Figure 1 Share of bilateral trade in total interregional trade
(without considering intraregional trade)

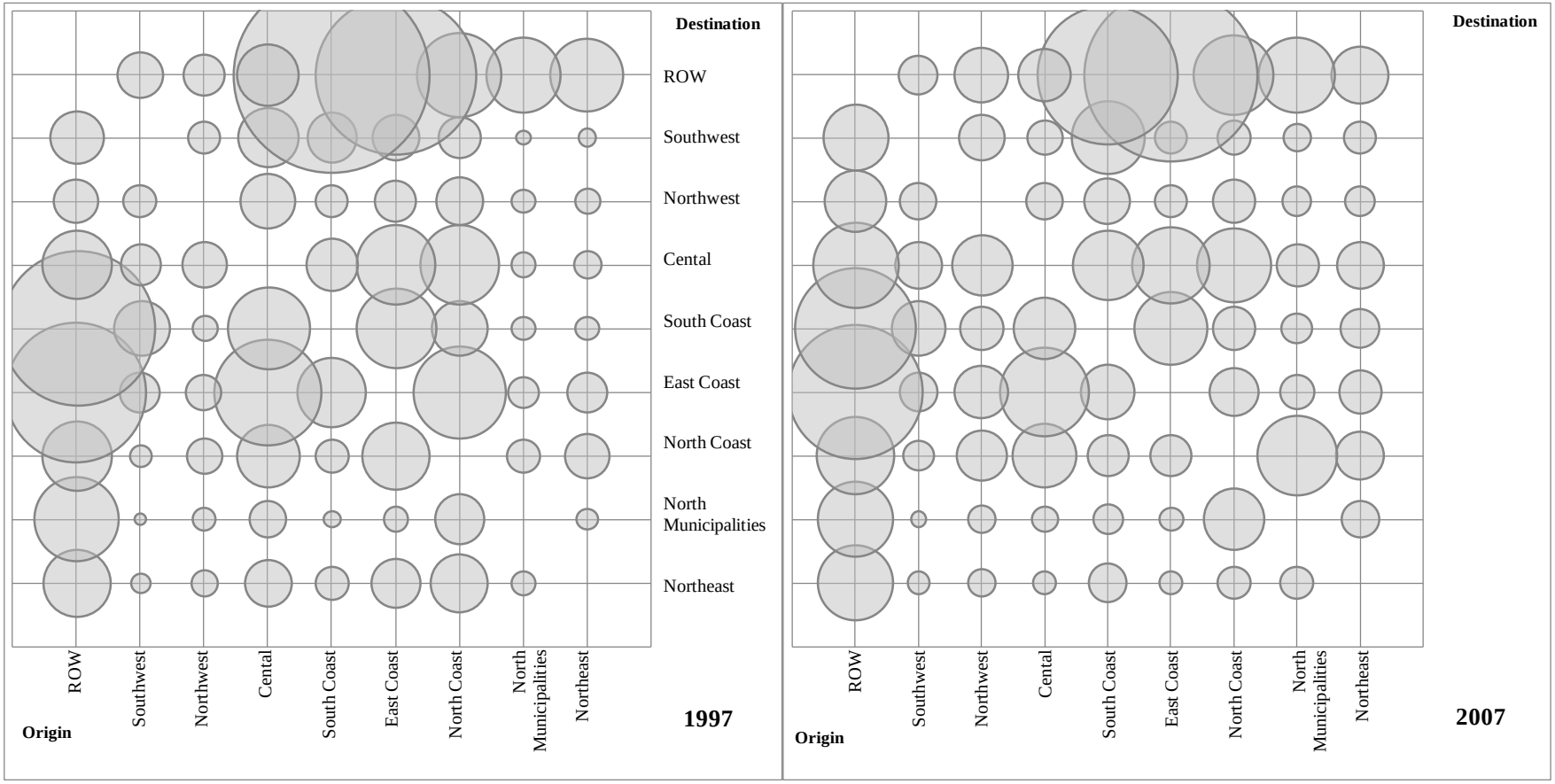
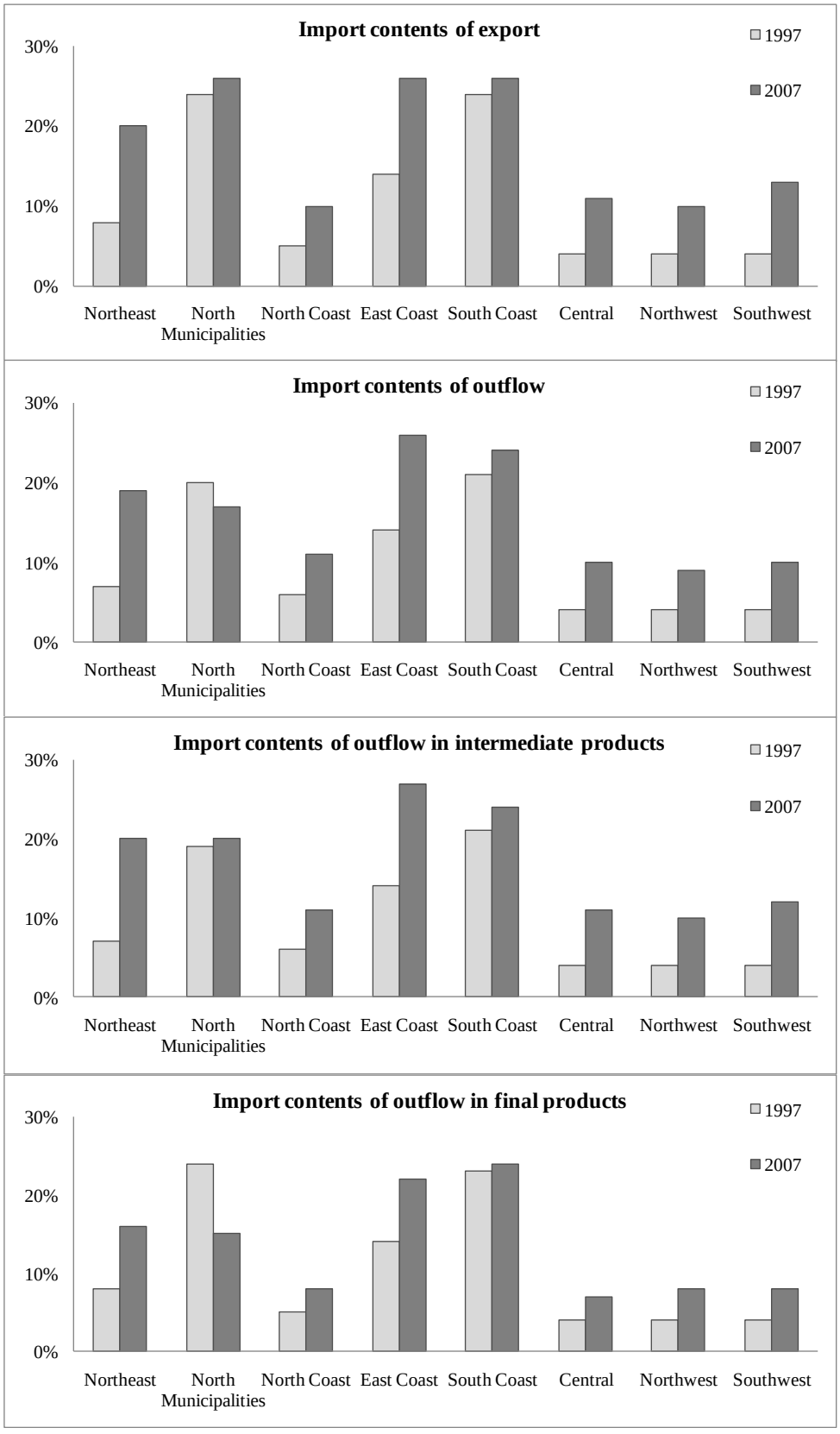
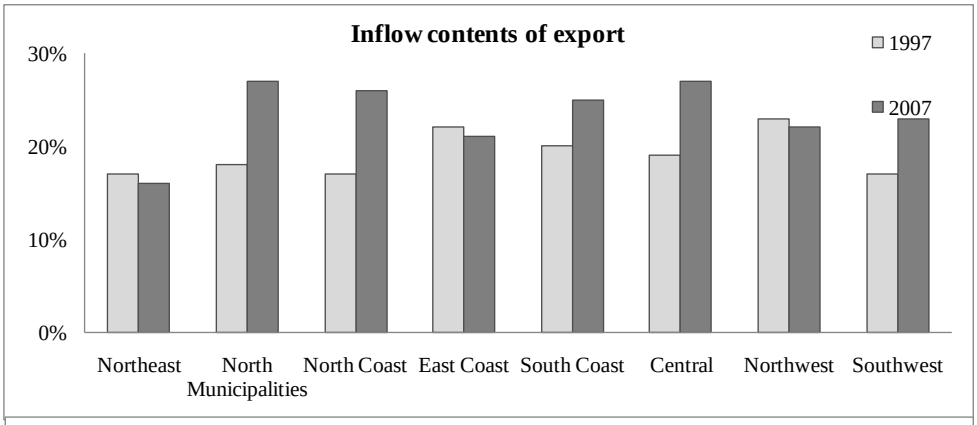


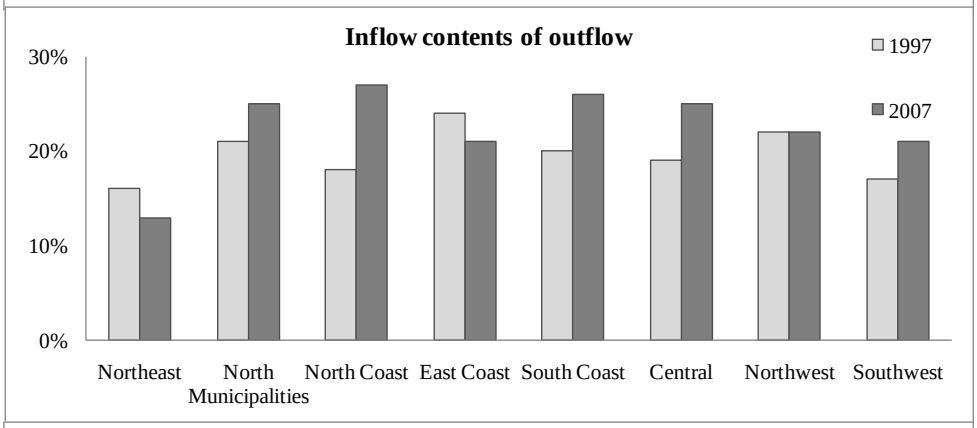
Table 2 Concentration degree (CV) of interregional trade in intermediate and final products

Sector	Intermediate products			Final products		
	1997	2007	Change rate	1997	2007	Change rate
Agriculture	1.26	1.81	44.1%	1.41	1.77	25.9%
Mining and quarrying	1.82	1.65	-9.2%	1.78	2.43	36.4%
Food products and tobacco	1.16	1.29	10.6%	1.11	1.45	29.9%
Textile and garment	1.66	1.56	-5.9%	1.44	3.40	136.2%
Wood products and furniture	1.91	1.78	-6.9%	1.51	1.76	16.4%
Pulp, paper, and printing	1.18	1.78	51.4%	1.22	3.46	183.0%
Chemical	1.31	1.18	-9.7%	1.49	1.32	-11.3%
Non-metallic mineral products	1.76	1.79	1.6%	1.48	2.06	39.5%
Metal products	1.56	1.42	-8.8%	1.31	1.76	34.1%
General machinery	1.67	1.67	-0.1%	1.81	2.07	14.0%
Transport equipment	1.25	1.37	10.0%	1.52	1.61	5.5%
Electric applicances and electronics	1.41	2.43	72.1%	1.58	2.19	38.2%
Other manufacturing products	1.35	1.66	23.2%	1.44	2.05	41.9%
Electricity, gas, and water supply	1.96	1.90	-3.0%	2.27	2.45	8.2%
Construction		2.00			1.77	
Trade and transportation	1.10	1.36	23.5%	1.00	1.65	64.5%
Other services		2.15			2.42	
Total products	1.23	0.97	-20.7%	1.09	1.11	2.0%

Figure 2 Vertical specialization indicator at regional level (1997-2007; unit: %)




Inflow contents of export
1997
2007
30%
20%
10%
0%
Northeast
North Municipalities
North Coast
East Coast
South Coast
Central
Northwest
Southwest


Inflow contents of outflow
1997
2007
30%
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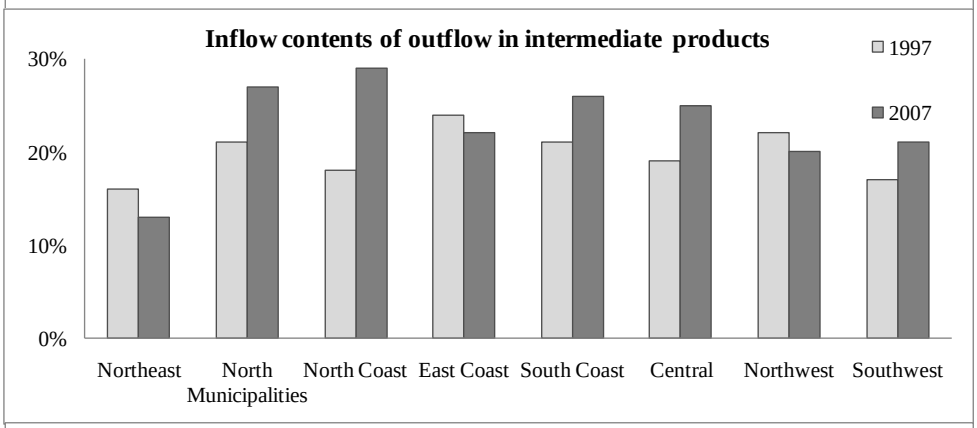
0%
Northeast
North Municipalities
North Coast
East Coast
South Coast
Central
Northwest
Southwest


Inflow contents of outflow in intermediate products
1997
2007
30%
20%
10%
0%
Northeast
North Municipalities
North Coast
East Coast
South Coast
Central
Northwest
Southwest

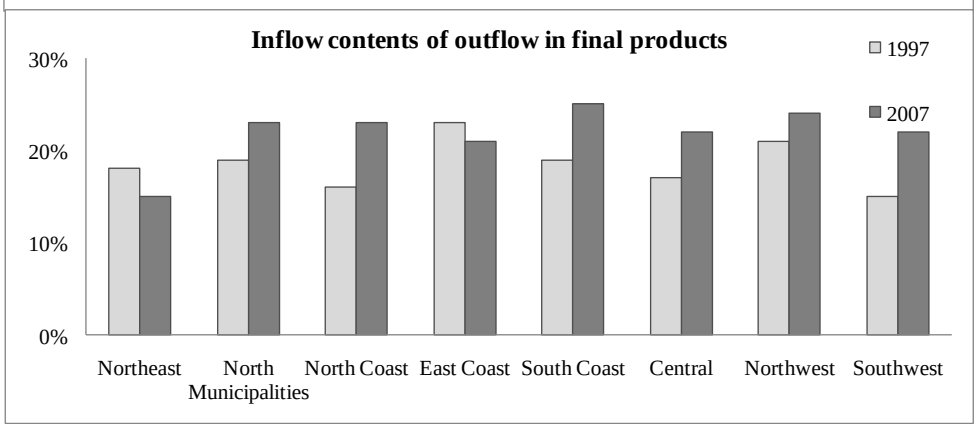

Inflow contents of outflow in final products
1997
2007
30%
20%
10%
0%
Northeast
North Municipalities
North Coast
East Coast
South Coast
Central
Northwest
Southwest

Table 3 Comparison of interregional trade and interregional trade in value added (1997 -2007)

	Interregional trade (billion Chinese yuan, current price)																	
	1997									2007								
	NE	NM	NC	EC	SC	CE	NW	SW	Toal	NE	NM	NC	EC	SC	CE	NW	SW	Toal
Northeast		8.19	35.67	29.27	10.07	13.75	11.98	5.58	114.51		156.63	255.09	205.34	172.34	243.57	97.56	115.55	1246.08
North Municipalities	10.78		19.99	16.70	10.43	10.45	9.85	3.67	81.87	120.93		726.21	137.79	101.07	199.30	94.87	84.18	1464.35
North Coast	60.09	45.41		156.65	57.42	112.55	41.73	32.32	506.17	123.90	418.62		265.45	203.99	624.79	205.53	125.58	1967.86
East Coast	43.26	10.94	82.60		119.60	115.12	31.26	39.37	442.15	57.09	62.86	187.70		609.47	681.43	116.56	119.56	1834.67
South Coast	19.89	5.12	19.80	87.82		49.17	18.15	44.67	244.62	167.18	98.36	192.61	335.80		557.84	235.70	604.27	2191.76
Central	41.36	24.37	73.12	208.99	127.05		55.64	65.21	595.74	61.70	75.45	463.24	910.49	424.85		153.04	136.09	2224.86
Northwest	11.92	8.93	22.56	22.57	12.18	37.79		18.56	134.51	84.49	86.32	283.05	318.80	209.95	411.93		230.23	1624.77
Southwest	7.00	2.39	8.56	29.47	57.73	29.92	19.63		154.70	57.53	27.75	100.20	159.94	335.55	247.54	154.42		1082.93
Total	194.30	105.35	262.30	551.47	394.48	368.75	188.24	209.38	2274.27	672.82	925.99	2208.10	2333.61	2057.22	2966.40	1057.68	1415.46	13637.28
	Interregional TiVA (billion Chinese yuan, current price)																	
Northeast		4.94	17.77	15.21	6.17	13.27	8.29	5.58	71.23		55.83	125.98	101.49	75.94	149.39	47.57	69.01	625.21
North Municipalities	5.81		8.77	6.92	4.01	7.07	5.02	2.78	40.38	50.92		328.30	63.81	42.80	122.99	43.46	57.66	709.94
North Coast	42.07	23.70		77.02	31.65	82.21	29.80	27.82	314.27	59.48	118.25		129.48	88.19	314.48	79.02	91.36	880.26
East Coast	25.50	6.12	38.99		40.65	67.44	19.18	25.45	223.33	31.69	20.58	83.60		159.34	274.31	48.95	79.01	697.48
South Coast	11.67	2.71	10.79	32.66		28.61	10.47	23.66	120.57	65.52	25.65	78.29	108.22		237.88	82.04	244.63	842.23
Central	32.85	14.52	44.88	101.30	64.61		38.02	48.87	345.05	41.45	37.92	182.42	381.08	145.26		67.69	98.07	953.89
Northwest	9.10	4.99	12.14	13.69	7.65	24.60		13.27	85.44	43.99	37.20	144.55	155.51	90.13	238.89		139.35	849.62
Southwest	6.32	1.93	6.76	17.53	26.96	23.64	13.58		96.72	35.31	16.26	58.82	82.46	125.50	163.93	75.10		557.38
Total	133.32	58.91	140.10	264.33	181.70	246.84	124.36	147.43	1296.99	328.36	311.69	1001.96	1022.05	727.16	1501.87	443.83	779.09	6116.01
	Share of interregional TiVA in interregional trade (%)																	
Northeast		60.35	49.82	51.96	61.28	96.52	69.22	100.05	62.20		35.64	49.39	49.42	44.06	61.33	48.76	59.72	50.17
North Municipalities	53.89		43.87	41.45	38.43	67.65	50.97	75.80	49.32	42.11		45.21	46.31	42.35	61.71	45.81	68.49	48.48
North Coast	70.01	52.19		49.17	55.12	73.05	71.41	86.09	62.09	48.01	28.25		48.78	43.23	50.33	38.45	72.75	44.73
East Coast	58.94	55.96	47.20		33.99	58.58	61.36	64.64	50.51	55.51	32.74	44.54		26.14	40.25	41.99	66.08	38.02
South Coast	58.68	52.97	54.49	37.19		58.19	57.69	52.96	49.29	39.19	26.08	40.65	32.23		42.64	34.81	40.48	38.43
Central	79.42	59.57	61.38	48.47	50.85		68.33	74.94	57.92	67.17	50.26	39.38	41.85	34.19		44.23	72.06	42.87
Northwest	76.37	55.88	53.81	60.64	62.83	65.10		71.51	63.52	52.07	43.10	51.07	48.78	42.93	57.99		60.53	52.29
Southwest	90.25	80.59	78.98	59.49	46.70	79.01	69.19		62.52	61.38	58.59	58.70	51.56	37.40	66.22	48.63		51.47
Total	68.62	55.92	53.41	47.93	46.06	66.94	66.06	70.41	57.03	48.80	33.66	45.38	43.80	35.35	50.63	41.96	55.04	44.85

Table 4 Trans-regional value added induced by regional consumption (production) of locally made products (1997-2007)

Trans-regional value added induced by regional consumption (production) of locally made final products for 1997 (unit: billion Chinese yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		3.57	15.03	12.53	4.56	9.64	5.50	3.86	54.70	0.4
North Municipalities	3.99		5.99	5.50	2.79	4.80	3.40	1.89	28.37	0.2
North Coast	28.22	16.36		59.25	21.60	55.07	18.09	17.82	216.41	1.9
East Coast	16.97	4.09	25.23		26.67	41.99	11.21	15.85	142.01	1.4
South Coast	6.96	1.69	6.75	23.39		17.00	5.73	13.51	75.04	0.7
Central	22.02	10.46	31.75	79.12	42.51		23.54	30.95	240.35	2.1
Northwest	6.52	3.63	9.97	11.19	5.28	19.22		9.28	65.11	0.5
Southwest	4.09	1.32	4.56	13.54	19.17	15.27	8.58		66.51	0.6
Column sum	88.77	41.13	99.29	204.53	122.58	162.99	76.06	93.16	888.50	
Give-out potential	0.8	0.4	0.9	1.6	1.1	1.5	0.8	0.9		
Trans-regional value added induced by regional consumption (production) of locally made final products for 2007 (unit: billion Chinese yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		22.22	53.43	53.15	26.19	44.44	12.90	23.40	235.74	0.8
North Municipalities	13.91		70.02	25.64	9.28	20.39	9.43	9.08	157.73	0.9
North Coast	26.88	65.56		69.56	29.63	87.15	27.88	23.93	330.58	1.2
East Coast	11.81	9.88	34.56		52.14	88.64	13.88	21.80	232.72	0.9
South Coast	22.31	12.36	33.80	61.90		63.35	21.20	68.02	282.94	1.1
Central	17.80	17.81	92.03	183.24	58.01		22.68	32.51	424.08	1.2
Northwest	19.26	15.30	52.95	77.69	32.29	60.83		37.46	295.79	1.1
Southwest	11.63	5.33	23.09	44.38	41.00	34.53	14.79		174.74	0.7
Column sum	123.58	148.46	359.88	515.56	248.54	399.34	122.76	216.21	2,134.33	
Give-out potential	0.4	0.4	1.3	1.3	1.0	2.0	0.6	1.0		
Growth rate of trans-regional value added between 1997 and 2007 (unit: %)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		522	256	324	474	361	134	507	331	79
North Municipalities	248		1,068	366	233	325	177	380	456	131
North Coast	-5	301		17	37	58	54	34	53	-36
East Coast	-30	141	37		96	111	24	38	64	-32
South Coast	221	629	401	165		273	270	403	277	57
Central	-19	70	190	132	36		-4	5	76	-27
Northwest	195	321	431	594	512	216		304	354	89
Southwest	185	305	407	228	114	126	72		163	9
Column sum	39	261	262	152	103	145	61	132	140	
Give-out potential	-42	50	51	5	-16	2	-33	-3		

Table 5 Trans-regional value added induced by regional consumption of final inflow products (1997-2007)

Trans-regional value added induced by regional consumption of final inflow products for 1997 (unit: billion Chinese yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		1.36	2.74	2.68	1.61	3.62	2.79	1.72	16.53	0.4
North Municipalities	1.81		2.77	1.42	1.22	2.27	1.62	0.89	11.99	0.2
North Coast	13.85	7.34		17.77	10.05	27.14	11.71	10.00	97.86	1.9
East Coast	8.53	2.03	13.76		13.98	25.45	7.97	9.60	81.34	1.4
South Coast	4.71	1.01	4.04	9.27		11.62	4.74	10.15	45.54	0.7
Central	10.83	4.07	13.13	22.18	22.10		14.48	17.92	104.70	2.1
Northwest	2.58	1.36	2.16	2.50	2.37	5.38		3.99	20.35	0.5
Southwest	2.23	0.62	2.20	4.00	7.80	8.38	5.00		30.22	0.6
Column sum	44.55	17.78	40.81	59.81	59.13	83.86	48.31	54.27	408.53	
Give-out potential	0.8	0.4	0.9	1.6	1.1	1.5	0.8	0.9		
Trans-regional value added induced by regional consumption of final inflow products for 2007 (unit: billion Chinese yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		20.52	43.02	24.55	31.96	69.93	23.52	29.44	242.94	0.8
North Municipalities	25.07		181.33	23.22	23.48	73.77	23.85	35.07	385.80	0.9
North Coast	18.66	24.97		29.57	37.89	153.62	32.62	46.02	343.34	1.2
East Coast	12.45	5.87	29.45		69.85	121.37	23.59	38.69	301.27	0.9
South Coast	27.85	7.28	26.13	20.96		118.77	41.61	119.27	361.87	1.1
Central	13.94	11.22	47.63	108.52	53.21		29.14	42.57	306.21	1.2
Northwest	14.42	13.18	57.72	41.37	36.71	122.06		69.22	354.68	1.1
Southwest	15.41	7.11	21.94	18.76	55.08	90.98	42.71		252.00	0.7
Column sum	127.80	90.15	407.23	266.94	308.18	750.50	217.03	380.27	2,548.11	
Give-out potential	0.4	0.4	1.3	1.3	1.0	2.0	0.6	1.0		
Growth rate of trans-regional value added between 1997 and 2007 (unit: %)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		1,407	1,470	815	1,880	1,830	743	1,610	1,370	136
North Municipalities	1,285		6,441	1,540	1,824	3,153	1,375	3,863	3,118	416
North Coast	35	240		66	277	466	179	360	251	-44
East Coast	46	189	114		400	377	196	303	270	-41
South Coast	491	620	546	126		923	778	1,075	695	27
Central	29	176	263	389	141		101	138	192	-53
Northwest	459	870	2,570	1,557	1,446	2,169		1,633	1,643	179
Southwest	590	1,054	897	369	606	986	754		734	34
Column sum	187	407	898	346	421	795	349	601	524	
Give-out potential	-54	-19	60	-28	-16	43	-28	12		

Table 6 Trans-regional value added induced by regional production of final outflow products (1997-2007)

Trans-regional value added induced by regional production of final outflow products for 1997 (unit: billion Chinese Yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		0.24	2.04	1.39	0.42	0.87	0.28	0.16	5.38	0.4
North Municipalities	0.11		0.85	0.63	0.29	0.45	0.19	0.08	2.61	0.2
North Coast	0.76	1.14		6.28	2.06	5.09	0.92	0.73	16.98	1.9
East Coast	0.48	0.31	3.72		2.97	4.00	0.60	0.70	12.79	1.4
South Coast	0.19	0.13	0.99	2.55		1.55	0.28	0.59	6.27	0.7
Central	0.59	0.71	4.46	7.98	3.80		1.15	1.29	19.98	2.1
Northwest	0.17	0.26	1.49	1.21	0.50	1.79		0.38	5.80	0.5
Southwest	0.11	0.09	0.66	1.38	1.73	1.41	0.40		5.78	0.6
Column sum	2.43	2.88	14.20	21.42	11.76	15.15	3.82	3.93	75.59	
Give-out potential	0.8	0.4	0.9	1.6	1.1	1.5	0.8	0.9		
Trans-regional value added induced by regional production of final outflow products for 2007 (unit: billion Chinese Yuan)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		17.25	9.82	7.20	9.14	6.08	8.90	5.88	64.28	0.8
North Municipalities	3.19		12.07	3.43	3.87	2.67	5.65	1.98	32.88	0.9
North Coast	6.10	42.10		8.63	14.19	11.34	18.83	5.90	107.08	1.2
East Coast	2.59	7.67	5.97		27.57	11.97	8.70	4.99	69.46	0.9
South Coast	4.58	9.63	5.89	8.23		7.84	12.86	15.11	64.13	1.1
Central	4.30	11.90	15.84	23.08	26.56		15.49	7.95	105.12	1.2
Northwest	4.81	11.10	10.30	10.39	13.85	8.18		8.86	67.49	1.1
Southwest	2.58	4.25	4.63	5.63	16.01	4.53	10.47		48.09	0.7
Column sum	28.14	103.90	64.52	66.61	111.18	52.62	80.89	50.68	558.53	
Give-out potential	0.4	0.4	1.3	1.3	1.0	2.0	0.6	1.0		
Growth rate of trans-regional value added between 1997 and 2007 (unit: %)										
	Northeast	North Municipalities	North Coast	East Coast	South Coast	Central	Northwest	Southwest	Row sum	Gain potential
Northeast		7,213	381	419	2,095	602	3,111	3,646	1,094	62
North Municipalities	2,712		1,319	443	1,224	498	2,907	2,333	1,162	71
North Coast	699	3,592		37	590	123	1,936	712	531	-15
East Coast	436	2,353	61		828	199	1,343	608	443	-27
South Coast	2,271	7,397	498	223		406	4,470	2,454	922	38
Central	634	1,571	255	189	599		1,249	516	426	-29
Northwest	2,664	4,199	590	758	2,694	357		2,248	1,064	58
Southwest	2,189	4,394	604	308	823	221	2,537		731	13
Column sum	1,060	3,505	354	211	845	247	2,018	1,189	639	
Give-out potential	57	388	-39	-58	28	-53	187	74		

Figure 3 Give-out and gain potentials of trans-regional trade in value added in terms of final demand on locally produced products

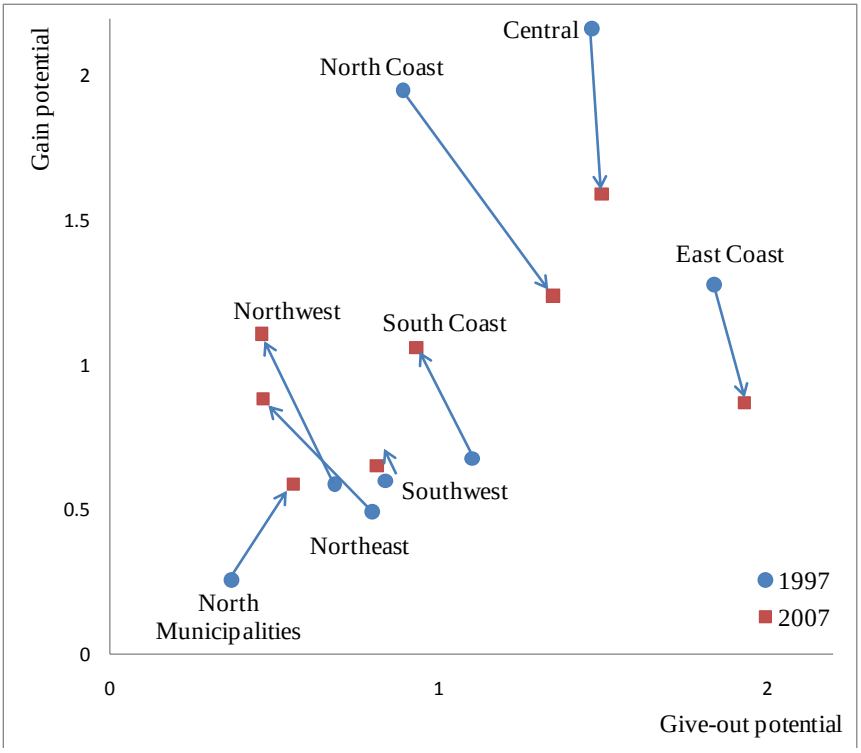


Figure 4 Give-out and gain potentials of trans-regional trade in value added in terms of final demand on inflow products

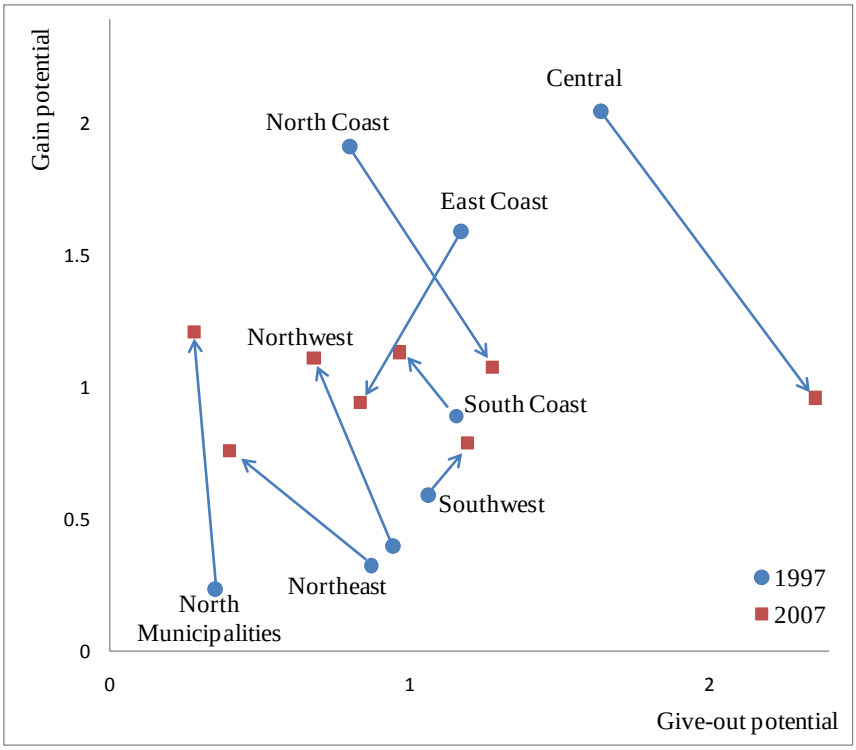


Figure 5 Give-out and gain potentials of trans-regional trade in value added in terms of supply of outflow products

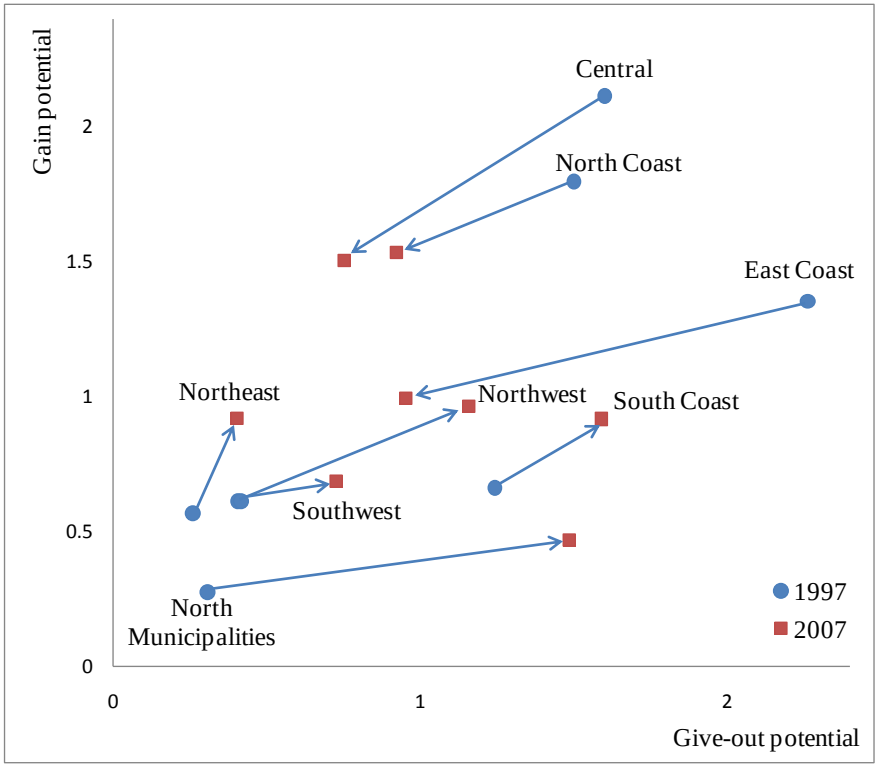


Table 6 TiVA based domestic revealed comparative advantage indicator and its changing pattern between 1997 and 2007

		Agriculture	Mining and quarrying	Food products and tobacco	Textile and garment	Wood products and furniture	Pulp, paper, and printing	Chemical	Non-metallic mineral products	Metal products	General machinary	Transport equipment	Electric applicances and electronics	Other manufacturing products	Electricity, gas, and water supply	Construction	Trade and transportation	Other services	SD	Change rate of SD (%)
1997	Northeast	0.63	2.42	0.53	0.34	1.39	0.44	1.28	1.10	1.20	0.99	1.13	0.50	0.82	0.68	0.15	0.91	0.41	0.52	
	North Municipalities	0.38	0.40	0.74	0.52	0.72	1.09	1.53	0.40	1.33	0.52	2.09	1.72	0.97	0.97	1.04	1.12	1.77	0.51	
	North Coast	1.02	1.11	1.04	0.90	0.42	1.03	1.12	1.07	0.99	1.81	0.51	0.76	0.71	0.98	1.34	0.88	0.95	0.30	
	East Coast	0.67	0.18	0.80	1.74	1.07	1.28	1.53	0.57	1.00	1.11	1.62	2.03	1.07	0.85	0.72	1.14	1.11	0.45	
	South Coast	1.03	0.43	1.02	2.31	0.87	1.31	0.63	0.73	0.57	0.29	1.26	1.90	1.49	1.05	1.67	1.23	1.25	0.51	
	Central	1.25	1.23	1.08	0.73	1.41	0.96	0.69	1.55	0.98	0.76	0.86	0.36	1.25	1.16	0.74	0.90	0.89	0.29	
	Northwest	1.10	1.78	0.72	0.28	0.42	0.39	0.83	0.53	1.41	0.45	0.44	0.86	0.57	1.22	0.75	1.07	0.85	0.39	
	Southwest	1.19	0.93	1.74	0.27	1.77	0.93	0.65	0.73	1.00	0.52	1.25	0.78	0.80	0.84	1.46	1.10	1.22	0.39	
	SD	0.29	0.71	0.34	0.70	0.46	0.32	0.36	0.36	0.24	0.46	0.52	0.62	0.28	0.17	0.46	0.12	0.37		
2007	Northeast	1.45	2.19	1.00	0.05	1.00	0.36	1.68	0.71	0.69	0.62	3.07	0.20	0.64	1.20	1.51	0.68	0.39	0.75	44
	North Municipalities	0.12	0.42	0.51	0.09	0.06	0.30	0.57	0.15	0.38	0.63	0.99	0.49	0.80	0.54	0.31	0.96	3.01	0.66	29
	North Coast	1.30	0.97	1.00	0.93	2.24	0.99	1.09	2.03	1.27	0.74	0.68	0.40	0.54	0.71	0.02	0.87	1.04	0.52	72
	East Coast	0.24	0.10	0.43	1.20	0.30	1.06	1.83	0.40	0.96	2.24	1.51	2.75	2.09	0.64	0.66	1.09	1.01	0.75	67
	South Coast	0.32	0.28	0.19	4.35	2.12	2.98	0.66	1.01	1.03	2.61	0.40	2.70	2.18	1.16	0.21	0.92	0.66	1.17	128
	Central	1.44	1.09	1.19	0.47	1.07	1.07	1.03	1.73	1.41	0.59	0.50	0.81	0.90	1.05	0.79	1.19	0.58	0.34	17
	Northwest	1.43	2.28	1.31	0.22	0.18	0.31	0.65	0.66	0.75	0.17	0.35	0.19	0.16	1.24	2.02	1.09	0.87	0.64	63
	Southwest	1.71	0.56	2.76	0.10	0.55	0.50	0.58	0.78	1.40	0.28	1.32	0.29	0.67	1.59	3.26	1.16	0.49	0.85	118
	SD	0.61	0.78	0.74	1.35	0.79	0.83	0.47	0.60	0.34	0.86	0.84	1.03	0.69	0.33	1.03	0.16	0.79		
Change rate of SD (%)		111	11	116	92	73	157	31	69	41	86	64	65	144	102	124	31	115		

* SD: Standard Deviation : first rank : second rank

Figure 6 Give-out potential of induced value added by regional exports

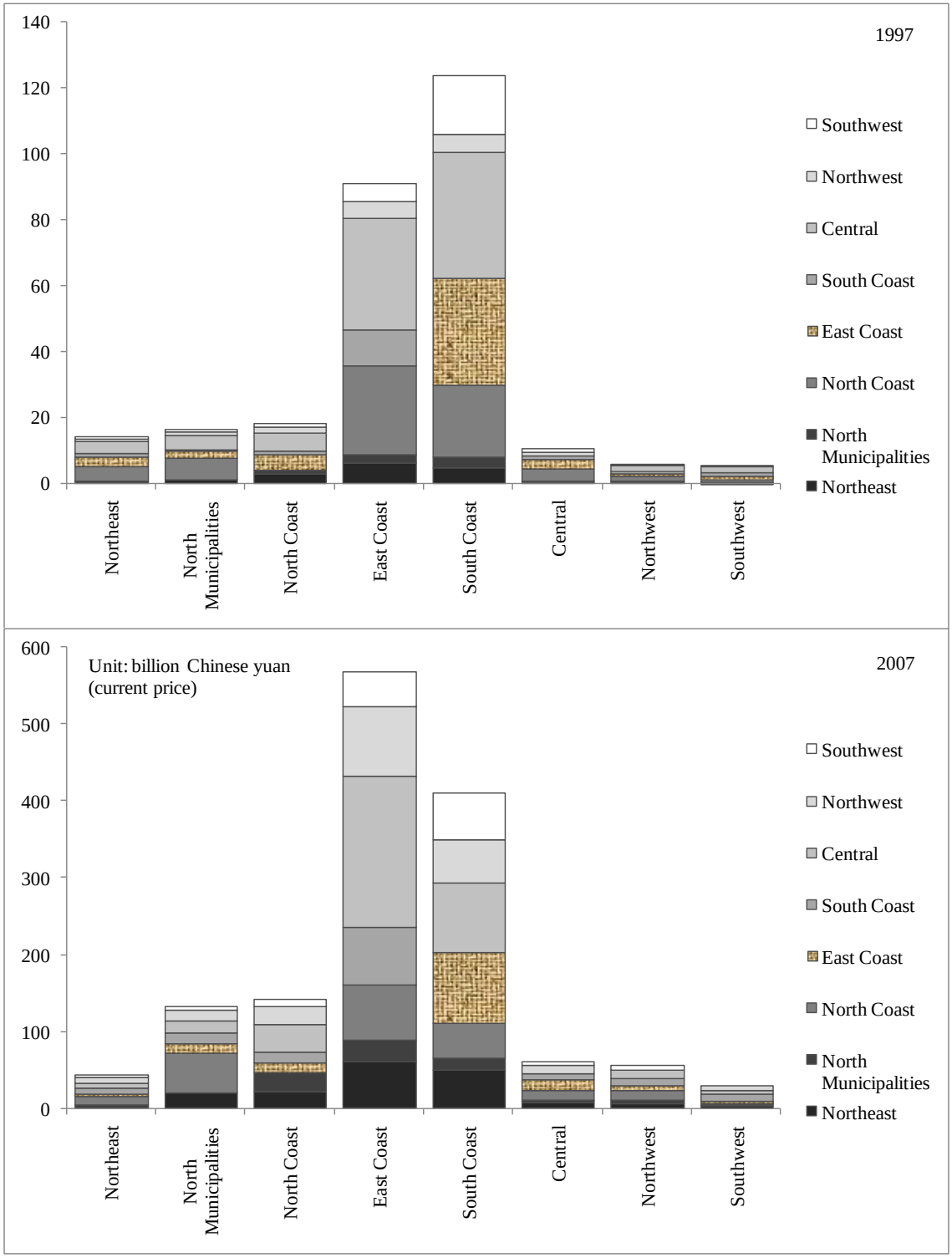
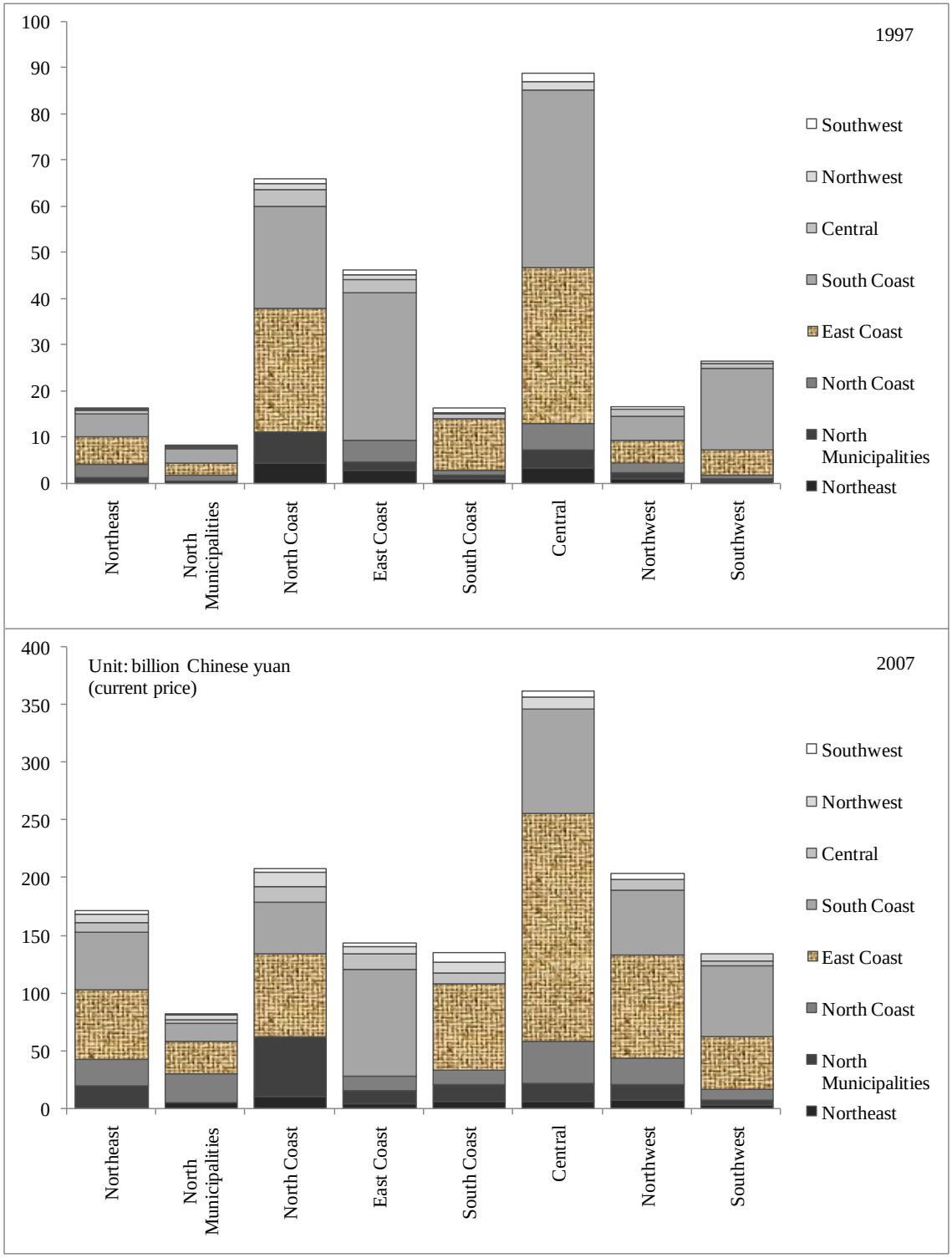


Figure 7 Gain potential of induced value added by regional exports



Appendix 1 Region classification

Eight Regions	**31 provincial level divisions**
Northeast	Liaoning, Jilin ,Heilongjiang
North Municipalitis	Beijing, Tianjin
North Coast	Hebei, Shandong
East Coast	Shanghai, Jiangsu, Zhejiang
South Coast	Fujian, Guangdong, Hainan
Central	Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan
Northwest	Inner Mongolia, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang
Southwest	Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet