Belt and Road Projects Reward Country Centrality and Similarity to China

Kaku Attah Damoah*, Giorgia Giovannetti†, Enrico Marvasi‡

Abstract

We analyze the relationship between trade patterns and the allocation of investment projects carried out under the China-led Belt and Road Initiative (BRI). Rooted on a novel database, we construct the intermediate trade network and assess its role in the allocation of the projects. Investments tend to concentrate in countries located in central nodes of the international production networks as well as towards suppliers of intermediate goods whose revealed comparative advantage (RCA) overlaps with China. High income countries closer to destination markets tend to attract fewer but larger investments. Controlling for gravity variables as well as for political proximity to China adds explanatory power without affecting the results on the importance of trade. The BRI represents an opportunity for China to upgrade its exports and for the countries receiving investments to enhance their participation in GVC with possible positive impact on development.

Keywords: Belt and Road, China, global value chains, trade in intermediates, network-centrality.

JEL classification: F14, F15, F21.

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1 Introduction

Officially announced by Xi Jinping in 2013, the Belt and Road Initiative (BRI) is China's most ambitious geo-economic and foreign policy initiative in decades. The BRI combines a land-based Silk Road Economic Belt and a sea-based 21st Century Maritime Silk Road therefore creating a network of connectivity across Central, Western and Southern Asia, reaching out to the Middle East, Northern and Eastern Africa.

Infrastructure development is the most explicit and visible aspect of the project. More than three hundred major infrastructure projects, including roads, railways, dry ports, and seaports, have been completed since the inception of BRI up to September 2018.[1] Roads account for almost two-thirds of infrastructural projects, while railways, dryports and seaports account for about 10-15% each. Through infrastructure development, the BRI has the potential to enhance regional trade and Global Value Chain (GVC) development, policy coordination, trade facilitation, financial integration as well as capital and labour mobility.

More than sixty countries are directly connected to the BRI with at least a completed infrastructure project. In 2018, their combined Gross Domestic Product including China is $27 trillion (32% of world GDP), with a population approximately 4.7 billion people (around 62% of the world population). Excluding China, the GDP of the remaining countries stands at $13.8 trillion (16% of world GDP) and a population of 3.3 billion people (44% of world population). These countries contribute 18% and 19% of world export and import, respectively. With over 70% of BRI countries in lower- and middle-income status, the initiative has the potential to lift untapped trade participation of countries involved through GVC and intermediate trade.

On the other hand, the BRI represents an opportunity for China to strengthen its trade relationships with neighboring countries by developing new export markets in Central, South, and Southeast Asian countries as well as secure suppliers for its manufacturing. By virtue of BRI-related investments, existing value chains are likely to be reconfigured in the region with new countries joining whilst participating countries are likely to move along the chain to different value-added phases.

Infrastructure development is undoubtedly an important determinant of trade participation. Limão and Venables (2001) estimate that deterioration in infrastructure increases transport cost by 12 percentage points thereby reducing trade volume by as

[1] The reported figure excludes infrastructure projects in phases other than completed such as those planned, initiated, and/or under-construction.

much as 28 percent. Given the economic motives behind the BRI which explicitly include trade and global value chain participation, the patterns and mechanism of project allocation. Therefore, the allocation projects could be linked to countries' trade specialization thus unearthing trade potentials and reconfiguring of the global value chains. In the same manner, projects allocation may favor countries with a specialization similar to China thus reinforcing trade centralization with China at the center of the node.

Hence, trade relations that underlines the allocation of BRI infrastructure projects is an empirical question. This paper investigates the distribution in the number of projects and the value of projects by analyzing countries trade in intermediate trade, position in production networks, trade patterns with China, and pre-existing performance in logistics infrastructure. Moreover, the possibility that investments are driven by geographical and political proximity is also considered.

We find that: i) more investment projects have been completed in large and relatively poor countries, while richer countries get fewer but greater investments; ii) project recipients display relatively more diversified export structures than similar countries that are involved in the BRI but have not yet received any investment project, and their specialization tends to overlap more with that of China; iii) investments tend to favor countries that are more involved in GVC as suppliers of intermediates to China; iv) China is clearly the core of the intermediate trade network of BRI countries, with some countries being more central and hence better positioned to connect to other regions; v) countries more involved in intra-industry trade and with relatively sophisticated export bundles are more likely to attract (larger) investments; vi) being considered a "friend" from a political point of view also helps attracting investments.

Our findings highlight that BRI investments are closely related to trade patterns and GVC considerations; therefore, not only they will contribute to strengthen the regional GVC and related production networks, but also provide a reliable base of suppliers to China, which in turn may be able to upgrade its production. If this is the case, then the Belt and Road Initiative is a win-win strategy.[2]

The rest of the paper is organized as follows. Section 2 introduces the recent and growing literature on the BRI initiative. Sections 3 describes the sources and construction of the dataset. Section 4 provides a descriptive analysis of the trade patterns focusing on trade in intermediates, while Section 5 presents an econometric analysis of project geographical allocation. Section 5 concludes.

[2] There are many problems with the BRI that we do not address here (e.g. debt, finance, geopolitical), see for instance Brakman et al. (2019) and Anastasiadou (2019).

2 Literature review

Poor infrastructure and remoteness inhibit countries potential to participate in global production networks. Limão and Venables (2001) show that the low level of trade flows from low-income countries is largely due to poor infrastructure. Not only infrastructure bridges the gap between countries, but international road networks also contribute to integrate rural and urban markets in developing countries leading to decrease in prices of imported goods and increase availability of products (Aggarwal 2018). This section reviews the emerging literature on the trade-related aspects of the Belt and Road Initiative that are more closely linked to this paper.

2.1 Reduction in trade costs

One of the main direct effects of the BRI is the reduction in trade and transport costs, especially for the land routes. As stressed by Amighini, (2017), "*As there is no comprehensive information available on the improvements to infrastructure or the construction of new infrastructure, it is difficult to estimate how much transportation costs will be reduced*" (Amighini, 2017 p. 135).

Domestic transport infrastructure is fundamental for countries participation in international markets as it contributes to a reduction in trade cost in various ways (Coşar and Demir 2016). Quantification of the likely reduction in transportation costs is, in fact, at the core of several papers. de Soyres, Mulabdic, and Ruta (2020) explicitly study the impact of infrastructural projects on shipment times and trade costs. They build an original dataset which includes information on projects and their geographical location and estimate that shipment times will decrease by 1.2-2.5%, which in turn implies a reduction in trade costs by 1.1-2.2% at the world level; results indicate even larger effects for BRI countries, especially along the land corridors. Johns et al. (2018) review the main trade facilitation performance indicators (e.g. the logistics performance index) and discuss the challenges of each of the six corridors. They show that BRI countries tend to perform poorly and proceed to identify the main priorities and recommendations, generally calling for increased cross-country coordination and transparency measures to be implemented on a corridor-by-corridor basis.

Two recent Eurasian Development Bank Reports study the BRI transport corridors. Vinokurov et al. (2018) give a quantitative assessment of the freight traffic along the corridors, concluding that there is little uncertainty about the fast growth of container traffic in the next few years. Lobyrev et al. (2018) describe the physical and regulatory barriers to freight traffic growth in the long run and the investments that could foster it. Among the physical barriers, the relatively inadequate transport and processing capacity of Polish railways is worth mentioning as Poland is the main terrestrial gateway to the EU. The necessary improvements require sensible investments in the area. Ghossein et al. (2018), using the same data source that we exploit in this paper (CSIS), describe procurement of BRI projects and discuss possible improvements in procurement practices.

2.2 Impact on trade patterns

Given that the BRI is likely to reduce transportation and trade costs, researchers have also tried to estimate the impacts on trade. Exploiting the same data as in de Soyres, Mulabdic, and Ruta (2020), Baniya, Rocha, & Ruta (2019) estimate a gravity model and comparative advantage model to investigate the potential trade increases for participating countries. Garcia-Herrero & Xu (2017) estimate the trade creation effects due to cheaper transportation and find that the elasticity of trade to transportation costs is 0.2 for railway, 0.55 for air and 0.11 for maritime. The simulations, based on different scenarios, show that EU countries, especially landlocked, are likely to benefit. Lu et al. (2018) estimate a gravity model of trade, reaching similar conclusions. Ramasamy et al. (2017) investigate econometrically the trade effects of improvements in both hard (i.e. physical) and soft (i.e. administrative and ICT) connectivity, showing how expected gains vary from corridor to corridor.

Focusing on production networks, Boffa (2018) studies the production and trade linkages. Exploiting both custom trade data and input-output tables (TiVA, which includes 28 BRI countries), the paper gives an in-depth description of the trade patterns and shows how regional trade integration between BRI countries has increased, mostly thanks to trade in intermediate goods and global value chains development. The paper also provides econometric estimates of the impact of trade costs on value-added trade: a decrease in trade costs increases gross and value-added trade between BRI countries by 1.3-1.7%. Chen & Lin (2018) focus on foreign direct investments along the BRI, shoving how improvements in transportation costs can have a positive impact also on investments. The authors highlight that the increase in FDI varies with the transportation mode. Furthermore, there is a complementarity effects since BRI infrastructural projects seem to foster further subsequent Chinese FDI; a finding that is in line with Du & Zhang (2018).

A more detailed and project-oriented view of the BRI is provided in a study by the Austrian Central Bank focusing on implications for Europe. The first part of the study (Barisitz and Radzyner 2017a) reviews the initiative, its main institution and the details of some of the main investment projects. Based on the evidence gathered, the authors stress how maritime connectivity, while representing the dominant and cheaper mode is likely to lose some ground to improved overland connectivity. The second part of the study (Barisitz and Radzyner 2017b) discusses the implications of the BRI for Europe, and Southern Eastern Europe in particular, discussing how the initiative can contribute to overcome the peripheral position of these countries increasing their role as hubs and gatekeepers in the Euro-Asian trade network.

2.3 Macroeconomic effects

A broader macroeconomic perspective on the impacts of the BRI is provided by Villafuerte et al. (2016). The authors investigate the economic impacts of the BRI using the GTAP model and find that there are possible benefits to trade and growth of both BRI and non-BRI countries, with some heterogeneity between countries. More recently, Enderwick (2018) offers an early stage assessment and discussion of the economic impact of the BRI, also considering it in a historical perspective. Overall, the possible benefits are heterogeneously distributed, with some poorer countries benefiting greatly and China being the major beneficiary.

The heterogeneous effects of the BRI in terms of gains from trade and growth highlighted by the recent research poses questions regarding the macroeconomic stability and exposure to shocks stemming from the increased interconnectedness between countries.

Bustos (2018) investigates the exposure of BRI countries to trade shocks originating from China. The author considers demand and competition shocks, the former referring to China as an importer and the latter to China as an exporter. In the last two decades, BRI countries have been, on aggregate, a main destination of China's exports, but not a main source of China's imports. The pattern seems to be gradually changing, with some countries having increased their exports towards China. Econometric results show that exports of BRI countries were significantly impacted by China's demand shocks, while competition shocks became somewhat more important in the last decade. The exposure to competition shocks is clearly related to trade similarity and specialization overlap with China.

Derudder et al. (2018) explicitly take a network analysis approach and investigate the hypothesis that a country's position in the network of connections (road, rail, air, and information technology) between BRI countries matters for the possible gains from the initiative. They conclude that prioritizing the weak links of the network and reinforcing them is likely to provide the largest benefits not only for the countries directly involved, but for the entire network as well.

3 Data sources

The data on infrastructural investments are taken from the Reconnecting Asia project of the Center for Strategic and International Studies (CSIS). This project maps five infrastructural projects types – road, rail, seaports, intermodal facilities, and powerplants – geographically spread in Eurasia countries from 2006.[3]

We focus on transport infrastructure projects completed between 2013 and September 2018. For each BRI country, we compile information on completed infrastructure projects by type and cost. Our dataset includes both the number of completed projects and their estimated value. We compiled a total of 329 completed infrastructure projects in BRI countries (September 2018). Roads account for 65% of all completed projects. Rails, dryports, and seaports accounts for 18%, 3%, and 14% respectively of all completed projects. Appendix A1 lists all completed projects by type for all BRI countries.

The source of the trade data is the Eora multi-regional input-output tables (Eora-MRIO). The use of input-output tables allows us to perform consistent GVC and network analyses, focusing on trade in intermediates. Our definition of trade in intermediates refers to sector-to-sector exchanges and reflects the endogenous input-output structure of trade. The Eora database, contrary to other sources, has a wide country coverage, including low and middle-income countries. Each Eora input-output table includes 187 countries and 26 sectors; hence, the intermediate block has 26 times 187 cells, for a total of more than 23.6 million country-sector-to-country-sector observations. In most of the empirical analysis, we elaborate and organize the data and the variables so to operate at the country-sector level, with 4862 country-sector observations. Other country level variables, such as GDP per capita and the logistics performance indicators are taken from the World Bank Doing Business and World Development Indicators (WDI). The geographical variables are taken from CEPII, while for political proximity to China we use the UN General Assembly voting similarity index with China by the UN (see Bailey et al., 2017; Voeten et al., 2009).

In what follows, we concentrate on the trade figures for the year 2012, a year before the 2013 official announcement. This allows us to describe the pre-existing trade patterns and then to investigate their relationship with the subsequent BRI investments

[3] For details on the CSIS database see the Appendix A1.

completed between 2013 and 2018. Note that, although the 2013 official announcement is a natural threshold, it cannot be regarded as a strictly exogenous event that triggered BRI and we cannot exclude anticipation effects. Furthermore, there is evidence of some investments in the (future) BRI economies in the ten years preceding the announcement (Constantinescu and Ruta 2018). With these limitations in mind, we gauge how existing trade patterns and other country characteristics are associated with subsequent infrastructure projects referring to the period 2013-2018.

4 The intermediate trade network

Our analysis of the intermediate trade network is based on the Eora multi-region input-output table. Input-output tables are structured as in Figure 1. There are four main blocks, namely the intermediate exchanges (Z), final demand (F), value added (VA) and total output (Y). We denote with Z_{sr} the generic sector-to-sector $N \times N$ square matrix of intermediate inputs produced in (row) country s and used by (column) country r, with $s, r = 1, \dots, G$. Similarly, F_{sr} is a $N \times 1$ vector of final goods and services supplied by country s to country r; VA_r is a $N \times 1$ vector of value-added; and, finally, Y_s is a $N \times 1$ vector of value-added generated by country s.

Figure 1 – Structure of a multi-region input-output table.

		Intermediate use				Final demand				Total output
		1	2	…	G	1	2	…	G	
Intermediate inputs	1	Z_{11}	Z_{12}	…	Z_{1G}	F_{11}	F_{12}	…	F_{1G}	Y_1
	2	Z_{21}	Z_{22}	…	Z_{2G}	F_{21}	F_{22}	…	F_{2G}	Y_2
	⋮	⋮	⋮	⋱	⋮	⋮	⋮	⋱	⋮	⋮
	G	Z_{G1}	Z_{G2}	…	Z_{GG}	F_{G1}	F_{G2}	…	F_{GG}	Y_G
Value added		VA_1'	VA_2'	…	VA_G'					
Total output		Y_1'	Y_2'	…	Y_G'					

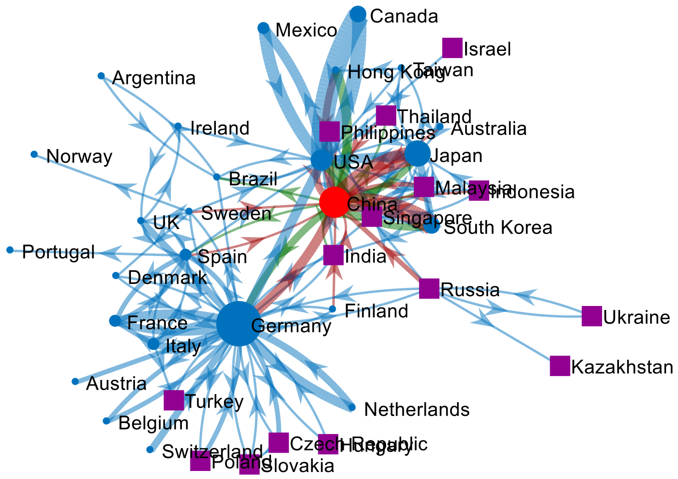
The off-diagonal matrices within the intermediate block Z and of the final demand block F identify international trade flows of intermediate and final goods and services. The $N \times 1$ vector of sectoral intermediate exports of country s to country r can be obtained by the row-sum of the Z_{sr} elements as $IX_{sr} = Z_{sr}J$, where $s \neq r$ and J is a column vector of ones. The $N \times 1$ vector of total exports (intermediate + final) of country s to country r is therefore given by the sum $TX_{sr} = IX_{sr} + F_{sr}$.

With simple manipulations, we can therefore retrieve the share of intermediates in overall trade and the share of intermediates exported to any given destination. Moreover, the bilateral nature of trade flows naturally leads to the consideration of its network structure. In our network analysis we focus on intermediate manufacturing export sectors only. This allows us to obtain information that is otherwise neglected concerning the international production linkages of countries and their centrality within the network. We consider directed trade networks whose edges are weighted by the trade flows value.

The world intermediate trade network, as is well known, shows three main manufacturing regions: Europe, Asia and North America and their respective hubs: Germany, China and USA. The centrality of China in the world production network is clear. In this configuration, the BRI is likely to reinforce the link between Europe and China, which is dominated by the China-Germany relation, possibly creating more and new linkages and making the network more stable, i.e. less sensitive to shocks to specific spokes. The development of this new linkages, in which China is likely to play a major role, will probably reinforce the importance of China in the world intermediate trade network.

If we only consider major trade flows at the world level, most BRI countries do not appear in the network because their trade linkages are small. To understand how BRI countries connect with the main players, we increase the detail and add them in Figure 2. BRI countries tend to distribute into three regions: most (Asian) BRI countries, as expected, gravitate around China; (East) European BRI countries relate to China through Germany and do not present strong direct linkages with Asia; some BRI countries, instead, belong to the Russian subnetwork. Creating significant trade connections between those countries, and probably with China, might deeply change the network configuration making all the BRI countries more central and reducing the importance of the other regional hubs (Germany, USA, Japan and Russia).

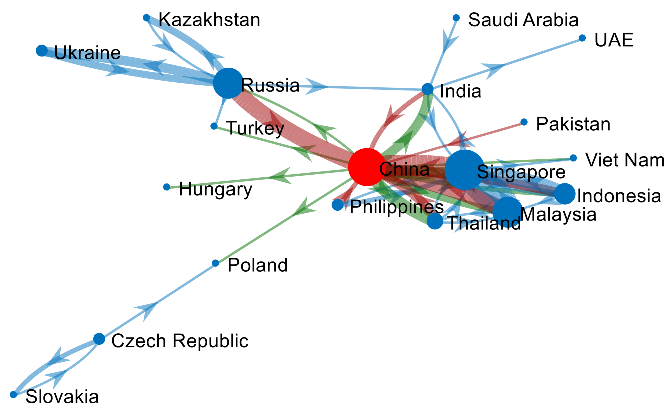
Figure 2 – World intermediate trade network plus main BRI countries.



Note: manufacturing sectors, year 2012, flows>0.1% of world trade for BRI countries, >0.5% for others.
Source: authors' elaborations based on Eora and CSIS.

The level of detail of the previous figures, focused on the world network, shows that many BRI countries do not share strong direct trade linkages. We thus change the scale and focus on the BRI intermediate trade sub-network in order to see the main linkages between BRI countries, which although small on the world scale, may represent the basis for further development of regional trade thanks to the BRI. Figure 3 highlights, again, the centrality of China.

Figure 3 – Intermediate trade network of BRI countries.

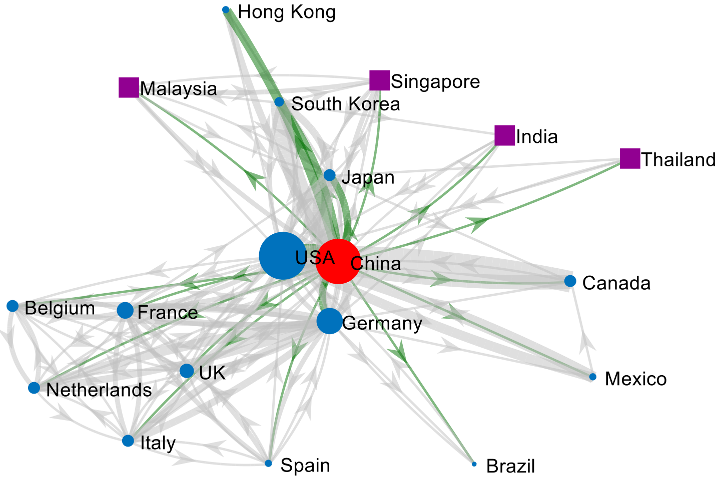


Note: manufacturing sectors, year 2012, flows >0.5% of total regional trade.
Source: authors' elaborations based on Eora and CSIS.

Eastern Asian countries are relatively well connected among themselves, with most of them supplying manufacturing inputs to China. Russia also is a major supplier of manufacturing inputs. On the contrary, the links with European countries are clearly weak and the only relevant connection goes through Poland, which is thus in the position to greatly benefit from the BRI. The importance of China both in the world trade network and as the main promoter of the BRI implies that understanding how countries connect to China, either as buyers or suppliers, directly or indirectly, can help understanding the main trade patterns.

In Figure 4, we display the direct outward production links of China, that is the destinations of China's intermediate exports. We also include in the figure the main trade linkages between the direct buyers of intermediates. China's main partners are US, Germany and two Asian countries: Japan and South Korea. Countries along the Belt and Road are in purple and the graph shows that they are directly connected to China by trade in intermediates although, not surprisingly, the value of the outward flows is not particularly large.

Figure 4 Destinations of China's intermediate exports.

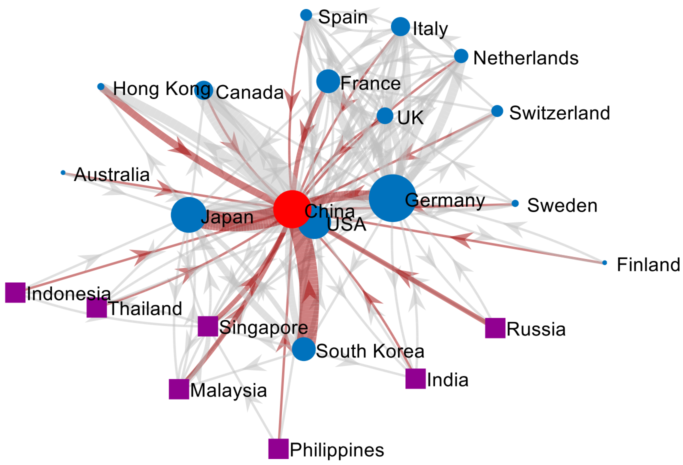


Source: authors' elaborations based on Eora and CSIS.

Looking at China's inward production links, that is the sources of intermediate imports, gives a different picture. In Figure 5, we see that Germany, Japan and South Korea largely increase their role as suppliers of intermediates; similarly, the flows of a larger number of BRI countries are non-negligible.

The BRI will probably reinforce these patterns since it facilitates regional trade. Beneficiary countries are likely to find the most attractive elements of the BRI to be its provision of hard infrastructure. Likewise, the BRI provides China with an opportunity to use its considerable economic means to finance (some of) these infrastructure projects around the world. The Asian Development Bank (ADB) estimates that the developing countries of Asia collectively will require $26 trillion in infrastructure investment to sustain growth.

Figure 5 – Sources of China's intermediate imports.



Source: authors' elaborations based on Eora and CSIS.

Finally, we report in Table 1 the top fifteen countries ranked by the main centrality indicators calculated for the BRI intermediate trade network (the values of the indicators as well as correlation matrices are reported in the Appendix A4). Although the indicators capture partially different aspects of the network and do not yield identical rankings, their correlations and rank correlations are very high. The indicators - briefly described in the Table note -, confirm the visual analysis, with China being the most central node of the network according to all but one indicator. The centrality of the other countries is also a useful information we are going to use in the last part of the paper, since it is likely that a country's network centrality matters in determining its attractiveness for infrastructure investments.

Table 1 – Indicators of centrality in the BRI intermediate trade network: ranks.

	PageRank	Hubs	Authorities	Outdegree	Indegree	Betweenness
China	1	5	1	1	1	1
Singapore	2	2	2	2	2	4
Russia	3	4	14	3	6	2
India	4	7	5	6	4	3
Malaysia	5	1	3	4	3	30
Thailand	6	6	4	7	5	11
Turkey	7	16	11	13	9	8
Ukraine	8	17	8	9	7	14
Czech Republic	9	13	17	8	11	13
Poland	10	19	12	11	10	18
Saudi Arabia	11	10	16	17	16	10
UAE	12	14	13	14	15	7
Indonesia	13	3	6	5	8	47
Iran	14	12	18	18	19	12
Hungary	15	20	15	15	13	6

Note: manufacturing sectors, year 2012, ranks by country (see the Appendix for the indicator values). PageRank is derived from a random walk in the network and measures the probability to encounter a given node. Hubs and Authorities centrality scores are related recursive measures: hubs score measures outward (here export) connections to relevant authorities, while authorities score measures inward (import here)

connections from relevant hubs. Out and indegree measure the number of forward (export) and inward (import) links. Betweenness centrality measures the likelihood that a node is in the shortest path between any two nodes.
Source: authors' elaborations based on Eora and CSIS.

5 Descriptive statistics

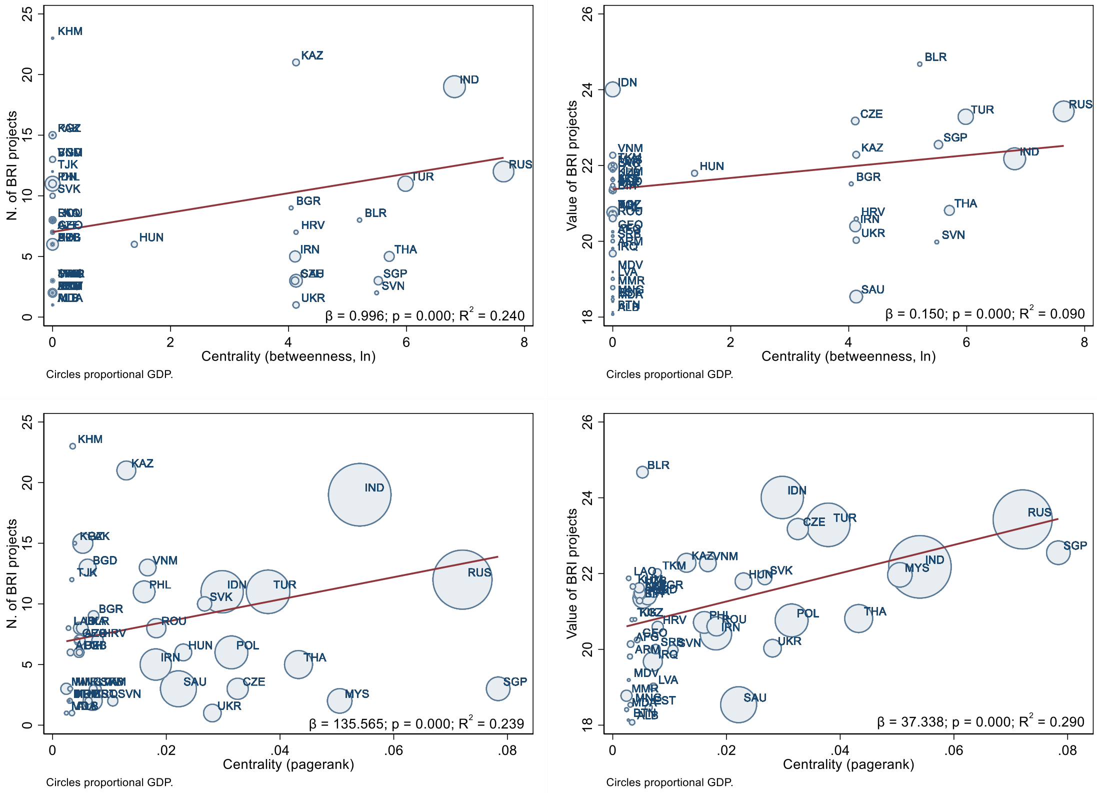
In this section, we present the main descriptive statistics about BRI projects and their association with the other variables considered in this paper. The main variables of interest are the number and the value of projects. The discussion below is based on a graphical analysis, on simple correlations and on basic bivariate linear regressions. For space reasons the details are reported in the appendix. Table 2 reports the summary statistics. The number of projects in our dataset lies in the interval 1-23, with an average of about 7 projects per country. Projects total value is between 70.8 thousand and 52 million dollars; the average country has received about 4 million dollars of investment projects. Both low- and high-income countries are involved in the BRI. The number of projects is positively corelated with GDP per capita while the total value invested is uncorrelated with GDP per capita. This, of course implies that richer countries receive less but larger projects. Larger countries in terms of population tend to receive more and larger projects. BRI projects tend to go towards countries that are less involved in intermediate trade (relative to total trade) and whose intermediates are exchanged more intensely with China (intermediate trade with China relative to total intermediate trade).

Table 2: Summary statistics on BRI countries with projects.

Variable	Source	Obs.	Mean	Std. Dev.	Min	Max
N. of projects	CSIS	1,196	7.2	5.4	1	23
Value of projects (US$, 1'000)	CSIS	1,196	4,000	8,620	70.8	52,000
GDP per capita (US$, 2010 constant prices)	WB	1,196	7,700	8,554	630	49,262
Intermediate exp. / Export	EORA	1,196	0.71	0.20	0.12	1
Intermediate imp. / Import	EORA	1,196	0.64	0.25	0	1
Int. Exp. to China / Int. exp.	EORA	1,196	0.05	0.10	0	0.94
Int. Imp. to China / Int. imp.	EORA	1,196	0.05	0.07	0	0.68
Pagerank	EORA	1,196	0.02	0.02	0	0.08
Hubs	EORA	1,196	0.02	0.04	0	0.15
Authorities	EORA	1,196	0.02	0.03	0	0.16
Outdegree	EORA	1,196	1.67	2.94	0	13.11
Indegree	EORA	1,196	1.60	2.39	0	12.19
Betweenness	EORA	1,196	104	334	0	2090
RCA overlap with China	EORA	1,196	0.41	0.16	0.00	0.67
Trade Logistics Performance index	WB	1,144	2.83	0.40	2.16	4.13
Export sophistication	EORA, WB	1,196	13,637	2,625	7,545	18,334
Distance from China (km)	CEPII	1,144	5,227	1,765	1,172	7,723
Political proximity to China (UN Gen. Ass. Voting agreement)	Harvard Dataverse	1,170	71.4	13.1	51.2	85.7

The first main aspect related to our research question regards the role of country centrality in the intermediate trade network. The descriptive evidence supports the idea that centrality may play a role in the allocation of projects. Country centrality is positively correlated with the number and the value of projects. This holds for different indicators. Figure 6 shows the correlations for pagerank and betweenness. Countries that act as hubs of intermediate goods and more connected to other important markets obtained more and larger investments. Russia, India, Turkey and Singapore are among the most central countries in the BRI intermediate trade network and the also received relatively more investments.

Figure 6 – Centrality vs. BRI number and value of projects.



The second main aspect related to our research question regards the role of country similarity with China in terms of sectoral specialization. Country-level similarity in the sectoral composition of exports can be easily measured by comparing sectoral shares in countries total exports. This is done, for instance by the Finger-Kreinin index. This comparison, however, does not immediately extend to sector-by-sector analyses and, more importantly, does not directly give *relative* similarity (that is relative to other countries similarity to China). We therefore need a measure that (i) compares a country to China, also at the sectoral level and (ii) relates the degree of similarity of a country to the degree similarity of others. To this end, we propose an index based on the (relative) overlap of normalized Balassa revealed comparative advantage indexes. Our index can be calculated on a sector-by-sector level as well as at the country level.

The *overlap index* (OI_{ij}) between the RCA_{ij} index of sector j of country i and the respective index for China, $RCA_{CHN,j}$, is computed as:

$$OI_{ij} = 1 - \frac{\Delta RCA_{ij}}{max\{\Delta RCA_{ij}|j\}}$$

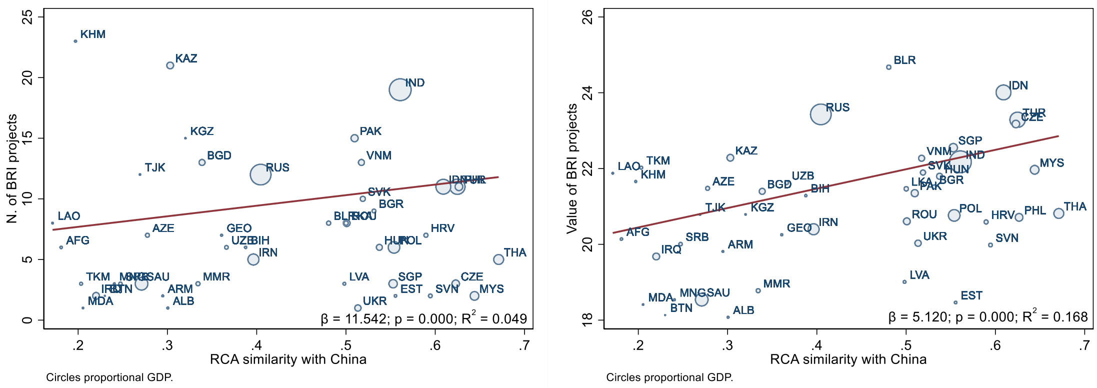
where $\Delta RCA_{ij} = |RCA_{ij} - RCA_{CHN,j}|$ is the absolute difference between the indexes, $max\{\Delta RCA_{ij}|j\}$ is the cross-country largest sectoral absolute difference (note that the smallest sectoral absolute difference is zero by construction). For the normalized Balassa index, the $\Delta RCA_{ij_{max}} = 2$, since the index goes from -1 to +1. The overlap index goes from zero (no overlap) to one (perfect overlap).

The country-level overlap index can be easily computed, starting from the aggregate absolute difference in RCA with China, as:

$$OI_i = 1 - \frac{\sum_j \Delta RCA_{ij}}{max\{\sum_j \Delta RCA_{ij}\}}$$

Figure 7 shows that both the number and the value of projects tend to increase with RCA similarity with China (i.e. the overlap index). BRI investments, hence, seem to favor countries whose specialization is more similar to China rather than those whose specialization instead complements it.

Figure 7 –Similarity vs. BRI number and value of projects.



Lastly, our dataset includes other variables capturing important aspects of countries that must be considered in the analysis of BRI projects. The trade logistics performance index by the World Bank represents an important measure of connectivity. BRI investments may build upon well connected countries to further improve their role or may try to improve logistics in countries where it is lacking. Another aspect that may be important concerns the so-called export sophistication, a concise measure of the export capabilities of countries. Low sophistication countries tend to attract more projects, while highly sophisticated ones get larger investments. Since both logistics and sophistication are highly correlated and depend on income, we use them as alternative controls in the following econometric analysis.

We consider two other variables that may play a role in the allocation of BRI projects: geographical distance to China and political proximity. We discuss these variables more in detail in the next section. As one could expect they both matter for obvious reasons. However, we show that our results concerning centrality and similarity are robust to their inclusion.

6 Econometric Analysis

We now assess the relative importance of the trade factors discussed above (as well as other factors) in explaining the location decisions of investments linked to the Belt and Road. Our aim is to understand to what extent intermediate trade and the position in the intermediate trade network represent important factors for the geographical allocation of projects. To this aim, building on the descriptive analysis presented in the previous section, we now move to the econometric analysis.

6.1 Econometric specification

We examine the association between BRI project allocation, network centrality in intermediate trade, and trade relations with China. Project allocation is represented by the number of distinct projects completed in each participation country and the total value of all completed projects. Examining both the determinants of number of projects and value of projects will shed light on strategic allocations of projects.

The underlying equation is:

$$y_i = \alpha + \beta_1 RCA_i + \beta_2 Betw_i + \beta_3 Exp_{ji} + \beta_4 Imp_{ji}$$
$$+\beta_5 Exp_{ji}^{CHN} + \beta_6 Imp_{ji}^{CHN} + \boldsymbol{\xi}' \boldsymbol{Z}_i + \delta_i + \varepsilon_i$$

where the dependent variable y_i is either: i) the number of completed projects; ii) total value of investments projects in the country (in logarithm).

Six key trade variables are central to our analysis. RCA_{ji} denotes the sector-level revealed comparative advantage overlap between country i and China. $Betw_i$ is a network centrality measure, that measures the shortest possible distance between two countries in the BRI trade network. Exp_{ji} is the intermediate export share of sector j over total export of country i. Imp_{ji} is the intermediate import share of sector j over total import of country i. Exp_{ji}^{CHN} is the share of China on total intermediate export of country i in sector j. Imp_{ji}^{CHN} is the share of China on total intermediate import of country i in sector j. The vector $\boldsymbol{Z}_i$ includes a series of country-level control variables such as GDP per capita (in log), trade logistics index, and export sophistication (in log). as well as measures of intra-industry trade. Finally, δ_i is a set of sector and/or regional dummies that captures sectoral as well as regional fixed effects, while ε_i is an idiosyncratic error term.

Given that the number of completed projects is a count variable, we implement Poisson Pseudo-Maximum Likelihood (PPML) estimator, typically employed in the estimation of gravity models (Silva & Tenreyro, 2006). Additionally, the cross-sectional nature of the data requires us to exclude contemporaneous correlation between variables. To overcome this, all independent variables including controls are lagged at year 2012 whilst our observed projects refer to the post announcement period only (2013-2018). In this way, our econometric design analyses how pre-BRI trade relations may contribute to explain selection and distribution of BRI infrastructure projects.

6.2 Main results

Results in Table 3 suggest a greater RCA overlap with China positively affects the number of completed projects. The nature of the Belt and Road Initiative is based on a network of transport infrastructure projects in multiple countries and the benefits of an infrastructure projects go beyond the single country where the project is located. This suggest that the country characteristics alone may fall short in explaining the number completed projects a country receives. We include a network centrality index between Belt and Road initiative countries. The network variable, betweenness, measures the likelihood that a node (country) is in the shortest path between any two nodes (countries). Betweenness is positive and statistically significant, suggesting that a country with a higher network centrality score is likely to receive more infrastructure projects *ceteris paribus*.

Table 3: Intermediate Trade and Projects Distribution

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Dependent Variable: Number of Completed Projects					
RCA overlap	0.489***	0.301***	0.564***	0.407***	0.119*	0.441***
	(0.0659)	(0.0677)	(0.0671)	(0.0662)	(0.0684)	(0.0679)
Betweenness	0.315***	0.240***	0.293***	0.263***	0.204***	0.233***
	(0.0109)	(0.0106)	(0.0107)	(0.0112)	(0.0111)	(0.0111)
Intermediate Export	-0.311***	-0.156*	-0.154*	-0.581***	-0.530***	-0.544***
	(0.0806)	(0.0850)	(0.0811)	(0.0822)	(0.0872)	(0.0829)
Intermediate Import	0.476***	0.220***	0.335***	0.193***	-0.0988*	0.0314
	(0.0612)	(0.0602)	(0.0618)	(0.0599)	(0.0589)	(0.0600)
Intermediate Export CHN	0.411***	0.795***	0.528***	0.169	0.247**	0.192
	(0.111)	(0.109)	(0.109)	(0.118)	(0.120)	(0.118)
Intermediate Import CHN	0.412**	0.747***	1.160***	1.449***	1.157***	1.756***
	(0.177)	(0.181)	(0.169)	(0.180)	(0.188)	(0.175)
GDP per capita (ln)	-0.408***			-0.335***		
	(0.0101)			(0.0122)		
Logistics index		-0.121***			-0.0757**	
		(0.0293)			(0.0299)	
Export soph. (ln)			-1.254***			-0.903***
			(0.0624)			(0.0635)
Constant	4.574***	1.642***	12.94***	4.563***	2.526***	10.43***
	(0.125)	(0.129)	(0.588)	(0.135)	(0.136)	(0.597)
Observations	1,586	1,508	1,612	1,586	1,508	1,612
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes	Yes
Pseudo R2	0.172	0.0461	0.0745	0.285	0.236	0.255

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The share of intermediate export over total export seems to reduce the number of infrastructure projects completed in a BRI country, while the opposite generally holds for intermediate import. Countries that import high quantities of intermediate inputs are likely to be more integrated in the network of global value chain production; these countries are likely to receive more infrastructure projects than their peers. Interestingly, it can be noted that, intensive intermediate trade – both export and import channels – with China positively correlates with the number of projects being completed in a BRI country. This seems to suggest that BRI countries supplying intermediate inputs to China receive more infrastructure projects than countries supplying them to the rest of the world.

We control for country-level characteristics that may correlate with infrastructure investments in general. The coefficients of GDP per capita, trade logistics index, and Export sophistication are negative and significant in all columns, indicating that countries with high living standards, good trade logistics infrastructure, and sophisticated exports will receive less BRI projects. This supports our previous intuition that the Belt and Road Initiative targets developing countries with high trade potentials.

We now investigate if and how trade patterns explain the value of the completed projects and whether results differ relative to the number of projects. We estimate an OLS regression where the dependent variable is the log of the value of infrastructure projects (Table 4).[4]

The impact on export and import shares of intermediate trade is in line with the previous regressions for the number of projects. Contrary to what we observe explaining the number of projects, the channels of intensive intermediate trade with China matters for the value of projects. The coefficient for intermediate export to China is negative even if not always significant. On the other hand, intermediate import from China positively correlates also with the value of completed projects. All in all, the results seem to suggest that buyers of intermediate imports receive higher value of infrastructure projects.

The coefficients for trade logistics and export sophistication are now positive and significant, in line with the descriptive evidence. The change in the sign of income, logistics and export sophistication seems to support the idea that BRI investments follow two different motivations: on average, less developed countries that are more involved in intermediate trade with China, especially as suppliers, receive a relatively larger number of smaller investments, while more developed countries that tend to import intermediates receive fewer but larger investments.

[4] Different estimation methods give very similar results.

Table 4: Intermediate Trade and Investments Value

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Dependent Variable: Projects value (ln)					
RCA overlap	1.279***	0.728***	0.989***	0.979***	0.621**	0.811***
	(0.246)	(0.254)	(0.252)	(0.236)	(0.241)	(0.243)
Betweenness	0.675***	0.663***	0.634***	0.686***	0.690***	0.660***
	(0.0308)	(0.0205)	(0.0275)	(0.0335)	(0.0238)	(0.0309)
Intermediate Export	-1.045***	-0.231	-0.909**	-0.964***	-0.313	-0.884**
	(0.381)	(0.385)	(0.379)	(0.370)	(0.374)	(0.370)
Intermediate Import	1.037***	0.791***	0.817***	0.809***	0.705***	0.713***
	(0.241)	(0.233)	(0.234)	(0.235)	(0.230)	(0.231)
Intermediate Export CHN	-0.269	0.0985	-0.146	-1.067*	-0.654	-0.968*
	(0.522)	(0.473)	(0.512)	(0.553)	(0.510)	(0.541)
Intermediate Import CHN	1.221	1.220	1.525**	1.650**	1.326*	1.691**
	(0.780)	(0.745)	(0.776)	(0.824)	(0.795)	(0.807)
GDP per capita (ln)	-0.00200			0.0368		
	(0.0389)			(0.0373)		
Logistics index		1.088***			0.878***	
		(0.0846)			(0.0937)	
Export soph. (ln)			0.950***			0.735***
			(0.175)			(0.210)
Constant	20.03***	16.83***	11.22***	20.53***	18.09***	13.96***
	(0.506)	(0.459)	(1.678)	(0.506)	(0.494)	(2.015)
Observations	1,196	1,144	1,196	1,196	1,144	1,196
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes	Yes
R2	0.161	0.236	0.173	0.226	0.280	0.231

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

6.3 Robustness checks

The above findings show that the allocation of Belt and Road projects is related to patterns of international trade with specific regard to specialization, global value chains, the related trade in intermediates, and the network structure of such exchanges. The association that we find in the data is robust to several specifications. Yet we cannot exclude that other factors play a role. Preexisting trade relations may be associated with projects allocation for several reasons and, for instance, the two variables may share common causes or be correlated with other factors that influence bilateral relations between countries. Among the other possible factors that are likely to have exerted some influence on either the allocation of projects and trade, geographical and political considerations are probably preeminent.

We include geographical distance, common border and political proximity to China in the regression models. The dependent variable is the number of projects in models (1) to (3) and their value in models (4) to (6). All models include sector and region fixed effects (see Table 5).

Common border has a positive effect both on the number and the value of projects. This is of course to be expected since the land corridors must pass through contiguous countries. On the contrary distance seems to play a role only for the value of projects. Finally, the degree of voting agreement with China is positively correlated with Belt and Road projects confirming that political proximity matters. The inclusion of these additional controls, while adding important elements to the analysis, does not change the baseline results. All the main findings are confirmed. The RCA overlap with China and the betweenness indicator remain positive and significant in all specifications.

Table 5: The role of geographical distance and political proximity.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Dep. Var.: Projects number			Dep. Var.: Projects value (ln)		
RCA overlap	0.435***	0.122	0.430***	0.0651***	0.0432***	0.0457***
	(0.127)	(0.124)	(0.131)	(0.0105)	(0.0104)	(0.0102)
Betweenness	0.217***	0.0948***	0.140***	0.0239***	0.0198***	0.0157***
	(0.0270)	(0.0195)	(0.0256)	(0.00220)	(0.00153)	(0.00185)
Intermediate Export	-0.479***	-0.244*	-0.394***	-0.0342***	0.00166	-0.0216*
	(0.143)	(0.147)	(0.149)	(0.0127)	(0.0130)	(0.0121)
Intermediate Import	0.189*	-0.177*	-0.00608	0.0302***	0.0214**	0.0136
	(0.102)	(0.0951)	(0.103)	(0.00921)	(0.00873)	(0.00863)
Intermediate Export CHN	0.0333	-0.172	-0.103	-0.0366**	-0.0330**	-0.0392**
	(0.255)	(0.306)	(0.303)	(0.0175)	(0.0157)	(0.0164)
Intermediate Import CHN	1.433***	1.144***	1.643***	0.182***	0.155***	0.199***
	(0.345)	(0.382)	(0.392)	(0.0304)	(0.0286)	(0.0293)
GDP per capita (ln)	-0.252***			0.00507**		
	(0.0380)			(0.00208)		
Logistics index		0.440***			0.0661***	
		(0.0859)			(0.00568)	
Export soph. (ln)			-0.176			0.124***
			(0.191)			(0.0118)
Common border	0.0301	0.393***	0.226***	0.000159	0.0220***	0.0193***
	(0.0714)	(0.0747)	(0.0763)	(0.00510)	(0.00518)	(0.00525)
Distance	-0.0564	-0.138	-0.134	0.0977***	0.0899***	0.104***
	(0.0953)	(0.105)	(0.102)	(0.00801)	(0.00910)	(0.00760)
Voting agreement CHN	0.0149***	0.0275***	0.0193***	0.00399***	0.00437***	0.00467***
	(0.00218)	(0.00201)	(0.00225)	(0.000187)	(0.000189)	(0.000184)
Constant	3.064***	-0.351	2.961	1.860***	1.728***	0.626***
	(0.830)	(0.969)	(2.170)	(0.0730)	(0.0761)	(0.134)
Observations	1,482	1,404	1,508	1,144	1,092	1,144
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.421	0.448	0.388	0.460	0.524	0.505

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

7 Conclusion

Our paper has shed light on few stylized facts regarding the BRI. Large and relatively poor countries attract a higher number of BRI related infrastructural projects, while richer countries get fewer but greater investments. Countries with completed projects have a relatively more diversified export structure than their peers and, more importantly for our study, their specialization tends to overlap with the one of China. GVCs involvement also matters. We find that more projects are completed in countries that supply intermediates to China. China is the core of the intermediate trade network of BRI countries, and, among the other countries involved in the Initiative, those better positioned, i.e. more central, receive more and larger investments. The pre-existing trade patterns can therefore help explaining the number and value of completed infrastructural investments. The econometric analysis shows that the comparative advantage overlap with China and the centrality in the intermediate trade network are both positively correlated with subsequent BRI investment projects both regarding their number and value, even after controlling for gravity variables and political proximity to China.

In summary, our findings highlight that the geographical allocation of BRI infrastructural projects is closely related to the pre-existing trade patterns and GVC considerations. BRI countries can provide a reliable base of suppliers to China, which in turn may be able to upgrade its productions and possibly alleviate its problems of overcapacity. The BRI is likely to reinforce China's comparative advantages by building on the specialization of other countries in the same sectors on different phases.

China is already an important GVC player at the world level and especially in Asia as well as being the main central node in the Asian intermediate trade network. The Belt and Road Initiative provides an opportunity for China to engage other developing countries in GVC trade and benefit from importing intermediate inputs and moving up in the value chain to higher value-added phases. At the same time the BRI is likely to reinforce the inter-regional connections by increasing the importance of strategic countries that are most likely to have a role as gates towards distant relevant markets such as Western Europe.

Infrastructure investments (new roads, railways, ports and communications) reduce transport costs and facilitate the movement of goods and people. Along the BRI corridors, firms will be able to better coordinate production and the division of labor across regions. Landlocked economies will benefit from easier access to important routes. For several of them, participating in GVCs can help a transition from being a supplier of natural resources and raw materials to becoming a manufacturer of goods and services. More generally, developing countries involved in the BRI are likely to be strongly affected by Chinese investments as the returns even to relatively small projects are likely to be large. In a network perspective strengthening the weak links is likely to make the entire network more stable as also Derudder et al. (2018) noticed. This is beneficial to the regional GVC and helps China building a reliable base of suppliers.

Opportunities are there, along the “silk road”. Policies in the different countries should be targeted at exploiting them.

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Appendices

A1: The BRI corridors and detailed projects information

Additional information on the data sources.

The compilation of the data by CSIS goes through three phases. First, primary information on infrastructure is collected from open sources with key information such as project type, cost, funders, commencement and projected completion dates. Primary sources of information include national agencies of host countries, regional development banks, projects contracts as well as CSIS partners. In the second phase, projects information is verified and de-conflicted by CSIS research team to identify the most reliable and trustworthy information.[5] Projects data that passed the second stage screening process are then geotagged into CSIS Reconnecting Asia project website and uploaded with supportive information in the final stage.[6] The filter tool on the project website mentioned above enables one to search for infrastructure projects by type, status (preparatory works, started, under construction, completed, and cancelled), commencement and completion dates, as well as funders. A list of member countries, geographic scope as well as related organizations, initiatives, projects and events is available on the website.[7]

[5] We do not know the duration required by CSIS to verify information in the second stage.
[6] Geotagged data can be publicly assessed on https://reconnectingasia.csis.org/map/
[7] See https://reconnectingasia.csis.org/database/initiatives/one-belt-one-road/

Corridors and countries.

Table A1 – BRI countries and completed projects (September 2018).

Corridors	Countries	Road	Rail	Dryport	Seaport	Total
New Eurasia Land Bridge Economic Corridor	Armenia	1	0	0	0	1
	Azerbaijan	6	2	0	0	8
	Belarus	4	3	0	0	7
	Georgia	3	1	1	1	6
	Kazakhstan	20	4	2	0	26
	Montenegro	0	1	0	0	1
	Poland	0	0	1	0	1
	Romania	1	1		0	2
	Russia	8	4	2	2	16
	Ukraine	2	0	1	1	4
China-Central Asia-West Asia Economic Corridor	Afghanistan	3	1	0	0	4
	Albania	2	0	0	0	2
	Bulgaria	2	2	0	0	4
	Croatia	3	0	0	5	8
	Iran	1	1	0	2	4
	Kyrgyzstan	21	0	0	0	21
	Mongolia	2	0	0	0	2
	Serbia	1	1	0	0	2
	Tajikistan	16	0	0	0	16
	Turkey	2	7	2	1	12
	Turkmenistan	1	0	0	0	1
	Uzbekistan	2	2	0	0	4
South-East Asia	Brunei	0	0	0	0	0
	Cambodia	21	1	0	0	22
	Indonesia	1	1	1	0	3
	Laos	9	1	1	0	11
	Malaysia	0	1	1	0	2
	Myanmar	1	0	0	1	2
	Philippines	0	0	0	5	5
	Singapore	1	0	0	2	3
	Thailand	2	4	0	0	6
	Timor-Leste	0	0	0	0	0
	Vietnam	13	2	3	3	21
South Asia	Bangladesh	2	1	10	1	14
	Bhutan	1	0	0	0	1
	India	8	0	6	4	18
	Maldives	1	0	0	0	1
	Nepal	0	0	3	0	3
	Pakistan	18	0	0	2	20
	Sri-Lanka	5	0	0	3	8
Middle East and Africa	Bahrain	0	0	0	1	1
	Egypt	0	0	0	0	0
	Iraq	1	0	0	1	2
	Israel	0	0	0	0	0
	Jordan	0	0	0	0	0
	Kuwait	0	0	0	0	0
	Lebanon	0	0	0	0	0
	Oman	0	0	0	0	0
	Palestine	0	0	0	0	0
	Qatar	0	0	0	0	0
	Saudi-Arabia	0	0	0	2	2
	Syria	0	0	0	0	0
	United Arab Emirates	0	0	0	0	0
	Yemen	0	0	0	0	0
Central Europe	Bosnia and Herzegovina	6	0	0	0	6
	Czech-Republic	0	0	0	0	0
	Estonia	0	0	0	3	3
	Hungary	2	0	0	0	2
	Latvia	0	0	0	2	2
	Lithuania	0	0	0	0	0
	Macedonia	0	0	0	0	0
	Moldova	1	0	0	0	1
	Slovakia	1	0	0	0	1
	Slovenia	0	0	0	1	1

Source: Center for Strategic and International Studies.

A2: Indexes and measures

Revealed comparative advantage indexes

Balassa RCA

The Balassa RCA index is computed as:

$$BRCA_{ij} = \frac{x_{ij}/X_i}{X_j/X}$$

where x_{ij} is exports of sector *j* of country i, $X_i = \sum_j x_{ij}$ is total exports of country i, $X_j = \sum_i x_{ij}$ is world exports of sector *j* and $X = \sum_i \sum_j x_{ij}$ is world exports. The index goes from 0 to infinity, with specialization sectors being those with $RCA_{ij} > 1$. Since the index is asymmetric, its normalized version is commonly used. The normalized Balassa index can be computed as:

$$\widetilde{BRCA}_{ij} = \frac{RCA_{ij} - 1}{RCA_{ij} + 1}$$

The normalized index goes from -1 to +1, being centered at zero. Positive (negative) values denote (de)specialization sectors.

Lafay RCA

The Lafay RCA index is computed as:

$$LRCA_{ij} = \left(\frac{x_{ij} - m_{ij}}{x_{ij} + m_{ij}} - \frac{X_i - M_i}{X_i + M_i}\right)\frac{x_{ij} + m_{ij}}{X_i + M_i}$$

where m and M denote imports. The index may take values in (-∞, +∞), with positive values indicating specialization sectors. By construction the index has the property that $\sum_j LRCA_{ij} = 0$.

Balassa and Lafay accordance

The table below show the shares of country-secto observations for which the two RCA indicators signal a comparative advantage (+) or disadvantage (-).

Table 6 – Specialization (+) and despecialization (-) sectors.

		Lafay +	Lafay -	Total
Balassa	+	41.4	8.1	49.6
Balassa	-	10.0	40.5	50.4
Total		51.4	48.6	100

Source: authors' elaborations based on Eora and CSIS.

Export and Import Sophistication indexes

The export sophistication index takes two steps. First, we calculate product sophistication as the average income level of exporting countries with weights equal to their RCA. A product is thus sophisticated if exported by specialized advanced economies. The index is computed as:

$$prody_j = \sum_i \frac{BRCA_{ij}}{\sum_i BRCA_{ij}} y_i = \sum_i \frac{x_{ij}/X_i}{\sum_i (x_{ij}/X_i)} y_i$$

where y_i denotes GDP per capita and $BRCA_{ij}$ is the Balassa RCA index for sector j of country i.

The country level export sophistication is obtained as a weighted average of the sophistication level of its export bundle.

$$expy_i = \sum_j \frac{x_{ij}}{X_i} prody_j$$

Import sophistication is computed similarly as a weighted average of the sophistication level of a country's import bundle.

$$impy_i = \sum_j \frac{m_{ij}}{M_i} prody_j$$

This way of measuring import sophistication has been proposed in Marvasi (2013) and has the advantage of being based on univocal definition of product sophistication. The fact that product sophistication is based on exports is meaningful since exports reflect more closely the production capabilities of countries and, empirically, countries are more diverse in their export bundles than in their import bundles. The implication of measuring import sophistication in this way is that countries with sophisticated imports are those that buy sophisticated products, that is products that tend to be exported by richer countries. This is particularly useful when input-output linkages matter, since import sophistication is likely to capture the fact that a country obtains its inputs from advanced economies, a fact that may represent itself a source of competitive advantage in GVC.

A3: Network centrality indicators

Table A3.1: – Centrality in the OBOR intermediate trade network (manufacturing; trade weighted indicators)

	PageRank	Hubs	Authorities	Outdegree	Indegree	Betweenness
China	0,148	0,112	0,258	18,0	21,3	3025
Singapore	0,080	0,170	0,175	13,0	13,4	427
Russia	0,072	0,114	0,015	11,1	5,5	1900
India	0,066	0,052	0,062	6,0	6,4	1160
Malaysia	0,048	0,177	0,097	10,4	7,1	0
Thailand	0,043	0,074	0,074	4,7	5,6	122
Turkey	0,034	0,007	0,020	1,8	3,0	262
Ukraine	0,030	0,007	0,029	2,7	3,4	61
Czech Republic	0,027	0,010	0,011	3,6	2,6	120
Poland	0,027	0,005	0,016	2,2	2,9	44
Saudi Arabia	0,025	0,014	0,013	1,4	2,0	122
UAE	0,024	0,009	0,016	1,7	2,0	272
Indonesia	0,024	0,117	0,047	7,1	3,2	0
Iran	0,023	0,011	0,009	1,0	1,4	121
Hungary	0,022	0,005	0,013	1,6	2,1	288

Source: authors' elaborations based on Eora.

Table A3.2 – Correlation of centrality indicators of the OBOR intermediate trade network (manufacturing; trade weighted indicators)

	PageRank	Hubs	Authorities	Outdegree	Indegree	Betweenness
PageRank	1					
Hubs	0,755	1				
Authorities	0,907	0,782	1			
Outdegree	0,945	0,908	0,905	1		
Indegree	0,972	0,780	0,977	0,946	1	
Betweenness	0,872	0,502	0,703	0,779	0,797	1

Source: authors' elaborations based on Eora.

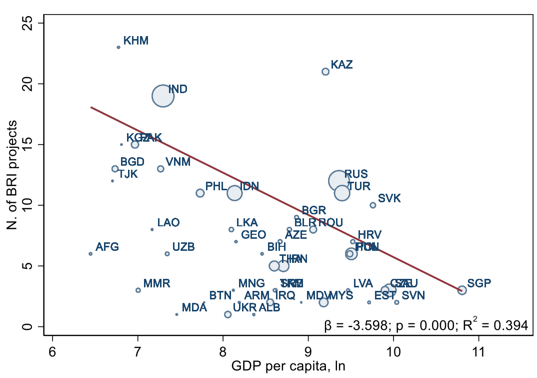
Table A3.3 – Rank correlation of centrality indicators of the OBOR intermediate trade network (manufacturing; trade weighted indicators)

	PageRank	Hubs	Authorities	Outdegree	Indegree	Betweenness
PageRank	1					
Hubs	0,769	1				
Authorities	0,869	0,852	1			
Outdegree	0,883	0,914	0,848	1		
Indegree	0,964	0,814	0,938	0,896	1	
Betweenness	0,591	0,501	0,471	0,572	0,531	1

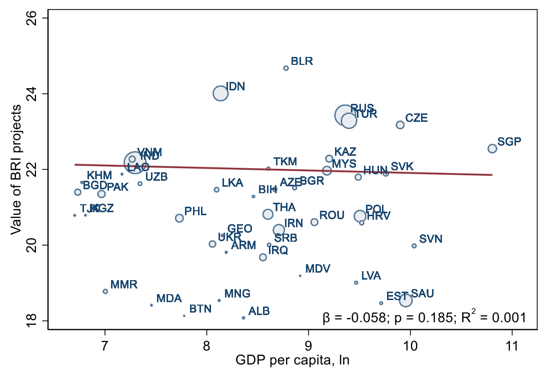
Source: authors' elaborations based on Eora.

A3: Additional figures

GDP per capita

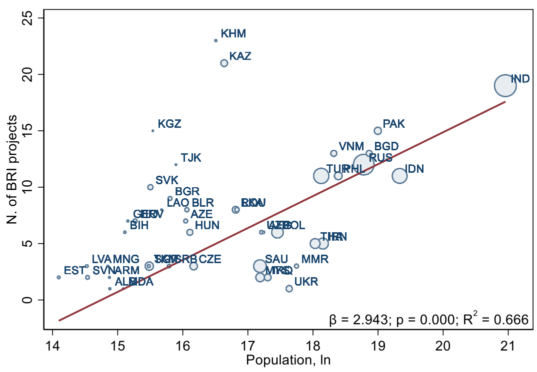


Circles proportional GDP.

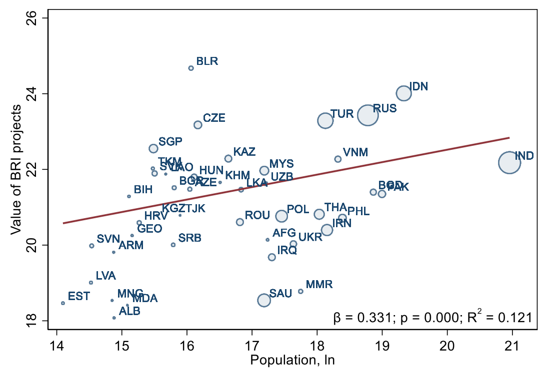


Circles proportional GDP.

Population

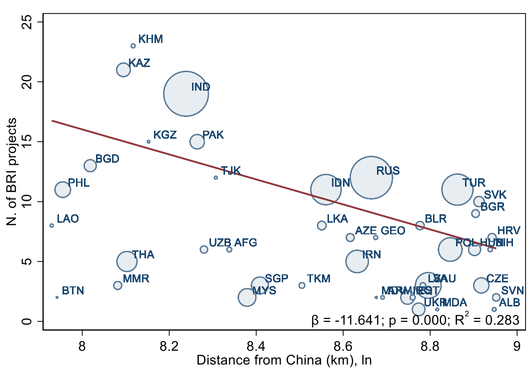


Circles proportional GDP.

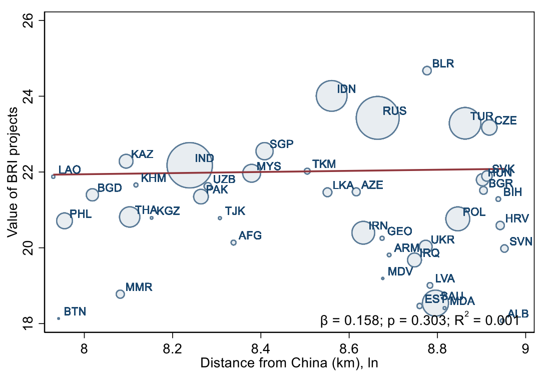


Circles proportional GDP.

Distance

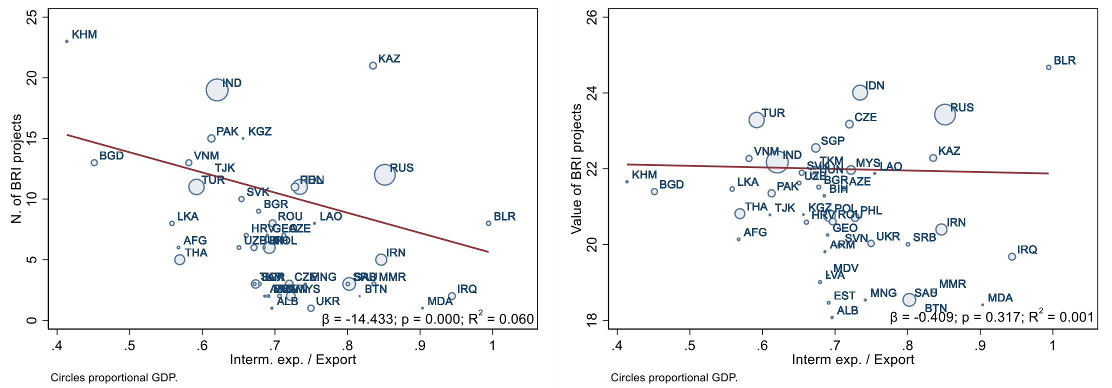


Circles proportional GDP.

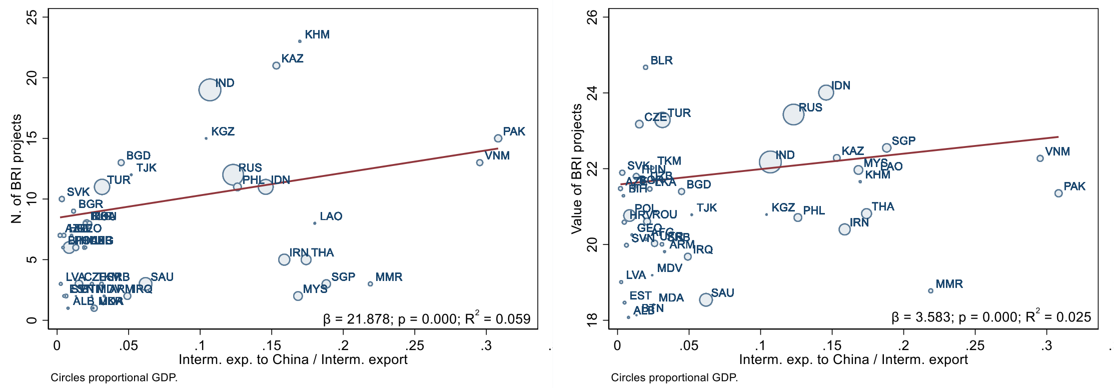


Circles proportional GDP.

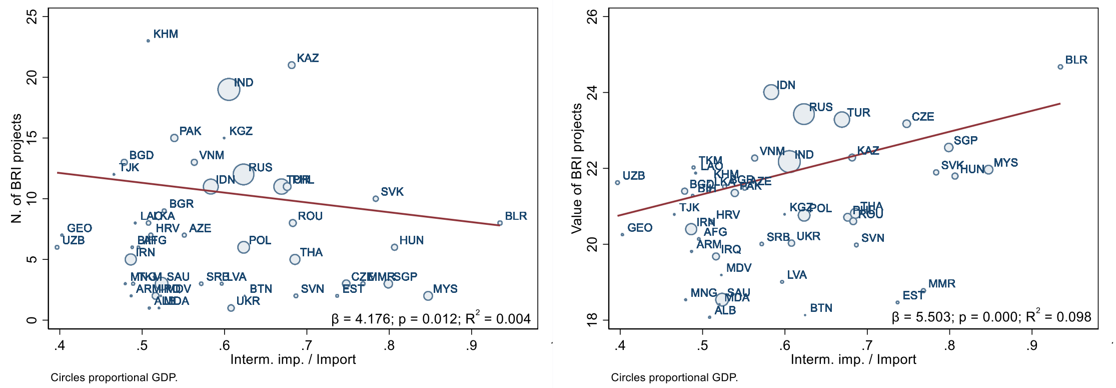
Intermediate export share



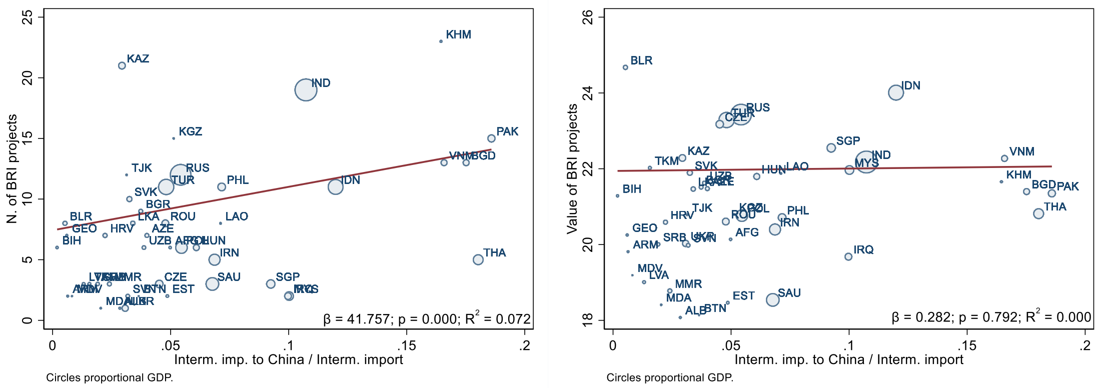
Intermediate export to China



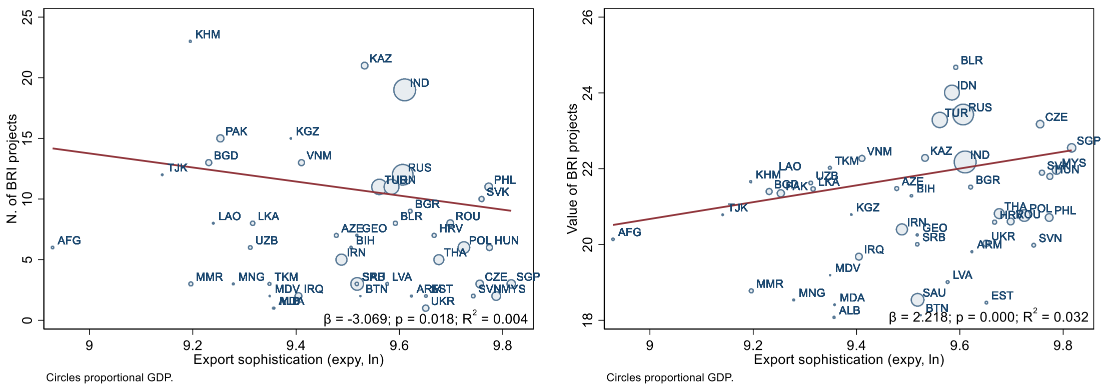
Intermediate import share



Intermediate import from China



Sophistication



FVA share