Global Value Chain Optimization Effect of the Belt and Road Initiative —From the Perspective of Improving Participating Countries' Position in the Division of Labor

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Abstract: *To promote the reconstruction and optimization of the global value chains (GVCs), it is essential to tackle the prominent contradictions and problems including inequality of opportunity and status in the evolution of the GVC division of labor. The Belt and Road Initiative (BRI) promoted by China has obtained remarkable achievements in this regard; however, there lacks sound theoretical and empirical evidence as to whether the BRI has driven the GVCs to develop towards a more equitable direction. This paper employs the difference-in-differences model to empirically analyze the GVC optimization effect of the BRI. In addition, on the basis of the so-called "five-pronged approach" index, the paper uses the mediating effect model to test the mechanism of influence. The empirical results suggest that the BRI has helped participating countries along the routes to increase their position in GVC division of labor significantly through the mediating mechanism of four out of the " five-pronged approach", namely policy coordination, road connectivity, unimpeded trade, and currency convertibility. The strengthening of and closer people-to-people ties has not yet appeared to be an effective mediator, and a possible explanation may be that its influence is indirect and lagging.*

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1. Introduction

Since the 1980s, the rapidly evolving labor division system of the global value chains (GVCs) led by multinational corporations in developed countries, through the stimulation and creation effects of comparative advantages, has lowered the threshold for developing countries to participate in the international division of labor, and enabled them to realize economic development in the course of economic globalization. As a result, more and more developing countries have integrated into the GVC labor division system and achieved rapid economic development, thereby triggering changes in global

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economic center which is increasingly charactered by the so-called pattern of "rising in the east and descending in the west" (Jin, 2019). Notwithstanding the prosperous development brought about by economic globalization, two concomitant phenomena however cannot be overlooked: On the one hand, many developing countries have confronted various tangible and intangible barriers such as geographical disadvantage, inadequate funds, backward technology and limited market size, making it difficult for their enterprises—especially small and medium-sized enterprises to smoothly integrate into the GVC labor division system; on the other hand, for those developing countries which have managed to integrate into the GVCs, they often face the risks and dilemma of "low-end embedding," or even "low-end lock-in", which leads to marginalization, and further reduces these countries to mere exporters of energy or natural resources.

The first phenomenon exposes the inequality of opportunity in the evolving GVC labor division system. Admittedly, multinational companies, when making choices about production factor flows and regional sitings, have to take into account the aforementioned tangible and intangible barriers which affect their cost factors. Hence, from their standpoint, this inequality of opportunity is not only justifiable in their global strategic layout, but also the precise result of the laws of the market economy. The second phenomenon gives away the inequality of status in the evolving GVC labor division system. Among the many reasons contributing to status inequality, two stand out: The first is caused by monopoly as a result of unequal economic strengths or competitive advantages, and the other can be attributed to the prevailing international economic and trade rules led by developed countries, which primarily reflect the interests of these countries while paying little attention to those of developing countries. Since there lacks a rule system that ensures a fair and equitable distribution of interests in the GVC division of labor, it seems to be inevitable that many developing countries have fallen into the predicament of "low-end lock-in" or marginalization. As a result, in the past few decades, while the process of economic globalization - characterised primarily by GVC development - has deepened, many contradictions and problems have also loomed large, posing great challenges to the sustainable development of economic globalization. In view of the global development trend, the Fifth Plenary Session of the 19th Central Committee of the Communist Party of China put forward a crucial agenda of "promoting high-quality development along the 'Belt and Road', and actively participating in the reform of the global economic governance system". This objective is of great significance for addressing the inequalities of opportunity and status confronting the GVC labor division system, and further bolstering the healthy and sustainable development of the world economy.

Ironically, there seems an antinomy in economic globalization. On the one hand, the essential feature of the GVC division of labor, i.e. an interdependent production pattern in which countries are all bound together in the global production network, inherently calls for more fairness and justice in the distribution of global interests (Dai, 2019); on the other hand, the intrinsic defects of the globalized market economy, coupled with unfairness and injustice in the global economic governance system, has not only failed to promote an equal distribution of the benefits of economic globalization, but brought about various contradictions including the gradual widening gaps between the North and the South. Arguably, the rise of the anti-globalization phenomenon, which has brought economic globalization to a crossroad, is to a large extent fuelled by the aggregation of the above-mentioned contradictions and problems. Therefore, to foster a healthy and sustainable development of economic globalization, the global value chains need to be optimized and revamped urgently.

Being fully aware of the new trends and challenges in economic globalization, President Xi Jinping pointed out in his keynote speech at the opening ceremony of the G20 Business Summit in September 2016: "We need to promote win-win outcomes, foster and improve the global value chains and increase the participation of parties concerned so as to create a chain of win-win global growth". In this line, the essence of promoting the reconstruction and optimization of GVCs is to create opportunities for more

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developing countries to participate in and gradually elevate their position in the GVC labor division system, so as to enable them to obtain more equal and just trade gains. In this relation, while advocating the principles of mutual benefit and win-win outcomes, China has been "walking the talk" by making ample efforts to improve the global economic governance system, and build mutually beneficial and inclusive GVCs. Among all practical endeavours, the Belt and Road Initiative (BRI) incepted and driven by China is the most remarkable one. Compared with the pattern of economic globalization promoted by developed countries, the BRI holds much more promise to reform the prevailing global economic governance system as it strives to build "a community with a shared future for mankind", and follows the principle of "extensive consultation, joint contribution and shared benefits".

The significance of China's BRI for promoting the reconstruction and optimization of GVSc has been widely recognized by scholars, and there is already a relatively solid theoretical basis to support the argument that the BRI is conducive to building more inclusive and mutually beneficial GVCs (Jin, 2016; Li, 2018). Since the initial proposal of the BRI, more than 150 countries and international organizations have signed cooperation agreements with China, pledging to jointly build the Belt and Road. Furthermore, concepts such as "a community with a shared future for mankind", and a global economic governance rule based on "extensive consultation, joint contribution and shared benefits" have been inscribed into the United Nations Resolutions, testifying that the BRI advocated by China has won impressive recognition, buy-in and support globally. This gratifying development however begs some questions: Are there already noticeable results concerning the concrete impact of the BRI on promoting the reconstruction and optimization of GVCs? And if so, what is the mechanism of influence? This paper aims to address these questions. It furthers the understanding of the BRI by focusing on objectively assessing the practical policy effects of the BRI on propelling GVCs towards a mutually beneficial direction, and proposing policy implications for upscaling the BRI impact through leveraging the existing mechanism.

2. Literature Review

Among the existing empirical studies, two strands of literature are closely related to this paper. One strand directly examines whether the BRI helps countries along the Belt and Road routes advance their status in the GVC division of labor, and the other empirically analyzes the multifaceted economic effects of the BRI from the perspective of specific economic activities. Below we will briefly review these two strands of literature.

In the first strand, scholars used quantitative data to illustrate the positive role of the BRI in promoting shared benefits by comparing the changes in the division of labor of the participating countries before and after joining the BRI. For example, taking the accession to the BRI as a critical point, Li and Chen (2018) compared the division of labor status index and value chain participation index of higher-end industries in China and other countries along the Belt and Road between 2011 and 2016, and found that the implementation of the BRI helped these countries improve the status of higher-end industries in the division of labor. Similarly, drawing upon the World Input-Output Data (WIOD) released by WIOD2016, Wang and Wu (2018) calculated and compared the changes in the index of non-equidistant export upstreamness of China and countries along the BRI routes from 2011 to 2014, and drew the conclusion that most of these countries achieved a certain degree of advancement in the value chains after 2013. Although such simple comparisons are useful to preliminarily identify positive changes in the division of labor after implementing the BRI, it is imprudent to tell that these changes are entirely brought about by the BRI as other policy interferences have not been ruled out in these analyses. Also, the selection of the sampling period may be too short (especially after 2013) to clearly show the effect of the BRI on changing the GVC division of labor.

The second strand of literature focuses on examining the specific economic effects brought about

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by some specific factors of the BRI. Most scholars drew the conclusion that the BRI had mutual benefit and win-win implications for countries along the routes based on the empirical analysis of the concrete economic impact generated by a specific mode of cooperation. Among them, the economic effects (manifested in economic growth, trade promotion, value chain elevation, etc.) of foreign direct investment (Li and Cai, 2018) and infrastructure construction (Hu *et al*., 2019) have received prominent attention. Ji (2019) further divided the Chinese factors of the BRI into three parts, namely foreign trade, foreign direct investment, and contracted foreign projects, and concluded that the synergistic effect of the three elements would help promote the economic growth of the participating countries along the Belt and Road and yield shared benefits.

To sum up, the existing literature has investigated the actual changing effects on the status of China and other BRI countries in the GVC division of labor directly brought out by the BRI or by other economic effects (including export trade, etc.). Revealing as these analyses are, they have several pitfalls which can be summarized in four aspects: (1) In terms of methodology, most of the existing research drew conclusions based on a simple before-and-after comparison, which failed to adequately account for the real implications of the BRI. (2) Although some empirical analyses revealed the potential impact of the BRI on matters such as outward foreign direct investment (OFDI), they, similar to the comparative statistical analysis, failed to account for the intrinsic effects of the BRI. (3) The existing empirical studies did not rule out other interfering factors when claiming the multifaceted economic effects brought about by the BRI, thus failing to provide reliable and convincing empirical evidence. (4) Even though some potential impacts of the BRI have been discussed in existing research, investigation into the mechanism of influence has been largely left out. In view of these drawbacks, this paper will expand on and complement the existing research by laying down the theoretical foundation before proceeding to employ the difference-in-differences (DID) model to explicate the specific effect of the BRI (excluding other policy interferences) on upgrading the status of the participating countries in the GVC division of labor. On this basis, the paper further examines the effect of China's BRI on reconstructing the GVCs, and explores whether the so-called "five-pronged approach" underpinning the BRI (i.e. policy coordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bond) constitute the mechanism of influence.

3. Theoretical Analysis and Research Hypotheses

As elaborated above, the reconstruction and optimization of GVCs can not only provide opportunities for more developing countries to participate in the GVC division of labor, but also help them climb up the ladder of the division of labor. Existing research has revealed that under the BRI, the investment and trade between China and the countries along the Belt and Road have shown substantial growth (Liu and Wu, 2018; Lu *et al*., 2019). In other words, it can be extrapolated that the BRI participating countries have, to a certain extent, improved the imbeddedness in the GVC labor division system which is characterized by foreign capital utilization and foreign trade development, signalling a beacon of hope for the equalization of opportunities in the GVCs. Data from the "2020 Statistical Bulletin of National Economic and Social Development" showed that despite the increasing uncertainty in the overall external environment and a sluggish open economy, the total import and export volumes of the BRI participating countries in 2020 reached over 9.3 billion yuan, an increase of 1.0% compared with last year. In particular, China's exports to other BRI countries amounted to over 5.4 trillion yuan, an increase of 3.2%. In terms of foreign direct investment, China's overall outward non-financial direct investment in 2020 was US$110.2 billion, a decrease of 0.4%, whereas the non-financial direct investment to other BRI countries amounted to US$17.8 billion, an increase of 18.3% against the headwind.

Economic globalization after the Second World War is essentially the globalization of the market

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economy. Therefore, the evolution of the GVC division of labor and the shaping of the current labor division system can arguably be attributed to the laws of the market economy by and large. However, the global market economy so far has been dominated by developed countries, and the intrinsic defects of the market economy have become a major impediment to building a more open, inclusive, balanced and mutually beneficial global labor division system. For example, existing research has explicated in depth that the primary thinkings underpinning the current pattern of economic globalization, including the binary opposition thinking in the zero-sum game, the "winner-take-all" thinking in the "law of the jungle" and egoism are self-limiting, posing significant hindrance to the sustainable and healthy development of economic globalization (Pei and Liu, 2018). In addition, since the present international economic order and global economic governance ruling system are dominated by developed countries such as the United States, they strongly reflect the interests of the dominant countries while underplaying those of developing countries (Ouyang, 2018). As a result, as important institutional bedrocks of GVC division of labor, the roles of international economic order and governance ruling system are contested as they embody inequality inherently.

On the contrary, we argue that the GVC development under the BRI, although also following the market laws of comparative strengths, is more in line with the standard and direction of a better global labor division system, as it strives to build "a community with a shared future for mankind" while promoting the principle of "extensive consultation, joint contribution and shared benefits" in economic globalization (Liu, 2018). As such, the BRI has the potential to overcome an array of challenges and contradictions confronting the global labor division system while driving GVC development towards a more mutually beneficial direction. From the perspective of participating countries along the Belt and Road, the BRI proposed by China provides ample opportunities for them to better integrate into the GVCs by fully unleashing their comparative strengths while circumventing the previously disadvantaged conditions shaped by multinational corporations in developed countries.

More importantly, compared with other countries along the Belt and Road, China generally has more advantages in high-end and technology industries. This means that while adhering to the concept of "a community with a shared future for mankind" and basic principle of "extensive consultation, joint contribution and shared benefits", China is unlikely to exert technological blockade on the BRI countries, but on the contrary, it is more inclined to encourage technology transfer through linking production factors, investment, trade and industries, thereby creating more pronounced technological and knowledge spillover effect contributing to trade and FDI (Amiti and Konings, 2007). This spillover effect will be more profound in light of the continuous upgrading of China's industrial structure and advancement of the technological level. On the basis of the above, this paper proposes several hypotheses:

Hypothesis 1: China's BRI will help countries along the Belt and Road routes to upgrade and improve their status in the GVC division of labor.

In order to drive the development of GVCs towards a more open, inclusive, balanced and mutually beneficial direction, it is essential to materialize advanced concepts and rules through concrete working mechanisms. Since the main purpose of the BRI construction is focused on "connectivity", the specific mechanism of influence of the BRI should be essentially linked to the "five-pronged approach", i.e. policy coordination, road connectivity, unimpeded trade, currency convertibility, and closer people-to-people ties. Through this mechanism the potential comparative advantages of the BRI countries can be unleashed, and developing countries along the Belt and Road can better share China's technological spillover effect, thereby achieving advancement in the GVC division of labor. As such, the foundation of labor division and cooperation between China and other BRI countries will be consolidated, and the scope and level of cooperation will be further expanded and deepened.

Policy coordination: Economic policy coordination has always been an important topic in international economic theory and practice. Existing research has testified the importance of policy

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coordination to promote effective division of labor and cooperation among countries, including its impact on the exchange and diffusion of knowledge, technology and information (Canzoneri *et al*., 2005). However, the policy coordination factor emphasized in traditional international economic theory mainly concerns open economic policies such as exchange rate. In contrast, policy coordination advocated under the BRI is more expansive and profound. Undoubtedly, policy coordination is the political foundation of the BRI and a prerequisite for cooperation. It includes the degree of political mutual trust and political cooperation mechanisms between China and the countries along the Belt and Road. In addition, the degree of policy stability of the countries is an important guarantee for effective policy coordination. If economic policy coordination advocated in the traditional international economic theories can have a positive impact on the diffusion of technology and knowledge, the policy coordination under the BRI, based on the principle of "consultation", is able to create more opportunities for participating countries to better integrate into the GVCs. The expanded GVCs will pay more attention to the interests of developing countries, and be more conducive to the docking of development strategy, development planning, mechanism and platform, specific projects, etc., thereby enabling countries to jointly discuss and optimize industrial, supply, service and value chains. As such, by promoting industrial complementarity, interaction and mutual assistance, countries and regions along the Belt and Road can jointly climb up the ladder of labor division.

Road connectivity: A wide array of literature has revealed the importance of infrastructure for division of labor and trade. Some studies assert that infrastructure improvement is an important mechanism for advancing technical complexity of a country's export, both in terms of "breadth" and "depth" (Wang *et al*., 2010). However, the existing literature predominantly focuses on domestic infrastructure, that is, intra-national connectivity (Glaeser et al., 2001). The connectivity of infrastructure and facilities under China's BRI undoubtedly expands beyond the boundary of one country. Specifically, connectivity here means that China and countries along the Belt and Road would jointly carry out infrastructure construction, including transportation facilities (railways, ports and airports), communication facilities (information highways), and energy facilities (new energy and traditional energy facilities). All of these facilities will help BRI countries integrate into and advance the position in the GVC labor system by increasing their ability to undertake transferred industries and production linkages, as well as to benefit from technological diffusion and absorption.

Unimpeded trade essentially means to create a more liberalized and enabling environment for trade and investment, and it is an important measure and manifestation of expanding opening-up. Liberalizing and facilitating trade not only entails reducing tariff and non-tariff barriers, but also reforming and optimizing relevant domestic regulations, legal systems and tax systems. Such adjustments and changes will undoubtedly help lower the cost of cross-border flow of goods and production factors including technologies, thereby creating an institutional environment conducive to attracting and aggregating higher-end industrial production factors. This means wider and higher-level opportunities for countries along the Belt and Road to participate in the GVC division of labor. Investment facilitation includes the signing of investment agreements and increases in bilateral investment flows, which provide technological and financial support for the industrial development of participating countries, and generate extensive technology spillover effect. Existing research on the impact of trade and investment liberalization and facilitation on upgrading industrial structure has already revealed their scale effect, competition effect and spillover effect, which would be more pronounced for countries with relatively backward industrial development and technological levels (Perez and Wilson, 2012). The same mechanism of influence also applies to the liberalization and facilitation of trade and investment under the BRI. That is to say, effective discussions around liberalization and facilitation of trade and investment between China and countries along the Belt and Road will help remove trade and investment barriers, reduce costs, and facilitate the free flow of commodities and productive factors. In particular,

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given that China has relative technological strength compared to most of the countries along the routes, the scale effect, competition effect and spillover effect can be better tapped to accelerate the integration of the BRI countries into the GVC labor division system.

Currency convertibility: Currency convertibility between China and the BRI countries is enabled mainly through financial cooperation, smooth credit exchanges, and a favorable financial environment. Financial cooperation includes the signing of agreements on currency exchange, memorandum of understandings (MoUs) on financial supervision, and investment banking cooperation, which help reduce risks of exchange rate, stabilize markets for securities and futures, and expand investment and financing platforms. Smooth credit exchanges refer to improve convenience for credits and regulate relevant credit platforms. In addition, maintaining the stability of the financial environment of the BRI participating is also vital to currency convertibility. Existing research on the impact of currency convertibility on export trade suggests that factors such as export credit are conducive to knowledge diffusion and spillover particularly through global industrial and supply chains. Factors such as a country's financial system and financial environment also affect its integration into the GVC labor division system, especially by affecting a company's competitiveness, innovation capability and investment in RandD (Xu, 2018). The currency convertibility advocated by the BRI can provide countries along the routes with sufficient funds for construction and abate their financial constraints, which help improve their production capacity, as well as the capability to absorb the transfer of value-added industries and products, and technologies. Arguably, addressing financial constraints in the GVC labor division system is also the linchpin to transforming the potential advantages of other production factors into practical advantages. Accordingly, the economic vitality of the Belt and Road region will also be stimulated.

Closer people-to-people ties: The Report to the 18th National Congress of the Communist Party of China for the first time raised the idea of "steadfastly promoting public diplomacy and cultural and people-to-people exchanges", which is critical for "consolidating the social foundation for the development of state relations". Cultural and people-to-people exchanges are particularly important as public opinions play an increasingly prominent role in fostering regional peace and development. The broad support from the people, including the people of the exchange countries, is the social foundation of stable development of state-to-state relations and foreign exchanges. Existing research has empirically proven, from the perspective of cultural trade, that promoting "closer people-to-people ties" could enhance mutual understanding and foster common interests, thereby bringing better economic and trade cooperation and communication (Janeba, 2007). In addition, as pointed out by previous studies, the concept of an open economy has gained more traction internationally, propelling countries to cooperate in broader areas, at a higher-level and with better quality. In this sense a solid foundation based on closer people-to-people ties is ever more indispensable as cultural identity is critical for countries to form a higher-level of open cooperation (Li, 2018). As such, it is crucial for China and countries along the Belt and Road to strengthen cultural exchanges and carry out cooperation in a wide range of fields such as science, education, culture, health, and people-to-people exchanges.

Based on the above, this paper proposes:

Hypothesis 2: The BRI helps countries along the routes advance their position in the GVC division of labor through the intermediary mechanism of "five-pronged approach": policy coordination, road connectivity, unimpeded trade, currency convertibility, and closer people-to-people ties.

4. Research Design

4.1 Model Proposal

This study aims to examine whether participating in the BRI will help countries along the routes improve their status in the GVC division of labor. Since the essence of this study is to identify policy

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effects of the BRI, the paper employs the difference-in-differences (DID) model which is widely used in academic research on evaluating policy effects. The model excludes the influence of other factors by comparing the double differences between before-and-after, and with-and-without the implementation of a policy. To be more specific, this paper adopts the DID model to study the optimization effect of China's BRI on the global value chains, that is, whether the BRI has improved the status of the countries along the routes in the GVC labor division system, and whether the "connectivity" mechanism is valid.

DID model in essence is a counterfactual experiment. On defining the treatment group and the control group, and the threshold of before-and-after the experiment, the model sets DID as an important variable, which is the cross product of the treatment variable (*Treat*) and time variable (*Time*): The treatment variable (*Treat*) is a dummy variable, and the value for the treatment group (with policy implementation) is 1, and the value for the control group (without policy implementation) is 0; the time variable (*Time*) is also a dummy variable, and the value for experiment (after the policy implementation) is 1, and the value for before-experiment (before the policy implementation) is 0. Due to multicollinearity, it is not possible to simultaneously include $Treat_{cj}$ and individual fixed effect, and $Time_{ct}$ and time fixed effect in the model. Therefore, in the two-way fixed effects model, $Treat_{cj}$ and $Time_{ct}$ have been omitted. Based on this, this paper constructs the DID panel model with two-way fixed effects as follows (equation 1):

$$GVC_PO_{cit}=\alpha_0+\alpha_1 \mathrm{DID}_{ct}+\beta X_{ct}+\gamma Y_{cit}+\lambda_t+\mu_{ci}+\upsilon_{cit} \quad (1)$$

Where, the subscript c represents a participating country of the BRI, i represents an industry, and *t* represents the year. In order to control for other time-varying factors that may affect the index of the GVC division of labor status (*GVC_PO*), this paper includes the time fixed effects (λ_t) and the individual fixed effects (μ_{ci}) in the model. In addition, this paper adds four variables (X_{ct}) which represent the characteristics of the participating country (i.e. labor structure, labor cost, labor productivity, and economic scale) to the model to control for the time-varying national factors (for details, see below). The model also adds variable Y_{cit} to denote the characteristic of a country's certain industry to control for the time-varying individual factors.

In equation 1, the coefficient α_1 of the DID is the policy implementation effect. If the estimated value of α_1 is significantly positive, it means that China's BRI does have an optimization effect on the GVCs by improving the status of the participating countries in the division of labor, hence verifying Hypothesis 1. When choosing the DID variables, this paper treats a country's signing of cooperation documents with China as its formal participation in the BRI. Cooperation documents include intergovernmental MoU, and official Belt and Road cooperation document. Data on the participating countries and their time of participation are from the China One Belt One Road website. It has to be noted the article selects 61 countries from the ADBMRIO 2018 database as research samples. Statistical results showed that from 2014 to 2018, every year there were new countries participating in the BRI, and as of the end of 2018, there were 24 countries out of the 61 samples that have not joined the BRI. Based on the above, the paper designed the following four models to minimize bias:

(1) Model 1: Based on the sample of 61 countries drawn from ADBMRIO 2018, this paper first takes the year of participation as the policy implementation year to construct the time-varying DID model (Model 1), where $DID1_{ct}$ is the time-varying DID variable. When country *c* has signed the cooperation document by year t, the value of this variable is 1, otherwise it is zero. The specific set-up is shown in equation (2):

$$DID1_{ct}=\begin{cases}1, \text{Country c signed MoU or cooperation document in year } t\\ 0, \text{Country c did not sign MoU or cooperation document in year } t\end{cases} \quad (2)$$

(2) Model 2: Considering that the influence of BRI on the position of participating countries in the GVCs can be lagging, for accuracy, this paper uses the method of eliminating the "observation period"

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as suggested by Chen (2018); that is, on the basis of Model 1, the data sample deletes countries which signed MoU in 2016 and 2017. As such, the research selects those countries that signed cooperation documents in the early period (2014 and 2015) as the treatment group, and countries that only signed in the end of 2017 and 2018 (including those that have not signed as of 2018) as the control group; and it takes the period of 2011-2013 as before-policy-implementation, and the period of 2016-2017 as after-policy-implementation. Model 2 is constructed as follows, with the variables shown in equations (3), (4) and (5):

$$DID2_{ct} = Treat1_c \times Time_{ct} \tag{3}$$

$$Treat1_{ct} = \begin{cases} 1, \text{Country } c \text{ signed MoU or cooperation document in 2014 or 2015} \\ 0, \text{Country } c \text{ did not sign MoU or cooperation document by 2017} \end{cases} \tag{4}$$

$$Time_{ct} = \begin{cases} 1, year > 2015 \\ 0, year < 2014 \end{cases} \tag{5}$$

(3) Model 3: In the control group of Model 2, there are 24 countries which have not joined the BRI as of 2018. Most of the non-member countries are not located along the Belt and Road routes, and the majority of them are developed countries (whereas most of the BRI members are developing countries). Considering that the precise nature of a developing or developed country may have been a big influencing factor in terms of decision-making, including the non-member developed countries in the control group may run the risk of violating the principle of policy randomness constructed by the DID counterfactual experiment. Therefore, on the basis of Model 2, the data sample further leaves out the 24 non-participating countries from the control group. Model 3 is constructed as follows, with the variables shown in equations (6), (7) and (5):

$$DID3_{ct} = Treat2_c \times Time_{ct} \tag{6}$$

$$Treat2_c = \begin{cases} 1, \text{Country } c \text{ signed MoU or cooperation document in 2014 or 2015} \\ 0, \text{Country } c \text{ signed MoU or cooperation document in 2018} \end{cases} \tag{7}$$

(4) Model 4: In Model 3, the control group is only composed of 8 countries that signed relevant BRI cooperation agreements in 2018. The small sample size might sacrifice the robustness of the empirical results. Therefore, considering the possible time-lag in policy implementation, on the basis of Model 3, this paper moves countries that joined the BRI later than November 2017 to the 2018 control group. Since countries joined the BRI after November 2017 would hardly show policy effects in the same year, they are categorized as the control group; whereas countries joined after November 2015 would show policy effects in 2016, hence they still belong to the treatment group. Based on the above considerations, Model 4 treats countries that joined the BRI in 2014 and 2015 (with adjustment) as the treatment group, and countries that joined in 2018 (with adjustment) as the control group; and the period of 2011-2013 as before-policy-implementation, and of 2016-2017 as after-policy-implementation. Model 4 is constructed as follows, with specific variables shown in equations (8), (9) and (5):

$$DID4_{ct} = Treat3_c \times Time_{ct} \tag{8}$$

$$Treat3_c = \begin{cases} 1, \text{Country } c \text{ signed MoU or cooperation document in 2014 or 2015 (with year adjustment)} \\ 0, \text{Country } c \text{ signed MoU or cooperation document in 2018 (with year adjustment)} \end{cases} \tag{9}$$

In addition, the article puts forward the hypothesis of BRI's mechanism of influence, i.e. the BRI helps enhance the status of countries along the route in the GVCs division of labor through the "five-pronged approach" mechanism. In order to verify this mechanism hypothesis, this paper employs the three-step method proposed by Baron and Kenny (1986). The specific process is outlined as follows:

(i) Regress the DID variables and the GVC division of labor index to verify the impact of the BRI

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on the GVC division of labor. See equation (10) for details. If the coefficient (α_1) is significantly positive, it indicates a positive impact.

(ii) Regress the DID variables with the first-tier indicators of "five-pronged approach" (namely the index for policy coordination, road connectivity, unimpeded trade, currency convertibility, and the people-to-people bond), to verify the impact of the BRI on the "five-pronged approach" areas, as shown in equation (11). If the coefficient (α_2) is significantly positive, this indicates that the construction of the BRI has indeed promoted the development of the "five-pronged approach" areas.

(iii) Respectively introduce the "five-pronged approach" index and DID variables into the model, and regress with the GVC division of labor status index, as shown in equation (12). If the coefficient DID α_3 is significant and less than α_1, and the coefficient estimate α_4 of the variable effect of "five-pronged approach" is still significant, it indicates that the BRI has indeed improved the division of labor of participating countries through the "five-pronged approach" mechanism, hence verifying Hypothesis 2. In equations (10), (11) and (12), WT_x_{ct} represents five variables: WT_A_{ct} (policy coordination index), WT_B_{ct} (road connectivity index), WT_C_{ct} (unimpeded trade index), WT_D_{ct} (currency convertibility index), and WT_E_{ct} (people-to-people bond index).

$$GVC_PO_{cit}=\alpha_0+\alpha_1 DID_{ct}+\beta X_{ct}+\gamma Y_{cit}+\lambda_t+\mu_{ci}+\upsilon_{cit} \tag{10}$$

$$WT_x_{ct}=\alpha_0+\alpha_2 DID_{ct}+\beta X_{ct}+\gamma Y_{cit}+\lambda_t+\mu_{ci}+\upsilon_{cit} \tag{11}$$

$$GVC_PO_{cit}=\alpha_0+\alpha_3 DID_{ct}+\alpha_4 WT_x_{ct}+\beta X_{ct}+\gamma Y_{cit}+\lambda_t+\mu_{ci}+\upsilon_{cit} \tag{12}$$

4.2 Core Variable Measurement and Data Explanation

(1) Explained variable: GVC division of labor status index. Remarkable achievements have been made in measuring the status of the GVC division of labor, among which the status index proposed by Koopman *et al*. (2010) has been widely recognized and used in relevant studies. This paper also draws on this index to measure the GVC division of labor of the BRI participating countries. The specific calculation equation is shown in equation (13), where, GVC_PO_{cit} is the status index of country c in the division of labor in industry i in year t, IV_{cit} is the domestic value added of country c in industry i in year t generated from exported products which have been re-exported by importing countries, and FV_{cit} is the foreign value added of the annual exports of country c in industry i in year t, and E_{cit} is the total export value of country c in industry i in year t. Based on the above measurement method, the higher the GVC_PO_{cit} index, the higher the proportion of domestic value added in indirect exports, the lower the proportion of foreign value added, and hence the higher status of the country in the GVC division of labor.

$$GVC_PO_{cit}=\ln\left(1+\frac{IV_{cit}}{E_{cit}}\right)-\ln\left(1+\frac{FV_{cit}}{E_{cit}}\right) \tag{13}$$

This paper uses the decomposition results of export value added of 35 industries in 61 countries from 2011 to 2017 from the UIBE GVC ABDMRIO2018 database to calculate the corresponding GVC labor status index (*GVC_PO*). It should be pointed out that the index measurement method proposed by Koopman *et al*. (2010) essentially only measures the upstream degree of a country in a value chain instead of its accurate position in the GVC division of labor. Despite the potential shortcoming, this measurement itself or a modified version is still widely used in relevant research fields (Dai and Liu, 2018; Zheng and Zheng, 2020). The reason is mainly because the so-called upstream and downstream degrees are usually closely correlated to the GVC division of labor. For example, the essence of the classic "smiling curve" is generally believed to reflect the division of labor status based on the upstream/downstream degree, that is, the production stages at both ends of the "smiling curve" are usually regarded as to create high value added, corresponding to a more favorable and higher status in

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the division of labor, whereas the production stages at the bottom of the "smiling curve" are usually considered to create low value added, representing a less favorable and lower status in the division of labor.

The existing research reveals that there is no universally recognized or unified measurement index with regard to the status in the GVC division of labor. The prevailing measurement indicators are either based on physical attributes, that is, measured from the physical positioning of different production links and stages in the value chain; or based on economic attributes, that is, measured against the capacity of value creation (Su and Gao, 2015). Both measurements have their rationality and limitations. In comparison, the method proposed by Koopman *et al*. (2010) is relatively comprehensive since it to some extend incorporates both the physical and economic attributes, as it not only measures the physical positioning such as upstream degree, but also uses information including value added to reflect economic attributes. However, this method clearly has its own pitfalls. Notably, from the perspective of industry characteristics, the GVC status index of primary industries is often high, but it does not have a high status in the division of labor. In other words, the GVC status index of primary products only indicates the upstream degree in the value chain instead of the status in the division of labor. In light of this, and considering that the focus of this research is on studying the BRI's impact on improving the status of participating countries in the GVC division of labor, this paper made some slight modification in the actual referencing and calculation process, that is, excluding two primary industries, industry 1 (agriculture, forestry, animal husbandry and fishery) and industry 2 (mining industry). In addition, it excludes industry 35 (private household employment services) since the export value of this industry is almost zero in many sample countries. Hence, the sample retains the industries numbered 3-34.

(2) Mediating variable: "Five-pronged approach" index. The BRI primarily includes five "connectivity" areas: "Policy coordination", "road connectivity", "unimpeded trade", "currency convertibility" and "closer people-to-people ties", which are commonly referred to as "five-pronged approach". The measurement of the "five-pronged approach" index is also divided into five parts accordingly: The policy coordination index (*WT_A*), the road connectivity index (*WT_B*), the unimpeded trade flow index (*WT_C*), the currency convertibility index (*WT_D*) and the people-to-people bond index (*WT_E*). A research group of Peking University released the "Belt and Road Five-pronged approach Index Report" successively in 2016, 2017 and 2018, which put forward a relatively systematic "five-pronged approach" index system. However, the index system slightly lacks logical consistency as the construction and measurement methods underwent updating every year, with the most important one being that the indicator system of the following year deleted some important baseline indicators of the previous year, but included practical results from Belt and Road construction (Chen, 2019). Since the research includes the years before the official initiation of the BRI and the countries that have not joined as of 2018, it needs to pay more attention to the baseline level of connectivity. Hence, based on the "five-pronged approach" index system reported by the research group in 2016, and after making minor adjustments, the paper constructs its own "five-pronged approach" index system, which includes five first-tier indicators, 15 second-tier indicators, and 38 third-tier indicators. And by adopting the methods of index weighting and data normalization, the "five-connectivity" index of 61 countries from 2011 to 2017 in the UIBE GVC ABDMRIO2018 database is calculated to ensure the logical consistency before and after the index calculation.

(3) Other explanatory variables. This paper selects the following four country-level control variables (X_{cit}) to control for the influence of national factors: (i) Labor force structure - the ratio of non-agricultural employees (*emp_nagr*); data are from the World Development Index (WDI); (ii) Labor cost - labor wage level (ln*wage*); data are based on the average monthly salary of employees from the UN ILO database; (iii) Labor productivity - human capital (ln*pci*); data are from the UNCTAD statistical database; and (iv) Economic scale - Gross domestic product (lng*dp*); data are drawn from the World

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Development Index (WDI). In addition, this paper selects two national industry-level control variables (Y_{cit}) to control for the impact of time trends at the industry-level: (i) Export scale—trade value (ln*e*), which includes the export value of each industry in each country from the World Input-Output Table while excluding the double-counting parts; (ii) industry comparative strength—explicit comparative advantage (*rca*); data are calculated by this paper using the ratio of the export value of a certain industry accounting for the total export value of the country, to the total global export value of this specific industry; where, the variables of labor cost, labor productivity, economic scale and export scale take the natural logarithm in the empirical analysis, and ln is the natural logarithm symbol.

5. Empirical Results and Analysis

5.1 Empirical Results

Based on the above four DID models, this paper empirically tests the impact of the BRI on the status of the participating countries in the GVC division of labor. The estimated results are presented in Table 1, where Columns (1)-(4) respectively show the results of Model 1, Model 2, Model 3, and Model 4. Table 1 reveals clearly that in all four models, the regression coefficients of the DID variables are significantly positive, indicating that China's BRI did have a significant effect on the reconstruction of global value chains by improving the status of the participating countries in the division of labor. As such, the aforementioned Hypothesis 1 can be verified.

In addition, referring to the practice of Tang *et al*. (2019), in the DID benchmark regression model, dummy variables of the years before and after the BRI were added to test the common trend, see equation (14); where, DID_{nct} is the interaction between the dummy variable and policy treatment variable *n* years before the policy implementation; $DID0_{ct}$ is the interaction factor between the dummy variable and policy treatment variable in the policy implementation year; and DID_{mct} is the interaction factor between the dummy variable and the policy treatment variable *m* years after the policy

Table 1: Benchmark Regression of the DID Model—Influence of the BRI on the GVC Division of Labor

	(1) *GVC_PO*	(2) *GVC_PO*	(3) *GVC_PO*	(4) *GVC_PO*
	Model 1	Model 4	Model 3	Model 4
*DID*1	0.0032**			
	(2.0825)			
*DID*2		0.0210***		
		(9.2670)		
*DID*3			0.0120***	
			(3.6356)	
*DID*4				0.0171***
				(4.9738)
Individual fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Control variable	Yes	Yes	Yes	Yes
_cons	-0.5320***	-0.1004	-0.1187	0.4422
	(-4.4443)	(-0.6327)	(-0.4022)	(1.5006)
N	13,215	6,719	2,879	3,519
R^2	0.0471	0.0753	0.0882	0.0645

Note: *, ** and *** denote significance at 10%, 5% and 1%, respectively, the same applies to the following tables.

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implementation. If the estimated coefficient of DID_n_{ct} is significantly zero, it means the model passed the test for common trend.

$$GVC_PO_{cit}=\alpha_0+\sum_{n=1}^{N}\alpha_{1n}DID_n_{ct}+\alpha_2 DID0_{ct}+\sum_{m=1}^{M}\alpha_{3m}DIDm_{ct}+\beta X_{ct}+\gamma Y_{cit}+\lambda_t+\mu_{ci}+\upsilon_{cit} \quad (14)$$

In the common trend test in Model 1, the dummy variables for the previous three years (2011, 2012, 2013), the current year (2014) and the succeeding three years (2015, 2016, 2017) of the BRI were added, giving *N* the value of 3 and *M* the value of 3. The empirical results are shown in Figure 1(a). The research found that before the implementation of the policy, the treatment group was slightly lower than the control group, so the strict common trend test was not met in the first three years. This may be attributed to the fact that the countries in the control group that did not participate in the BRI were largely developed countries, which already had a higher status in the value chains, as well as an endogenous climbing mechanism. On the contrary, compared with the coefficients of the three years succeeding the policy implementation, the value chain position of the treatment group was significantly higher than that of the control group. From this, we can derive that the time-varying DID model can only explain the policy effects of the BRI to a certain extent, but falls short at rigorous policy identification.

Model 2, Model 3, and Model 4 are all DID models that have deleted the observation period. In the common trend test, dummy variables for the preceding two years (2012, 2013) of the observation period (2014 to 2015) of the BRI and succeeding two years (2016, 2017) were added, giving N the value of 2 and M the value of 2. The empirical results of Model 2, Model 3, and Model 4 are shown in Figure 1(b), Figure 1(c), Figure 1(d) respectively. The results show that after deleting the observation period, Model

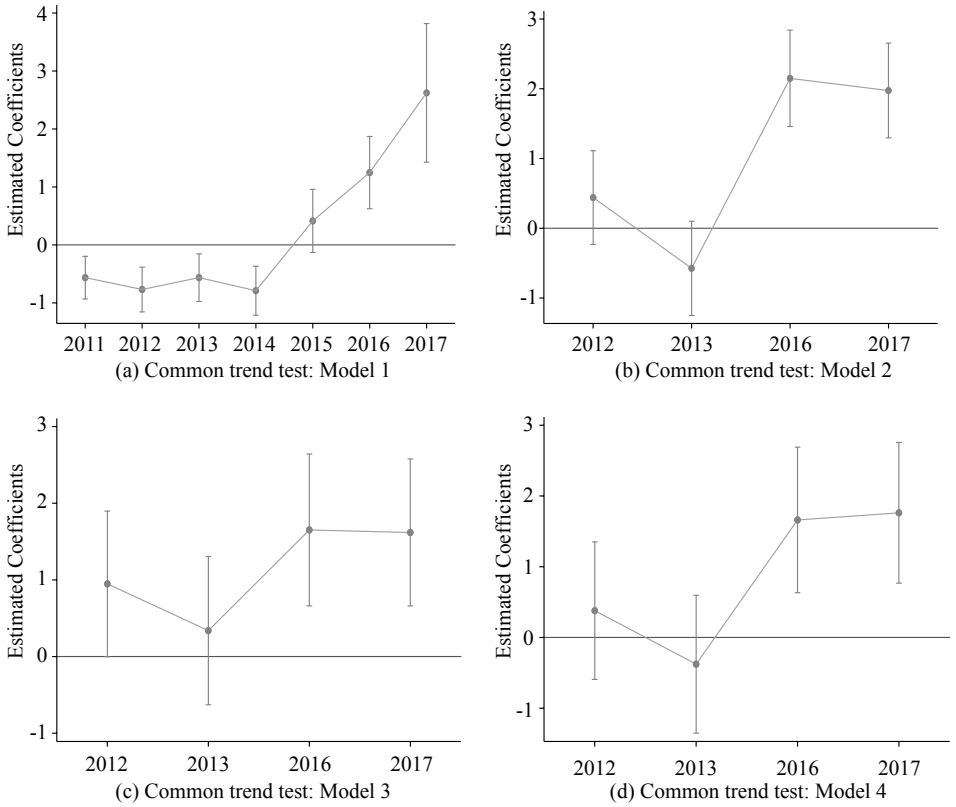


Figure 1: Common Trend Tests of the Treatment Group and Control Group

Note: The small black dots in the figure represent the estimated coefficients, and the vertical lines are the 95% confidence interval.

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2, Model 3, and Model 4 all passed the common trend test. On this basis, this paper holds that the DID model deleting the observation period is better than the multi-time-point DID model, and that Model 4 is the most accurate model in terms of identifying the policy effects of the BRI. Hence, in what follow we will perform further analysis and robustness test on Model 4.

5.2 Robustness Test

(1) Policy uniqueness test. It is inevitable that other concurrent policies might also influence the GVC division of labor of participating countries other than the BRI. For example, in 2012, China and 16 Eastern European countries established the "Eastern European 16+1" multilateral cooperation system, and have since conducted close cooperation activities in infrastructure, trade connectivity, investment, etc., making this region one of the closest BRI partners. Given the ample duplication and overlapping with the BRI, the "16+1" initiative may also affect the division of labor of the countries. Moreover, due to the different distributions of the 16 Eastern European countries in the treatment and control group, the DID method could not effectively exclude the influence of the "16+1" initiative in the examination. Therefore, in order to eliminate the possible interferences caused by other policy measures, the research excluded the countries in the "16+1" group from the sample. The actual impact of the BRI on the division of labor of the participating countries excluding the "16+1" countries is presented in Column (1) of Table 2. The estimated results show that after excluding these countries, the regression estimated value of the DID coefficients was 0.0273, and it passed the statistical significance test at a confidence level below 1%. Hence, we draw the conclusion that ruling out the possible interference of the "16+1" cooperation initiative, the BRI still shows a significant impact on promoting the status of the participating countries in the GVC division of labor.

(2) Time randomness test. In order to further test the robustness of the estimated results, the policy time node is moved forward from after the signing of MoU in 2016 to before the signing of MoU in 2013. Another factor to bear in mind, as mentioned above, is the "Eastern Europe 16+1" cooperation which was officially proposed in 2012 and could have influenced the GVC division of labor of the 16 Eastern European countries in 2013. Based on this consideration, the regression estimate performed in this paper is divided into two parts, one part is based on the total sample, the other is based on the sample excluding the 16 Eastern European countries. The regression estimated results are shown respectively in Columns (2) and (3) of Table 2. According to the estimated results presented in Column (2) of Table 2, the regression estimated value of the DID coefficient based on the total sample was 0.0071, and it passed the statistical significance test at a confidence level below 5%, confirming the previous assumption that the "16+1" regional cooperation policy did play a certain role in promoting the division of labor of relevant countries. However, after excluding the 16 Eastern European countries, although the regression estimates of the DID coefficient shown in Column (3) of Table 2 was positive, it failed the statistical significance test. It can be derived from this robustness test that the policy effect of the BRI is significant. In other words, after considering the interfering nature of policies, the hypothesis that the BRI advanced the GVC division of labor of participating countries still holds.

(3) Perform robustness test on the treatment group of countries that have not signed the BRI. In order to further test Hypothesis 1, this paper introduced a placebo group to compare the impact of the BRI. Since the GVC division of labor of non-participating countries is hardly affected by the BRI, if these countries are used as objects for DID estimation and the estimated value of the DID coefficients is also significantly positive, then there are good reasons to believe that the BRI is not the sole reason contributing to the improvement of the status of division of labor of participating countries. To this end, this paper used countries that have not signed BRI cooperation agreements with China as of 2018 as the placebo group to replace the treatment group, and conducted DID estimate on this basis. The empirical results are reported in Column (4) of Table 2, which shows that the regression estimate of the

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Table 2: Robustness Test of the DID Model Showing the BRI's Effect on the Division of Labor of Participating Countries

	(1) *GVC_PO*	(2) *GVC_PO*	(3) *GVC_PO*	(4) *GVC_PO*
	Policy uniqueness Test	Temporal randomness test (total sample)	Temporal randomness test (Excluding "16+1 countries)	Robustness test using non-participating countries as treatment group
*DID*4	0.0273***	0.0071**	0.0079	-0.0046
	(5.2776)	(2.1525)	(1.6049)	(-1.6351)
Individual fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Control variable	Yes	Yes	Yes	Yes
_cons	1.1566***	0.3809	1.0436**	0.0737
	(2.7002)	(1.2873)	(2.4179)	(0.4019)
N	2,079	3,519	2,079	5,760
R^2	0.0845	0.0582	0.0707	0.0512

DID coefficients was -0.0046, but it failed to pass the statistical significance test, further supporting the rationality and robustness of the previous estimated results.

(4) Placebo test based on random sampling of the treatment group. In order to further exclude the influence of possible missing variables on the validity of the treatment results, this paper drew on the method of Ferrara *et al*. (2012) to select random countries as the treatment group for further placebo test. The treatment group above included 10 countries that joined the BRI before 2016, and the control group included 12 countries that joined in 2018, based on which the treatment variable "*Treat*" was constructed. For this test, 10 countries were randomly selected from the 22 total samples as the treatment group, and the remaining 12 countries were used as the control group, and a pseudo-treatment variable "$Treat^{pesudo}$" was constructed to replace the pseudo DID term "DID^{pesudo}" of the original treatment variable "*Treat*" in equation (1), and the pseudo DID coefficients α_1^{pesudo} was obtained when estimated according to equation (4). The above process was performed randomly 1,000 times, and the estimated kernel density of α_1^{pesudo} is plotted as shown in Figure 2, where the vertical line represents the coefficients of the real DID factor α_1. It can be drawn from Figure 2 that the estimated results of random grouping are concentrated around zero, and are more in line with normal distribution; the mean is close to 0, and most of the p-values are greater than 0.1, indicating that the BRI had no significant effect on the randomly selected treatment group. In addition, α_1 (solid vertical line) is far away from the main distribution range, which shows that there is only a small probability that the BRI helped the value chain advancement of participating countries is a random result.

(5) Multidimensional fixed effects were included. On the basis of the previous DID and double fixed effect model, the research added the country-year fixed effect (the cross term of the country fixed effect and the (*Time*) fixed effect) to control for the unobservable effect of country-level changes over time; and the industry-year fixed effect (the cross term of the industry fixed effect and the time fixed effect) to control for the unobservable effects of industry-level changes over time. The regression estimation results were all positive and have passed the statistical significance test at a confidence level below 5%, which further supports the assumption that the BRI was beneficial to participating countries to improve their status in the GVC division of labor.

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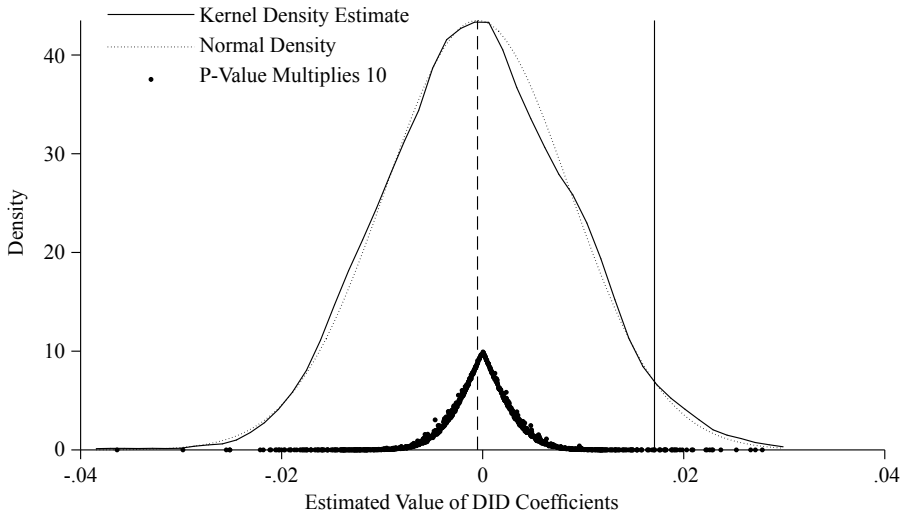


Figure 2: Pseudo DID Factor Estimation Results for Random Grouping

6. Further Verification of Mechanism

The empirical results above have in principle confirmed that the BRI did help participating countries to advance their status in the global value chains. The follow-up question is, what is the mechanism of influence? Or to be more specific, does the BRI generate this impact through the mechanism of the five intermediaries of policy coordination, road connectivity, unimpeded trade, currency convertibility, and closer people-to-people ties? This section aims to test whether this mediating mechanism exists based on the three-step method proposed above. The first step of the three-step approach was to verify whether the BRI helps boost the GVCs division of labor, which has been validated by the empirical results above. The second step was to verify whether the BRI is conducive to the development of the "five-pronged approach" areas. To this end, the regression estimated results reported in Table 3 show that when the "five-pronged approach" indexes were used as explained variables respectively, the DID terms were all significantly positive at a confidence level of below 1%, verifying that the BRI had a significant role in promoting the development of the "five-pronged approach" areas.

In the third step, the indexes of the "five-pronged approach" and the DID factors were concurrently incorporated into the measurement equation, and the regression estimation results obtained are reported in Table 4. Column (1) of Table 4 shows the estimated results when the "five-pronged approach" indexes were not included, and Columns (2)-(6) of Table 4 were the regression results when they were included. It can be observed that on the one hand, the DID coefficients were reduced to varying degrees after adding the "five-pronged approach" indexes, and in particular, the estimated values of the regression DID coefficients of Columns (2)-(6) were all smaller than 0.0171 in Column (1); on the other hand, the estimated values of the coefficient regression of the "five-pronged approach" index variables were all positive, and most of them have passed the statistical test of significance. To be more specific, the estimated values of four index variables, namely policy coordination, road connectivity, unimpeded trade, and currency convertibility passed the statistical test of significance, but the index variable of closer people-to-people ties failed to pass the test despite a positive estimated value of regression. This shows that China's BRI has indeed promoted the improvement of the division of labor of participating countries along the routes through the "five-pronged approach" intermediary mechanism, and in particular through the first four of them.

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Table 3: Empirical Results Demonstrating the BRI's Impact on "Five-pronged Approach"

	(1) Policy coordination	(2) Road connectivity	(3) Unimpeded trade	(4) Currency convertibility	(5) Closer people-to-people ties
DID	2.6748***	1.8485***	1.4511***	2.3662***	0.4726***
	(39.3844)	(29.5158)	(42.7937)	(24.2400)	(22.3736)
Individual fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
Control variable	Yes	Yes	Yes	Yes	Yes
_cons	130.6813***	30.0839***	31.6140***	135.9732***	6.5451***
	(22.4377)	(5.6015)	(10.8720)	(16.2431)	(3.6130)
N	3,519	3,519	3,519	3,519	3,519
R^2	0.6372	0.5433	0.6501	0.7721	0.3814

Table 4: Test Results of the Mechanism of Influence of the BRI

	(1) *GVC_PO*	(2) *GVC_PO*	(3) *GVC_PO*	(4) *GVC_PO*	(5) *GVC_PO*	(6) *GVC_PO*
DID	0.0171***	0.0110**	0.0139***	0.0121***	0.0139***	0.0148***
	(4.9738)	(2.5686)	(3.5393)	(2.7422)	(3.6709)	(3.9553)
WT_A		0.0023**				
		(2.3890)				
WT_B			0.0017*			
			(1.6565)			
WT_C				0.0034*		
				(1.7943)		
WT_D					0.0014**	
					(2.0522)	
WT_E						0.0050
						(1.6127)
Individual fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.4422	0.1442	0.3906	0.3337	0.2568	0.4098
	(1.5006)	(0.4508)	(1.3185)	(1.1097)	(0.8336)	(1.3878)
N	3,519	3,519	3,519	3,519	3,519	3,519
R^2	0.0642	0.0660	0.0651	0.0652	0.0663	0.0656

7. Conclusion and Policy Implications

The urgent reconstruction and optimisation of the global value chains is the top priority for a sustainable and healthy development of economic globalization. This primarily means promoting more inclusive GVCs, the kernel of which is to create more opportunities for developing countries to participate in the labor division system and help them climb up the ladder as much as possible. The BRI promoted by China is not only a clear demonstration of China's expanding opening-up efforts, but also an important policy measure to promote the reconstruction and optimization of global value chains, thereby contributing to the sustainable and healthy development of economic globalization.

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Since its debut in 2013, the BRI has seen ample achievements. As confirmed by President Xi Jinping in his keynote speech at the opening ceremony of the second Belt and Road Forum for International Cooperation: "A large number of cooperation projects have been launched, and the decisions of the first Belt and Road Forum have been smoothly implemented. More than 150 countries and international organizations have signed agreements on Belt and Road cooperation with China". The active participation of countries, including those along the Belt and Road routes to a certain extent testifies that the initiative has indeed brought opportunities for more developing countries to integrate into the GVC labor division system. The rapid growth in investment and trade between China and countries along the Belt and Road in recent years also provides empirical evidence in this regard.

However, there is still inadequate theoretical and empirical research with regard to the BRI's impact on steering the GVC division of labor towards a more equitable direction. The aim of this paper was to fill this lacuna. On the theoretical front, this paper established that on the one hand, unlike the economic globalization pattern promoted by developed countries in the past, China's BRI is more conducive to improving the status of countries along the routes in the GVCs as it aims to build a "community with a shared future for mankind" and follows the principle of "extensive consultation, joint contribution and shared benefits", which are in line with the actions needed to overcome the contradictions of "unequal opportunities and unequal status" confronting the current GVC labor division system. On the other hand, since connectivity is the cornerstone of the BRI, the paper postulated that the BRI's impact should be attributed to the intermediary mechanism of "five-pronged approach", namely policy coordination, road connectivity, unimpeded trade, currency convertibility and closer people-to-people ties.

At the empirical level, the quantitative test results based on the DID model showed that: (1) The BRI did have a significant impact on improving the status of participating countries in the GVC division of labor. The assumption was still valid after undergoing various robustness tests such as randomness tests and placebo tests. This further showed that the BRI did drive the development of the GVC division of labor towards a more equitable direction. (2) The BRI played a positive role in optimizing the global value chains through the intermediary role of the first four connectivity areas. (3)Although the BRI promoted the closer people-to-people ties between China and the participating countries to a certain extent, the intermediary mechanism of this connectivity has not yet played its due role. This probably could be explained by the fact that the other four elements have more direct and immediate effects than the "closer people-to-people ties" element, and hence the influencing effect of the latter is lagging in the short term.

The research in this paper identified the practical effects of China's BRI on promoting the reconstruction and optimization of global value chains from the perspective of a more equal division of labor of participating countries along the routes. The examination has provided empirical evidence to support the argument that the BRI is scientific and practically effective. In addition, we also outline the below policy implications, aiming to provide some suggestions with regard to how to further push the global value chain towards a more open, inclusive, balanced and mutually beneficial direction building upon the BRI:

(1) While focusing on connectivity, we must deepen pragmatic cooperation in the joint pursuit of the BRI so as to tackle the problems, contradictions, risks and challenges confronting the current economic global development together, and finally create a "win-win global growth" to achieve mutual benefit and common development. To this end, it is imperative for China to further analyze the general laws of connectivity, comprehensively grasp the status quo of connectivity, and continue to accelerate the construction of connectivity theory and guide the practice of connectivity on the basis of the actual development needs of both China and participating countries along the routes.

(2) We must pay close attention to significant political and social changes in neighboring countries, and timely adjust the blueprint of promoting connectivity between China and participating countries, and advance the implementation on the premise of "extensive consultation, joint contribution and shared benefits". Undeniably, although the BRI has been recognized by more and more countries, regions and international organizations, misunderstandings and misconception still prevail, including among

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countries and regions along the Belt and Road. The most effective way to clear such misunderstandings is to draw and advance the blueprint based on mutual agreement and benefit.

(3) We must devote more efforts to promoting closer people-to-people ties while continuing the construction of infrastructure and other aspects of connectivity. Although the empirical research in this paper found little evidence that closer people-to-people ties played a significant role in building and optimizing value chains, it does not deny the significance of this element per se. On the contrary, closer people-to-people ties are vital for carrying out pragmatic cooperation for long-term, higher-level and higher-quality development, which can ultimately lead to the reconstruction and optimization of global value chains. Moreover, closer people-to-people ties are the cornerstone of building connectivity in other areas.

(4) We must pay attention to the risks that may arise from the construction of the BRI and timely prevent and resolve them. The participating countries have different political systems, cultural customs, ideologies and so on, making the situation on the ground extremely complicated. Therefore, in the course of promoting the construction of the BRI, it is of paramount importance to identify and resolve various underlying dangers and risks including terrorist activities along the Belt and Road. To this end, it is necessary to build a risk assessment model and form an early warning mechanism taking into account risks pertaining to economic, political, business environment and legal areas, so as to provide decision-making consultation and guarantee services for the BRI construction.

(5) We must establish a long-term cooperation mechanism. As a responsible big country with an open economy, with the BRI instrument, China has shown unswerving efforts to promote connectivity in various areas and won more opportunities for all parties, thereby contributing to the construction of a new pattern of global value chain based on mutual benefit and win-win outcomes. However, it must be pointed out that at present, the cooperation mechanism of the BRI is rather loose and informal. This means it is still challenging to effectively promote high-quality construction and development in face of misaligned interests and demands. Therefore, moving forward, China and participating countries must establish a unified long-term cooperation mechanism.

In summary, this paper discussed the optimization effect of China's BRI on the GVC division of labor from the specific perspective of upgrading the status of the participating countries along the routes. However, there are still some limitations in this study. First, in measuring the GVC division of labor, although the paper referenced and modified the methods commonly used in the existing literature, certain pitfalls and deficiencies still remain. With the aid of more advanced and improved measurement methods, future research most likely can render more scientific and rigorous results. Second, as a developing country, China's status in the GVC division of labor is also low, and the optimization of the division of labor should also include that of China, which this research did not. Hence, this paper points out an important direction for future studies, that is, to investigate, on the premise of a more comprehensive and systematic examination of the BRI, how China and countries along the Belt and Road can rely on constructing regional value chains to drive the GVC division of labor towards a more inclusive direction.

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