

Trade Linkages Between the Belt and Road Economies

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Abstract

This paper studies the production and trade linkages between a selected group of economies belonging to the Belt and Road Initiative (BRI). After defining a group of Belt and Road Economies, the paper uses three standard trade databases to analyze trade and production linkages among these economies. With the help of state of the art economic decompositions of input-output tables, coupled with standard international trade statistics, the

analysis quantifies the amount of production sharing between the economies of the area. The main finding is that trade integration among Belt and Road Economies has largely increased: Intraregional exports went from 30.6 percent in 1995 to 43.3 percent in 2015. Since the increase in gross exports was driven mostly by intermediate goods, the study investigates the evolution of regional production networks across Belt and Road Economies.

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Trade Linkages Between the Belt and Road Economies^{*}

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Contents	
1. Background	3
2. Trade Linkages between B&R Economies: Gross Trade.....	5
2.1 Gross Trade Linkages between B&R Economies Revealed by UN Comtrade Data	5
2.2 Gross Trade Linkages between B&R Economies Revealed by TiVA Data	10
3. Origin of Value-Added in Exports of B&R Economies.....	13
3.1. Concept and Methodology	13
3.2. Origins and Destinations of Foreign Value-Added in Exports of B&R Economies.....	15
4. Quantifying Vertical Trade among the B&R Economies.....	18
4.1 Concept and Methodology	18
4.2 Backward Linkages.....	20
4.3 Forward Linkages	23
5. Visualization of Value-Added Network of B&R Economies	27
6. Trade Linkages between China and other B&R Economies	31
6.1. Gross Trade between China and other B&R Economies	31
6.2. China's Position in GVCs	33
7. Potential Benefits from Further Integration	36
8. Conclusion.....	37
References	39
Appendix	41
A1: Comparison between EORA and Tiva GVC Indicators	41
A2: Network Analysis of Origin and Destination of Value-added using EORA.....	45
A3: Indicators of Vertical Trade using EORA.....	48
A4: B&R Economies in the Paper	53

1. Background

The Belt and Road Initiative (BRI), first proposed by President Xi Jinping of China in 2013, is an ambitious effort to improve regional cooperation and connectivity on a trans-continental scale. The initiative aims to strengthen infrastructure, trade, and investment links among countries along the Belt and Road. The “Belt” (Silk Road Economic Belt) links China to Central and South Asia and onward to Europe, while the “Road” (New Maritime Silk Road) links China to the nations of South East Asia, the Gulf Countries, North Africa, and on to Europe. Six economic corridors have been identified: The China-Mongolia-Russia Economic Corridor; the New Eurasian Land Bridge; the China–Central Asia–West Asia Economic Corridor; the China–Indochina Peninsula Economic Corridor; the China-Pakistan Economic Corridor; and the Bangladesh-China-India-Myanmar Economic Corridor.

The overarching objective of the BRI as stated by the Government of China (GOC)¹ is “win-win cooperation that promotes shared development and prosperity”. It is a comprehensive package of five priorities, including but not limited to infrastructure connectivity. The other four are: coordination of development strategies and policies; trade facilitation to ensure “unimpeded trade”, financial integration, and people-to-people exchange.

Given the stated intention to promote trade flows among economies involved in the BRI, it is important to understand the existing trade linkages between economies along the Belt and Road (the “B&R Economies” from now on). The objective of this paper is to describe the existing trade linkages between B&R Economies in terms of gross trade as well as trade in value-added, which is a reflection of international shared production linkages. The intention is to lay a foundation for further study on potential impact of the BRI on trade and growth, as well as policies and institutions needed to maximize the benefit of BRI.

Since the BRI is presented as an open arrangement in which all countries are welcome to participate, there is not an official list of “BRI countries”. Different versions of unofficial lists of countries along the Belt and the Road exist, none of which received confirmation from the GOC. While some other longer lists include countries such as New Zealand and South Africa², in this paper, we use one that has 66 countries and 68 economies as found in Table 1 of Appendix A1, where China; Taiwan, China; Hong Kong SAR, China are treated as three economies in order to be aligned with trade data. However, data are not available for every B&R Economy. The analysis in the paper revolves around two databases: the UN Comtrade and the OECD-WTO Trade in Value-Added (TiVA). The UN Comtrade database covers 60 of the 68 B&R Economies, while only 28 B&R Economies appear in the TiVA database (see Table 1 of Appendix A1 for details).

The first step of the analysis focuses on gross trade flows of intermediate and final goods. With the help of the UN Comtrade database we quantify the weight of the 60 B&R Economies in global trade. The trade data show that B&R Economies account in 2015 for 37 % of world trade. In addition, we notice that they are key players in the manufacturing of intermediate goods. However, there are strong regional discrepancies. Using the World Bank regional classification, we find that Europe and Central Asia (ECA) and East-Asia and Pacific (EAP) accounted, in 2015, for about 80 % of total exports from B&R economies. Thus, part of the spectacular growth in exports is driven by dynamic economies present in these two regions. Nonetheless, intra-regional trade has been on the rise and mostly because of high demand and supply of EAP economies for intermediate goods. The most important sector for B&R exports is the computer and electronics one.

We notice that there are strong sectoral disparities in the composition of B&R exports. The importance of the computer and electronics sector derives from the weight of EAP economies. Mining and quarrying

¹ Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road. 2015/03/28.

² For example, the list put together by Hong Kong Trade Development Council includes New Zealand and South Africa. See <http://china-trade-research.hktdc.com/business-news/article/The-Belt-and-Road-Initiative/The-Belt-and-Road-Initiative-Country-Profiles/obor/en/1/1X000000/1X0A3610.htm>.

is important for both ECA and Middle-East North-Africa (MENA), while South Asia (SAR) excels in transport and storage services.

To move over gross trade figures, the second step consists in presenting the trade in value-added data to study production linkages. Value chains are the process of adding value to a product from its conception to its final consumption passing through design, production, transport, distribution and retail.³ Nowadays, the life cycle of a product is no longer confined to a single firm. Firms specialize in business functions and take on different tasks that allow to serve the final consumer. Through the process of value addition, all factors that contributed to production, foreign and domestic, get remunerated.

In recent years, because of the decrease in transport and communication costs, value-chains have unbundled, and they are no longer tied to one specific geographical location. Firms use and supply both foreign and domestic contractors for a variety of business functions. In doing so, the firm at the top of the chain eventually exports a final good or service and is double counting all intermediate steps in the gross exports figures. National statistics do not cover these flows at the firm level, which poses a challenge for measuring Global Value Chains (GVCs).

Input-output tables allow for an accounting of sources of value-added by effectively slicing the value-chain. The sources involve revenues to labor, capital but also upstream sectors. In addition, they allow for a regional separation of value-added by geographical origin of imports. While input-output tables do not record specifically firms' transactions, they measure intra- and inter-industry flows between countries. By slicing the value chain, input-output tables allow us to determine the amount of double counting derived from goods crossing the border several times.

In this study, we use the multi-regional input-output tables from the TiVA database to identify the existing value-added networks in the B&R Economies. The database records exports of intermediate and final goods across industries and countries through downstream and upstream industry channels. Therefore, it allows to track how countries contribute within GVCs into the production of final goods by specializing in segments where they exploit their comparative advantage. The TiVA database covers 62 economies, of which a group of 28 are members of the "B&R Economies" as defined above.⁴

Economies that integrate into GVCs, and regardless of their position, are either sellers or buyers of value-added. On the one hand, they supply intermediate goods to foreign industries. On the other hand, they import foreign goods for their own production purposes. Therefore, Koopman et al. (2014) and Wang et al. (2013) propose to look at the phenomenon of vertical integration from both the importing and the exporting side. We use their battery of indicators in the context of B&R Economies.

We determine the origin of value-added in exports in the B&R Economies using the Leontief decomposition. The Leontief decomposition of input-output tables that tracks the value-added by source country and industry. The Leontief insight lies in determining how much an economy has sourced from its partners. We exploit it to showcase the share of value-added that B&R Economies source from different country groups. We analyze the extent to which trade among B&R Economies is GVC driven, pointing out which countries are the most important. We find that China and the Russian Federation are the key partners for these economies.

As a third step, we look at how the value-added is used and the amount of vertical specialization embedded in exports. We use the decomposition developed by Wang et al. (2014) which traces value-added by final use. The decomposition complements the Leontief insight by showing which exports are going to serve final consumption and count the amount of value-added that is going to eventually return home. The decomposition allows for identifying the extent of vertical specialization embedded in trade flows, which in turn reveals if GVC trade is prevalent among these economies. Once again, the heterogeneity of the B&R Economies manifests itself. ECA and EPA have high shares of vertical trade while MENA and SAR are only mildly integrated.

³ Notice the crucial difference between Value Chains which are a succession of business functions (marketing, R&D, distribution, conception and production) and supply chains which are a succession of sales and acquisition of raw materials in view of manufacturing.

⁴ In addition, we provide for the sake of robustness an analysis of the EORA database in the Appendix (A1, A2 and A3) which has higher country coverage, with 171 economies, 63 of which B&R, at the expense of some quality issues.

2. Trade Linkages between B&R Economies: Gross Trade

To help visualize the strength of the production sharing network, we provide a complete overview of sourcing patterns using network analysis tools. From the analysis, it turns out that China, and to a lesser degree Russia, are the main economic centers of the B&R network. Given the importance of China, we proceed to quantify its sourcing patterns as well as the extent of vertical trade.

We conclude the study by calculating the expected impact of GVC trade flows of a reduction of costs in the B&R. Because of the cascading effect of trade costs, which increase with each time crossing a border, GVC trade is more elastic to these changes. We estimate a regression model where GVC trade depends on these costs.

The rest of the paper is structured as follows. Section 2 presents stylized facts on the B&R Economies based on gross exports. Sections 3 and 4 introduce the economic methodology to decompose gross exports into several value-added components. Section 5 uses network analysis tools to visualize the strongest production linkages between the B&R Economies. Section 6 discusses the integration of China in GVCS. Section 7 discusses the implications of further integration within B&R and section 8 concludes.

2. Trade Linkages between B&R Economies: Gross Trade

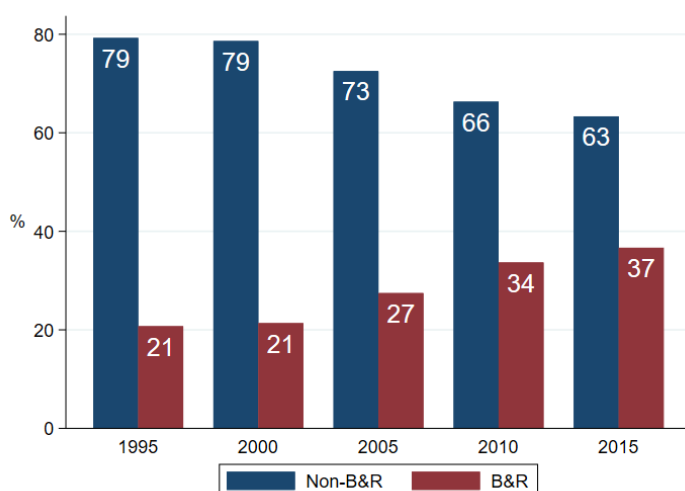
2.1 Gross Trade Linkages between B&R Economies Revealed by UN Comtrade Data

The section presents stylized facts based on the evolution of trade patterns of B&R Economies using the UN Comtrade database, which covers bilateral trade of 182 economies in total. The database only contains product level information, so it can inform us only on gross trade flows of intermediate and final goods. The UN Comtrade database has the greatest country coverage of all the databases at disposal for scrutiny. For 182 countries, it covers all bilateral gross trade figures. These are exports and imports of final and intermediate goods that are recorded by customs agencies.

The first stylized fact is that the share of B&R Economies in world trade has been increasing through time. In Figure 1, we observe that in 2015 the share of the 60 B&R Economies in world exports (i.e., exports of the 182 economies covered in the database) is 37 %, and their importance in world exports has been growing since 1995 when their share was 21 %. Figure 2 further suggests that this has been mainly driven by exports of intermediate goods, of which the share of B&R Economies grew faster than that of final goods, reflecting an increase in GVC participation. B&R Economies also have a relatively larger share of intermediate goods exports, accounting for 42 % of total intermediate exports (Figure 2, panel A), compared with 24 % for the share of final goods (Figure 2, panel B).

2. Trade Linkages between B&R Economies: Gross Trade

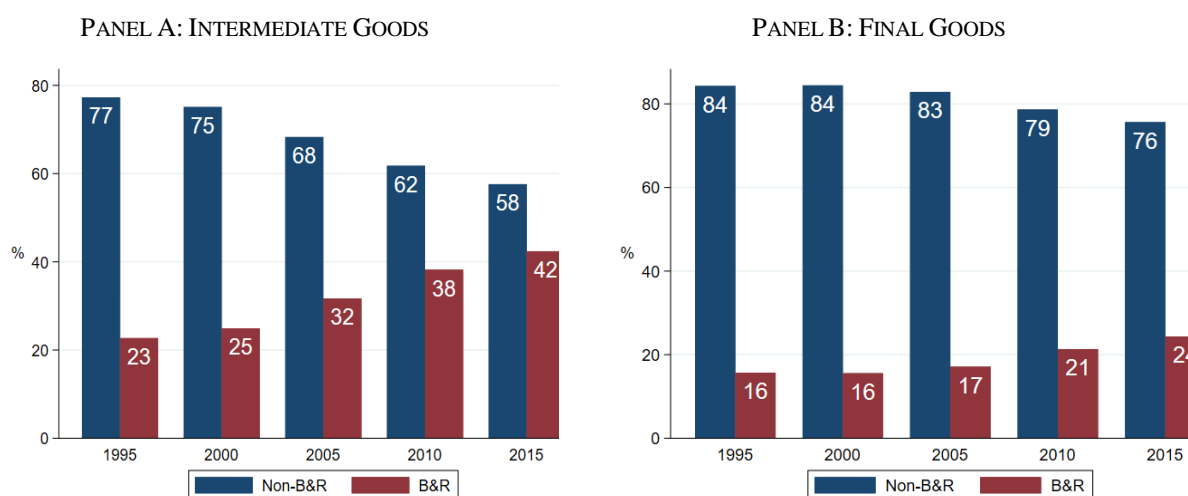
FIGURE 1: SHARE OF B&R ECONOMIES IN WORLD EXPORTS, 1995-2015



Source: Author's calculations based on COMTRADE.

Note: The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The shares are with respect to total world exports of both final and intermediate goods.

FIGURE 2: SHARE OF B&R ECONOMIES IN INTERMEDIATE AND FINAL GOODS EXPORTS, 1995-2015



Source: Author's calculations based on COMTRADE.

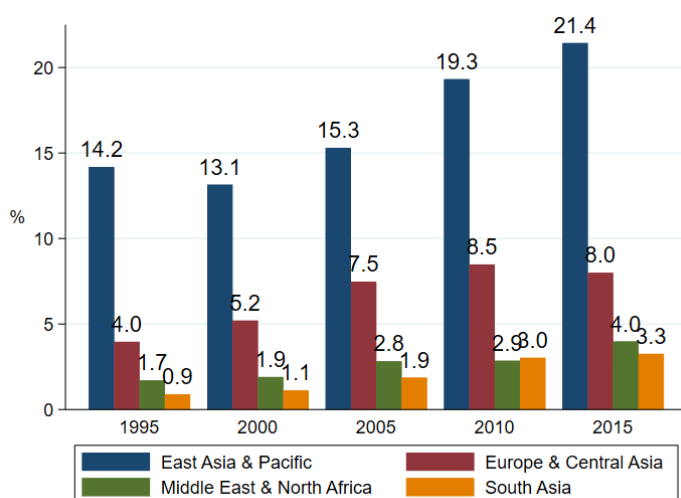
Note: The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The shares are with respect to total world exports in 2015 of both final and intermediate goods. The distinction between final and intermediate goods was carried out according to the BEC classification.

The growth is mainly driven by the rise of China, East Asia and Pacific (EAP) economies, and Europe and Central Asia (ECA). Both Middle East and North Africa (MENA) and South Asia (SAR) contribute little to this expansion. To better capture the heterogeneity of B&R Economies we split the trade shares according to the World Bank classification of regions (see Table 1 in Appendix 1 for details). In

Figure 3, it is shown that the lion's share of exports is undertaken by EAP together with ECA. The share of B&R Economies in the EAP region of world trade went from 14.2% in 1995 to 21.4 % in 2015. ECA also doubled its share from 4% to 8% of world exports in the same time span. In contrast, both MENA and SAR represent a lower weight in B&R trade flows although they have also grown.

2. Trade Linkages between B&R Economies: Gross Trade

FIGURE 3: SHARE OF B&R ECONOMIES IN WORLD EXPORTS, BY WORLD BANK REGIONS, 1995-2015

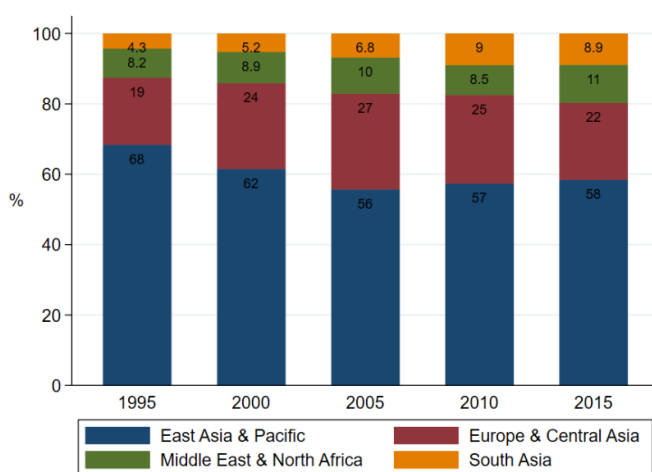


Source: Author's calculations based on Comtrade.

Note: The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The shares are with respect to total world exports of both final and intermediate goods. Regional groups based on the World Bank regional classification.

In particular, B&R Economies in EAP and ECA together account for 80 % of exports of the 60 B&R Economies (Figure 4). When splitting the export shares in intermediate and final goods, we realize that B&R Economies in EAP are exporting more intermediate goods, while those in ECA have a larger share of exports of final goods (Figure 5). Not surprisingly, the most important exporting region is EAP, which accounts for 58% of the total exports of B&R Economies in 2015. And the shares have been relatively stable throughout the last 20 years indicating that most B&R countries have been performing well. B&R Economies appear to have become involved in the trade of intermediate goods.

FIGURE 4: SHARE IN GROSS EXPORTS OF B&R ECONOMIES, BY WORLD BANK REGION, 1995-2015

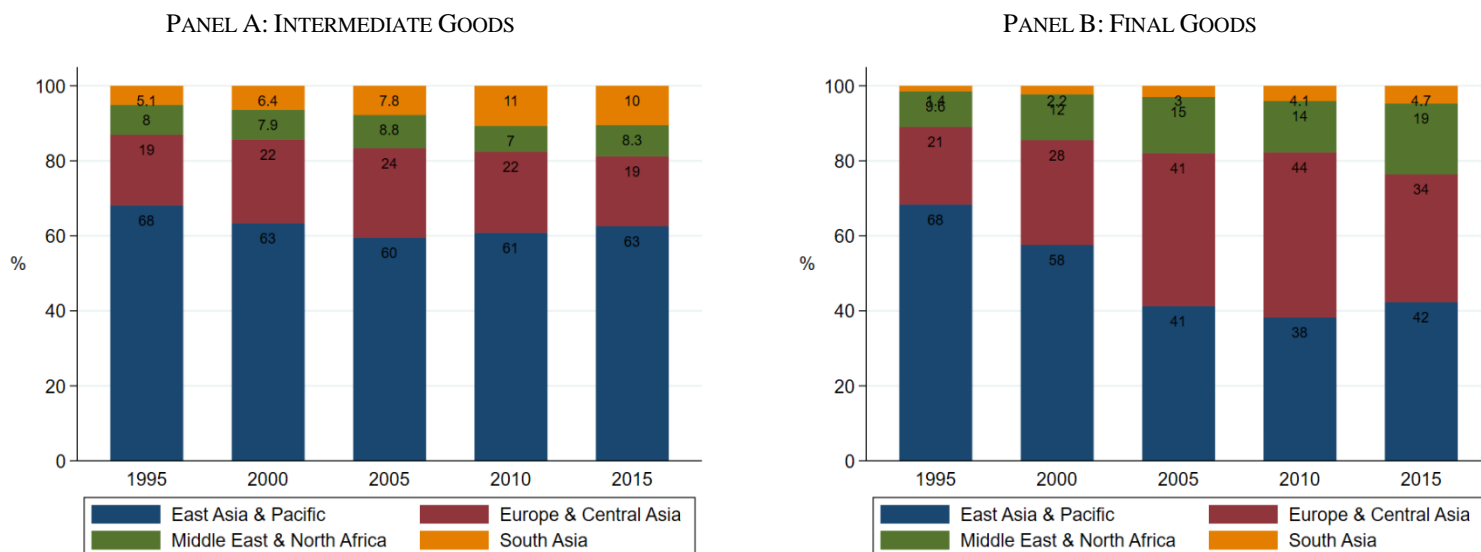


Source Author's calculations using UN Comtrade.

Note: The y-axis is the share of each regional group of the B&R Economies in total gross exports of B&R Economies. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. Regions are defined according with the World Bank regional classification.

2. Trade Linkages between B&R Economies: Gross Trade

FIGURE 5: SHARE IN GROSS EXPORTS OF B&R ECONOMIES, BY WORLD BANK REGION AND INTERMEDIATE AND FINAL GOODS, 1995-2015

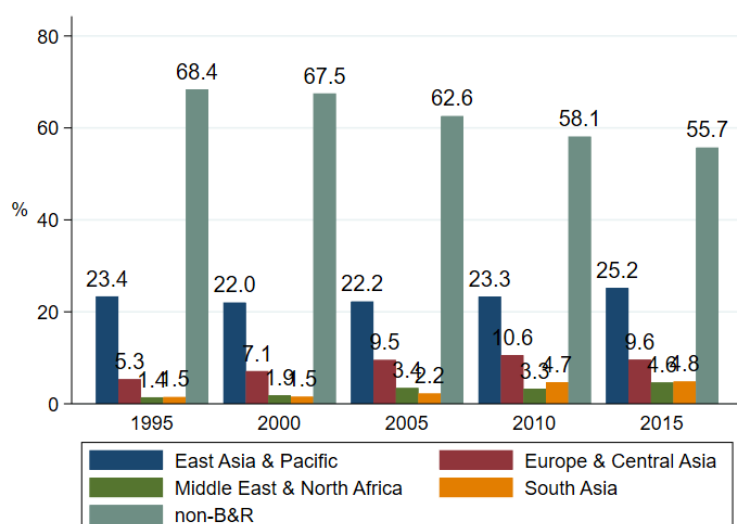


Source: Author's calculations using UN Comtrade.

Note: The y-axis is the share of each regional group of the B&R Economies in intermediate (Panel A) or final (Panel B) gross exports of B&R Economies. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. Regions are defined according with the World Bank regional classification. The distinction between final and intermediate goods was carried out according to the BEC classification.

In terms of intra- and inter-regional trade, the main destinations of gross exports of B&R Economies are countries outside the Belt and Road (Figure 6). However, the share of intra-B&R (i.e., between B&R Economies) exports in total B&R exports has grown from 31.6 % in 1995 to 44.3 % in 2015. The increase in intra-B&R trade comes from more trade flows of ECA and EAP B&R Economies.

FIGURE 6: DESTINATION OF EXPORTS OF B&R ECONOMIES, BY WORLD BANK REGIONS, 1995-2015



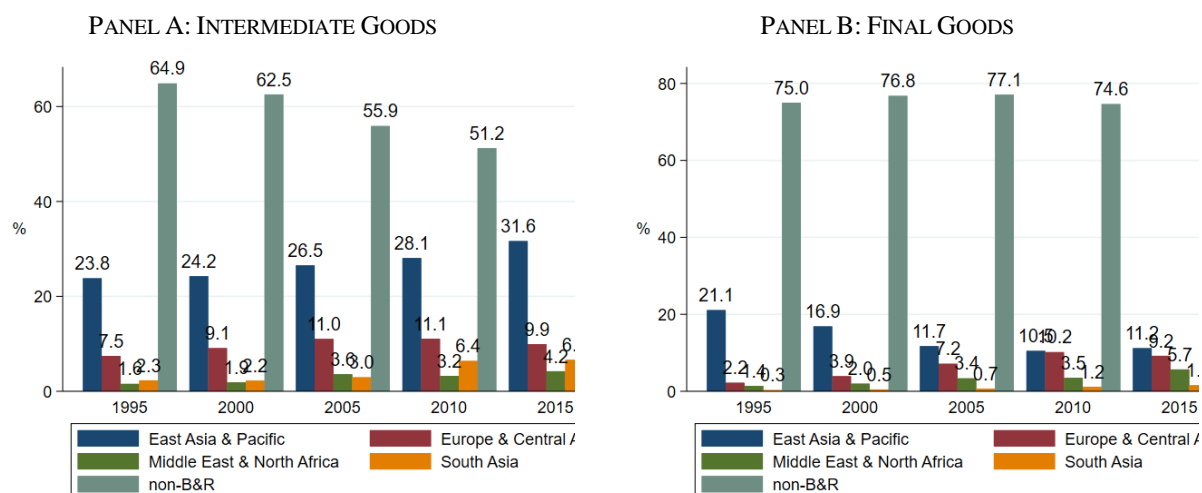
Source: Author's calculations using UN Comtrade.

Note: The variable on the y-axis is the share of total gross exports of B&R Economies that goes to a particular regional group of B&R Economies or non-B&R economies. Regions are defined according with the World Bank regional classification. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4.

2. Trade Linkages between B&R Economies: Gross Trade

Trade flows in parts and components are increasing among B&R Economies, again driven by the EAP group (Figure 7). Trade in intermediate goods is a clear indicator of increasing international shared production.

FIGURE 7: DESTINATION OF EXPORTS B&R ECONOMIES, BY WORLD BANK REGIONS AND INTERMEDIATE AND FINAL GOODS, 1995-2015

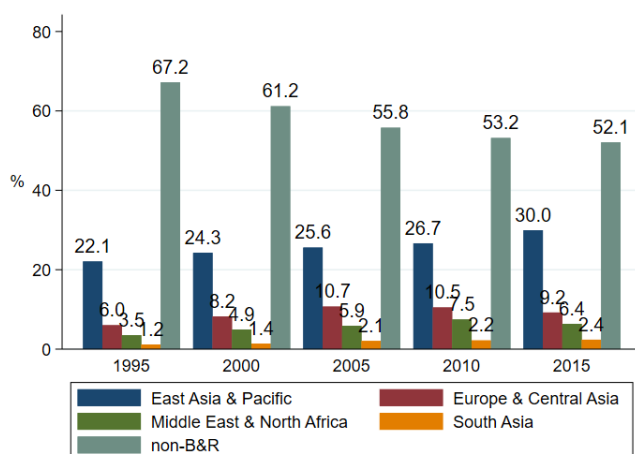


Source: Author's calculations using UN Comtrade.

Note: The variable on the y-axis is the share of total gross exports of intermediate (Panel A) or final goods (Panel B) of B&R Economies that goes to a particular regional group of B&R Economies or non-B&R economies. Regions are defined according with the World Bank regional classification. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The distinction between final and intermediate goods was carried out according to the BEC classification.

On the importing side, we have a similar pattern. B&R Economies import more and more from each other and even so for intermediate goods. In Figure 8 we observe a sharp decrease in the share of imports from non-B&R Economies during the years together with an increase of imports from both ECA and EAP. Figure 9, Panel A, shows that this comes essentially from an increased use of EAP intermediate inputs.

FIGURE 8: ORIGIN OF IMPORTS OF B&R ECONOMIES, BY WORLD BANK REGIONS, 1995-2015

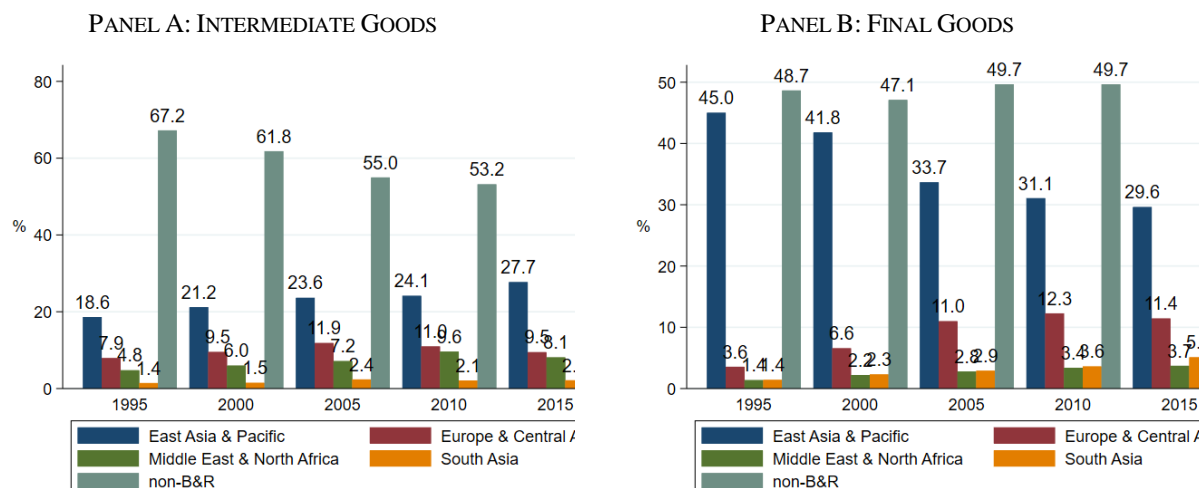


Source: Author's calculations using UN Comtrade.

2. Trade Linkages between B&R Economies: Gross Trade

Note: The variable on the y-axis is the share of total gross imports of B&R Economies that comes from a particular regional group of B&R Economies or non-B&R economies. Regions are defined according with the World Bank regional classification. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4.

FIGURE 9: ORIGIN OF IMPORTS OF B&R ECONOMIES, BY WORLD BANK REGIONS AND INTERMEDIATE AND FINAL GOODS, 1995-2015



Source: Author's calculations using UN Comtrade.

Note: The variable on the y-axis is the share of total gross imports of intermediate (Panel A) or final goods (Panel B) of B&R Economies that comes from a particular regional group of B&R Economies or non-B&R economies. Regions are defined according with the World Bank regional classification. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The distinction between final and intermediate goods was carried out according to the BEC classification.

2.2 Gross Trade Linkages between B&R Economies Revealed by TiVA Data

To further study the trade linkages between the B&R Economies, we use the input-output tables data of the TiVA database from the OECD. The tables contain information on the origin of value-added for 34 sectors in 62 economies from 1995 to 2010. Table 1 of Appendix A4 shows all the economies in our sample. Since not all countries are covered in the database, TiVA provides a “Rest of the World (ROW)” aggregate that acts as a balancing term. Overall, the tables consider all the aggregate accounting relationships of an economy. The contributions of value-added reported by the database are accurate for those economies whose input-output tables are known to the OECD. The sample is therefore representative for all countries included, regardless of the omitted countries. While the tables do not include data beyond 2011, they remain the most relevant source of production linkages data available to date, and as the previous section has shown, the changes in gross trade figures between 2010 and 2015 have not been drastic.

Among the 62 economies covered by the database, 28 are B&R Economies (see Table 1 of Appendix A1), and some of the missing B&R Economies are part of this ROW aggregate. However, a comparison with the Comtrade database using TiVA's data on both final and intermediate goods shows that the magnitude of impact of the missing B&R Economies is limited. As shown in Figure 10, the share of 28 B&R Economies in world exports using TiVA data is 31% in 2010, while the corresponding number of the 60 B&R Economies in the Comtrade database is 34%. In other words, the missing linkages should not account for more than 3% of world trade. For non-B&R Economies TiVA data record a 61 % share of world exports compared with 66% using Comtrade data. The statistics point out that the ROW aggregate in TiVA is essentially evenly distributed between B&R and non-B&R Economies, and its magnitude is small. This is likely because the missing economies that are captured in the ROW aggregate are relatively small. Figure 10, the share of 28 B&R Economies in world exports using TiVA data is 31% in 2010, while the

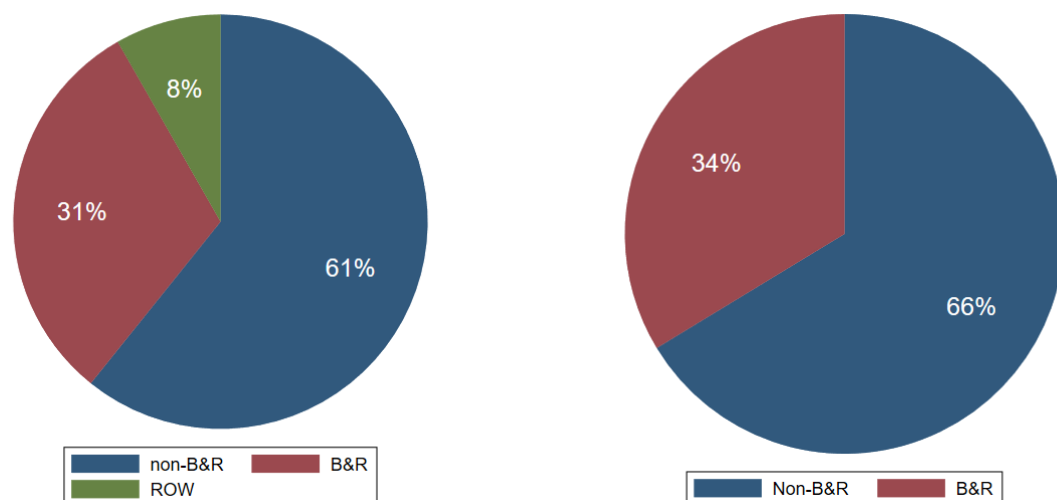
2. Trade Linkages between B&R Economies: Gross Trade

corresponding number of the 60 B&R Economies in the Comtrade database is 34%. In other words, the missing linkages should not account for more than 3% of world trade. For non-B&R Economies TiVA data record a 61 % share of world exports compared with 66% using Comtrade data. The statistics point out that the ROW aggregate in TiVA is essentially evenly distributed between B&R and non-B&R Economies, and its magnitude is small. This is likely because the missing economies that are captured in ROW aggregate are relatively small.

FIGURE 10: SHARE OF B&R ECONOMIES IN WORLD EXPORTS, 2010, COMPARISON BETWEEN TiVA AND COMTRADE

PANEL A: TiVA, SHARE OF WORLD EXPORTS, 2010

PANEL B: COMTRADE, SHARE OF WORLD EXPORTS, 2010



Source: UN Comtrade and WTO-OECD TiVA.

Note: Share of total gross exports of all B&R Economies in the sample as a percentage of total world exports. The subset of B&R Economies included in the figure is given in Table 1 in the Appendix A4. The shares are with respect to total world exports in 2010 of both final and intermediate goods.

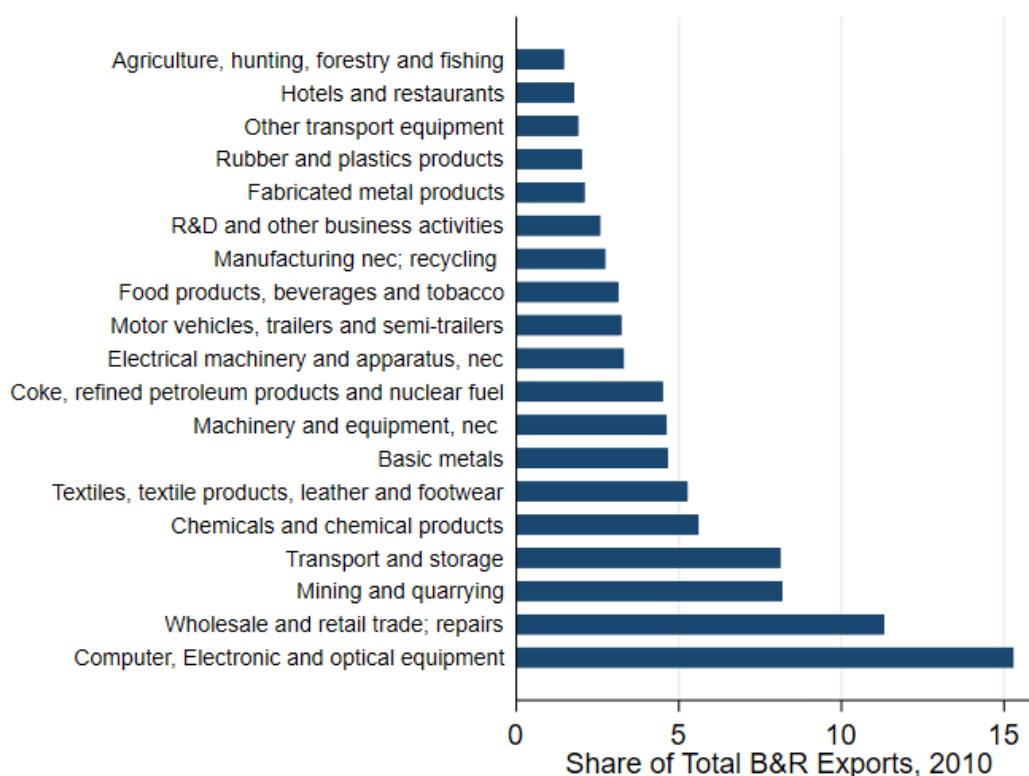
An advantage of TiVA over Comtrade is that input-output tables record the value of business functions involved in the production of goods, making it well fit for study on production linkages. Production linkages are the tasks or activities necessary to produce a final good. In the context of input-output tables, trade flows between countries and industries are recorded by sector. Of course, sectors usually perform more than one task, but we can at least allocate within sector remuneration of workers and the necessary intra-sectoral inputs to produce the final good. All intermediate products are eventually allocated across countries and industries to serve the global demand of consumers for final goods.⁵

The Computer, Electronics and Optical Equipment industry is the most important sector for the B&R Economies (Figure 11), accounting for about 15 % of total exports and 20 % of intermediate goods exports (Figure 12) of B&R Economies. The proportion is lower for that sector in final goods exports but it remains nonetheless the most important exporting sector for the B&R Economies.

⁵ In the input-output framework, supply is assumed to adjust to exogeneous shocks in aggregate demand. Therefore, the model is mostly suited to analyze the impact of changes in global demand on intra and inter-industry trade.

2. Trade Linkages between B&R Economies: Gross Trade

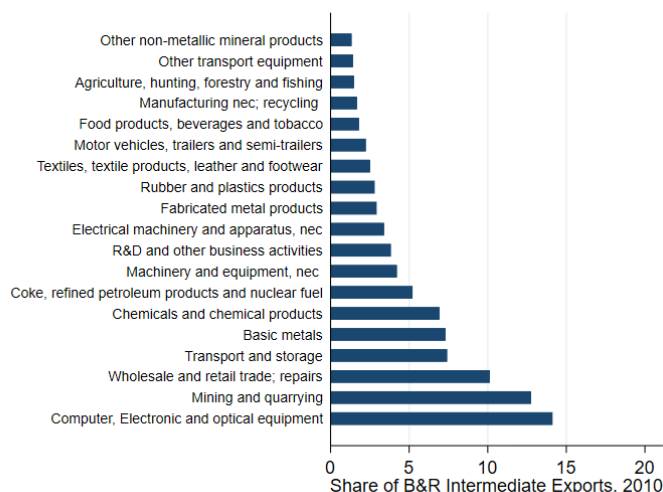
FIGURE 11: SHARE OF SECTORS IN GROSS EXPORT OF B&R ECONOMIES, 2010



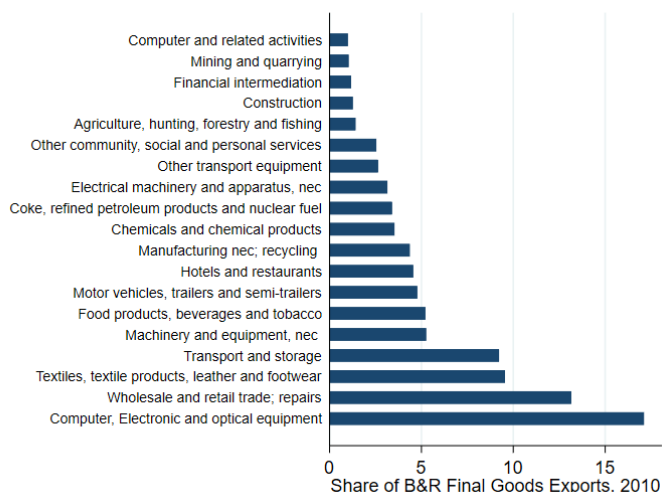
Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the TiVA database and the Kummritz and Quast (2017) algorithm. We include the shares of the most important 19 sectors in terms of gross exports.

FIGURE 12: SHARE OF SECTORS IN INTERMEDIATE AND FINAL GOODS EXPORTS, 2010

PANEL A: INTERMEDIATE EXPORTS, B&R,2010



PANEL B: FINAL EXPORTS, B&R,2010



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the TiVA database and the Kummritz and Quast (2017) algorithm. We include the shares of the most important 19 sectors in terms of the respective export shares.

3. Origin of Value-Added in Exports of B&R Economies

A focus on intra-B&R trade reveals varying degree of importance of sectors from region to region (Figure 13). In particular, the dominance of Computer, Electronics and Optical Equipment is only an EAP phenomenon.

FIGURE 13: SHARE OF EXPORTS OF B&R SUB-REGIONS TO B&R ECONOMIES, TOP 5 SECTORS



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the TiVA database and the Kummritz and Quast (2017) algorithm. The x-axis represents the share of a sector's exports to B&R Economies.

3. Origin of Value-Added in Exports of B&R Economies

3.1. Concept and Methodology

Since gross trade data do not allow a full understanding of the importance of production linkages, this section turns to trade in value-added. We focus on the origin and destination of exports of value-added, effectively identifying the shares of foreign tasks needed to produce exports.

To assess the amount of value-added that B&R Economies source from each other, we separate the sample in three groups: B&R, Non-B&R and the Rest of the World (ROW). Once again, please notice that there are some countries in the ROW aggregate that are part of the B&R initiative but for whom it is not possible to separate the effect because of data issues. Although of high quality, the TiVA database only

covers 62 economies. Therefore, to support the conclusions in the paper, we turn to another database that has higher country coverage but exhibits some accuracy issues. For the sake of robustness, we replicate the analysis using another set of input-output tables in the appendix (A1).

Value-added is the remuneration of factors of production. Understanding the origin of value-added in gross exports figures allows us to establish the remuneration of tasks for value-chains in different industries. It should be noted that there is not a good or bad share of foreign value-added in a country's gross exports. However, a larger share denotes a higher likelihood of being part of GVCs.

Value-added in exports refers to the use of foreign business functions that are necessary for the domestic industry to produce its own exports. The use of such activities results in linkages across industries and economies, where firms specialize in a given activity and thus provide value to a GVC. By both selling to and buying from GVCs, firms specialize in the activities for which they have a comparative advantage and associate with other firms around the globe, sourcing and contributing with value-added.

Identifying the origin of value-added in exports allows to quantify the linkages of economies and industries as “buyers of values added”. Thus, the origin of value-added is the origin of foreign content of activities/intermediate inputs/services that are needed for domestic exports. They are sometimes denoted as backward linkages in the literature.

Since for each buyer there is a seller, we can also identify the economies and industries that export their own value-added that third economies use in their domestic industries to produce exports. We refer to the third economies as the destinations of domestic value-added. This is the supply of domestic inputs/business functions/services that is exported and then used in the production of the partner's exports. This type of linkages is also known as forward linkages.

In this section, we identify the share of value-added in exports by origin and destination using the Leontief decomposition of gross exports. The decomposition considers the flows of intermediate goods between countries and industries that are necessary to satisfy the global demand for consumption goods. By balancing out the unit requirements of each country-industry, the decomposition accounts for the remuneration of all industries' and countries' factors of production. To that effect, gross exports are deflated by their value-added, pinpointing the distribution of shared production between countries. A well-known example is the one of Apple's iPhone. The full value of an iPhone that is assembled in China and shipped abroad is accounted in China's gross exports, however, some intermediate tasks to produce it were done in other economies. The remuneration of those tasks is the foreign value-added in China's iPhones' exports.

BOX 1: VALUE-ADDED IN EXPORTS BY ORIGIN AND DESTINATION

As described by Wang et Al. (2013), if the question of interest is to find the origin of the value-added in exports, the simplest approach is to use the Leontief insight. The approach has been extended to the multiregional case by Johnson and Noguera (2012). Wang et Al. (2013) discussed in depth the technical derivations that are necessary to perform the decomposition.

The Leontief decomposition is based on the fact that for every final good that is consumed, a certain amount of intermediate goods (which themselves needed raw materials) has been produced. These intermediate goods have either been traded between industries -in the same or different countries- or within an industry. Thus, in order to produce 1 unit of a final good, we need a certain amount of intermediate goods from a variety of industries. This ratio is referred to as the technical coefficient.

Using the matrix of technical coefficients and all the inter-industry and intra-industry flows, Leontief accounted for the origin of all the goods consumed in an economy. The difference between the value paid for the final goods and all the intermediates necessary for their production is the value-added. Value-added is used to remunerate all factors of production, labor, rent of land and capital.

Extending the concept to many countries, for each 1 currency unit in gross exports some of it was used to pay intermediate goods and the rest is value-added to remunerate factors of production. Whenever a good

3. Origin of Value-Added in Exports of B&R Economies

required a task performed in another country, the remuneration to that task will be counted a foreign value-added. All purely domestically performed tasks are referred to as domestic value-added.

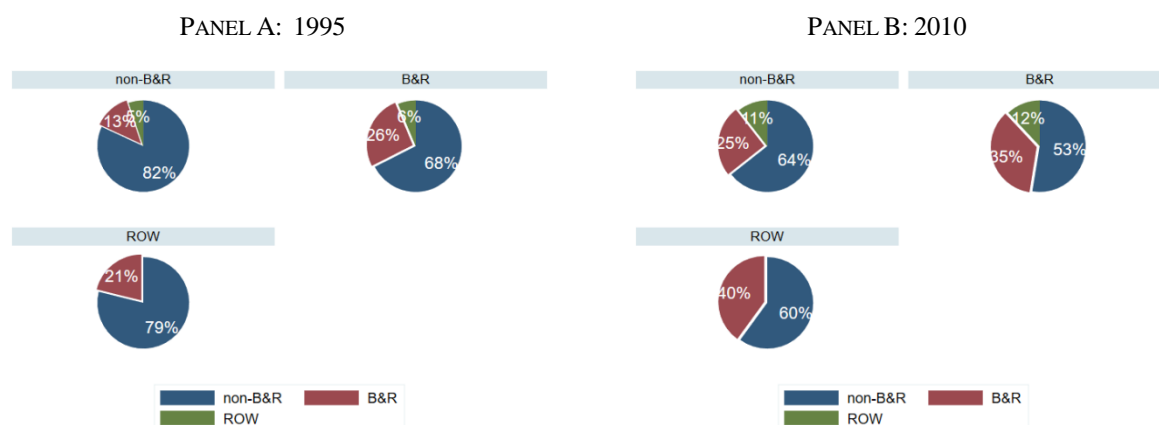
In the report, we show which countries use the foreign-value-added in their exports and where the domestic value-added in exports ends up. The strongest linkages are going to pinpoint where we have strong GVC hubs.

Source: Author's elaboration based on Koopman et Al. (2014) and Wang et Al. (2014)

3.2. Origins and Destinations of Foreign Value-Added in Exports of B&R Economies

The first result from analysis of the TiVA data is that the integration among the B&R Economies is high and has grown over time. The selected group of 28 B&R Economies (see Table 1 Appendix A4) has deepened the sourcing of tasks between themselves. As shown in Figure 14, they sourced 26 % of the total foreign value-added of their exports from each other in 1995, and this share increased to 35% in 2010. Overall, B&R Economies are sourcing more and more tasks intra-regionally.

FIGURE 14: ORIGIN OF FOREIGN VALUE-ADDED IN EXPORTS B&R AND OTHERS, 1995 AND 2010



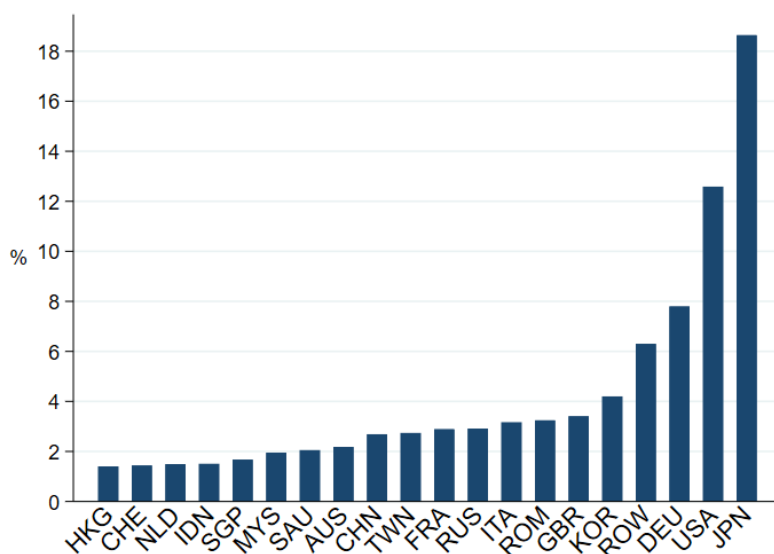
Source: Author's calculations based on the Leontief decomposition indicators extracted using the Wang et Al. (2013) methodology on the TiVA database.

Note: For each of the categories the slice represents the sourced foreign-value added as a share of total foreign value-added.

In 2010, China and Russia are the most important intra-regional sources of foreign value-added for B&R Economies (Figure 16). In 1995 (Figure 15), the most important sources of value-added for exports were Japan, the United States and Germany and, among the B&R Economies (Figure 15), Romania, Russia and China were important but they only accounted, altogether, to less than the contribution of Japan. In 2010 (Figure 16), China rose to be the third largest provider of foreign value-added for B&R Economies.

3. Origin of Value-Added in Exports of B&R Economies

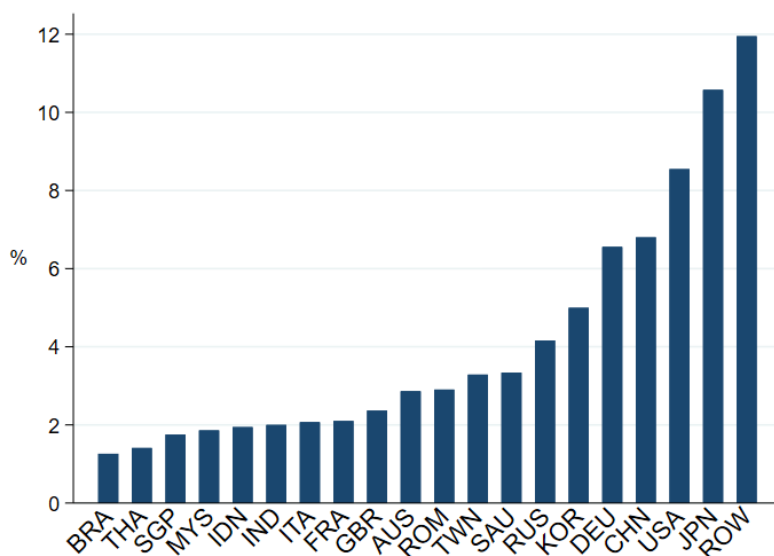
FIGURE 15: ORIGINS OF FOREIGN VALUE-ADDED IN EXPORTS OF B&R ECONOMIES, 1995



Source: author's calculations based on TiVA.

Note: All values are shares of economies along the x-axis in total foreign value-added in exports of B&R Economies. The x-axis shows the economies contributing the most in terms of value-added for B&R exports in 1995. We display the top 20 most important partners.

FIGURE 16: ORIGINS OF FOREIGN VALUE-ADDED IN EXPORTS OF B&R ECONOMIES, 2010



Source: author's calculations based on TiVA.

Note: All values are shares of economies along the x-axis in total foreign value-added in exports of B&R Economies. The x-axis shows the economies contributing the most in terms of value-added for B&R exports in 2010. We display the top 20 most important partners.

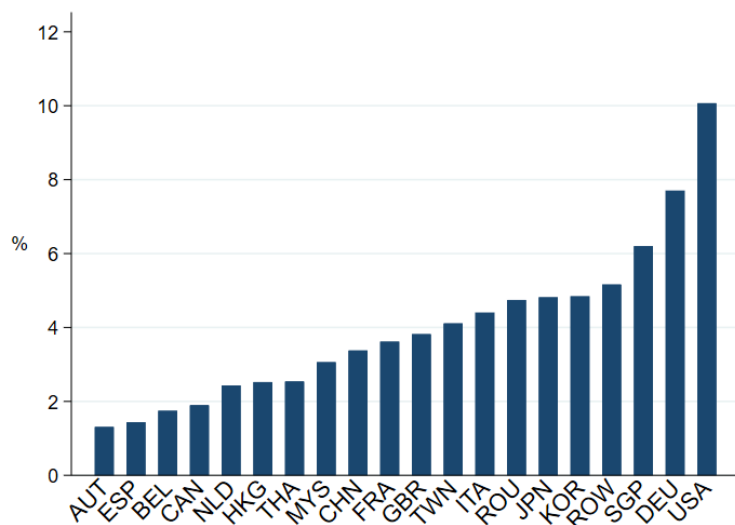
What are the most popular destinations of exported value-added? Indeed, it is not only essential to understand sourcing patterns, we also need to identify selling networks. To do that, we use the Leontief decomposition by destination of the value-added. This identifies the most important sellers of tasks in the selected group of B&R Economies. The only drawback with this measure is that it does not inform us on

3. Origin of Value-Added in Exports of B&R Economies

the final use of the value-added and thus it cannot explain forward linkages in depth. It can only tell us if some domestic value-added was used in exports but not how.

We find that in 2010 China is the most popular destination of exported value-added B&R Economies (Figure 17), followed by Malaysia and Romania (Figure 18).

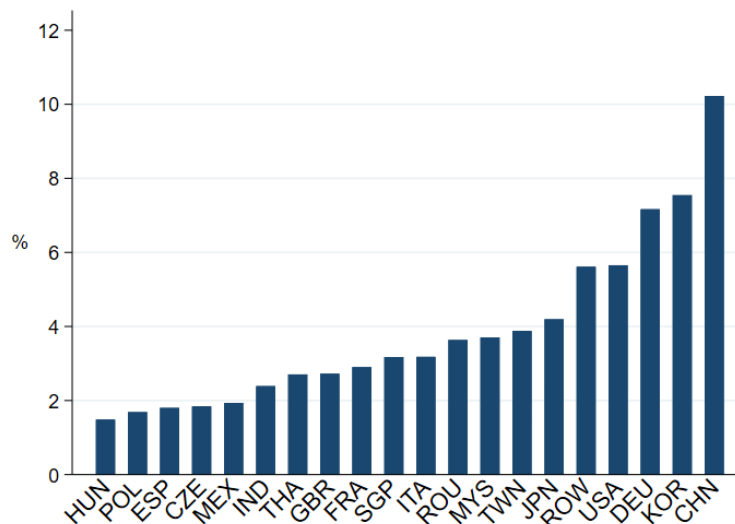
FIGURE 17: DESTINATION OF VALUE-ADDED OF EXPORTS OF B&R ECONOMIES, 1995



Source: author's calculations based on TiVA.

Note: All values are shares of economies along the x-axis in total domestic value-added exported by B&R Economies. The x-axis shows the economies that used the most the exported value-added to generate their own exports in 1995. We display the top 20 most important partners.

FIGURE 18: DESTINATION OF VALUE-ADDED OF EXPORTS OF B&R ECONOMIES, 2010



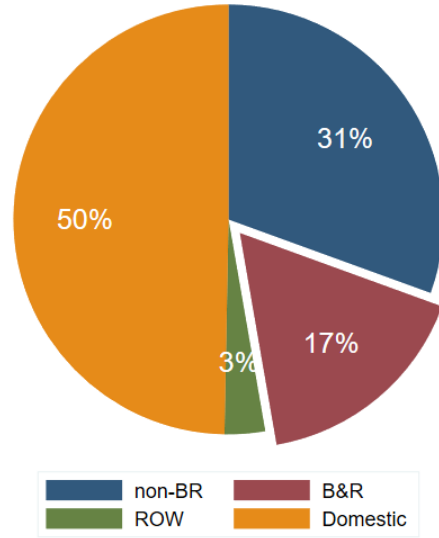
Source: author's calculations based on TiVA.

Note: All values are shares of economies along the x-axis in total domestic value-added exported by B&R Economies. The x-axis shows the economies that used the most the exported value-added to generate their own exports in 2010. We display the top 20 most important partners.

4. Quantifying Vertical Trade among the B&R Economies

We conclude by highlighting the most important sourcing patterns for the Computer and Optical Equipment Sector. To identify the linkages, we first divide the value-added of the industry between domestically sourced, sourced from B&R Economies, and sourced from other countries. We notice that the sector uses 50 % of domestic value-added and 50 % of foreign value-added. There is a large contribution of value-added coming from outside the B&R Economies. This suggests that there could be potential for larger integration in this sector.

FIGURE 19: SOURCE OF VALUE-ADDED IN THE COMPUTER, ELECTRONICS AND OPTICAL EQUIPMENT SECTOR OF B&R ECONOMIES, 2010



Source: Author's calculations based on GVC indicators extracted using the Leontief decomposition on the TiVA database (Kummriz and Quast, 2017). The graphs consider as using countries only the selected group of B&R Economies.

Note: for each of the categories the slice represents the origin of value-added as a share of exports.

4. Quantifying Vertical Trade among the B&R Economies

4.1 Concept and Methodology

In this section, we measure the extent to which B&R Economies participate in GVCs. Integration in GVCs can be measured in two ways: integration as a seller (how much an economy's exports contribute to a value chain) or integration as a buyer (how much an economy sources from value chains for its own exports). For the sake of robustness, we replicate the analysis using another set of input-output tables in the appendix (A3).

One country's gross exports may contribute to other countries in at least two ways. First, if country A buys intermediate goods from upstream sectors in country B to finalize its own production, a part of the income generated by country A's exports is redistributed to country B. In turn, an increase in final demand for country A's goods will generate more demand for intermediate foreign inputs from country B as well. Second, exported intermediate goods are used by third countries to generate themselves exports. Therefore, exports of intermediate goods from China contribute to GVCs in third countries. In other words, most exports need imported inputs and some exports contribute as intermediate inputs themselves.

The economic literature has focused on the two linkages and characterized global shared production as vertical specialization from the importing side and vertical specialization from the exporting side.

4. Quantifying Vertical Trade among the B&R Economies

Formally, the first type of linkages is referred to as backward linkages. It is the amount of foreign value-added in gross exports plus the double counted items from foreign sources.⁶ The second type of linkages are denominated forward linkages. They are the amount of domestic value-added in intermediate goods that is used to generate exports to third countries.⁷ Forward linkages are defined by the final use of the exports and categorized in that form. For example, there is a difference between exports that are going to be consumed in the partner country, exports that are going to be re-processed and shipped to third countries and exports that are going to be shipped back to the original exporter.

The two types of measures are crucial to understand how GVCs effectively redistribute a share of the export revenues to all participating countries. Therefore, we investigate the two types of linkages in depth considering the partners along the B&R and the non-B&R Economies.

We use the state of the art methodology developed by Wang et al. (2013) which decomposes bilateral gross exports in four major terms (Figure 20): domestic value-added absorbed abroad, foreign value-added, domestic value-added that returns home and purely double counted exports. Exploiting the algorithm of Quast and Kummritz (2016) the four terms can be combined to form statistics at the country level which explain vertical specialization from the importing side and from the exporting side. We discuss the findings for the aggregate economy in the next two sections.

BOX 2: DECOMPOSING VALUE-ADDED IN DIFFERENT COMPONENTS

We use the methodology pioneered by Johnson and Noguera (2012) and extended by Koopman et al. (2014) and Wang et al. (2013). The methodology decomposes production on each country according to where it is finally consumed. The goal is to trace production stages and all possible intermediate steps. Through input-output linkages, exports are deflated by the amount of imported inputs, removing the double counting of trade statistics. The composition relies in complex matrix algebra manipulation, the exact steps are described in Wang et al. (2013). We obtained the indicators with the help of the computational method developed by Quast and Kummritz (2016).

The decomposition of Wang et al. (2014), which is the state of the art methodology, decomposes bilateral sectoral exports by destination country in 16 terms. The 16 terms can be formalized in four major groups. Formally, for each exporting country s , exporting industry j and importing country m . Notice that all variables can be indexed by j , m and s . For the sake of simplicity, we omit the subscripts.

Gross exports are divided in four major terms.

$$Exports = VAX + RDV + FVA + PDC$$

VAX is the domestic value-added in exports absorbed abroad. RDV is the domestic value-added first exported, then processed in third countries and then returned to the home country. FVA is the foreign value-added embedded in the exports of country s and industry i . PDC are pure double counted items.

From these four major components, we further decompose at the bilateral level to get additional indicators of GVC integration between the partners.

The domestic value-added absorbed abroad can be decomposed in three terms. First, the domestic value-added in exports of intermediate goods that is going to be absorbed by the direct partner, DVA_int . Second, the domestic value-added in final goods exports to the direct partner, DVA_int . Third the domestic value-added in intermediate goods that is going to be re-exported to third countries and finally be absorbed abroad.

RDV is the domestic value-added that returns home. Therefore, it can be decomposed in domestic value-added that returns home via final goods or via intermediate goods' imports.

⁶ Double counted items occur because some goods cross borders several times and are therefore counted twice in trade statistics while they were only produced once. Input-output tables allow to estimate the percentage of this type of intermediate goods that cross a border several times. Notice that double counting in gross exports is large when GVC trade is prevalent.

⁷ Among backward linkages we might also separate between intermediate goods that are re-exported to third countries and intermediate goods that return to the home market for further processing.

4. Quantifying Vertical Trade among the B&R Economies

FVA in the foreign value-added in bilateral sectoral exports. The foreign value-added can again be present in intermediate goods exports (FVA_int) or final goods exports (FVA_fin). Each of these sources of value-added can come from the direct partner or from third countries.

Finally, PDC are purely double counted items that can come from two sources. FDC and DDC.

The vertical specialization index from the importing side (VS, backward linkages) denotes the foreign content of exports. It is defined as the share of value-added in gross exports that comes from foreign sources plus the double counted terms.

$$VS = FVA + FDC$$

Each of the terms of VS indicates a country-sector position into global value chains (Wang et al. 2014).

From the exporting side, we define vertical specialization (VS1, forward linkages) as the domestic value-added that gets re-exported to third countries. In addition, we also separate the domestic value-added first exported and then returned home (VS1*=RDV).

Source: Author's elaboration based on Koopman et Al. (2014) and Wang et Al. (2014)

4.2 Backward Linkages

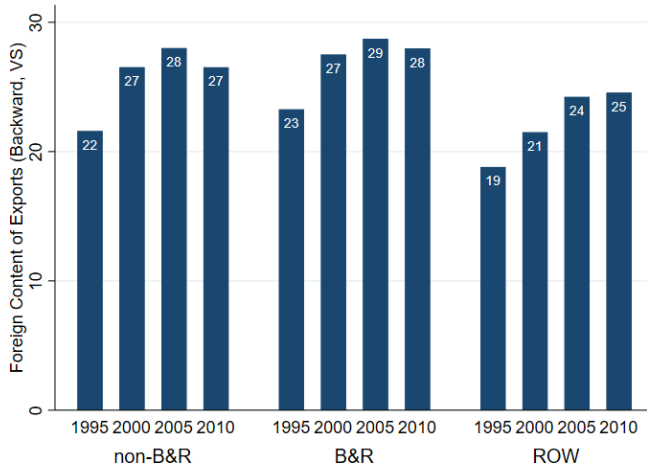
Backward linkages represent vertical specialization from the importing side. They refer to the use of foreign inputs (foreign value-added) embedded in a country's gross exports. Using the decomposition of Wang et al. (2013), we can calculate backward linkages at the bilateral-sector level.⁸ Therefore, we are able to map backward value-added linkages existing in exports of the selected group of B&R Economies.

We use the vertical specialization index (VS) discussed in Box 2 to map the foreign content of exports by the B&R Economies. The foreign content of exports refers to the remuneration of foreign activities embedded in a country's gross exports. A large foreign content of exports implies stronger linkages from an inputs' perspective to map the foreign content of exports by the B&R Economies. The foreign content of exports refers to the remuneration of foreign activities embedded in a country's gross exports. A large foreign content of exports implies stronger linkages from an inputs' perspective.

We notice in Figure 20 that the share of foreign content of exports of B&R Economies increased to 29 % in 2005 and started decreasing to reach 24 % in 2010. This is an indication that total exports are using more domestic inputs and rely a bit less in foreign intermediate goods for production. The pattern is similar for both exports to B&R and non-B&R Economies.

⁸ Trade in value-added at the bilateral-sectoral level is not properly defined using the pure Leontief decomposition.

FIGURE 20: VERTICAL SPECIALIZATION FROM THE IMPORTING SIDE (SHARE OF FOREIGN CONTENT OF EXPORTS), B&R ECONOMIES AND OTHERS, 1995-2010



Source: Author's calculations based on the TiVA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the foreign content of exports.

One important indicator of GVC positioning is the composition of the Vertical Specialization index. There are three main elements in the index: foreign value-added in intermediate exports, foreign value-added in final goods exports and double counted foreign intermediate imports. An economy that has a large share of foreign value-added in intermediate goods can be in the middle of the value chain, doing intermediate processing. In contrast, if an economy has a large share of foreign value-added in its final goods exports, it is likely to be at the end of the value chain, performing mostly assembly duties. Double counting refers to intermediate goods that have crossed borders several times⁹ (and were double counted in trade statistics). According to Wang et al. (2013), double counting can only occur whenever GVC is prevalent.

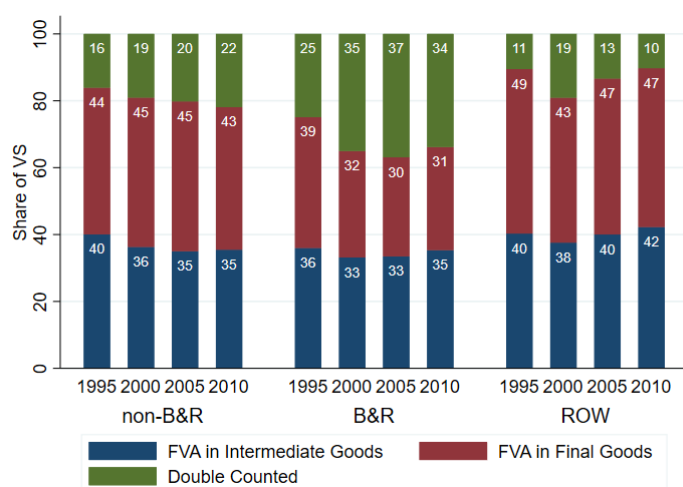
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Figure 21, we notice that the composition of the index is quite different even if the share of foreign inputs was similar across destinations. In 2010, double counting has accounted for 34 % of the vertical specialization index for exports to B&R Economies. In contrast, whenever exports are directed towards non-B&R Economies the share of double counting is a mere 21 %. This indicates that from the point of view of backward linkages, B&R Economies have a trade structure that requires more and more inputs from within their network. If we look at exports towards non-B&R Economies, we notice that 43 % is foreign value-added in exports. This suggests a high share of assembly duties of these exports.

⁹ An example of double counted trade would be the exports of textiles' raw materials. Cotton gets first exported to be processed, trimmed and cut. After that the second country will re-export it to another destination for making a shirt. The shirt might then be re-exported another time. In the value of the shirt we have intrinsically the value of the cotton which was double counted several times in customs' statistics while being embedded in another good.

4. Quantifying Vertical Trade among the B&R Economies

FIGURE 21: COMPOSITION OF THE VERTICAL SPECIALIZATION INDEX



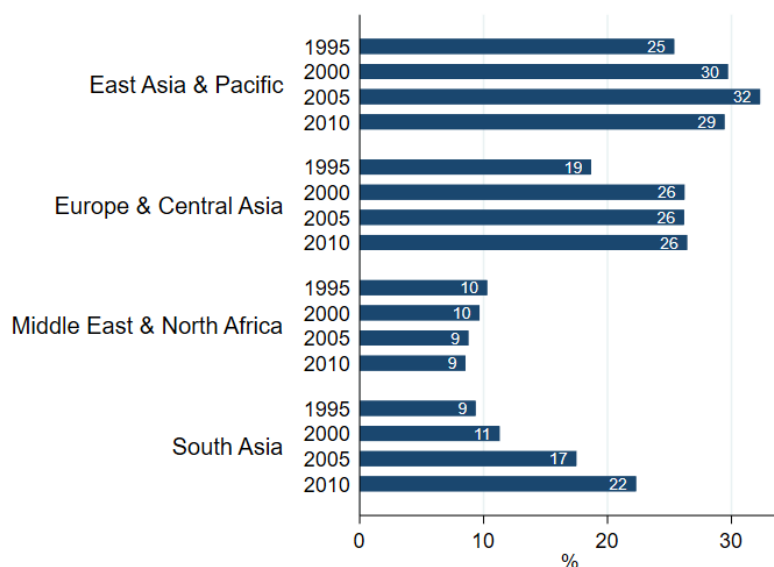
Source: Author's calculations based on the TiVA database.

Note: All numbers are the share of the foreign content of exports. The variable of interest is the foreign content of exports.

However, the B&R Economies are a substantially heterogenous group. Hence, we provide a decomposition of the increase in the foreign content of exports by breaking down the index across World Bank regions. As a result, we end up with Figure 22. We observe that B&R Economies in EAP and ECA are well integrated in GVCs from the perspective of the foreign content of exports. Those in SAR are gradually catching up, and those in MENA do not appear as integrated.

Figure 23 breaks down the composition of foreign value-added of exports for the B&R Economies and corroborates the previous findings. Namely, the share of double counted items is the largest in those B&R Economies in ECA and EAP. This indicates that GVC trade is more frequent in these regions.

FIGURE 22: EVOLUTION OF FOREIGN CONTENT OF EXPORTS (VS), B&R ECONOMIES BY WORLD BANK REGIONS, 1995-2010

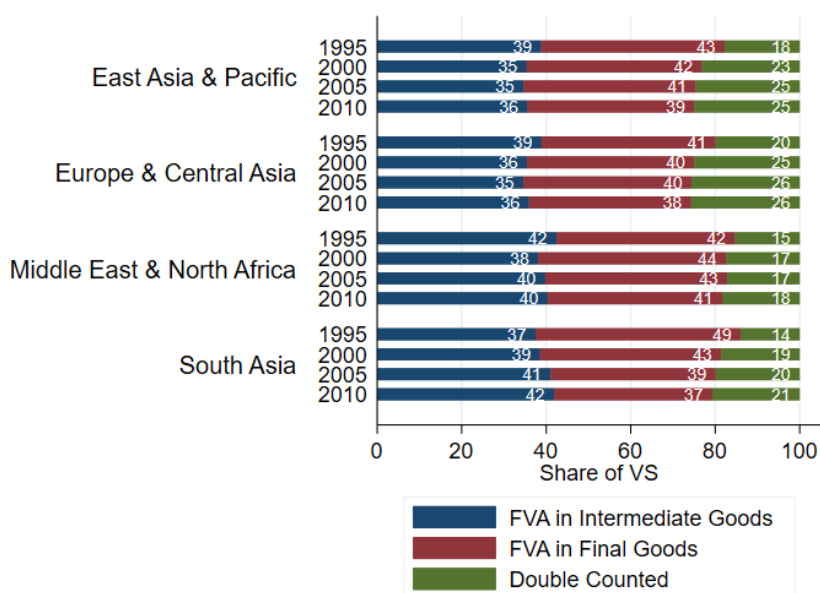


Source: Author's calculations based on the TiVA database.

4. Quantifying Vertical Trade among the B&R Economies

Note: All numbers on the x-axis are percentages of gross exports. The variable of interest is the foreign content of exports.

FIGURE 23: COMPOSITION OF FOREIGN CONTENT OF EXPORTS FOR B&R ECONOMIES BY WORD BANK REGIONS, 1995-2010



Source: Author's calculations based on the TiVA database.

Note: All numbers are the share of the foreign content of exports. The variable of interest is the foreign content of exports.

4.3 Forward Linkages

Forward linkages refer to the final use of domestic value-added in exports. It is the value-added from domestic activities that enters into other countries' production. Examples of the type of exports include parts and components that are essential to a value chain to produce the final good. There are two important indicators of forward linkages; they differ by the final destination of exports.

The first indicator of vertical specialization from the exporting side (VS1) is all the intermediates produced that are re-exported by the partner. In this case, the country consuming the final good will always be different from the exporting country.

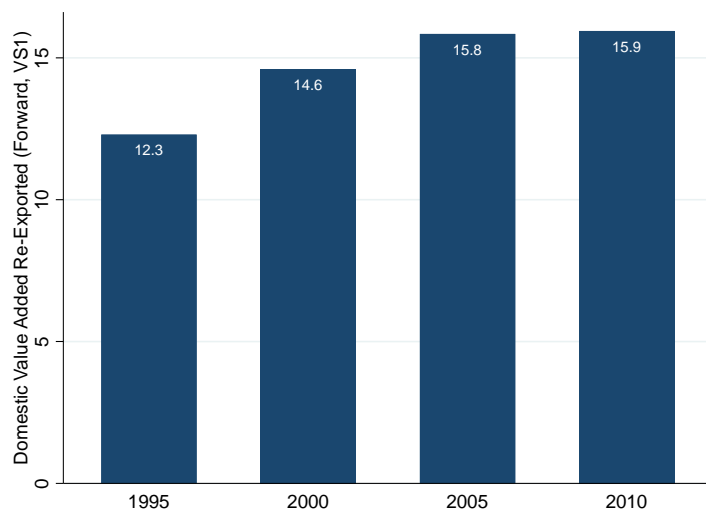
The second important indicator is the domestic value-added exported that eventually returns home after further processing abroad (VS1*). The GVC in question relies on the exporting country's domestic market as the main motor.¹⁰ The index considers the use of partner countries for assembly and processing of goods that are eventually going to serve the domestic market's aggregate demand. Given the size of the Chinese, Russian and Indian domestic markets, it is essential to understand this circular flow of value-added.

We observe that overall, B&R Economies are becoming more oriented towards forward GVC linkages over time (Figure 24). Although the increase is still modest in the composition of gross exports (from 12.3 % to 15.5 %) it represents a substantial number in growth rates, suggesting that domestic value-added in exports has grown at a faster rate than gross exports themselves.

¹⁰ To draw a parallel, one may think of the automobile production in NAFTA. There, the United States export intermediate goods to Mexican factories for further processing and then re-import the processed goods.

4. Quantifying Vertical Trade among the B&R Economies

FIGURE 24: DOMESTIC VALUE-ADDED RE-EXPORTED AS PERCENTAGE OF GROSS EXPORTS OF B&R ECONOMIES, 1995-2010



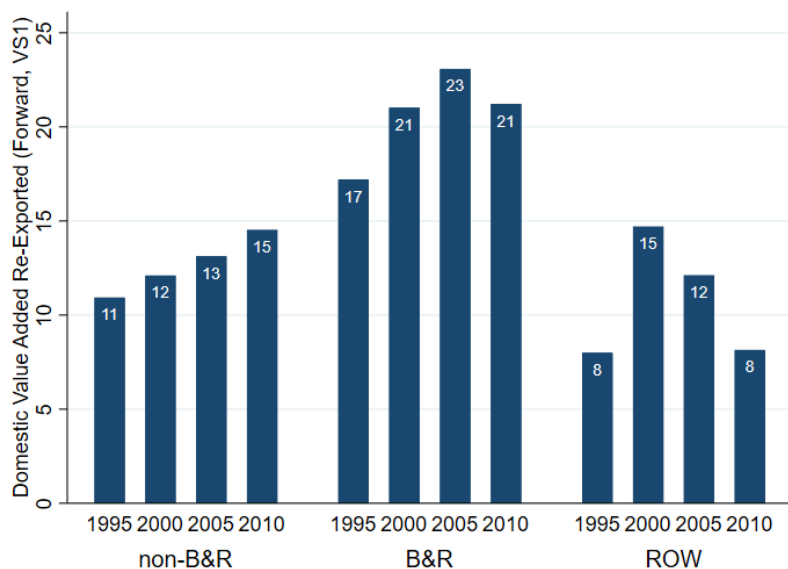
Source: Author's calculations based on the TiVA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the domestic value-added re-exported to third countries.

Forward GVC linkages are stronger between B&R Economies than between other economies (Figure 25). From B&R Economies, 21 % of gross intra-B&R exports are domestic value-added that serves as intermediate inputs to generate exports in B&R Economies. This suggests that the B&R Economies in our sample are well integrated vertically and more than with the rest of the world. In

Figure 25, we notice that the highest values of vertical integration are from the Middle East and North Africa region. Considering their important exports of minerals, the result is not surprising. We also notice that all the regional groups of B&R Economies have been increasing their forward linkages.

FIGURE 25: DOMESTIC VALUE-ADDED RE-EXPORTED, BY DESTINATION (% OF GROSS EXPORTS)

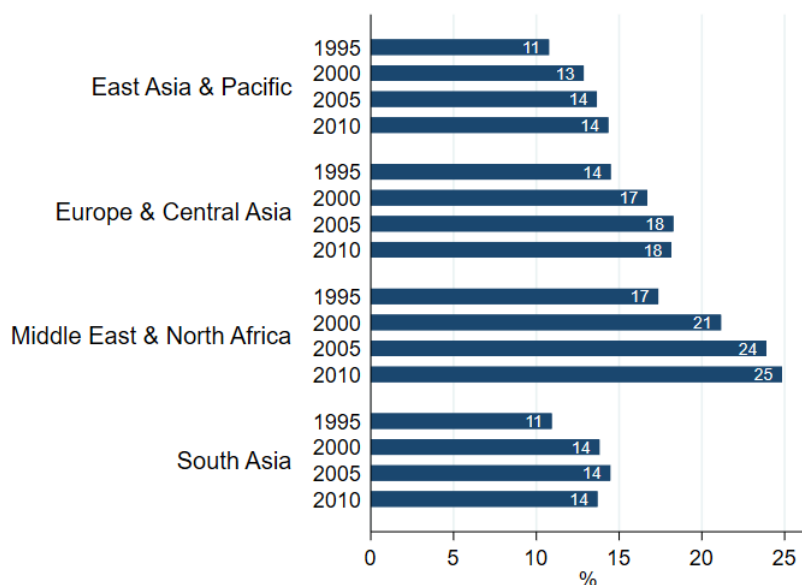


Source: Author's calculations based on the TiVA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the domestic value-added re-exported to third countries.

4. Quantifying Vertical Trade among the B&R Economies

FIGURE 26: DOMESTIC VALUE-ADDED RE-EXPORTED TO THIRD COUNTRIES, B&R ECONOMIES, BY WORLD BANK REGIONS



Source: Author's calculations based on the TiVA database.

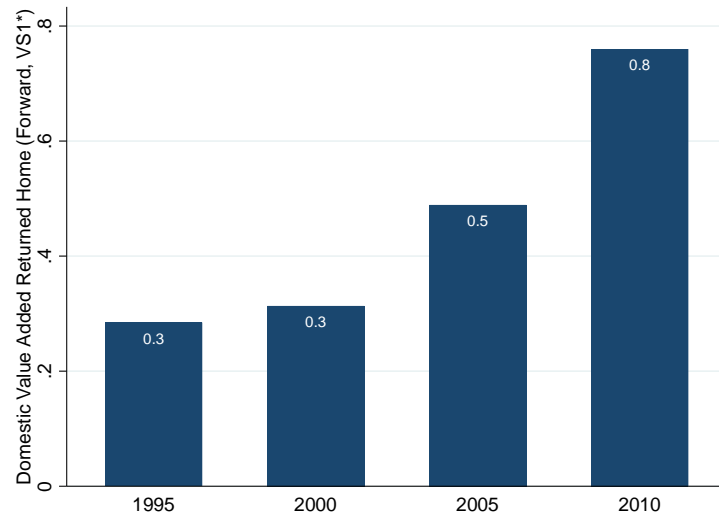
Note: All numbers on the x-axis are percentages of gross exports. The variable of interest is the domestic value-added re-exported to third countries.

Most importantly, the domestic market is more and more important in terms of forward linkages B&R Economies. Figure 27 and

Figure 28 show that the domestic value-added that returns to, and is absorbed by, the exporting country (VS1*) has been steadily increasing. The increase has been more important with B&R Economies, suggesting that GVC trade in view of serving domestic markets is becoming the new paradigm of the region. About 1.3 % of exports of B&R Economies returned to the original B&R exporter in 2010. The share of VS1* is comparable to some developed economies. If we compare some of the top performing countries with some larger B&R Economies in terms of VS1*, we see that in 2010 China is among the top with the United States, Japan and Germany (Figure 29). Russia and Indonesia are also close behind clinching 1% (Figure 30).

4. Quantifying Vertical Trade among the B&R Economies

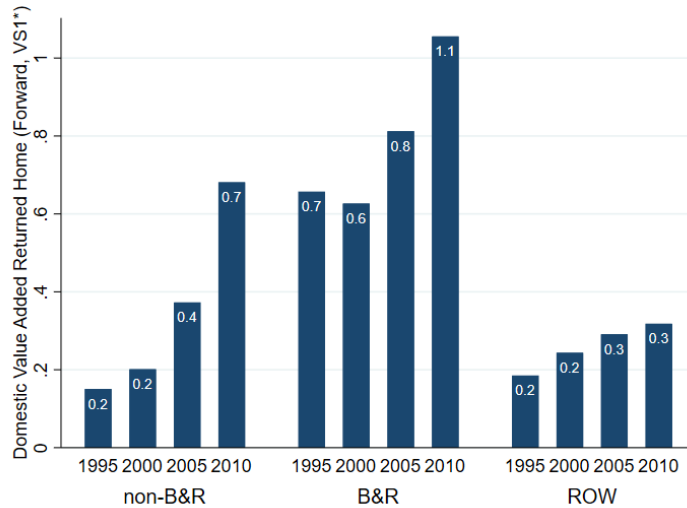
FIGURE 27: DOMESTIC VALUE-ADDED RETURNED HOME, B&R ECONOMIES (% OF GROSS EXPORTS)



Source: Author's calculations based on the TiVA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the domestic value-added that return home.

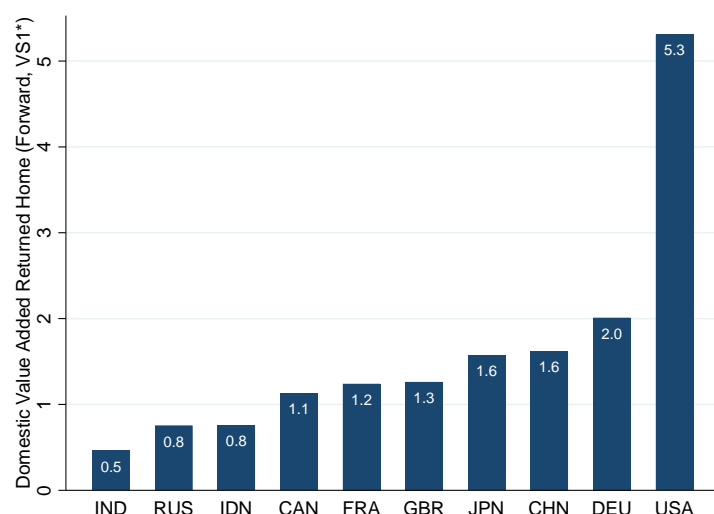
FIGURE 28: DOMESTIC VALUE-ADDED RETURNED HOME, BY DESTINATION OF EXPORTS (% OF GROSS EXPORTS)



Source: Author's calculations based on the TiVA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the domestic value-added that return home.

FIGURE 29: COMPARISON OF COUNTRIES WITH THE LARGEST VS1*, 2010



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the TiVA database.

5. Visualization of Value-Added Network of B&R Economies

In this section, we take the same value-added data by origin and destination used in the previous section to build network graphs.¹¹ Network analysis allows us to visualize the most important providers and users of value-added. The value-added that we are considering is the amount of foreign value added in exports and the domestic value added used by third countries for re-exports. Formally, the technique defines countries as “nodes” and the “trade flows” between them as edges. Network visualization algorithms map these graphs of nodes and edges to identify specific patterns.

We start by plotting the most important sources of value-added (Figure 30) for the world economy. The sources of value-added can be thought of as the origin of intermediate tasks that are necessary for countries to produce their own exports. For example, the automotive industry in Germany needs ignition mechanisms from Turkey. In our example, Turkey would be an important source of value-added for Germany. In Figure 30, we compare the top 3 most important sources of value-added in 1995 and 2010. The size of the arrows denotes the amount of value-added traded and the size of the node reflects the centrality (number of partners) of the economy in the network. We observe that in 1995 (Panel A) the two dominant sources of value-added were the United States and Germany. The links between Japan, the United States, Canada, Mexico and the Republic of Korea are obvious. Germany, together with some European countries (Italy, France, Great Britain, Belgium and the Netherlands) formed a strong network too. In 2010 (panel B), China emerged as the third important actor with much more activity at the global level. The Germany and United States networks are still present. To better grasp the role of China we plot, in Figure 31, only the nodes that are active in its network. We see that China is a truly global actor and we can distinguish a network with the Americas (United States, Brazil, Chile, Mexico, Canada and Colombia) and another one with mostly B&R Economies.¹²

FIGURE 30: ORIGIN OF VALUE-ADDED IN GROSS EXPORTS, 1995 AND 2010, WORLD ECONOMY

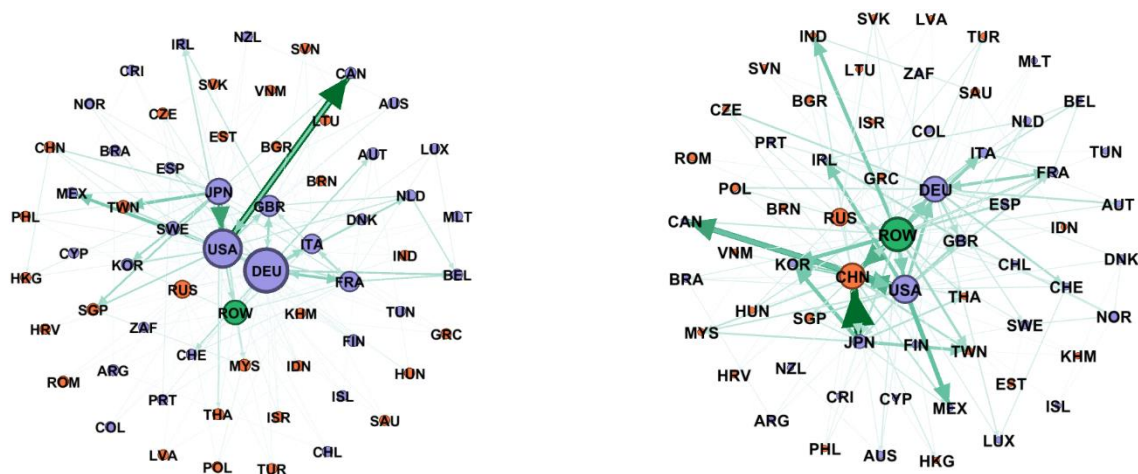
PANEL A: ORIGIN OF VALUE-ADDED IN EXPORTS, 1995

PANEL B: ORIGIN OF VALUE-ADDED IN EXPORTS, 2010

¹¹ Taglioni and Winkler (2016) provide a detailed discussion on the use of network analysis for studying international shared production.

¹² In the appendix (A4), we consider the same type of network using the EORA multi-regional input-output tables.

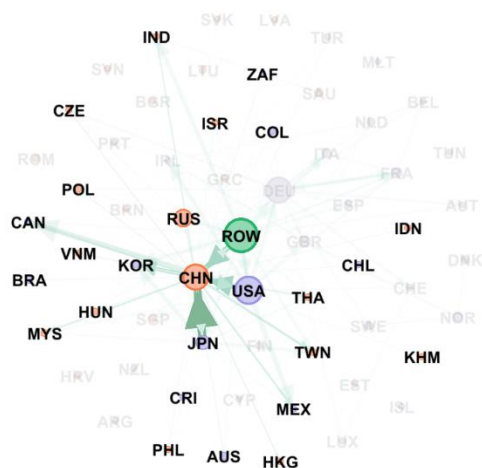
5. Visualization of Value-Added Network of B&R Economies



Source: Author's computations using Gephi.

Note: The size of nodes represents the number of countries for which the source of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 31: ORIGIN OF VALUE-ADDED IN GROSS EXPORTS, WORLD ECONOMY IN 2010, ZOOM ON CHINA



Source: Author's computations using Gephi.

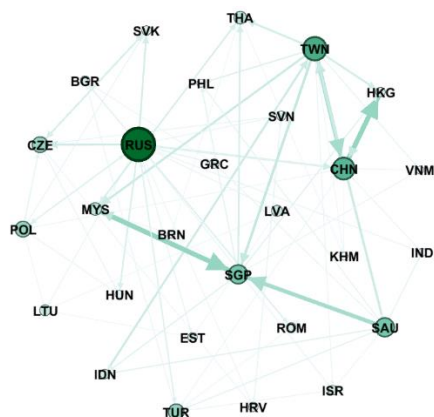
Note: The size of nodes represents the number of countries for which the source of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

To observe the source of value-added networks with more depth, we focus only on B&R Economies. In Figure 32 we plot the evolution of the network from 1995 to 2010 while taking into account, for each country, the three most important B&R partners. We observe essentially two strong networks, one that has a central point Russia and the other one China. The two were strong providers of value-added in 1995 and they are even more important in 2010. In Figure 33, we zoom in the two most important B&R sub-networks in 2010, China and Russia. We notice that Russia is mainly connected to China and the eastern European B&R Economies. China, instead, is tightly linked with most countries in the network. Bulgaria, Latvia and Lithuania are the only ones linked to China through Russia.

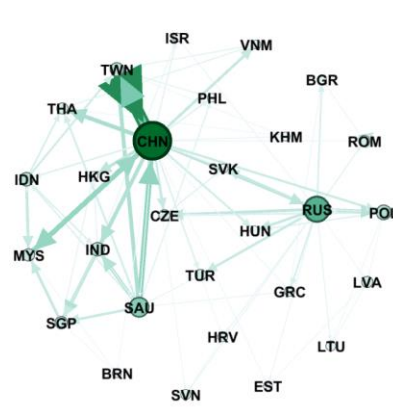
5. Visualization of Value-Added Network of B&R Economies

FIGURE 32: ORIGIN OF VALUE-ADDED IN GROSS EXPORTS, SUB-NETWORK OF B&R ECONOMIES, 1995 AND 2010

PANEL A: ORIGIN OF VALUE-ADDED IN EXPORTS
(B&R), 1995



PANEL B: ORIGIN OF VALUE-ADDED IN EXPORTS (B&R),
2010

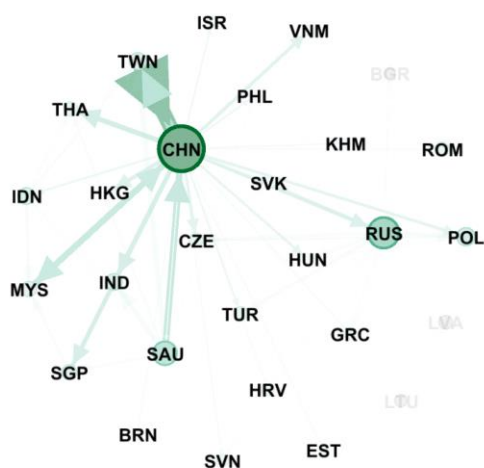


Source: author's computations using Gephi.

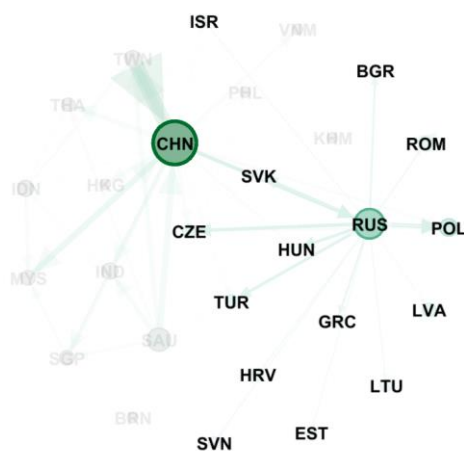
Note: We focus on origins of value-added within our sub-sample of B&R partners. The size of nodes represents the number of countries for which the source of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 33: ORIGIN OF VALUE-ADDED IN GROSS EXPORTS, SUB-NETWORK OF B&R ECONOMIES, 2010

PANEL A: B&R, 2010, ZOOM ON CHINA



PANEL B: B&R, 2010, ZOOM ON RUSSIA



Source: Author's computations using Gephi.

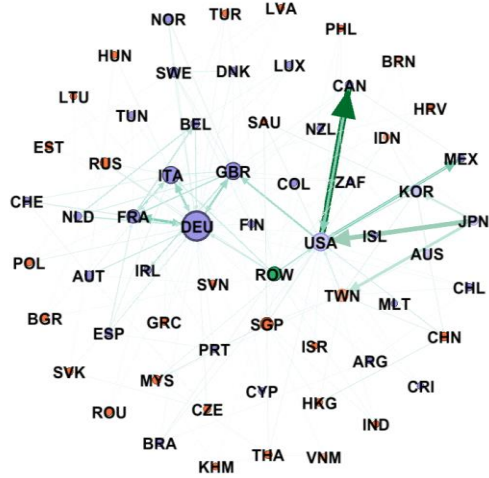
Note: We focus on origins of value-added within our sub-sample of B&R partners. The size of nodes represents the number of countries for which the source of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

Similarly, we study the main destinations of domestic value-added that is going to serve to create exports. The conclusion is the same. At the global level, Germany and China are the most central economies, attracting value-added from most neighbors (Figure 34, Panel B). Regarding the B&R network of destination of value-added (Figure 35), we notice that China is the most central actor and receives most of

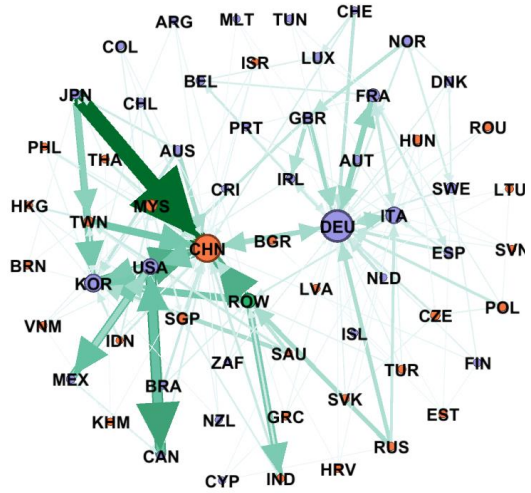
the value-added exported by its neighbors. In order to understand linkages in the B&R it is essential to examine China's linkages in depth. We report some insights specifically on China in the next section.

FIGURE 34: MAIN DESTINATIONS OF VALUE-ADDED, 1995 AND 2010, WORLD ECONOMY

PANEL A: DESTINATION OF VALUE-ADDED IN EXPORTS, 1995



PANEL B: DESTINATION OF VALUE-ADDED IN EXPORTS, 2010

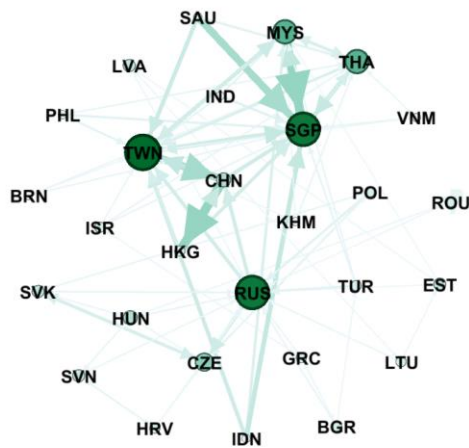


Source: Author's computations using Gephi.

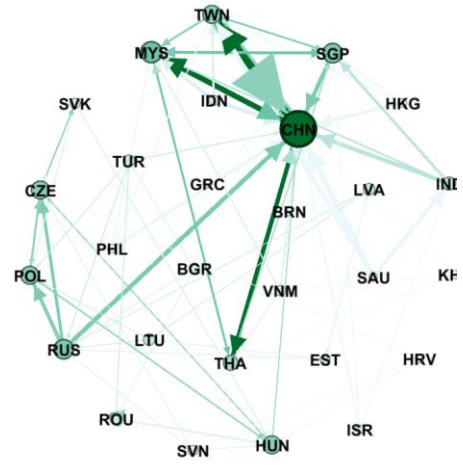
Note: The size of nodes represents the number of countries for which the destination of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 35: DESTINATION OF VALUE-ADDED, SUB-NETWORK OF B&R ECONOMIES, 1995 AND 2010

PANEL A: DESTINATION OF VALUE-ADDED IN EXPORTS (B&R), 1995



PANEL B: DESTINATION OF VALUE-ADDED IN EXPORTS (B&R), 2010



Source: Author's computations using Gephi.

Note: We focus on the destination of value-added within our sub-sample of B&R partners. The size of nodes represents the number of countries for which the source of value-added was among the three most important partners. The thickness of the edges represents the strength of the link. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

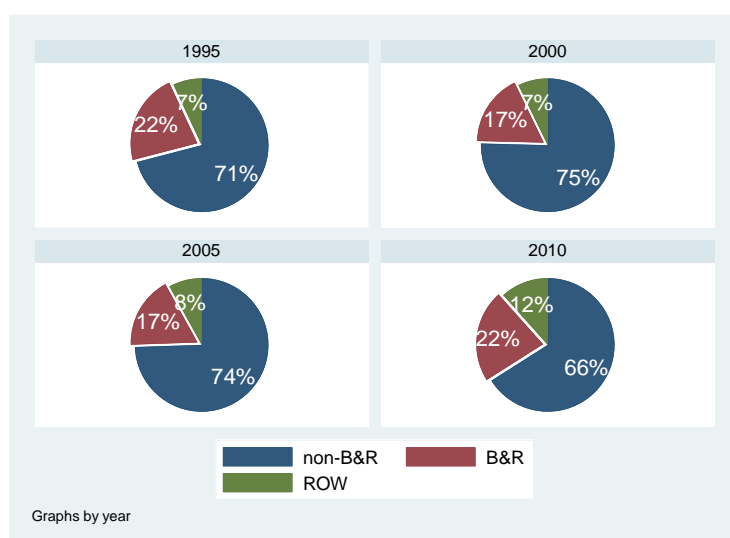
6. Trade Linkages between China and other B&R Economies

6.1. Gross Trade between China and other B&R Economies

B&R Economies are already important trading partners of China. In terms of the destination of total gross exports, B&R economies were the destination of 22 % of China's gross exports, while non-B&R accounted for 66 % (Figure 36). Repeating the exercise in Figure 44 from the point of view of China's gross imports, B&R economies are much more important to China as sources of imports, accounting for 30% of its total imports in 2010 (

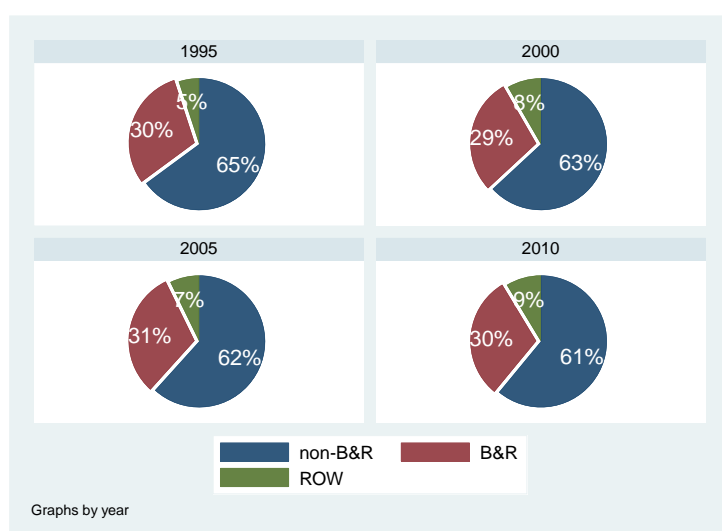
Figure 37).

FIGURE 36: EXPORTS OF CHINA BY DESTINATION, 1995-2010



Source: Author's calculations using the Tiva database.

FIGURE 37: IMPORTS OF CHINA BY ORIGIN, 1995-2010



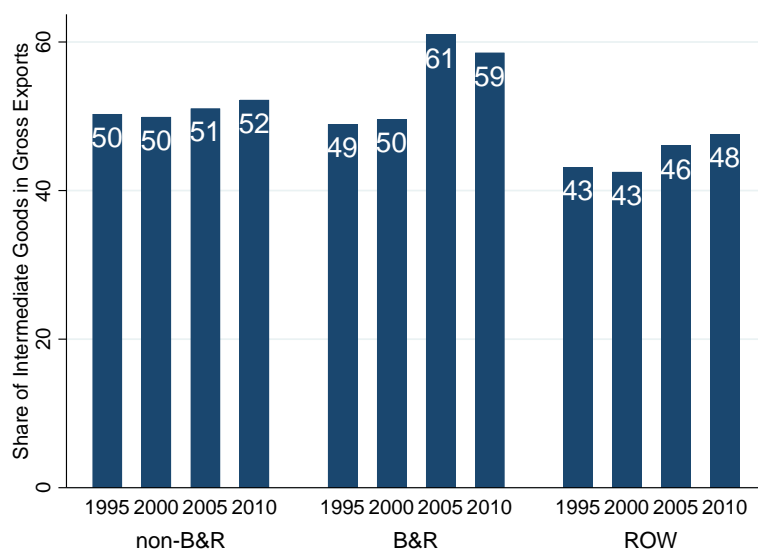
6. Trade Linkages between China and other B&R Economies

Source: Author's calculations using the Tiva database.

LOOKING AT THE DIFFERENCE BETWEEN INTERMEDIATE AND FINAL GOODS, WE NOTICE THAT CHINA IMPORTS MORE INTERMEDIATE GOODS THAN IT EXPORTS. HOWEVER, EXPORTS TO OTHER B&R ECONOMIES HAVE BECOME MORE AND MORE INTENSIVE IN INTERMEDIATES (FIGURE 38), REACHING 59 % IN 2010. FROM THE IMPORTING SIDE, WE SEE THAT CHINA'S IMPORTS ARE MOSTLY INTERMEDIATE GOODS (

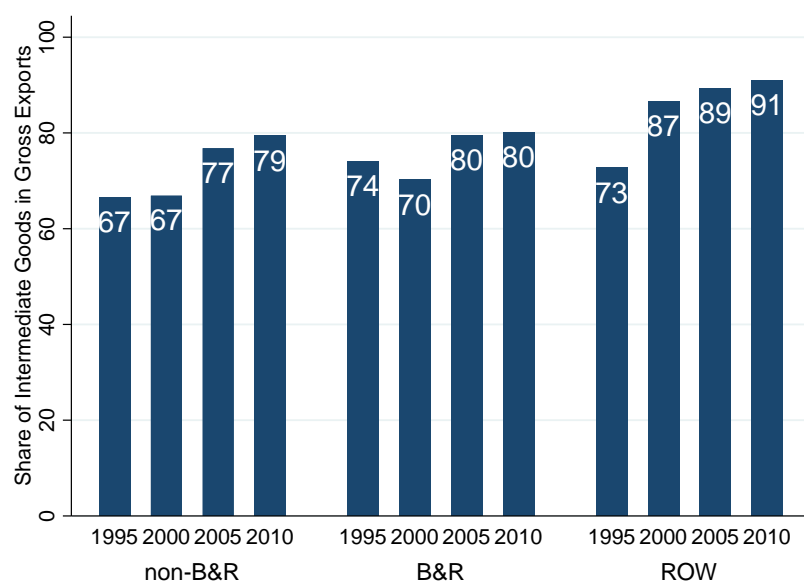
Figure 39). The results suggest that China has stronger GVC linkages as a buyer of value-added than as a seller.

FIGURE 38: SHARE OF INTERMEDIATE GOODS IN CHINESE EXPORTS TO B&R AND NON-B&R ECONOMIES, 1995-2010



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

FIGURE 39: SHARE OF INTERMEDIATE GOODS IN CHINESE IMPORTS FROM B&R AND NON-B&R ECONOMIES, 1995-2010

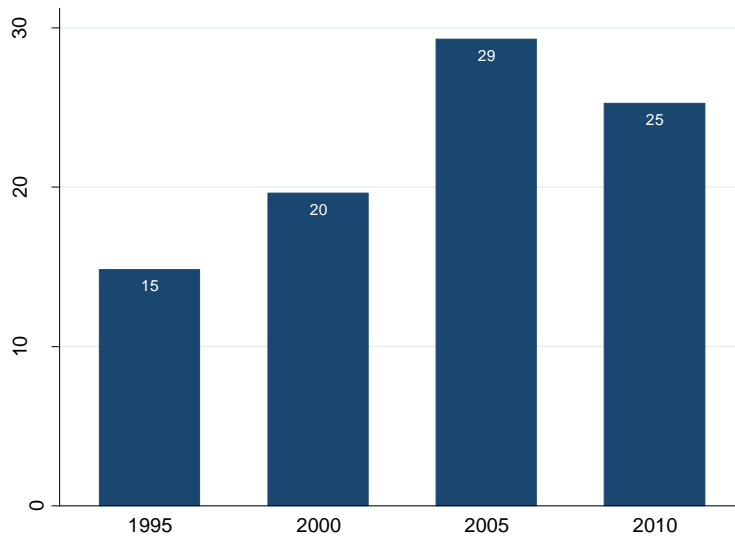


Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

6.2. China's Position in GVCs

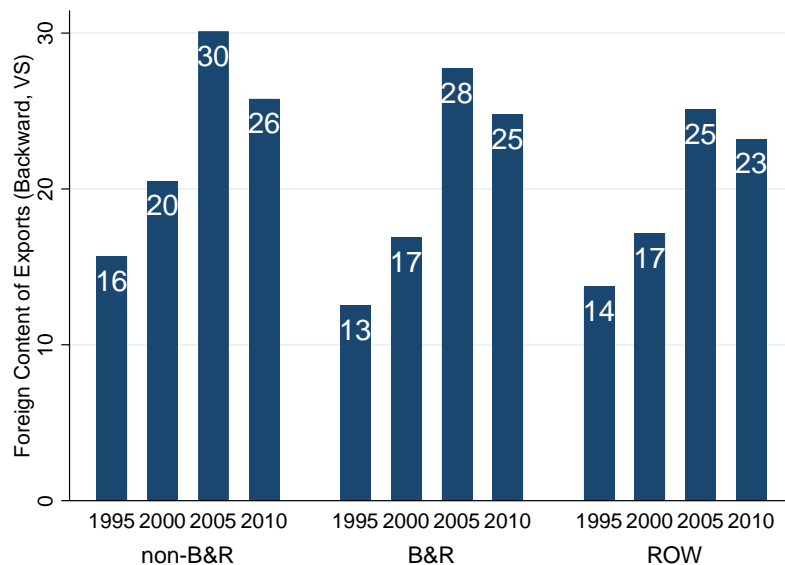
We use the vertical specialization index discussed earlier (VS) to map the foreign content of China's gross exports. We notice in Figure 40 that the share of foreign content of exports has increased up to 29 % in 2005 and started decreasing to reach 24 % in 2010. This is an indication that total exports are using more domestic inputs and rely a bit less in foreign intermediate goods for production. Figure 41 further shows that the pattern is similar for both exports to B&R and non-B&R economies.

FIGURE 40: SHARE OF FOREIGN CONTENT OF CHINESE EXPORTS, 1995-2010



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

FIGURE 41: SHARE OF FOREIGN CONTENT OF CHINESE EXPORTS TO B&R AND OTHER ECONOMIES, 1995-2010

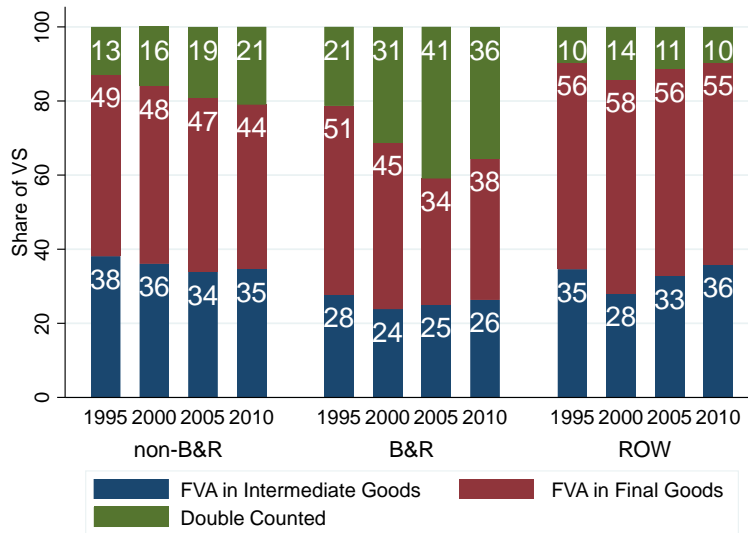


6. Trade Linkages between China and other B&R Economies

Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

From the point of view of backward linkages, B&R Economies have a trade structure with China that is increasingly reliant in GVCs. This is reflected in Figure 42, which report the indicator of GVC positioning in terms of the composition of the Vertical Specialization index. In 2010, double counting has accounted for 36 % of China's vertical specialization index for exports to B&R Economies. In contrast, non-B&R economies have only a share of double counting of 21 %.

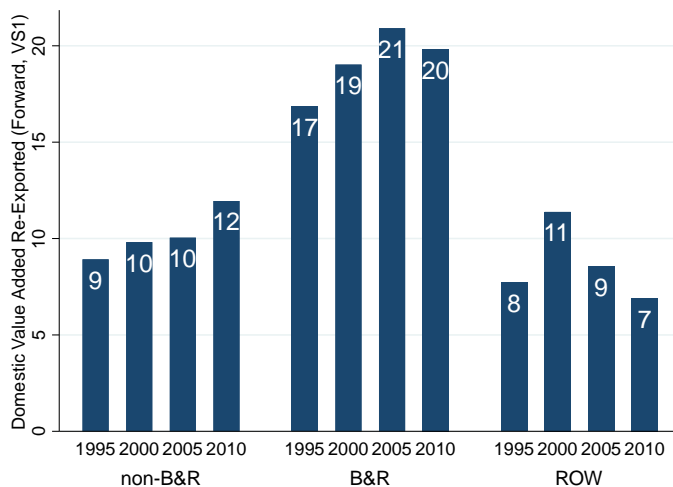
FIGURE 42: COMPOSITION OF THE VERTICAL SPECIALIZATION INDEX, CHINESE EXPORTS TO B&R AND OTHER ECONOMIES



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

Forward GVC linkages of China with B&R Economies are also stronger than with non-B&R economies. As shown in Figure 43, 20% of Chinese exports to other B&R Economies is domestic value-added from China that serves as intermediate goods to generate exports of the importing B&R Economies. China is therefore contributing to the development of GVCs in B&R Economies.

FIGURE 43: DOMESTIC VALUE-ADDED OF CHINA RE-EXPORTED, BY DESTINATION (% OF GROSS EXPORTS)

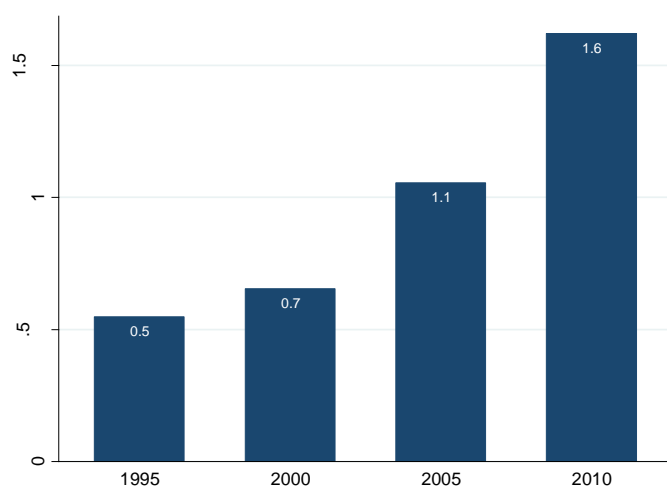


6. Trade Linkages between China and other B&R Economies

Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

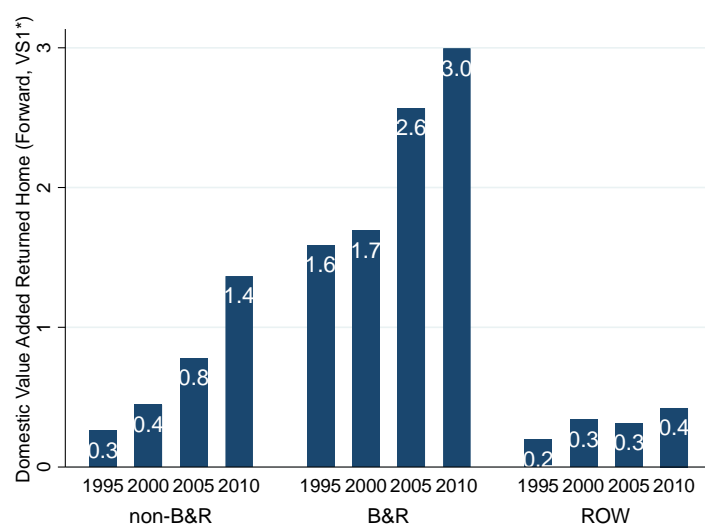
In addition, the Chinese domestic market is more and more important to its B&R partners. The Chinese domestic value-added that returns to China (VS1*), of course, through Chinese imports, has been steadily increasing (Figure 44). The increase has been more important with B&R Economies, suggesting that GVC trade in view of serving Chinese domestic markets is becoming the new paradigm. About 3 % of China's exports returns from B&R countries. As shown in Figure 29 in Section 4, in terms of the share of VS1*, China is comparable to some developed economies: in 2010 China is among the top with the United States, Japan and Germany.

FIGURE 44: CHINA, DOMESTIC VALUE-ADDED RETURNED HOME (% OF GROSS EXPORTS)



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

FIGURE 45: CHINA, DOMESTIC VALUE-ADDED RETURNED HOME, BY DESTINATION (% OF GROSS EXPORTS)

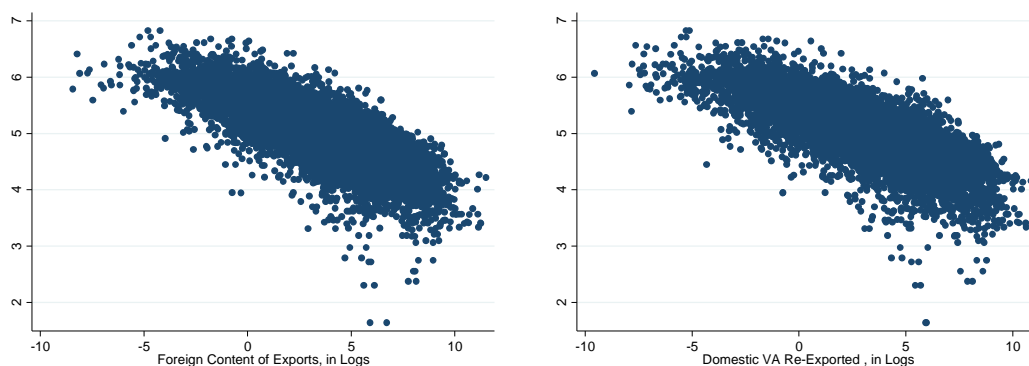


Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva database.

7. Potential Benefits from Further Integration

To evaluate the potential benefits from further integration between B&R Economies and China, we estimate a regression model of value-added flows on trade costs (Figure 37). We match our value-added database to the trade costs database of Arvis et al. (2013). The trade costs explain the variation in our database well.

FIGURE 46: TRADE COSTS AND TRADE IN VALUE-ADDED INDICATORS, B&R ECONOMIES, 1995-2010



Source: Author's calculations based on Trade Costs Database (Arvis et Al. 2013) and GVC indicators extracted using the Wang et Al. (2013) methodology from TiVA.

We find that a reduction of trade costs of 1% is likely to increase bilateral trade between B&R Economies by 1.3 %. Concerning trade in value-added indicators, the order of magnitude stays the same except for the indicator of domestic value-added that returns home (VS1*). For this indicator, we find that trade cost reduction by 1% would yield an increase of more than 1.7 %. The result is especially appealing since this type of value chain is the most beneficial to both economies as it builds not only on their production capabilities but also on their domestic markets.

BOX 3: CONSEQUENCES OF REDUCING TRADE COSTS

To estimate the impact of furthering economic integration between B&R Economies and China, we estimate a regression model where the dependent variable is the trade in value-added and the independent variables are the trade costs. The approach assumes that the B&R initiative will reduce trade costs between all B&R partners.

The estimating equation is

$$\log(\text{TradeVA}_{ijt}) = \beta_1 \log(\text{TradeCosts}_{ijt}) + \alpha_{ij} + \lambda_t + \epsilon_{ijt}$$

Where TradeVA_{ijt} is one of our trade in value-added indicators. β_1 is the elasticity of trade with respect to trade costs and α_{ij} and λ_t are sets of fixed effects. The estimated coefficients are in Table 1.

TABLE 1 REGRESSION RESULTS, IMPACT OF REDUCING TRADE COSTS

	(1) Log Exports	(2) Gross Log VS	(3) Log VS1	(4) Log VS1*
Log Trade Costs	-1.13*** (0.06)	-1.22*** (0.06)	-1.21*** (0.06)	-1.73*** (0.08)
Constant	10.32*** (0.31)	9.11*** (0.33)	8.67*** (0.33)	5.66*** (0.43)
Observations	12,408	12,408	12,408	12,408
R-squared	0.48	0.53	0.49	0.45
Number of pair_id	3,493	3,493	3,493	3,493
Pair FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's elaboration

8. Conclusion

Integration within the economies of the B&R has already begun. We find that our selected group of B&R Economies are well integrated with regard to both backward and forward linkages. Still, they source some of the value-added in exports from third partners.

There are two important interconnected production networks around China and Russia. They are central in the value-added as both providers and users of inputs. With their strong linkages, they are well connected to other B&R partners and they leverage on their domestic markets by building value-chains around them. In fact, the share of exports that returns to be consumed in their domestic markets is as high as that of some developed countries.

There is substantial scope for further integration in the key sector of Computer, Electronics and Optical Equipment sector which accounts for over 15 % of gross exports from the B&R Economies. Surprisingly, in this key sector only 15 % of the value added comes from B&R partners, while around 30 % comes from mostly developed economies. Therefore, there is substantial room for further integration and a more intensive use of B&R inputs.

China's role in GVCs is evolving once again. From an exporting structure based on assembly and intensive in foreign inputs, China is moving up the value chain to become one of the most important GVC hubs. We observe that while overall the use of foreign value-added has diminished, the composition of the vertical specialization index with B&R Economies revolves around the double counted terms. This suggests that trade between China and B&R Economies is intensive in GVCs. China is nowadays at the center of the trade network under all angles. It occupies a dominant position together with Germany and the United States. B&R Economies are among its main partners and they are the most important partners for circular value chains that leverage on the domestic economy.

In the paper, we find that an eventual reduction of trade costs, generated by improved connectivity, is likely to increase not only trade but also the vertical specialization linkages in the region from the exporting and importing side. Given the increasingly large domestic market in China, it is not surprising that most of the gains from lower trade costs would come from domestic value-added that returns home (the circular value chain). The finding is encouraging as this is a win-win value chain where countries specialize in their comparative advantage and leverage their own domestic economies.

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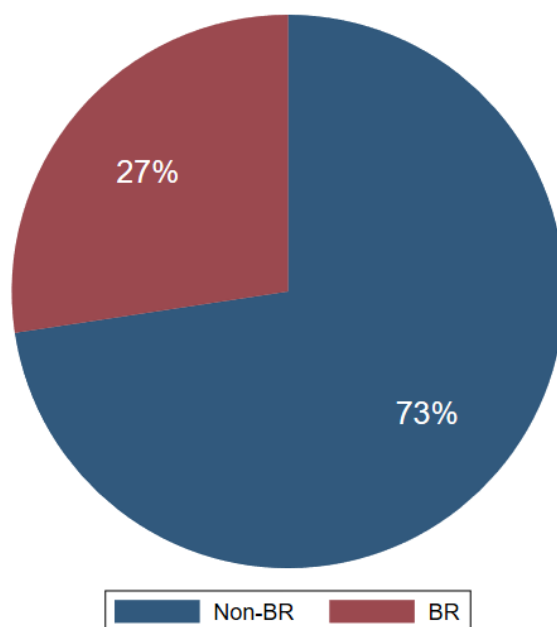
Appendix

A1: Comparison between EORA and Tiva GVC Indicators

We briefly present an alternative input-output database. The EORA database (Lenzen et Al., 2012, Lenzen et Al. 2013) is a multiregional input-output table with high resolution. The higher country coverage relies on assumptions with respect to the technology of countries for which we are missing national input-output tables. The missing tables are replaced with the technical coefficients of countries in the same region and income class. The model allocates flows of intermediates goods through an optimizing algorithm.

Therefore, the data in EORA, although having a higher country coverage, are much more uncertain because of the approximation of interregional input-output tables at the national level for many countries. We use the EORA database as a robustness check of our analysis and we provide a full replication of the results in the appendix. At the aggregate level, EORA appears to underestimate the role of B&R countries by giving them a share of 27 % of world exports in 2010.

FIGURE 47: SHARE OF WORLD EXPORTS, EORA



Source: Author's calculations based on EORA.

There are differences and similarities between the two input-output tables at our disposal, EORA and Tiva. Both EORA and Tiva are based in national input-output tables to produce in the end a multiregional tables of production linkages. To compare both databases, we take as year of reference 2010.

We compare the three main vertical specialization indicators developed by Koopman et al. (2014). The foreign content of exports, VS, the domestic value-added re-exporter by partners, VS1, and the domestic value-added that returns to the domestic market (VS1*).

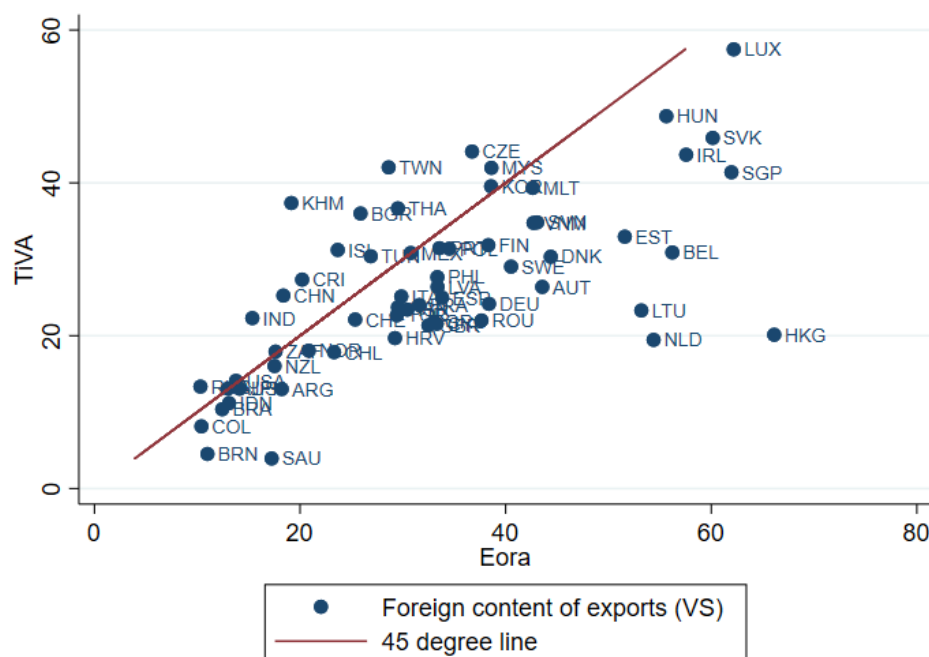
In Figure 48, we compare the foreign content of exports between the two databases. We find, for the 60 economies in the two databases, a correlation of 66% between the two variables. In particular, we observe that the estimates from Tiva are more conservative, while most estimates from EORA are at the right of the 45-degree line.

In Figure 49, we compare the values for the domestic value-added re-exported to third countries. Here we find a correlation of 64 %. Once again, most estimates from EORA are at the right of the 45-degree line, which implies larger estimates than in Tiva.

Figure 50, we plot the domestic value-added exported that returns to the domestic market for final absorption. We notice that there is one large outlier, the United States, therefore, we plot once again the relationship excluding the value for the United States in Figure 51. In this case the two indicators are rather similar, and the correlation is 89 %.

We conclude that the estimates from Tiva are in general more conservative. The values from the two databases tend to differ, although they are generally strongly correlated.

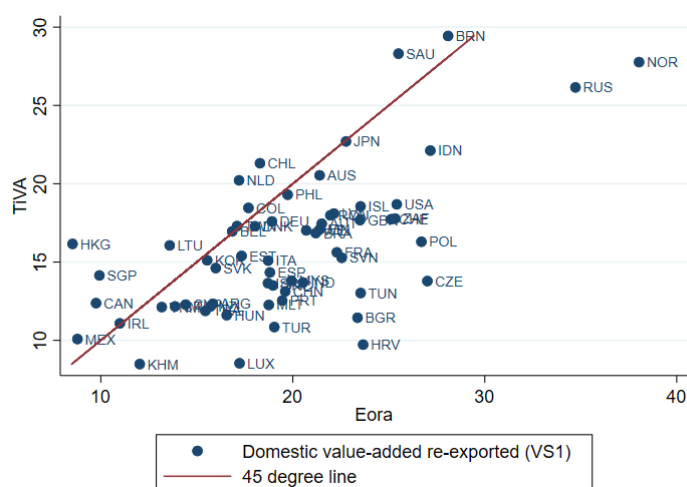
FIGURE 48: COMPARISON FOREIGN CONTENT OF EXPORTS, EORA AND TIVA



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva and EORA database. The computations were performed with the Kummritz and Quast (2017) algorithm.

Note: All numbers are shares of gross exports at the country level.

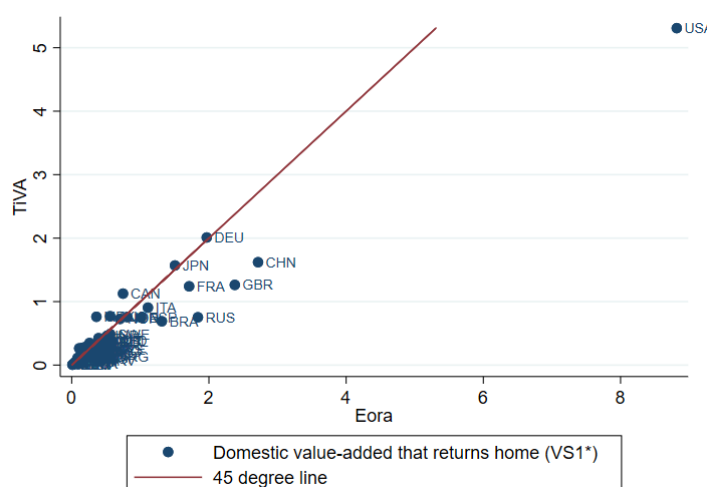
FIGURE 49: COMPARING VERTICAL SPECIALIZATION FORM THE EXPORTING SIDE, EORA AND TIVA



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva and EORA database. The computations were performed with the Kummritz and Quast (2017) algorithm.

Note: All numbers are shares of gross exports at the country level.

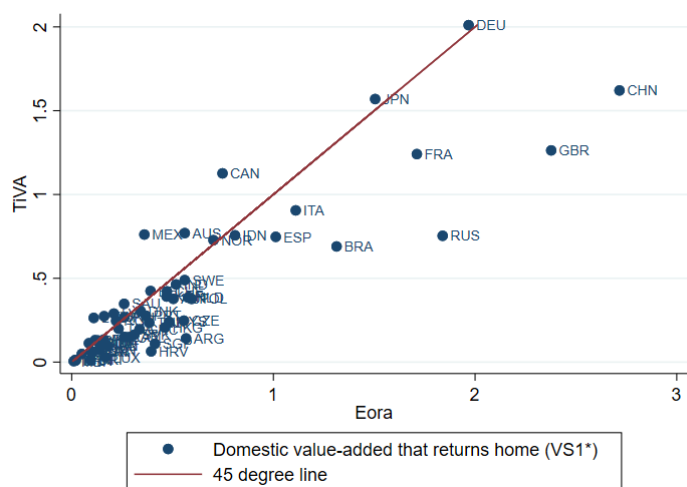
FIGURE 50: COMPARISON OF DOMESTIC VALUE-ADDED THAT RETURNS HOME, TIVA AND EORA



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva and EORA database. The computations were performed with the Kummritz and Quast (2017) algorithm.

Note: All numbers are shares of gross exports at the country level.

FIGURE 51: COMPARISON OF DOMESTIC VALUE-ADDED THAT RETURNS HOME EXCLUDING USA, TIVA AND EORA



Source: Author's calculations based on GVC indicators extracted using the Wang et Al. (2013) methodology on the Tiva and EORA database. The computations were performed with the Kummritz and Quast (2017) algorithm.

Note: All numbers are shares of gross exports at the country level.

A2: Network Analysis of Origin and Destination of Value-added using EORA

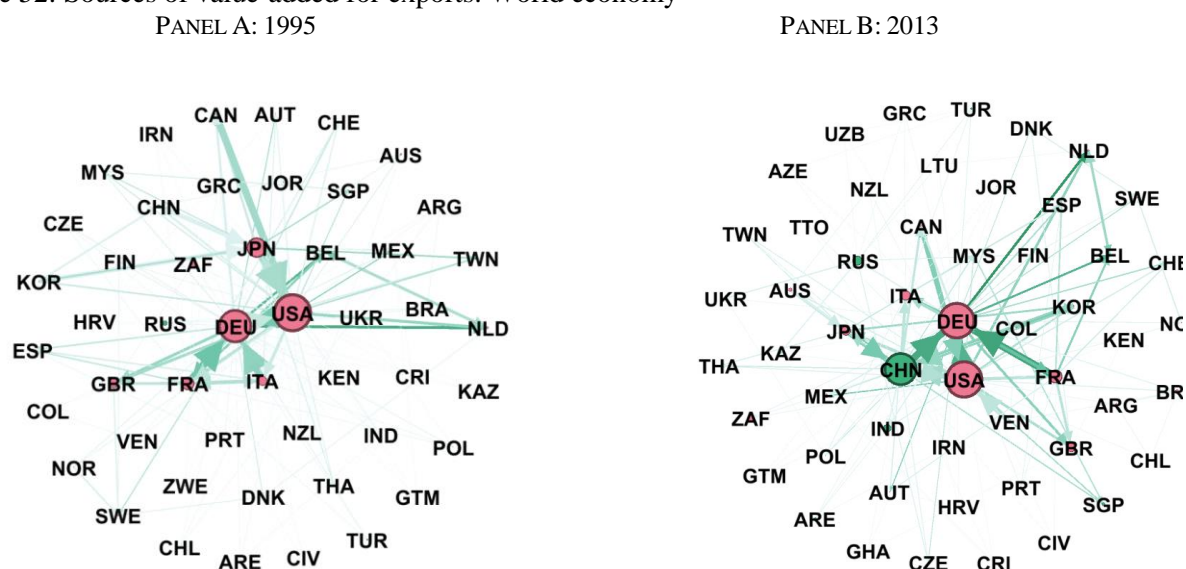
In this appendix, we repeat the mapping of value-added using EORA multiregional input-output tables. The goal is to observe similarities with the network analysis in Tiva. To that effect, we map for every country the three most important linkages in terms of value-added.

In Figure 52, we observe the most important sources of value added in 1995 (Panel A) and 2010 (Panel B). In 1995, the most important source of activities/inputs/services for producing exports were Germany, Japan and the United States. We can distinguish two clear networks. One formed by the European countries and another by North America. In 2010, we see that Japan has been displaced to a more peripheral position that is now occupied by China as the third most important source of value-added for exports.

In Figure 53, we observe the most important destinations of value added in 1995 (Panel A) and 2010 (Panel B). These are the countries that send most of their domestic value-added abroad for further processing and exporting. We surprisingly see only Germany at the center of the network. However, there is a clear trend towards the center for China as well in panel B.

Figure 54 and Figure 55 focus on the B&R subnetwork. In both cases we see a clear trend, with China, Russia and Singapore occupying a central position. The figures confirm the analysis in Tiva. For B&R economies there are two gravitational centers, China and the Russian Federation, and some very well-connected countries such as Poland, Malaysia and Singapore.

Figure 52: Sources of value-added for exports. World economy

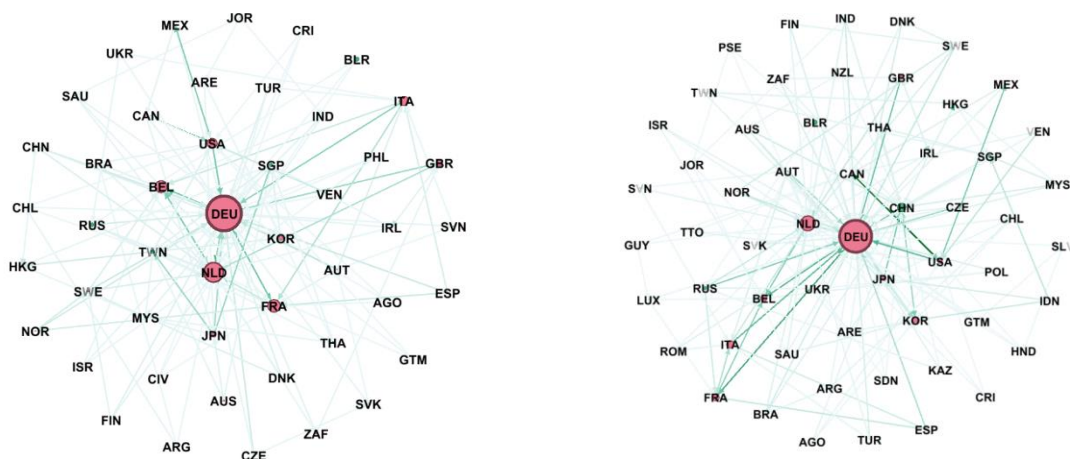


Source: author's computations using Gephi on EORA multiregional input-output tables

Note: Each node represents a country. The size of the node is the total number of times for which the country was among the top 3 sources of value added for its partners. The thickness of the edges represents the strength of the link in terms of value-added. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 53: DESTINATION OF VALUE-ADDED RE-USED FOR EXPORTS

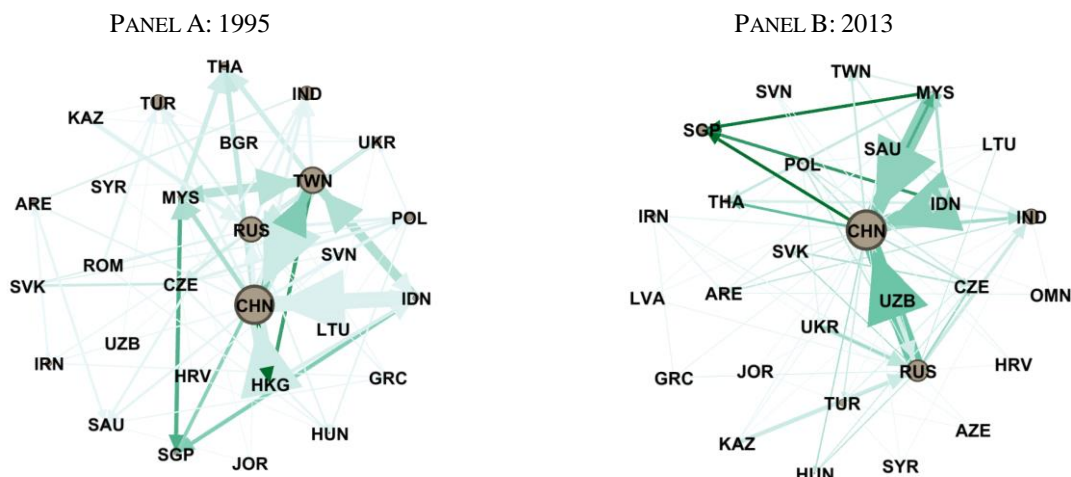




Source: author's computations using Gephi on EORA multiregional input-output tables

Note: Each node represents a country. The size of the node is the total number of times for which the country was among the top 3 destinations of value added for each of its partners. The thickness of the edges represents the strength of the link in terms of value-added. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 54: SOURCE OF VALUE-ADDED, B&R SUB NETWORK



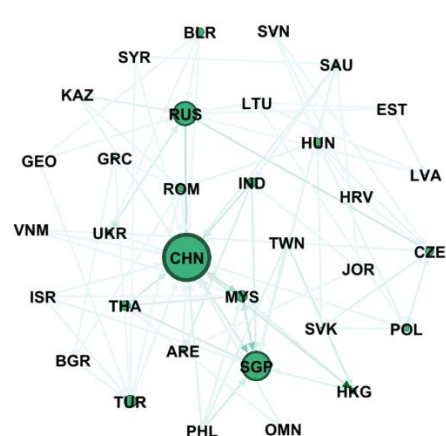
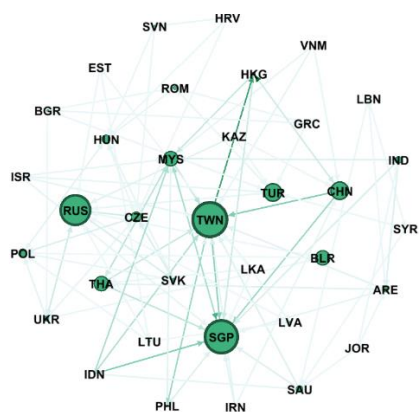
Source: author's computations using Gephi on EORA multiregional input-output tables.

Note: Each node represents a country. The size of the node is the total number of times for which the country was among the top 3 sources of value added for each of its partners. The thickness of the edges represents the strength of the link in terms of value-added. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships.

FIGURE 55: DESTINATION OF VALUE-ADDED, B&R SUB-NETWORK

PANEL A: 1995

PANEL B: 2013



Source: author's computations using Gephi on EORA multiregional input-output tables

Note: Each node represents a country. The size of the node is the total number of times for which the country was among the top 3 destinations of value added for each of its partners. The thickness of the edges represents the strength of the link in terms of value-added. More central countries are at the center of the graph, while less connected ones are the periphery. We use the Fruchterman Reingold (1991) algorithm to rearrange the nodes according to the strength of their relationships. B&R economies are defined in

A3: Indicators of Vertical Trade using EORA

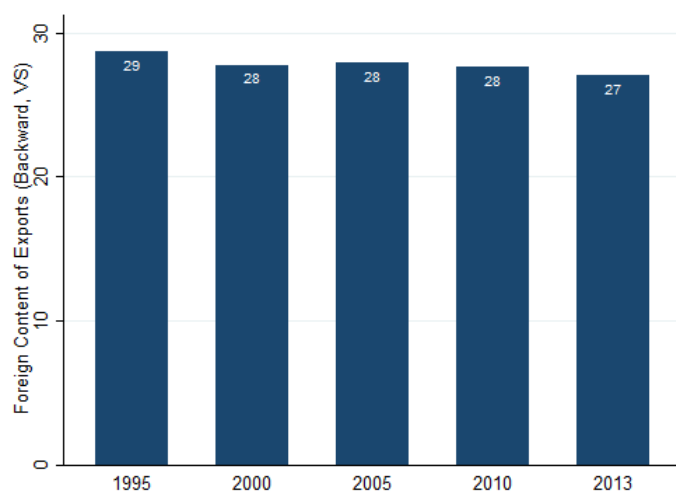
Here we report the same GVC participation indicators using EORA data. The results tend to confirm the observations that we made with Tiva. Therefore, the explanations provided in the paper are still valid using EORA data.

Figure 56 and Figure 57 show the foreign content of exports in B&R economies. We observe that the foreign content has been fairly stable through time. Exports that have B&R countries as destination tend to have a higher share of foreign value-added. Figure 58 shows the composition of the vertical specialization index for B&R exports.

Figure 59 and Figure 60 show forward linkages in the form of domestic value-added re-exported to third countries. Here we observe that these forward linkages have been increasing, especially when trading with non-B&R economies.

Figure 61, Figure 62 and Figure 63 all focus in domestic value-added that eventually returns home. The indicator has been increasing over time, especially when B&R economies trade among themselves. The countries with the highest values of domestic value-added that returns home are like those in Tiva. Although, the value of the United States is 2 percentage points larger.

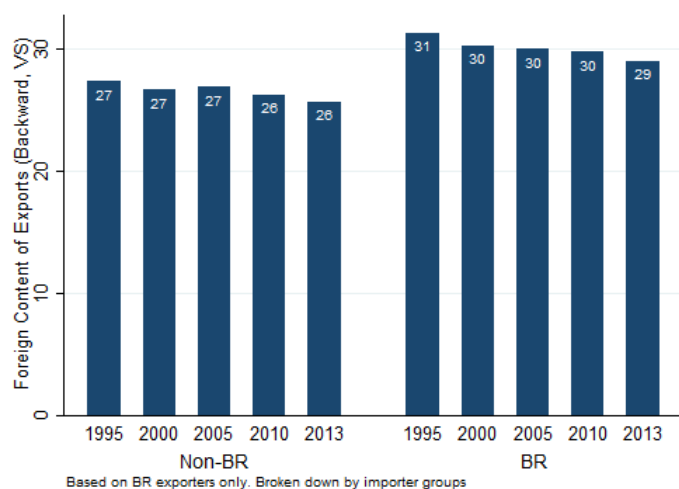
FIGURE 56: FOREIGN CONTENT OF EXPORTS, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the foreign content of exports of B&R economies.

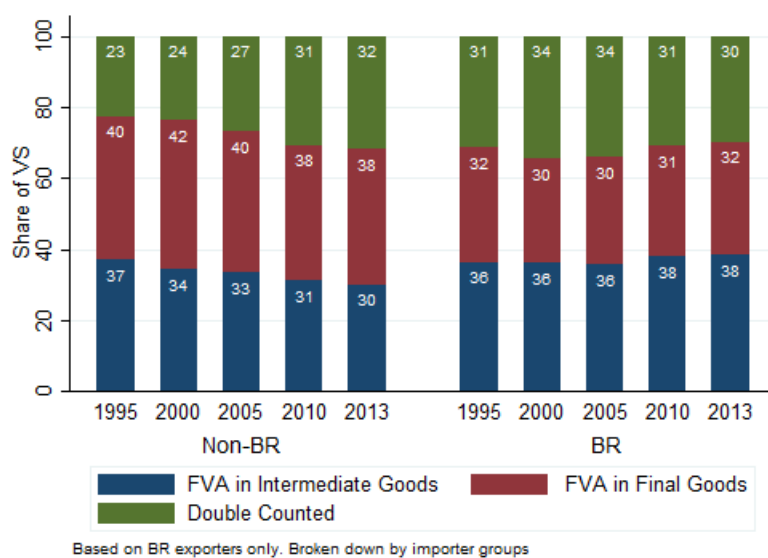
FIGURE 57: B&R FOREIGN CONTENT OF EXPORTS BROKEN DOWN BY DESTINATION



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports. The variable of interest is the foreign content of exports of B&R economies broken down by the destination of exports.

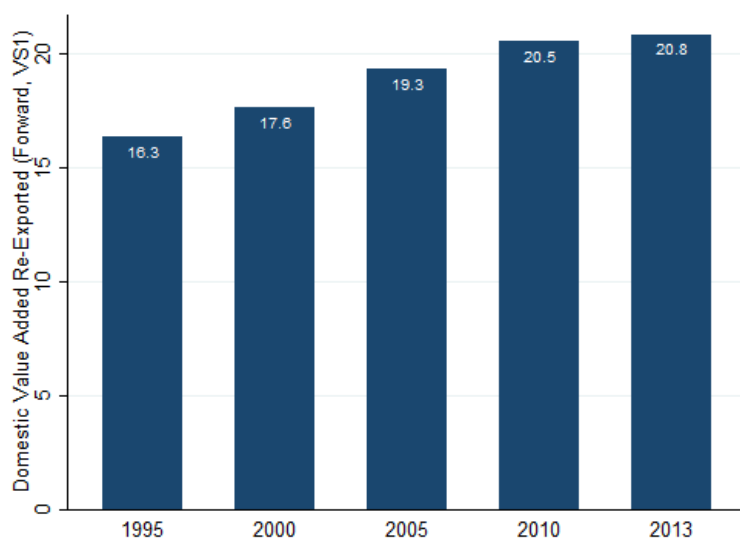
FIGURE 58: COMPOSITION OF VERTICAL SPECIALIZATION INDEX, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of the foreign content of exports.

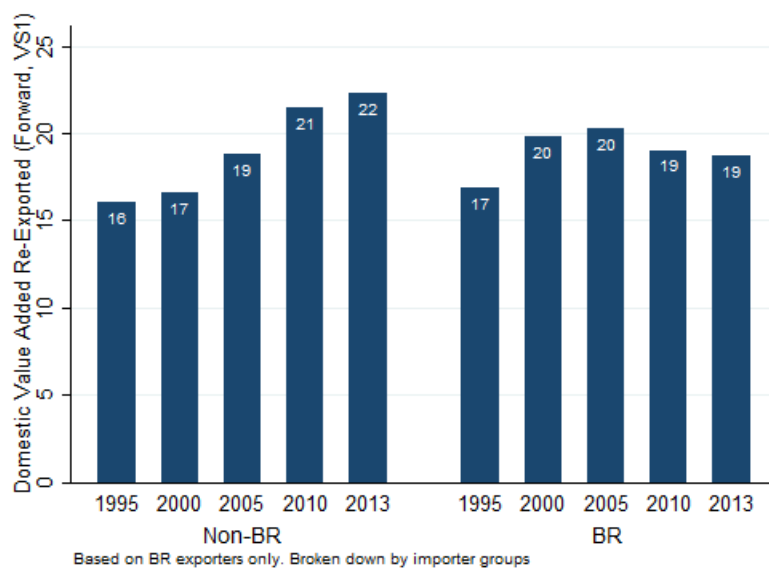
FIGURE 59: GROWTH OF DOMESTIC VALUE-ADDED RE-EXPORTS, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports.

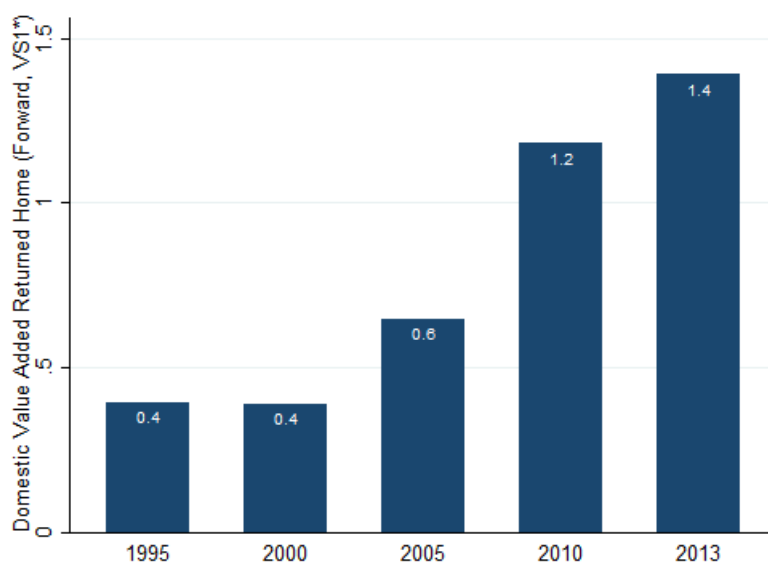
FIGURE 60: DOMESTIC VALUE-ADDED IN EXPORTS BY DESTINATION, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports broken down by destination.

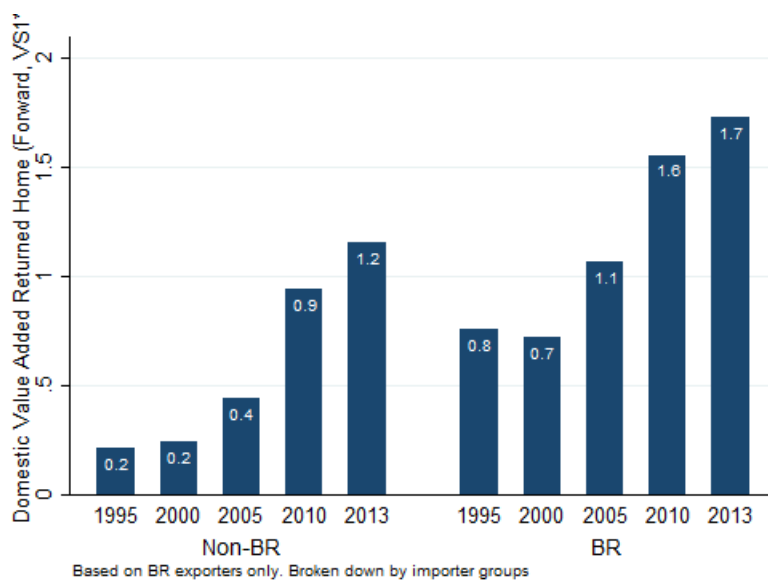
FIGURE 61: DOMESTIC VALUE-ADDED THAT RETURNS HOME, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports.

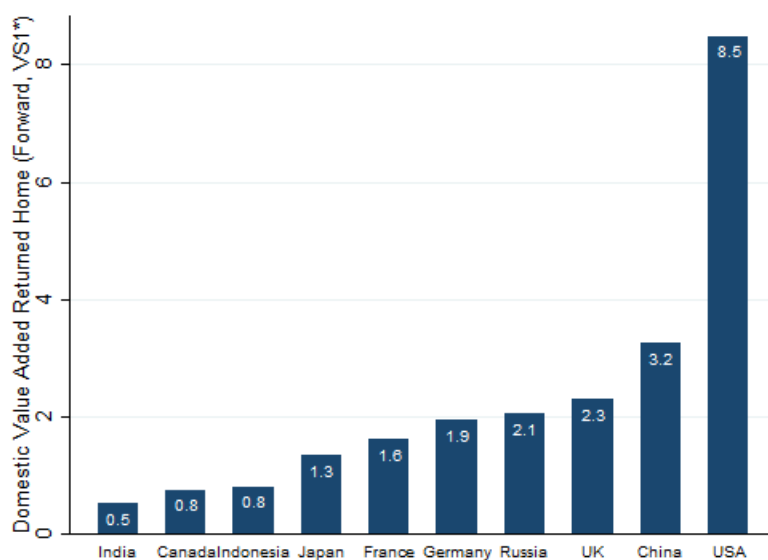
FIGURE 62: DOMESTIC VALUE-ADDED THAT RETURNS HOME BY DESTINATION, B&R ECONOMIES



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports broken down by destination.

FIGURE 63: LARGEST VALUES FOR DOMESTIC VALUE-ADDED THAT RETURNS HOME, 2013



Source: Author's calculations based on the EORA database.

Note: All numbers on the y-axis are percentages of gross exports.

A4: B&R Economies in the Paper

TABLE 1: B&R ECONOMIES AND THEIR DATA AVAILABILITY

No.	Country/Economy	ISO Code	World Bank Region	Covered in UN Comtrade?	Covered in TiVA?	Covered in EORA?
1	Brunei Darussalam	BRN	EAP	Yes	Yes	Yes
2	China	CHN	EAP	Yes	Yes	Yes
3	Cambodia	KHM	EAP	Yes	Yes	Yes
4	Hong Kong SAR, China	HKG	EAP	Yes	Yes	Yes
5	Indonesia	IDN	EAP	Yes	Yes	Yes
6	Lao PDR	LAO	EAP	Yes	No	Yes
7	Malaysia	MYS	EAP	Yes	Yes	Yes
8	Mongolia	MNG	EAP	Yes	No	Yes
9	Myanmar	MMR	EAP	Yes	No	Yes
10	Philippines	PHL	EAP	Yes	Yes	Yes
11	Singapore	SGP	EAP	Yes	Yes	Yes
12	Taiwan, China	TWN	EAP	No	Yes	Yes
13	Thailand	THA	EAP	Yes	Yes	Yes
14	Timor-Leste	TLS	EAP	No	No	No
15	Vietnam	VNM	EAP	Yes	Yes	Yes
16	Afghanistan	AFG	SAR	Yes	No	Yes
17	Bangladesh	BGD	SAR	Yes	Yes	Yes
18	Bhutan	BTN	SAR	Yes	No	Yes
19	India	IND	SAR	Yes	Yes	Yes
20	Maldives	MDV	SAR	Yes	No	Yes
21	Nepal	NPL	SAR	Yes	No	Yes
22	Pakistan	PAK	SAR	Yes	No	Yes
23	Sri Lanka	LKA	SAR	Yes	No	Yes
24	Bahrain	BHR	MENA	Yes	No	Yes
25	Egypt, Arab Rep.	EGY	MENA	Yes	No	Yes
26	Iran, Islamic Rep.	IRN	MENA	Yes	No	Yes
27	Iraq	IRQ	MENA	No	No	No
28	Israel	ISR	MENA	Yes	Yes	Yes
29	Jordan	JOR	MENA	Yes	No	Yes
30	Kuwait	KWT	MENA	Yes	No	Yes
31	Lebanon	LBN	MENA	Yes	No	Yes
32	Oman	OMN	MENA	Yes	No	Yes
33	West Bank and Gaza	PSE	MENA	No	No	No
34	Qatar	QAT	MENA	Yes	No	Yes
35	Saudi Arabia	SAU	MENA	Yes	Yes	Yes
36	Syrian Arab Republic	SYR	MENA	Yes	No	Yes
37	United Arab Emirates	ARE	MENA	Yes	No	Yes

38	Yemen, Rep.	YEM	MENA	Yes	No	Yes
39	Albania	ALB	ECA	Yes	No	Yes
40	Armenia	ARM	ECA	Yes	No	Yes
41	Azerbaijan	AZE	ECA	Yes	No	Yes
42	Belarus	BLR	ECA	Yes	No	Yes
43	Bosnia and Herzegovina	BIH	ECA	Yes	No	Yes
44	Bulgaria	BGR	ECA	Yes	No	Yes
45	Croatia	HRV	ECA	Yes	Yes	Yes
46	Czech Republic	CZE	ECA	Yes	Yes	Yes
47	Estonia	EST	ECA	Yes	Yes	Yes
48	Greece	GRC	ECA	Yes	Yes	Yes
49	Georgia	GEO	ECA	Yes	No	Yes
50	Hungary	HUN	ECA	Yes	Yes	Yes
51	Kazakhstan	KAZ	ECA	Yes	No	Yes
52	Kyrgyz Republic	KGZ	ECA	Yes	No	No
53	Latvia	LVA	ECA	Yes	Yes	Yes
54	Lithuania	LTU	ECA	Yes	Yes	Yes
55	Macedonia, FYR	MKD	ECA	Yes	No	No
56	Moldova	MDA	ECA	Yes	No	Yes
57	Montenegro	MNE	ECA	No	No	No
58	Poland	POL	ECA	Yes	Yes	Yes
59	Romania	ROM	ECA	Yes	Yes	Yes
60	Russian Federation	RUS	ECA	Yes	Yes	Yes
61	Serbia	SRB	ECA	No	No	No
62	Slovak Republic	SVK	ECA	Yes	Yes	No
63	Slovenia	SVN	ECA	Yes	Yes	Yes
64	Tajikistan	TJK	ECA	No	No	Yes
65	Turkey	TUR	ECA	Yes	Yes	Yes
66	Turkmenistan	TKM	ECA	Yes	No	Yes
67	Ukraine	UKR	ECA	Yes	No	Yes
68	Uzbekistan	UZB	ECA	No	No	Yes

TABLE 2: INDUSTRY DESCRIPTION, TiVA DATABASE

Industry Code	Industry Description
C01T05	Agriculture, hunting, forestry and fishing
C10T14	Mining and quarrying
C15T16	Food products, beverages and tobacco
C17T19	Textiles, textile products, leather and footwear
C20	Wood and products of wood and cork
C21T22	Pulp, paper, paper products, printing and publishing
C23	Coke, refined petroleum products and nuclear fuel
C24	Chemicals and chemical products
C25	Rubber and plastics products
C26	Other non-metallic mineral products
C27	Basic metals
C28	Fabricated metal products
C29	Machinery and equipment, nec
C30T33X	Computer, Electronic and optical equipment
C31	Electrical machinery and apparatus, nec
C34	Motor vehicles, trailers and semi-trailers
C35	Other transport equipment
C36T37	Manufacturing nec; recycling
C40T41	Electricity, gas and water supply
C45	Construction
C50T52	Wholesale and retail trade; repairs
C55	Hotels and restaurants
C60T63	Transport and storage
C64	Post and telecommunications
C65T67	Financial intermediation
C70	Real estate activities
C71	Renting of machinery and equipment
C72	Computer and related activities
C73T74	R&D and other business activities
C75	Public admin. and defense; compulsory social security
C80	Education
C85	Health and social work
C90T93	Other community, social and personal services
C95	Other services

Source: OECD-WTO Trade in Value-added Database.