BOFIT Policy Brief
2017 No. 4

Heli Simola

Chinese production chains rely increasingly on domestic services

Bank of Finland, BOFIT
Institute for Economies in Transition

BOFIT Policy Brief
Editor-in-Chief Juuso Kaaresvirta

BOFIT Policy Brief 4/2017
18 April 2017

Heli Simola
Chinese production chains rely increasingly on domestic services

ISSN 2342-205X (online)

Bank of Finland
BOFIT – Institute for Economies in Transition

PO Box 160
FIN-00101 Helsinki

Phone: +358 10 831 2268
Fax: +358 10 831 2294

Email: bofit@bof.fi
Website: www.bofit.fi/en

Heli Simola

Chinese production chains rely increasingly on domestic services

Abstract

We examine the international fragmentation of production chains in different countries using international input-output tables with a focus on China. We explore the development of main macro-level trends established in the previous literature with the most recent data available and compare Chinese production chains to those of other countries. We find that while international fragmentation of value chains has increased notably in other countries during 2000–2014, in China it has turned to decline in the latter part of the time period. The share of domestic value added has increased both in Chinese manufacturing and business service chains. The role of services has increased in the value chains of all countries, but even more pronouncedly in China mainly due to higher contribution from domestic services. Comparing globalization as opposed to regionalization in production chains shows that for most countries globalization has increased. A notable exception are other Asian countries than China, where value chains have instead become increasingly regional. Both these trends are largely due to the increased role of China in international production chains.

Keywords: China, international production chains, input-output

Contents

1. Introduction

Production chains[1] and their international fragmentation has become an increasingly topical issue. The phenomenon as such is obviously not new, since especially raw materials have been traded between countries for centuries[2]. But the scale, geographical scope and level of detail in international fragmentation of value chains has increased substantially especially in past couple of decades.

In economic research much work has been dedicated lately on identifying and measuring international value chains and related trade flows, as it is often difficult to track them from traditional trade statistics compiled primarily for different purposes. Moreover, international organizations have recently published several new databases facilitating the examination of international value chains.[3]

In this note, we sum up the main macro-level trends established in the previous literature and extend the analysis to the most recent data available. We focus on the viewpoint of China, since its opening up and integration to the world economy has had an important role in shaping the international value chains especially after it joined the WTO in 2001. We compare the general trends in the evolution of value chains in other countries and China as well as examine the development of China's role in international value chains.

We proceed to first briefly presenting the data and methodology used in the analysis. The following sections present the results of the analysis comparing the value chains in China and other countries. First we depict the overall development of foreign participation in value chains and then we discuss the trends in terms of sectors and regions. Finally we present a bit more detailed comparison of certain production chains in selected individual economies. The last section concludes with a brief discussion of the results.

2. Data and methodology

For examining the international value chains we use the international input-output tables from the WIOD database. The international input-output tables depict global production structures and divide the total output of a sector in a country to the value added created in that sector and to the inputs needed from other sectors and countries. Therefore it allows to separate the actual value added created in the sector itself from the inputs coming from other sectors and countries in different stages of the production chain.

The WIOD data is constructed utilizing national statistics on production and trade flows and complemented with estimated inputs. The data is annual and the latest version covers years 2000–2014. The data includes 43 individual economies (all 28 EU member countries and other world's largest economies) and a rest of the world block. It is divided to 56 sectors based on the ISIC rev. 4 classification. The data is expressed in nominal USD.[4]

The methodology we use follows closely earlier research and has been applied to earlier versions of the WIOD database[5]. We extend the analysis to later years and provide some more detailed analysis especially from China's perspective. A value chain or production chain includes all

[1] We use production and value chains inter-changeably, as there a clear consensus on terminology has not emerged yet in the literature, see e.g. Park & al. (2013).

[2] Historical development of international value chains is discussed e.g. in Baldwin (2012).

[3] Extensive surveys on the literature are provided by e.g. Park & al. (2013) and OECD (2013). Different databases are discussed e.g. in Timmer & al. (2015).

[4] Comprehensive information and discussion on the construction of the data and underlying data sources is provided by Timmer & al. (2015) and Timmer & al. (2016).

[5] Timmer & al. (2014), Los & al. (2015), Timmer & al. (2015).

inputs or production stages needed to complete the output. The sector and "nationality" of the chains are defined based on the last stage of production from where the products are supplied directly to final consumption either domestically or in export markets. We take as a starting point the global demand for e.g. Chinese textiles and clothes and trace all the value added components from different countries and sectors needed to fulfil this demand.

More specifically, we decompose the global input-output matrix to country-sector value chains. We denote the output vector of a sector in a country by Q, the coefficient matrix of intermediate inputs by B and the final demand vector by C. Then the output can be expressed: $Q = (I - B)^{-1}C$, where I is the identity matrix and $(I - B)^{-1}$ is the so called Leontief inverse. As we want to concentrate on the actual value added we still need to multiply Q by a diagonal matrix F that contains the ratios of value added to gross output of all countries and industries in its diagonal. Now we can calculate the value added production K needed to supply final demand C from $K = F(I - B)^{-1}$C. In order to calculate the value added needed in the country-sector chains, we insert for C the global demand for the final products of that chain, e.g. Chinese textiles and clothes.

Using this decomposition methodology we get 2 408 individual production chains (56 sectors for 43 economies as we exclude the chains in the rest of the world -block) for every year in the sample. We use the share of foreign value added in the chains as a measure of international fragmentation of the production chain. For ease of exposition, we use in the analysis mainly (unweighted) averages calculated over countries and sectors. In the comparisons, we label the average over other countries than China as the world and by China we refer to mainland China. In the last section, we also examine selected individual production chains in more detail. In addition, in most parts of the analysis we concentrate only on manufacturing and business services sectors as output and input sectors (i.e. exclude primary, mining and quarrying as well as other sectors), as they are the most interesting sectors from the viewpoint of international value chains. Excluding inputs from primary and mining sectors also diminishes the effects of fluctuations in commodity prices, which are inevitably present in data expressed in nominal terms.

3. International fragmentation of production chains has increased in other countries, but declined in China

There is a lot of evidence in previous literature that in general the international fragmentation of production has increased especially during past couple of decades, although there is much variation between countries and sectors. Motivations behind fragmentation stem from improved efficiency from deeper specialization as well as from taking advantage of lower production costs abroad for certain stages of production. Further fragmentation has been enabled by improved information and communication technologies as well as declining transport costs. Worldwide liberalization of trade and investment policies has further supported international fragmentation of production. Moreover, the opening up of many emerging markets like China and Central Eastern European countries for international transactions has provided possibilities for cost savings with lower labor costs.[6]

So as expected, we find that international fragmentation of production chains has increased gradually since 2000 in nearly all countries and sectors. Almost all production chains are, however, still dominated by domestic value added (DVA). The upward trend in international fragmentation has continued in most countries throughout 2000–2014, although pausing in 2009 and slowing down in

[6] See e.g. Baldwin (2012), Backer & Miroudot (2013), Johnson & Noguera (2012b), Baldwin & Lopez-Gonzalez (2013), OECD (2013), Timmer & al. (2014).

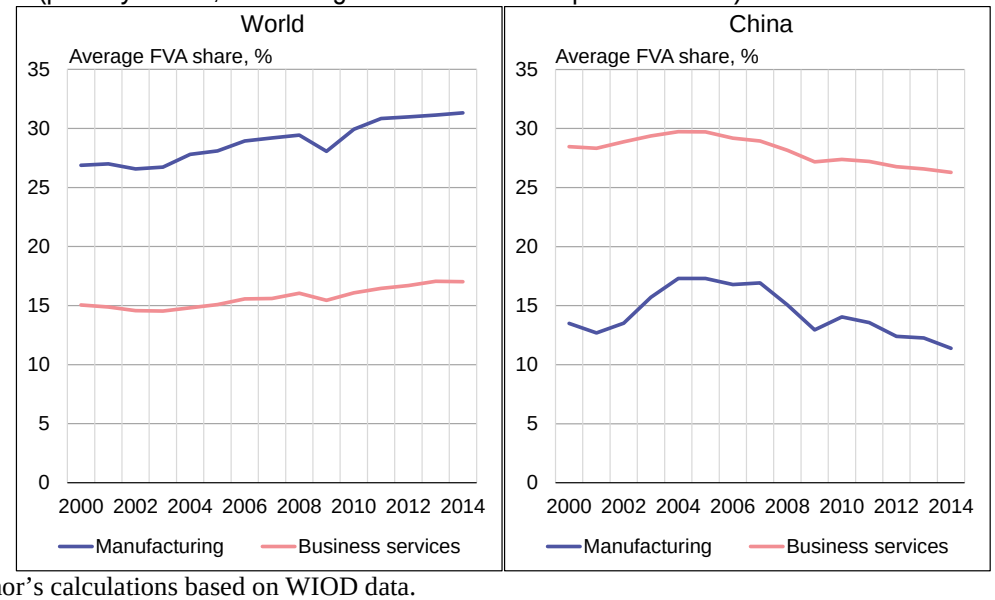
the latest years of the data[7]. China is a notable exception, however. It seems that in Chinese production chains international fragmentation increased in the first years of 2000s, but then the trend turned to the opposite. So Chinese production chains have actually become *less* fragmented internationally.

Despite common trends, there is much variation in the level of fragmentation between sectors and countries. Unsurprisingly, the most fragmented production chains are found in manufacturing. The average share of foreign value added (FVA) calculated over all countries and all manufacturing sectors was 31 % in 2000 and increased to 38 % by 2014. The average FVA share was the highest at 50–60 % in 2014 in manufacturing sectors relying heavily on raw material inputs like oil refining and manufacturing of basic metals and the lowest at about 30 % in food and wood product manufacturing. In business services, primary production and other sectors the average share of FVA has increased more slowly and was only around 20 % still in 2014.

The general increase in fragmentation, however, partly reflects higher commodity prices as the data is expressed in nominal terms. While the average share of FVA in manufacturing sector production chains increased by 7.5 percentage points between 2000 and 2014, about a third of this was due to increased FVA from primary products and oil refining. In the case of China, the overall share of FVA remained practically unchanged between 2000 and 2014. However, this resulted from a 2 percentage point increase in FVA from primary products and a corresponding decline in the FVA from other sectors.

The overall picture of the development of international fragmentation remains similar even if we concentrate only on manufacturing and business services both as the sector of outputs as well as inputs (figure 1). The average share of FVA is in general slightly lower when primary and other sectors[8] are excluded, but it has increased in the production of other countries and declined in the production of China. The trend is similar for both manufacturing and business services, but more muted for business services.

Figure 1. The average share of foreign value added in the production chains of other countries and China in 2000–2014, % (primary sector, oil refining and other sector inputs excluded).



Source: Author's calculations based on WIOD data.

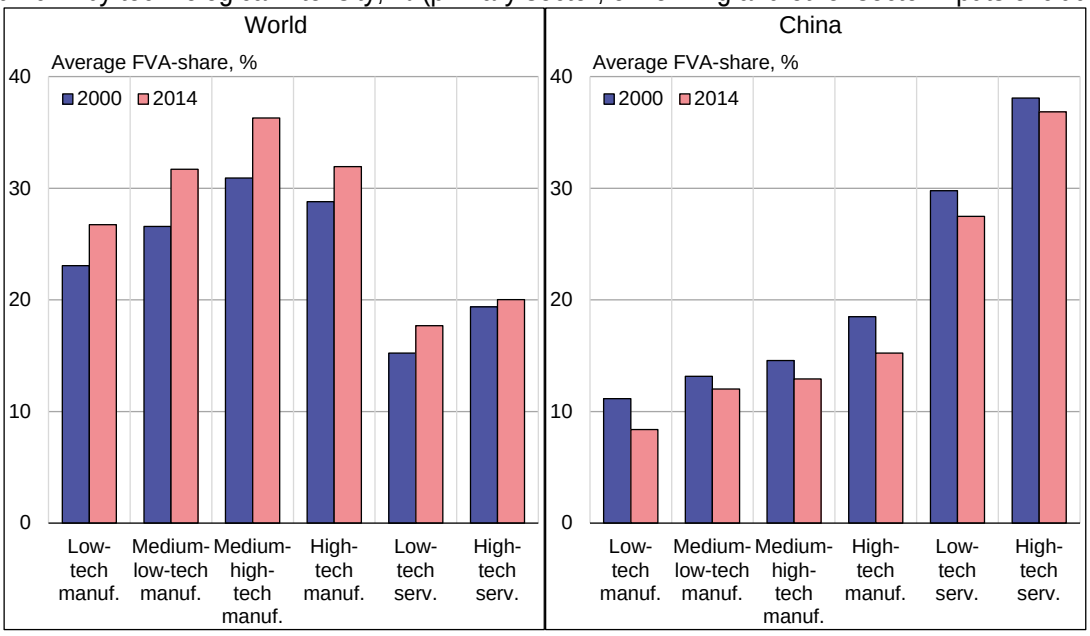
[7] Timmer & al. (2016) conclude that globally international fragmentation of production has even slightly declined in 2011–2014 applying a slightly different methodology and including China in the global aggregate.

[8] Contrary to conventional classifications, but for ease of exposition we include mining and quarrying sector to primary sectors. Other sectors include sectors that are heavily domestically oriented like electricity supply and public services. For more details, see Appendix.

In addition, it seems that the average share of FVA is much lower in Chinese manufacturing chains compared to the other countries. This should be taken with some caution, however, as the share of FVA in Chinese production might be somewhat underestimated in the data. The underlying assumption in the data is that all production (both for domestic markets and exports) uses imported intermediates in equal proportions. In the case of China, this is not completely appropriate as there is evidence that Chinese production destined for exports is using imported inputs more heavily than the production destined for domestic markets[9]. This problem is alleviated by the fact that especially in the latest years of the data the share of exports in Chinese production was only about 20 %. In Chinese business service chains, the share of FVA is still much higher than in other countries, although it has declined during past decade.

For examining the sectors more closely, we divide them further by technological intensity[10]. The analysis shows that the general trends are similar across sectors (figure 2). In other countries, the average share of FVA has increased in all sectors, but the largest increases are seen in the medium-technology manufacturing sectors. In business services, the share of FVA has increased only slightly in high-technology services and much more in low-technology services. In China, the average share of FVA has decreased in all sectors, but especially in low- and high-technology manufacturing as well as low-technology services. This suggests that China has been able to some extent localize its value chains at least in less technology intensive production. The decreasing share of FVA also in high-technology sectors could indicate that China is shifting also in qualitative terms to higher value added production. These findings are in line with results from the earlier literature that China has replaced imports by domestic supply in its domestic demand as well as increased the localization of its export production.[11]

Figure 2. The average share of foreign value added in the production chains of other countries and China in 2000 and 2014 by technological intensity, % (primary sector, oil refining and other sector inputs excluded).



Source: Author's calculations based on WIOD data.

[9] On the limitations of the data see Timmer & al. (2015). The import share of Chinese exports is discussed e.g. by Koopman & al. (2012)

[10] For details, see Appendix.

[11] For evidence on domestic demand see e.g. Timmer & al. (2016), Simola (2017) and on exports Kee & Tang (2016).

4. Role of services has increased especially in Chinese production chains

Another general trend observed in the earlier literature is that the role of services has increased and the role of manufacturing decreased in creating value added in production chains, especially in manufacturing production chains. This is often referred to as "deepening of the smile-curve" or "servicification of manufacturing". It might reflect increasing complexity of manufacturing products that require more service inputs like R&D and design. It can also be related to higher dispersion of production chains causing increased demand for coordinating and connecting services (like transport and communication), changes in relative prices (manufacturing stages shifted to regions with lower labor costs) and reclassification of activities (outsourcing services previously performed in-house in a manufacturing company, like marketing). Increasing international fragmentation of services has been supported by the advancements in coordination and communication technologies that have made it possible to separate more stages of the production chain than before.[12]

When dividing the value added created in the value chains to aggregate sectors we find that on average the share of value added created by business services has indeed increased during 2000–2014 (table 1). Concerning world average, the change is quite moderate and has mainly taken place in the first half of the time period, whereas in the latter part the situation seems to have stabilized. The trend is, however, more visible if we exclude the inputs from primary and other sectors: the share of value added created by manufacturing has declined and the share of business services increased.

In China, the share of value added created by business services has increased more than in the other countries, but it is still slightly lower especially in manufacturing. The increasing share of business services has, however, occurred in China mainly in the latter part of the time period unlike in other countries. Another notable difference in Chinese value chains is that the primary sectors account for a much larger share than in the other countries and the difference has not narrowed much during 2000–2014. This might reflect the relatively low labor costs in China.

Table 1. Average shares of aggregate sectors in manufacturing and business services value chains in world and China, %.

Manufacturing value chains (average)							
World				**China**			
	2000	2007	2014		2000	2007	2014
Primary	9.5	10.8	11.3	Primary	17.9	21.3	22.5
Manufacturing	56.3	53.0	52.3	Manufacturing	55.5	51.5	47.8
Bus. services	26.1	27.3	27.2	Bus. services	21.3	20.6	24.2
Other	8.0	8.8	9.2	Other	5.3	6.7	5.5
	100.0	100.0	100.0		100.0	100.0	100.0
Excluding primary and other sectors				*Excluding primary and other sectors*			
	2000	2007	2014		2000	2007	2014
Manufacturing	68.3	66.0	65.8	Manufacturing	72.3	71.5	66.4
Bus. services	31.7	34.0	34.2	Bus. services	27.7	28.5	33.6
	100.0	100.0	100.0		100.0	100.0	100.0

[12] Discussion and evidence for Asian countries provided e.g. in Baldwin & al. (2015)

Business service value chains (average)							
World				**China**			
	2000	2007	2014		2000	2007	2014
Primary	2.7	3.3	3.5	Primary	9.1	10.5	9.7
Manufacturing	7.3	6.5	6.3	Manufacturing	16.6	13.2	11.5
Bus. services	82.2	82.0	81.7	Bus. services	70.1	71.4	74.9
Other	7.7	8.3	8.5	Other	4.1	4.9	3.8
	100.0	100.0	100.0		100.0	100.0	100.0
Excluding primary and other sectors							
	2000	2007	2014		2000	2007	2014
Manufacturing	8.2	7.3	7.1	Manufacturing	19.2	15.6	13.4
Bus. services	91.8	92.7	92.9	Bus. services	80.8	84.4	86.6
	100.0	100.0	100.0		100.0	100.0	100.0

Source: Author's calculations based on WIOD data.

Separating the aggregate sector value added further to domestic and foreign parts shows another notable difference between other countries and China. In other countries, the increasing share of business services is due to foreign business services, which have replaced domestic manufacturing and business services (table 2). In contrast, it is mainly the share of domestic business services, that has increased in China replacing domestic and foreign manufacturing value added.

Table 2. Average shares of domestic and foreign value added by aggregate sector in manufacturing and business services value chains in world and China, % (excluding inputs from primary and other sectors).

Manufacturing value chains (average)							
World				**China**			
	2000	2007	2014		2000	2007	2014
DVA manufacturing	51.9	48.9	48.2	DVA manufacturing	62.8	60.7	59.3
DVA bus. services	20.4	20.8	19.4	DVA bus. services	23.2	21.6	28.5
FVA manufacturing	14.9	15.5	16.1	FVA manufacturing	8.4	9.8	6.1
FVA bus. services	12.8	14.7	16.2	FVA bus. services	5.6	8.0	6.0
	100.0	100.0	100.0		100.0	100.0	100.0
Business service value chains (average)							
World				**China**			
	2000	2007	2014		2000	2007	2014
DVA manufacturing	4.1	3.3	2.9	DVA manufacturing	14.8	11.5	11.3
DVA bus. services	83.9	84.0	83.3	DVA bus. services	77.1	79.3	83.1
FVA manufacturing	4.2	4.0	4.3	FVA manufacturing	4.7	4.6	2.5
FVA bus. services	7.9	8.6	9.5	FVA bus. services	3.4	4.6	3.1
	100.0	100.0	100.0		100.0	100.0	100.0

Source: Author's calculations based on WIOD data.

In China, the increasing role of services likely reflects mainly the process of economic development and structural change that have been proceeding in the country gradually during the past years. In

2000, China was still clearly a developing country and the share of services in Chinese production was low in international comparison. Still in the last decade, the Chinese growth model relied quite heavily on investment and related heavy industry. In latest years this growth model has lost steam, however, and Chinese economy has been gradually shifting to a more consumption-led growth. This together with rapid growth in the Chinese income level has supported the development of the domestic service sector. Some of the above-mentioned global reasons may naturally have played a role also in China's development.

5. Production chains have become increasingly global – owing much to China

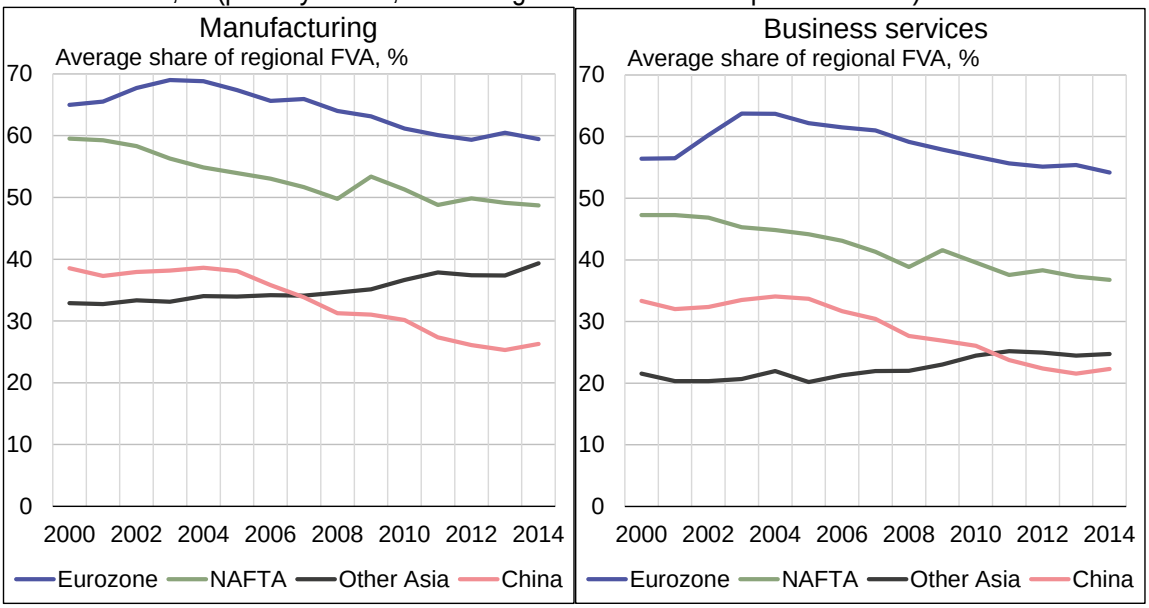
In line with previous literature[13], we find that the international fragmentation of production chains has been to a large extent regional, but in many cases it has shifted from regional level more towards global fragmentation. There are some differences between regions, but all these developments reflect to a large extent the increased role of China in international value chains. We now concentrate only on the FVA part of the production chains and divide it to two parts, regional and global. We then calculate the shares of regional and global value added in the total FVA for all individual countries and sectors and compare the regional averages. So we are examining the relative globalization or regionalization of the value chains. The results should be interpreted with caution, as the data is so heavily dominated by European countries and lacking countries from other continents. We again consider only manufacturing and business services both as the output and input sectors.

The analysis shows that in all regions business service chains are more global (as opposed to regional) than manufacturing chains (figure 3). European[14] value chains both in manufacturing and in business services are still mainly regional, although the share of global value added has increased. Regionalization has declined even more visibly in the production chains of the NAFTA countries and in the latest years of the sample their total FVA has originated quite evenly from regional and global sources. In contrast, in China and other Asian countries the FVA seems to have come mainly from global instead of regional sources throughout 2000–2014. This might, however, be caused by the limited country sample as many Asian countries are not included. In addition, the trends in China and other Asian countries seem to be opposite. In Chinese value chains, regional share in total FVA has declined, whereas in other Asian countries it has increased.

[13] Analysis in this section follows Los & al. (2015), similar results are also obtained in e.g. Amador & Cabral (2016), Baldwin & Lopez-Gonzalez (2013) and Johnson and Noguera (2012a).

[14] Here we present the results only for the Eurozone and regard as regional all value added originating in EU28. The results are very similar also for the whole EU28.

Figure 3. The average share of regional value added in total foreign value added in production chains by region in 2000–2014, % (primary sector, oil refining and other sector inputs excluded).



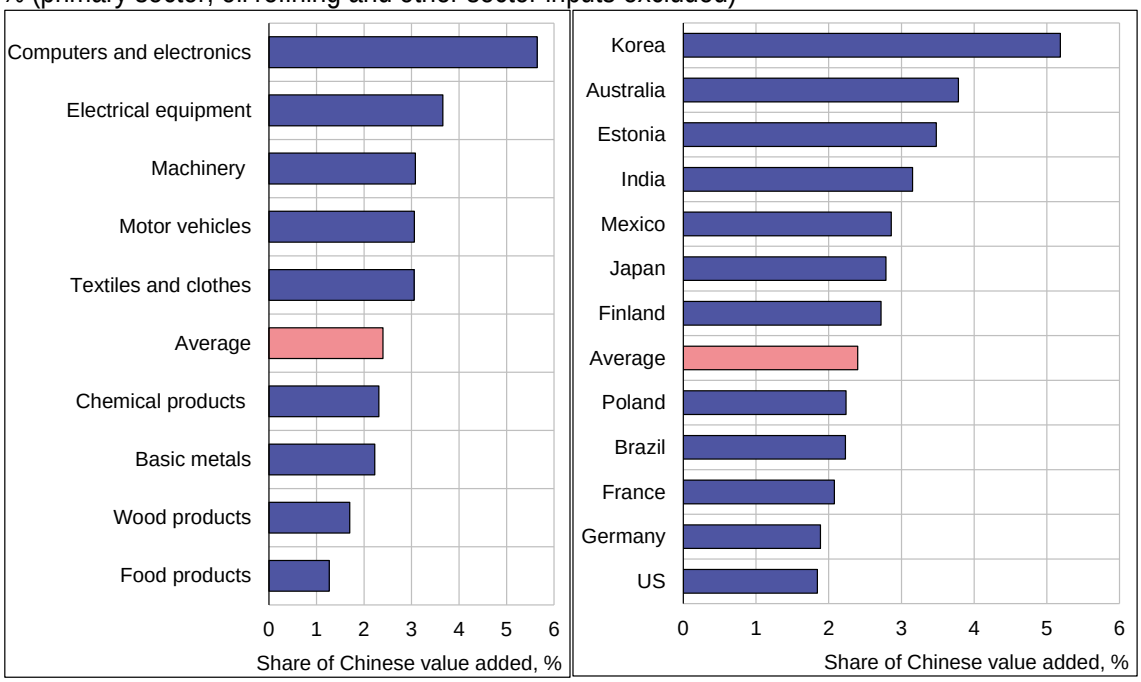
Source: Author's calculations based on WIOD data.

The overall high share of regional FVA vis-à-vis global FVA can be explained by distance-related costs like transports costs that are important especially in manufacturing as well as the impact of trade agreements and deeper economic integration especially in Europe. These factors are found to be important determinants also in value chain trade as they are in trade of final goods[15]. The increased globalization of value chains may partly reflect the increased role and fragmentation of services in value chains noted above, since trade in services is more globalized than trade in goods.

Another important factor behind the trend of growing globalization is the increased participation of China in international value chains. The share of Chinese value added has increased in nearly all production chains across countries and sectors during 2000–2014. In manufacturing, China's average share in foreign production chains has increased from 0.4 % in 2000 to 2.5 % in 2014, whereas in business services the corresponding shares were 0.2 % and 0.8 %. Unsurprisingly, China's average share in 2014 was largest in the production chains of computer products and electric equipment (figure 4). In geographical terms, China's average share was the highest in production chains of Asian countries. In European and NAFTA production chains China's average share was much lower, except for the computer and electric equipment sectors in NAFTA countries.

[15] Johnson & Noguera (2012a), Kowalsky & al. (2015)

Figure 4. Average share of Chinese value added in the manufacturing production chains of other countries in 2014, % (primary sector, oil refining and other sector inputs excluded)



Source: Author's calculations based on WIOD data.

6. Chinese production chains remind both large and emerging country chains

So far we have compared the characteristics of Chinese production chains with the averages of all other countries included in the dataset. As the differences between countries are quite large, in this last section we perform similar analysis in country and individual manufacturing sector level. We compare Chinese production chains of textiles and clothes, computers and electronics as well as motor vehicles with the chains of selected peer countries.

In earlier research it has been found that the international fragmentation of production chains is largely explained by structural factors like the size and remoteness of the economy. Larger countries as well as more isolated countries tend to have less internationally fragmented production chains and rely more on domestic inputs. The level of income and level of industrialization also have an impact, but it is more complex. From policy-related factors, openness to foreign direct investment and participation in trade agreements tend to increase the internationalization of production chains. There is also evidence that international production chains are concentrated among few large regional hubs that trade intensively with smaller spoke countries.[16]

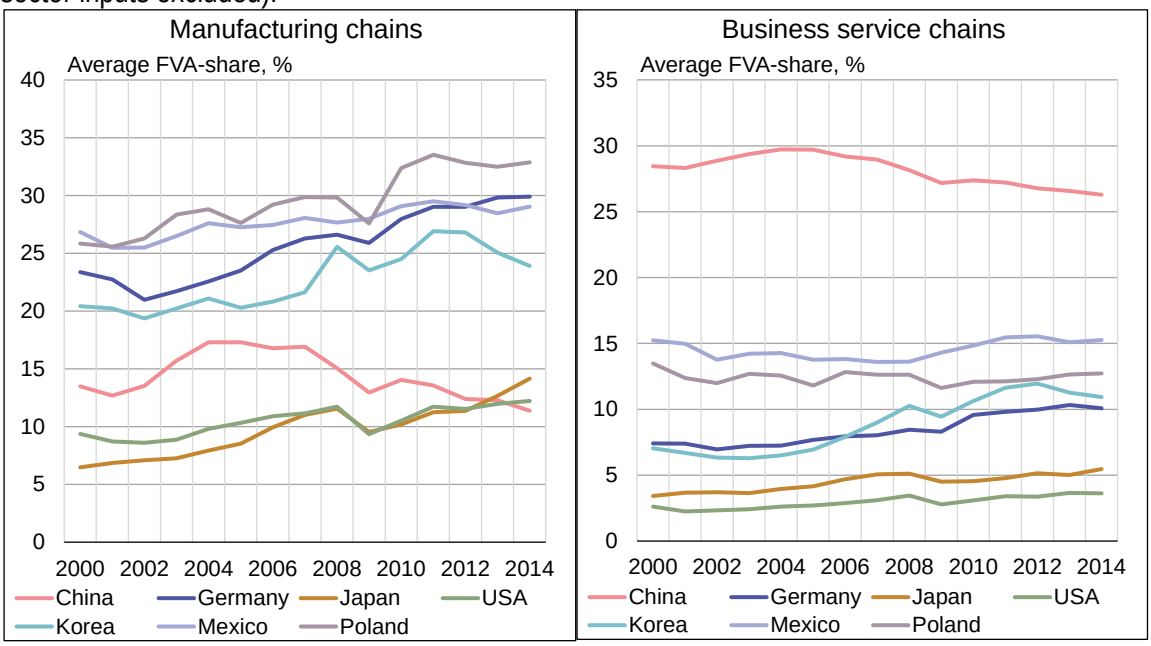
By the size of the economy and its hub-like position in regional value chains China reminds the other large economies of the world. But compared to these countries, income level in China is still much lower and the level of industrialization much higher[17]. Therefore, we compare China both to the countries that are closest by the size of the economy (the U.S., Japan and Germany), but also to countries more similar by the income level and industrial structure (Mexico, Korea and Poland).

[16] Amador & Cabral (2016), Kowalsky & al. (2015), Baldwin & Lopez-Gonzalez (2013)

[17] Level of industrialization refers to the share of industry in total production. It is much larger in China than higher income economies, where services account for a larger part of production. For additional information, see e.g. Simola (2017).

As noted above, the share of foreign value added has increased in the production chains of other countries than China. From the largest economies, this development has been the most pronounced in Germany. In German manufacturing chains, the average share of FVA has increased from about 20 to 30 % during 2000–2014 and in business service chains more modestly from 7 to 10 % (figure 5). Especially in the U.S. but also in Japan the development has been much more moderate both in manufacturing and business service chains. In this respect, German development is actually more similar to that of the emerging economies than the other largest economies.

Figure 5. Share of foreign value added in production chains by country, % (primary sector, oil refining and other sector inputs excluded).



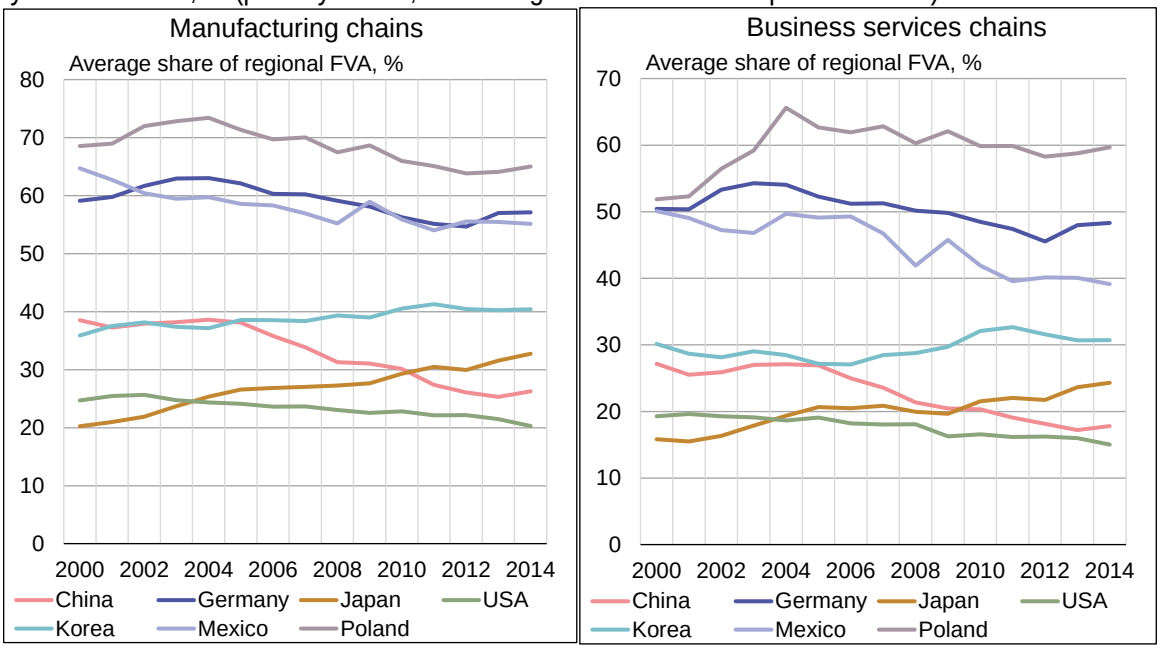
Source: Author's calculations based on WIOD data.

In Chinese manufacturing production chains, the share of FVA has been higher than in the other large economies, but lower than in the emerging economies during most of the time period. But as the share has declined during the latter half of the time period, it has reached about the same level as the U.S. in 2014. However, it should be kept in mind that the share of FVA in Chinese production might be somewhat underestimated in the data. In Chinese business service chains, the share of FVA seems to be notably larger than in any of the other countries despite declining in latest years of the sample. So, in coming years it might be expected that the declining trend of FVA in Chinese service value chains continues. In manufacturing chains, the share of FVA could start to increase again gradually, if China follows a similar development path as the other countries. There are already pressures to shift most labor-intensive production stages from China to countries with lower labor costs, since the costs in China have increased rapidly.

Examining more closely the trends in global and regional shares of production fragmentation shows that the tendencies are similar also in individual country level than in the aggregate level (figure 6). The share of regional FVA in the total FVA has declined in the latter part of the time period in all other countries except Japan and Korea, both in manufacturing and business service chains. This globalization trend has been strongest in the production chains of China and Mexico and mildest in Germany and Poland. In level terms, the ratio of global FVA to regional FVA is highest in the value

chains of the U.S. and China, whereas regionalization dominates in the value chains of Poland and Germany[18].

Figure 6. The average share of regional value added in total foreign value added in production chains by country in 2000–2014, % (primary sector, oil refining and other sector inputs excluded).



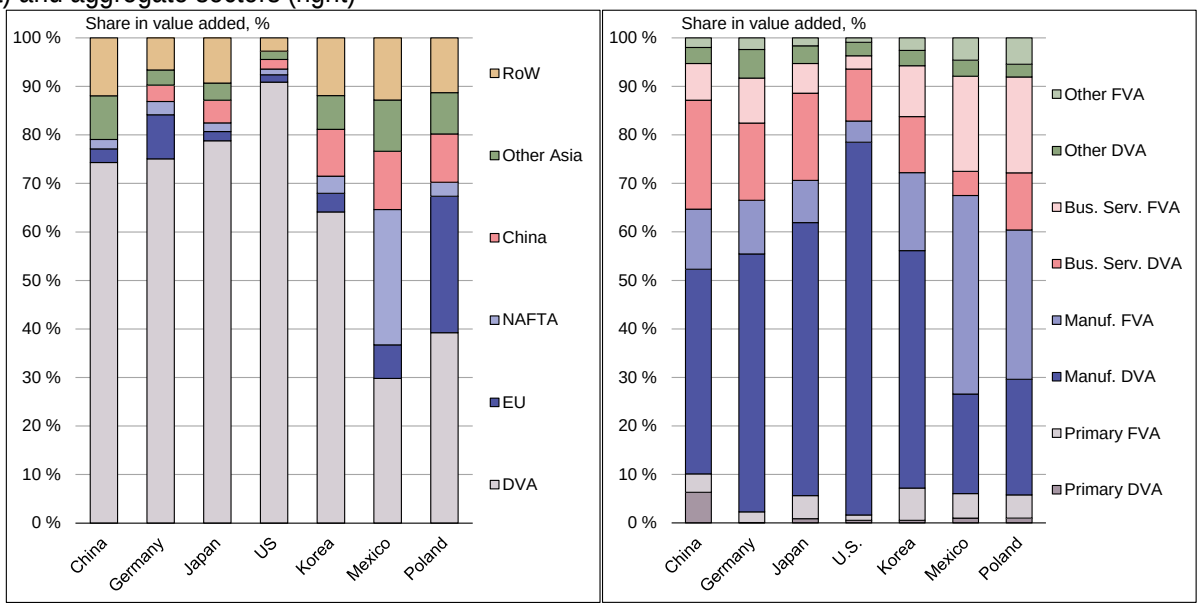
Source: Author's calculations based on WIOD data.

Finally we examine in more detail the production chains in a few individual sectors in these countries. We divide the total value added created in these chains to domestic and foreign shares by region as well as to aggregate sector shares (computer and electronics chains presented as an example in figure 7). Obviously, the comparisons are only indicative, as the data on production chains is on a relatively aggregate level instead of individual products.

In general, Chinese chains differ from all the others by the higher share of the primary sector inputs. This is the most pronounced in the textile and clothes sectors, but applies to all sectors examined. As noted above, it probably reflects relatively low labor costs in China during the time period under consideration. It might also be partly related to location, as e.g. in Japan the share of primary sector is also higher compared to the U.S. and Germany. Otherwise, the sector structure of value added in Chinese chains reminds in some cases more the large economies and in others the emerging economies. In the computer and electronics chains, the share of manufacturing is much lower in China and emerging economies than in the large economies, especially the U.S. But in the chains of motor vehicle manufacturing, the shares of manufacturing and services in Chinese chains are quite similar to those in the U.S. or Germany.

[18] More detailed examination from a slightly different perspective for the Eurozone countries is provided by e.g. Amador & al. (2015)

Figure 7. Value added shares in production chains of computers and electronics in 2014, %-share by regions (left) and aggregate sectors (right)



Source: Author's calculations based on WIOD data.

The overall share of DVA is quite high in Chinese chains and this applies to both manufacturing and business services. From this perspective, China reminds more the large economies than the emerging markets. This may reflect several factors. First, China is more strongly oriented towards supplying domestic demand than exports in comparison to other emerging markets. Supply for domestic demand tends to be more localized than supply for exports in emerging markets. Even in Chinese exports, the DVA share is estimated to be somewhat higher compared to some other emerging countries[19]. The higher DVA share can also reflect the fact that foreign companies have established more local production in China, whereas with other emerging markets fragmentation of value chains is realized through trade.

7. Conclusion

We have compared the development trends of China's value chains to those in other countries. We find that while the average share of foreign value added in the production chains of other countries has increased during 2000–2014, in Chinese production chains it has decreased since 2007. China has replaced imported inputs with domestic ones in all sectors, but the most in low-technology manufacturing and services as well as high-technology manufacturing.

Currently, the share of foreign value added seems to be relatively small in Chinese manufacturing chains, but large in Chinese high-technology service chains compared to the other countries. If the development of Chinese value chains follows the previous global trends, we might expect the share of foreign value added to start increasing again in Chinese manufacturing chains. Production costs in China have risen rapidly giving possibilities for cost savings by shifting some production stages to countries with lower production costs. In Chinese service chains, the trend of

[19] OECD estimates provided in its TiVA database for 2011 indicate e.g. following DVA shares in gross exports of computers and electronics: China 45 %, Germany 75.6 %, Japan 82.8 %, the U.S., Korea 57.8 %, Mexico 35.9 % and Poland 46.3 %.

declining foreign value added will probably continue with the advancement of the domestic service sectors.

The share of value added produced by business services has increased in all countries, but the increase has been much more pronounced in China. In other countries, the increase has mainly stemmed from foreign services inputs, whereas in China the main contribution has come from domestic services. This largely reflects the rebalancing of Chinese economy from investment and industry to consumption and services that has started in recent years. This development is likely to continue also in coming years, as the rebalancing process is slow and the share of services is still much lower in China compared to high-income countries.

When foreign value added is split in regional and global parts, China shares the common trend of increasing globalization with respect to regionalization with European and NAFTA countries, although in China it seems to have stalled in the latest years under examination. The relative globalization seems, however, to be already higher in China than in the other economies. In the other Asian economies, the trend seems to have been the opposite: the share of regional foreign value added in total foreign value added has increased. This contrary development largely reflects the increased role of China in their value chains. For China, the share of regional value added may increase in the coming years, as Chinese value chains may become more fragmented into the low cost neighboring countries.

The general characteristics of Chinese value chains are in some cases closer to those of the other large economies in the world, especially Japan and the U.S. and in other cases closer to emerging economies' chains. Development following the path of other large economies suggests that China will rely in its production mostly on domestic inputs, even if increasing fragmentation of some production stages abroad e.g. to reach cost savings. However, Chinese production still requires much improvement in qualitative terms if China plans to rely mostly on domestic supply also for inputs of sectors that are intensive in higher technology like the other largest economies.

8. References

Amador, J. & S. Cabral (2016). Networks of Value-Added Trade. The World Economy, October 2016.

Amador, J., R. Cappariello & R. Stehrer (2015). Global Value Chains: A View from the Euro Area. ECB Working Paper 1761, March 2015.

Backer, K. D. & S. Miroudot (2013). Mapping Global Value Chains. OECD Trade Policy Working Paper No. 159, OECD Publishing.

Baldwin, R. (2012). Global Supply Chains: Why They Emerged, Why They Matter and Where Are They Going. CEPR Discussion Paper 9103, August 2012.

Baldwin, R., R. Forslid and T. Ito (2015). Unveiling the Evolving Sources of Value Added in Exports. IDE-JETRO Joint Research Program Series No. 161, March 2015.

Baldwin, R. and J. Lopez-Gonzalez (2013). Supply-Chain Trade. A Portrait of Global Patterns and Several Testable Hypotheses. CEPR Discussion Paper No. 9421, April 2013.

Johnson, R. C. and G. Noguera (2012a). Proximity and Production Fragmentation. American Economic Review: Papers & Proceedings 2012, 102(3), pp. 407-411.

Johnson, R.C. and G. Noguera (2012b). Fragmentation and Trade in Value Added over Four Decades. NBER Working Paper 18186, June 2012.

Kee, H. L. and H. Tang (2016). Domestic Value Added in Exports: Theory and Firm Evidence from China. American Economic Review 2016, 106(6), pp. 1402-1436.

Koopman, R., Z. Wang and S. J. Wei (2012). How Much of Chinese Exports is Really Made in China? Assessing Foreign and Domestic Value Added in Gross Exports. Journal of Development Economics 99, pp. 178-189.

Kowalsky, P., J. Lopez-Gonzalez, A. Ragoussis and C. Ugarte (2015). Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies. OECD Trade Policy Papers No. 179.

Los, B., M. P. Timmer and G. J. de Vries (2015). How Global are Global Value Chains? A New Approach to Measure International Fragmentation. Journal of Regional Science, Vol. 55, No. 1, pp. 66-92.

OECD (2013). Interconnected Economies: Benefiting from Global Value Chains, OECD Publishing.

Park, A., G. Nayyar and P. Low (2013). Supply Chain Perspectives and Issues: A Literature Review. World Trade Organization and Fung Global Institute.

Simola, H. (2017). China's growing role in global production boosted by strong competitiveness – evidence from international input-output tables. BOFIT Policy Brief 2/2017.

Timmer, M. P., A. A. Erumban, B. Los, R. Stehrer and G. J. de Vries (2014). Slicing up Global Value Chains. Journal of Economic Perspectives, Vol. 28, No. 2, Spring 2014, pp. 99-118.

Timmer, M. P., B. Los, R. Stehrer and G.J. de Vries (2016). An Anatomy of the Global Trade Slowdown Based on the WIOD 2016 Release. Groningen Growth and Development Centre Research Memorandum 162, November 2016.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer and G.J. de Vries (2015). An Illustrated User Guide to the World Input-Output Database: the Case of Global Automotive Production. Review of International Economics, 23(3), pp. 575–605.

9. Appendix. Description of the data and classifications

Table 1. Economies covered in the WIOD database

Australia	Estonia	Japan	Romania
Austria	Finland	Korea	Russia
Belgium	France	Latvia	Slovakia
Brazil	Germany	Lithuania	Slovenia
Bulgaria	Great Britain	Luxembourg	Spain
Canada	Greece	Malta	Sweden
China	Hungary	Mexico	Switzerland
Croatia	India	Netherlands	Taiwan
Czech Republic	Indonesia	Norway	Turkey
Cyprus	Ireland	Poland	United States
Denmark	Italy	Portugal	Rest of the world

Table 2. Sectors covered in the WIOD database and classifications used in the analysis

A01 Crop and animal production, hunting and related service activities	Primary	H50 Land transport and transport via pipelines	Low-tech business serv.
A02 Forestry and logging	Primary	H51 Water transport	Low-tech business serv.
A03 Fishing and aquaculture	Primary	H52 Air transport	Low-tech business serv.
B Mining and quarrying	Primary	H53 Warehousing and support activities for transportation	Low-tech business serv.
C10–C12 Manufacture of food products, beverages and tobacco products	Low-tech manuf.	H54 Postal and courier activities	Low-tech business serv.
C13–C15 Manufacture of textiles, wearing apparel and leather products	Low-tech manuf.	I Accommodation and food service activities	Low-tech business serv.
C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Low-tech manuf.	J58 Publishing activities	High-tech business serv.
C17 Manufacture of paper and paper products	Low-tech manuf.	J59–J60 Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	High-tech business serv.
C18 Printing and reproduction of recorded media	Low-tech manuf.	J61 Telecommunications	High-tech business serv.
C19 Manufacture of coke and refined petroleum products	Primary	J62–J63 Computer programming, consultancy and related activities; information service activities	High-tech business serv.
C20 Manufacture of chemicals and chemical products	Medium high-tech manuf.	K64 Financial service activities, except insurance and pension funding	High-tech business serv.
C21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	High-tech manuf.	K65 Insurance, reinsurance and pension funding, except compulsory social security	High-tech business serv.
C22 Manufacture of rubber and plastic products	Medium low-tech manuf.	K66 Activities auxiliary to financial services and insurance activities	High-tech business serv.
C23 Manufacture of other non-metallic mineral products	Medium low-tech manuf.	L68 Real estate activities	High-tech business serv.
C24 Manufacture of basic metals	Medium low-tech manuf.	M69–M70 Legal and accounting activities; activities of head offices; management consultancy activities	High-tech business serv.
C25 Manufacture of fabricated metal products, except machinery and equipment	Medium low-tech manuf.	M71 Architectural and engineering activities; technical testing and analysis	High-tech business serv.
C26 Manufacture of computer, electronic and optical products	Medium high-tech manuf.	M72 Scientific research and development	High-tech business serv.
C27 Manufacture of electrical equipment	Medium high-tech manuf.	M73 Advertising and market research	High-tech business serv.
C28 Manufacture of machinery and equipment n.e.c.	Medium high-tech manuf.	M74–M75 Other professional, scientific and technical activities; veterinary activities	High-tech business serv.
C29 Manufacture of motor vehicles, trailers and semi-trailers	Medium high-tech manuf.	N Administrative and support service activities	Other

C30 Manufacture of other transport equipment	Medium high-tech manuf.	O84 Public administration and defence; compulsory social security	Other
C31–C32 Manufacture of furniture; other manufacturing	Low-tech manuf.	P85 Education	Other
C33 Repair and installation of machinery and equipment	Other	Q Human health and social work activities	Other
D35 Electricity, gas, steam and air conditioning supply	Other	R–S Other service activities	Other
E36 Water collection, treatment and supply	Other	T Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	Other
E37–E39 Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	Other	U Activities of extraterritorial organizations and bodies	Other
F Construction	Other		
G45 Wholesale and retail trade and repair of motor vehicles and motorcycles	Low-tech business serv.		
G46 Wholesale trade, except of motor vehicles and motorcycles	Low-tech business serv.		
G47 Retail trade, except of motor vehicles and motorcycles	Low-tech business serv.		

BOFIT Policy Brief

https://www.bofit.fi/fi/julkaisut/policy-brief/

2013

No 1 K.C. Fung, Hsiang-Chih Hwang, Francis Ng and Jesús Seade: International trade and production networks: Comparisons of China and greater China versus India and South Asia
No 2 Heli Simola, Laura Solanko and Vesa Korhonen: Näkökulmia Venäjän energiasektoriin
No 3 Heli Simola, Laura Solanko and Vesa Korhonen: Perspectives on Russia's energy sector
No 4 Hubert Fromlet: The Chinese Government Debt – What Do We Know and What Should Be Done?
No 5 Laura Solanko and Lauri Vilmi: Globaalit energiamarkkinat murroksessa
No 6 Laura Solanko and Lauri Vilmi: The transformation of global energy markets
No 7 Andrei Yakovlev: Is there a 'new deal' in state-business relations in Russia?
No 8 Ilkka Korhonen, Vesa Korhonen, Seija Lainela and Laura Solanko: Venäjän kasvu vaatii muutakin kuin energiaa. BOFIT Venäjä-tietoisku 2013
No 9 Sergey Vlasov: Analysis of Russia's fiscal sustainability under the new fiscal rules
No 10 Heli Simola: Turkin talous – saadaanko kasvu kestävälle pohjalle?
No 11 Juuso Kaaresvirta, Iikka Korhonen, Jouko Rautava, Heli Simola and Laura Solanko: Kiina ja uudistusten aika. BOFIT Kiina-tietoisku 2013

2014

No 1 Jouko Rautava: Crimean crisis will cost Russia too
No 2 Jouko Rautava: Krimin kriisi on jo nyt tullut kalliiksi Venäjälle
No 3 Heli Simola: Tracing trade interdependency between EU and East Asia
No 4 Heli Simola and Laura Solanko: Kaasu jälleen kiistakapulana Venäjän ja Ukrainan välillä
No 5 Heli Simola and Laura Solanko: Gas once again a bone of contention between Russia and Ukraine
No 6 Ilya Voskoboynikov and Laura Solanko: When high growth is not enough: Rethinking Russia's pre-crisis economic performance
No 7 Iikka Korhonen, Vesa Korhonen, Seija Lainela, Heli Simola and Laura Solanko: BOFIT Venäjä-tietoisku 2014
No 8 Zuzana Fungáčová and Laurent Weill: A view on financial inclusion in Asian countries
No 9 Heli Simola: Russia's restrictions on food imports
No 10 Zuzana Fungáčová and Iikka Korhonen: Ukrainian banking sector in turmoil
No 11 Yin-Wong Cheung: The role of offshore financial centers in the process of renminbi internationalization
No 12 Lev Freinkman and Andrey Yakovlev: Institutional frameworks to support regulatory reform in middle-income economies: Lessons from Russia's recent experience
No 13 Yao Lei: Policy discussion of internet finance in China
No 14 Riikka Nuutilainen: Shanghain ja Hongkongin pörssiyhteistyökokeilu avasi Kiinan osakemarkkinat ulkomaisille yksityissijoittajille
No 15 Hubert Fromlet: Deregulation of financial markets and the risk of financial crises: Lessons from Sweden for China and other emerging economies
No 16 Annikki Arponen, Iikka Korhonen, Riikka Nuutilainen, Jouko Rautava and Heli Simola: BOFIT Kiina-tietoisku 2014

2015

No 1 Alexey Kudrin and Evsey Gurvich: A new growth model for the Russian economy
No 2 Heli Simola: Venäjän valuuttavaranto ja rahastot
No 3 Stephan Barisitz and Zuzana Fungáčová: Ukraine: Struggling banking sector and substantial political and economic uncertainty
No 4 Heli Simola: Russia's international reserves and oil funds
No 5 K.C. Fung, Alicia Garcia-Herrero and Jesus Seade: Beyond minerals: China-Latin American Trans-Pacific supply chain
No 6 Anni Norring: Suomen ja Venäjän välisten suorien sijoitusten tilastot
No 7 Vesa Korhonen, Zuzana Fungáčová, Laura Solanko, Iikka Korhonen ja Heli Simola: BOFIT Venäjä-tietoisku 2015
No 8 Yang Yao: When are fixed exchange rates an appropriate policy tool for growth?
No 9 Heli Simola: Rebalancing of demand in China – illustrating possible effects with an input-output analysis
No 10 Iikka Korhonen: How fast can Russia grow?
No 11 Jouko Rautava, Riikka Nuutilainen, Anni Norring, Iikka Korhonen ja Jyrki Kallio: BOFIT Kiina-tietoisku 2015

2016

No 1 Riku Niemi: The Eurasian Union – much potential, little results
No 2 Andrei Yakovlev: What is Russia trying to defend?
No 3 Andrei Yakovlev, Lev Freinkman and Anton Zolotov: Domestic and external factors in the development of Russia's economic think tanks sector
No 4 Mikko Mäkinen: Nowcasting of Russian GDP growth
No 5 Iikka Korhonen, Tuomas Forsberg, Vesa Korhonen ja Heli Simola: BOFIT Venäjä-tietoisku 2016
No 6 Heli Simola: Economic relations between Russia and China – Increasing inter-dependency?
No 7 Ivan Lyubimov: Are educational reforms necessarily growth-enhancing? Weak institutions as the cause of policy failure
No 8 Laura Solanko: Opening up or closing the door for foreign trade – Russia and China compared
No 9 Heli Simola ja Vesa Korhonen: Arktisen alueen taloudellinen merkitys Venäjälle
No 10 Masaaki Kuboniwa: Estimating GDP and foreign rents of the oil and gas sector in the USSR then and Russia now
No 11 Masaaki Kuboniwa: Considerations on new Rosstat data on the contribution of Russia's military goods sector to GDP growth in recent years

2017

No 1 Jouko Rautava: Kiinassa talouspolitiikka ei pysy maan muutosten vauhdissa
No 2 Heli Simola: China's growing role in global production boosted by strong competitiveness – evidence from international input-output tables
No 3 Heli Simola ja Laura Solanko: Katsaus Venäjän öljy- ja kaasusektoriin
No 4 Heli Simola: Chinese production chains rely increasingly on domestic services

http://www.bofit.fi • email: bofit@bof.fi
ISSN 2342-205X