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Infrastructure development under the Belt and Road Initiative in Pakistan: A gravity model approach to Pakistan's trade potential

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Simeão Versos

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Resumo

A redefinição da política internacional tem sido uma das preocupações da China e a Nova Rota da Seda, anunciada em 2013 pelo presidente chinês Xi Jinping, pode ser vista como uma forma de alterar a economia global, sobretudo através do desenvolvimento de infraestrutura em países onde não existe ou é ineficiente, e através da ligação entre esses países e entre eles e a China. A iniciativa transformará o comércio e o investimento, podendo vir a criar blocos regionais de poder que vão alterar dinâmicas económicas mais tradicionais. Por causa disso, é importante entender como é que tal iniciativa pode ter impacto nos países que dela fazem parte, especialmente no que toca ao possível efeito sobre os fluxos comerciais, já que pode vir a haver importantes transformações regionais. Assim, este trabalho vai analisar o desenvolvimento de infraestrutura no Paquistão, enquanto membro da iniciativa chinesa, numa tentativa de perceber se houve algum impacto significativo no potencial comercial do país. Primeiramente, vai ser a presentada uma revisão de literatura sobre os impactos económicos gerais e no comércio, em particular, do desenvolvimento de infraestrutura, focando-se nos países da Nova Rota da Seda e, em particular, no Paquistão. Posteriormente, através de um modelo gravitacional, analisar-se-á o potencial de comércio entre o Paquistão e outros países – pertencentes ou não à iniciativa – durante o período que vai desde 2003 até 2023. O Paquistão é um país em desenvolvimento com vários problemas domésticos, incluindo um défice comercial elevado, que se traduz numa fraca capacidade exportadora. Os resultados deste estudo mostram que a participação na Nova Rota da Seda não parece (ainda) ter permitido ao país ultrapassar essas limitações relacionadas com a vertente exportadora, continuando o Paquistão a importar mais, mesmo dentro da Nova Rota da Seda.

Palavras-chave: Nova Rota da Seda, Paquistão, Desenvolvimento de Infraestrutura, Potencial Comercial, Modelo Gravitacional

Abstract

Redefining global politics has been a major concern for China, and the Belt and Road Initiative (BRI), announced in 2013 by Chinese President Xi Jinping, can be seen as a way of

reshaping global economics, mainly through the development of infrastructure in countries where it lacks or is insufficient, and through the consequent connection of those countries with each other and with China. Such an initiative will most likely bring changes to trade and investment and even create regional power blocks that will alter the traditional economic dynamics. Because of that, it is important to understand how such an initiative can impact the countries that are a part of it, mostly to see if it can have a real effect on their trade flows, which could potentially help transform different regions. Therefore, this work analyses infrastructure's development under the BRI in Pakistan, aiming to understand whether there has been an impact on the country's trade potential. It will, firstly, present a literature review on the general economic and trade impacts of infrastructure development, especially on BRI's economies, and then turn to the case of Pakistan. From there, by using a gravity model, the goal is to analyse the trade potential of Pakistan with other countries – BRI members and other non-member countries – for the period of 2003-2023. Pakistan is a developing country with several domestic issues, including a high trade deficit, that may be due to poor export performance. The results of this study show that participating in the BRI does not (yet) seem to be allowing the country to overcome those export issues, with Pakistan continuing to import more, even inside the BRI.

Key words: Belt and Road Initiative, Pakistan, Infrastructure Development, Trade Potential, Gravity Model

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Abbreviations

AIIB	Asian Infrastructure Investment Bank
ASEAN	Association of Southeast Asian Nations
BRI	Belt and Road Initiative
CEPII	Centre d'Études Prospectives et d'informations Internationales
CPEC	China-Pakistan Economic Corridor
DSR	Digital Silk Road
EXIM	Export-Import Bank of China
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GPI	Global Peace Index
ICT	Information and Communications Technologies
LPI	Logistics Performance Index
MSR	Maritime Silk Road
NSRB	New Silk Road Fund
OLS	Ordinary Least Squares
SEZ	Special Economic Zones
SREB	Silk Road Economic Belt
SWF	Sovereign Wealth Fund

1. Introduction

The Belt and Road Initiative (BRI) is a Chinese strategy that connects different regions by developing infrastructure, trade and investment. It stands for global development by taking improved infrastructure to developing countries. Such countries will be more connected to each other, which may eventually lead to trade boosting amongst them and greater economic integration[1]. Still, before such transformations occur, it is necessary for the countries involved to be able to absorb the investment made on them by the initiative. Studying the BRI, then, gives one the possibility to contribute to the existing knowledge by investigating the impacts of infrastructure development in diverse countries and environments. The current work will focus on the trade potential created by the infrastructure development under the BRI in one of the participant countries – Pakistan. The country is part of a specific corridor, the China-Pakistan Economic Corridor (CPEC), that is seen as crucial for the initiative, since it provides a strategic trade point for China, while at the same time allowing for Pakistan not just to improve its economic performance and to try to overcome some of its internal deficiencies, but also to turn the country into a trading hub in the region, deepening its connectivity with other countries[2]. Prior to that analysis, however, one must look, first, at the BRI and its basic objectives, and afterwards at what the literature has to say on the impacts of infrastructure development on economic growth and trade facilitation in general and in BRI countries, in particular.

The BRI can be divided into three main projects:

- the Silk Road Economic Belt (SREB), which includes the land-based economic corridors;
- the Maritime Silk Road (MSR), connected to the development of ports and other maritime infrastructure;
- the Digital Silk Road (DSR), created for greater inclusion in the global digital world (Menhas et al., 2019).

[1] See the discussion in sub-section 2.1.3.
[2] The CPEC and its implications for Pakistan will be discussed in more detail in subsection 2.2.

The BRI can serve different goals, depending on the country under analysis. Looking at China, the initiative is relevant to Chinese domestic goals for it can be an "outlet for domestic overcapacity and overseas investment" (Yang et al., 2022, p.410). In fact, overcapacity is a real issue for China, and construction firms "have suffered from domestic overinvestment" (Ghiasy & Zhou, 2017, p.6), hence the need to find new alternatives abroad. Investing in new channels can be achieved through the BRI, since its projects are to be funded by Chinese investments with the help of several funding mechanisms, mainly the Asian Infrastructure Investment Bank (AIIB) and the New Silk Road Fund (NSRF). Also, banks like the China Development Bank (CDB), the New Development Bank (NDB) and the Export-Import Bank of China (EXIM), alongside China's Sovereign Wealth Fund (SWF), the China Investment Corporation, and China's Foreign Exchange Reserves are part of the funding scheme (Ghiasy & Zhou, 2017). Moreover, the initiative can equally lead to the geographic diversification of Chinese exports (Yang et al., 2022), and it can create new channels for energy and raw materials, that will reduce China's dependence on other countries (Ghiasy & Zhou, 2017). Another important aspect regarding China's interests has to do with its search for making the Chinese Yuan a global reserve currency and to allow Eurasia to become the most prominent economic market, reducing the centrality of the dollar-based financial system (Djankov et al., 2016).

Besides having an impact on its proponent country, the BRI is also expected to benefit other Asian economies that joined the initiative, in the long run. Indeed, many authors believe that China can use its comparative advantage in infrastructure construction (Callahan, 2016) to deal with "Asia's vast infrastructure deficit" (Ghiasy & Zhou, 2017, p.7), that countries cannot address by themselves. Better infrastructure thus leads to an improvement in the countries' economic performance, and it can also lead to trade facilitation in the region, mainly by reducing distance and, consequently, transport time, that can eventually result in lower costs (Djankov et al., 2016)[3].

Pakistan, as part of the BRI as well as through the CPEC's multi-dimensional strategic potential, can itself be expected to benefit from the opportunities brought by the initiative. Indeed, the country is seen as a relevant piece of the BRI, especially because of its strategic location, and there seems to be an attempt to transform it into an economic hub in South Asia (Shahzad et al., 2023). The development of infrastructure under the BRI can help

[3] See section 2 on infrastructure's impact on trade and economic growth.

with Pakistan's transformation. Indeed, it can boost the domestic economy by improving transport and industrial networks, and it can enhance regional trade, via, for example, the Gwadar Port. Furthermore, it may allow the country to address issues related to its energetic sector, that has faced shortfalls in recent years. The investment made by China could help the country overcome those problems, hence leading to the creation of more industries, and, consequently, more job opportunities, while also allowing Pakistan to grow and to attract more foreign investment (Khan & Khalid, 2020)[4]. The CPEC is a project that aims at changing not just Pakistan and China, but also the whole region of South Asia – by connecting it with Central Asia and the Arabian Peninsula (Javed & Ismail, 2021). The corridor is a central piece of the BRI, which is why it is important to assess how Pakistan is being impacted by it. The main purpose of this work is that of, by using a gravity model, acknowledging whether the development of infrastructure has had a relevant impact in Pakistan's trade potential.

The work is divided into four complementary sections. Section 2 explores the existing literature relevant to understand the topic of the current research. It is mainly related to the impact of infrastructure on economic growth and trade, in general, and in the case of BRI participating countries, with particular focus on Pakistan. The theoretical framework of gravity models is also tackled in section 2. Section 3, then, presents the data and the model's specifications. It is followed by Section 4, which analyses and discusses the main results of the study. Finally, Section 5 is that of the concluding remarks on the topic studied.

[4] See sub-section 2.2 on the impact of CPEC in Pakistan.

2. Literature review

2.1 General views on infrastructure development and BRI's effects

2.1.1 Infrastructure's impact on economic growth

Regarding the role of infrastructure in countries' economic growth, the literature offers several contributions on the topic, and the prevalent view is a positive one, meaning that infrastructure, and particularly its quality, can indeed enhance economic growth. Still, one should bear in mind that investing in infrastructure may not automatically lead to development, especially when gains do not cover the investment made.

Already in 1956, Solow (1956) argued that technological progress was one of the main contributors to economic growth. Infrastructure could increase the output, if accompanied by such technological improvements. In his article, however, there is not yet a distinction between public infrastructure and private capital, with infrastructure being treated as part of the aggregate physical capital. Then, one of the most influential studies was developed by Aschauer (1989), who examined declines in productivity in the US and found that public investment strategies, related to the building of infrastructure, have a role to play in economic growth and in improvements in productivity. Similar results were later found by Calderón et al. (2011), that, when analysing whether infrastructure capital was productive, concluded that the output of infrastructure could have economically significant implications, with the ratio of aggregate infrastructure to output helping explain why countries have different levels of marginal productivity in infrastructure. Ng et al. (2019) in a study on road infrastructure also found that it could indeed contribute to economic growth, helping even increase exports. Authors like Irshad et al. (2022) and Ibahimov et al. (2023) reached akin conclusions, arguing that continuous investment in infrastructure contributes to the economic growth of countries.

Krugman (1991) had equally considered that transport infrastructure was relevant for economic development because it can, for instance, decrease trade costs, promote specialization, and enlarge markets. At the same time, infrastructure can, nonetheless, lead to increases in regional inequality if manufacturing moves from smaller regions to bigger economic zones. From a perspective more focused on the impact of infrastructure on

inequality and the economic growth of countries, Estache et al. (2002) argued that infrastructure deficits constrain productivity in low-income countries. Calderón & Servén (2010) also showed that deficient infrastructure hinders growth, while developed infrastructure contributes to it and to inequality reduction. Others like Alinsato (2015) refer to the fact that infrastructure can increase income, and so poverty can be fought against through available infrastructures, also depending on their quality. Moreover, infrastructure is seen as a way of connecting marginalized areas with core activities, and as having a positive impact on health and education (Palei, 2015).

2.1.2 Infrastructure's impact on trade

Trade is a channel that contributes to economic growth, usually having a positive impact on a country's development. Infrastructure also plays a role in increasing trade, with high-quality infrastructure contributing to higher levels of trade (Olarreaga, 2016). Besides quality, Francois & Manchin (2007) reckoned that export performance and participation in trade depended also on the access countries have to infrastructure.

Infrastructure can also lead to trade facilitation and to a reduction in trade costs. Bougheas et al. (1999), by analysing the inverse relationship between infrastructure and trade costs, concluded that in countries with optimal levels of investment in infrastructure, infrastructure and trade could have a positive relationship. A similar conclusion was found by Limão & Venables (2001), who supported the idea that trade costs depend on the level of infrastructure of a given country. Countries with poor infrastructure tend to have higher transport costs. In an interesting study, Nordås & Piermartini (2004) point to the importance of infrastructure's quality, especially port efficiency, on bilateral trade flows. The authors consider that better infrastructure associated with lower trade costs improves trade. Such fact can be problematic for less developed countries, that could see their share of world trade fall. The solution, according to the study, would be to improve the quality of infrastructure. Although such investments may be costly, countries could – through the liberalization of certain services and the development of, for instance, port efficiency – manage to do it (Nordås & Piermartini, 2004, p.18). Wilson et al. (2005) enlarged the concept of infrastructure for it to include such aspects as customs administration, transparency in regulation, and information technology, concluding that improvements in those areas also

led to trade facilitation, by increasing a country's exports. On trade facilitation, Portugal-Perez and Wilson (2012) equally found that physical infrastructure combined with institutional improvements can help increase exports. Developing transport infrastructure and business practices seem relevant for developing countries, whereas information technology plays a more significant role in more developed and richer countries. Similarly, through an infrastructure index, encompassing quantity and quality measures, Donaubauer et al. (2018) concluded that improved infrastructure increases trade flows. Furthermore, it reduces not only bilateral trade costs, but also multilateral trade costs, showing that infrastructure can lead to better market access, too. Finally, Celbis et al. (2014) presented a comprehensive meta-analysis of 36 previous empirical studies mainly on public transport and communication infrastructure affects trade. They concluded that a 1% increase in domestic infrastructure raises exports by approximately 0.6% and imports by 0.3%. Moreover, developing countries are the ones where the effects are greater felt, with land transport infrastructure also having a wider impact on trade flows. The authors' findings, then, corroborate the idea that there is a positive relationship between infrastructure and international trade.

2.1.3 BRI infrastructure's impact on participating countries

The point made previously – that infrastructure can help facilitate trade – is relevant if one considers the BRI. Indeed, the initiative can be an opportunity for developing countries to have easier access to investment for quality infrastructure. That means that it could theoretically contribute to trade enhancement in those countries, depending also on the way the receptor countries manage to absorb it. Indeed, infrastructure needs trade and policy reforms to work more efficiently (World Bank, 2019).

Recently, research on the impact of infrastructure – it being on economic growth or on trade facilitation - has been applied to the BRI, and, although challenges exist, especially related to the way in which countries absorb the investment and also to internal bureaucracies, many authors believe that the impacts may be positive. Regarding economic growth, Chen (2023) presented a study that showed that the BRI and its infrastructure projects had a positive impact on many participating countries, alongside industrial upgrades and greater innovative capacity. Ma (2022) also found that upgrading infrastructure improves

productivity and leads to increases in income. Other authors focused on the improved connectivity between BRI member-countries, that can translate into economic benefits for those countries. Using a connectivity index, Chen et al. (2019) found that connectivity in the BRI contributes to economic growth, by having an impact on the GDP growth of the participating countries. Muhammad et al. (2023) also agree that enhanced connectivity under the BRI will stimulate economic activity, especially if China and the countries involved are able to finance the gap and develop infrastructure in a sustainable way. The same idea is supported by Chan (2018), regarding countries within ASEAN that struggle to fund infrastructure development projects by themselves, and that may consequently benefit from the BRI. Wang et al. (2020) in a spatial econometric study covering BRI countries between 2007 and 2016 also found that transport infrastructure facilitates economic growth. The authors argued that there could even be spillover effects along the BRI countries – the smaller the geographic distance, and the closer the economic, cultural and institutional distances, the better for countries to grow. Then, considering trade increases between member-countries of the BRI, Konings (2018) argued that developing ports and railways will reduce costs and increase trade between BRI countries, eventually leading to more competition and innovation amongst industries. However, the author also suggests that specific patterns may vary depending on the trade flow under analysis. This conclusion was also supported by Ramasay et al. (2017), who stated that trade gains are not the same in all economic corridors. Baniya et al. (2020) held that new connections under the BRI will reduce trade times, with even bigger reductions if combined with a decrease in border delays. At the same time, improved connectivity and export structures are expected to influence the impact of the BRI along different countries, and infrastructure development is said to "increase total trade among BRI economies between 2.5% to 4.1%" (Baniya et al., 2020, p.30). The previous conclusion had been reached by Ismail & Mahyideen (2015), that asserted that infrastructure under the BRI improved trade flows between BRI countries, with Information and Communication Technologies (ICT) infrastructure having an important role to play in the enhancement of trade. Finally, some studies have also pointed to the attraction of foreign direct investment, with, for instance, Ma (2022) identifying trade and investment as the causes to increases in the real per capita income of the participating countries. Also, Li et al. (2024) and Kohl (2019) have considered the impact of the BRI in the countries' access to the global value chains, finding a positive relation between such access and the infrastructure

developed under the BRI. Still, the impact will depend on each specific country and on issues like market access and geographic distance.

2.2 The case of Pakistan

This section will, now, analyse the existing literature on the impacts of BRI's infrastructure development in Pakistan, which is the country under analysis in the present work. Pakistan is part of the initiative under the China-Pakistan Economic Corridor, which has been divided into three phases, as indicated by Chen et al. (2024):

- A first phase already completed in 2019, and related to energy and infrastructure;
- Then, several projects connected to the construction of the Special Economic Zones (SEZ), created to attract more foreign investment to Pakistan;
- And, finally, the last phase (2025-2030) is to focus on the sustainable economic growth of the country.[5]

The CPEC is seen as an attractive project to the two-involved countries, China and Pakistan. According to Khan & Khalid (2020), CPEC offers China reduced distances for trade, while also allowing the country to have access to the Indian Ocean, and to expand its investment overseas. As for Pakistan, this initiative can contribute to its economic growth, by helping the country overcome energy shortfalls, by creating new jobs and by developing the infrastructure apparatus to attract foreign investment. The CPEC may also enhance regional connectivity, specifically because of the specific geographic areas it connects – mainly those of Central and South Asia, and the Arabian Peninsula (Javed & Ismail, 2021). As a matter of fact, it has been stated that, through the CPEC, Pakistan may transform into an economic hub in the region (Anwar, 2010; Javed & Ismail, 2021). The authors point, for

[5] Regarding the first phase and the SEZ projects more information on them can be found in the following works: Ali, T., Huang, J., & Xie, W. (2022). Bilateral Economic Impacts of China–Pakistan Economic Corridor. *Agriculture*, 12(2), 143.; Khadim, Z., Batool, I., Lodhi, M. B. (2021). China–Pakistan Economic Corridor, Logistics Developments and Economic Growth in Pakistan. *Logistics*, 5(35).; Khan, Z. U. M., & Khan, M. M. (2019). China-Pakistan Economic Corridor. *Strategic Studies*, 39 (2), 67-82.; Sadiq, A., & Haider, A. (2025). Statistical Analysis of the Potential Benefits of the Belt and Road Initiative (BRI) for Pakistan. *Pakistan Journal of Law, Analysis and Wisdom.* 4(1), 41-51.

instance, to the relevance of the Gwadar Port – a project that, on the one hand, can work as a gateway to China, and, on the other, it can contribute to the economic renewal of Pakistan.

Although the CPEC seems to be promising, more stability in the region is needed for countries to engage in deeper commercial relationships (Anwar,2010). At the same time, Pakistan needs to be able to, internally, take advantage of the opportunities brought by the initiative, in order not to jeopardize the potential benefits of the CPEC. Indeed, the country is still more import-oriented, with weak exports' performance. The country has a structural trade deficit, with its economy relying a lot on imported industrial raw materials, energy and machinery (Dilawar, 2026). Adding to that, the country's exports are mostly based on low-value products, such as textiles (Dilawar, 2026).

Malik et al. (2017) listed several domestic problems that need to be tackled for Pakistan to change its presence in international trade. Those include low FDI, little technological progress and insufficient skilled human resources, competition from other developing countries and a negative image associated with Pakistani products – that are seen as having low quality and not following certain social and environmental standards (Malik et al., 2017, p.15-20). Moreover, the authors believe that firms are not competitive due to high costs for doing business, energy shortages and fuel prices. Firms also face import duties on raw materials and machinery that increase their production costs, making them less competitive in foreign markets, as well as less prone to exporting, choosing to sell in the domestic market instead (Walther, n.d.). That, alongside weak infrastructures, contributes to trade deterrence. And, of course, this is where the CPEC could eventually help, with the creation of new regional trade opportunities (Malik et al., 2017, p.22). However, the corridor will only have a real positive effect on the country, if Pakistan manages to change its own internal policies to overcome some of its problems. The trade policy reform (2025-2030) aims at improving some of those issues by liberalizing trade more. Nevertheless, a reduction of tariffs may not be sufficient – changes in the foreign exchange market, in the energy sector or even in the business environment are needed complementary reforms that should take place, too (Walther, n.d.).

Studies on the CPEC that usually focus on analysing the potential impact of the economic corridor on Pakistan, tend to converge on the conclusion that it will be positive. For example, authors like Ali et al. (2022) and Ahmad et al. (2022) analysed the possible impact of investment on transport infrastructure in Pakistan and concluded that trade

between China and Pakistan may increase, which will lead to higher GDP and welfare gains for Pakistan. Menhas et al. (2019) also considered that the development of infrastructure associated with the energy and social sectors can have a positive impact on Pakistan's GDP. The same conclusion is also supported by Islam & Cansu (2021) that indicated that CPEC can indeed contribute to economic stability and infrastructure growth, while helping diminish unemployment in Pakistan. The latter point was reached by Anwar et al. (2024), that also believe that CPEC can boost local economy and increase GDP growth. Furthermore, Chen et al. (2024) have sustained the idea that CPEC can attract more investment to Pakistan, claiming that certain projects are of the utmost importance. According to the authors, the Gwadar Port can be turned into a trading hub in South Asia, and the Quaid-e-Azam Solar Power Plant has the capacity of increasing Pakistan's clean energy potential. More recently, Sadiq & Haider (2025) presented a statistical analysis of the likely impact of the BRI in Pakistan that aggregates most of the previous suggestions, showing that the initiative has already allowed for an increase in FDI, especially from China, and that it has enhanced the country's trade and contributed to its economic growth. Finally, a note should be made on the fact that the CPEC has already changed trade in Pakistan. Niazi & Saeed (2022) have pointed to the country's import of heavy machinery to develop the projects under the CPEC, which has contributed to an increase in total imports. At the same time, the authors consider that the increasing imports are also connected to the lack of competitiveness and export performance in the country.

2.3 Explaining trade patterns – the gravity model

The likely effects of the BRI in Pakistan have been analysed by some authors, as seen in the previous sub-section. However, there is a lack of studies on the trade potential created by the BRI in the country. To address this issue, a gravity model will be used to understand the variables that impact Pakistani trade, with a focus being given to the participation in the initiative. Ever since its use by Tinbergen (1962) and Pöyhönen (1963), the gravity model has been applied to the prediction of international trade flows, indicating that bilateral trade will depend on the economic sizes of the countries, with GDP having a positive influence on trade; and on their physical distance, which, in turn, will be a barrier to trade, since it may signify increased costs of transportation and a smaller prevalence of intangible factors, such

as personal direct contact (Krugman et al., 2018). The standard gravity model was considered to lack theoretical foundation (Abbas & Waheed, 2019; Abed et al., 2025), which led other authors to try to provide it. Anderson (1979) used a model that included the Armington assumption, that is, that goods could be differentiated by country of origin, and in which consumers had preferences over the differentiated products (World Trade Organization, 2012). The author found that the larger the country, the more it imports and exports, and that trade flows were reduced by transport costs. In an original study, Anderson & van Wincoop (2003), by empirically evaluating bilateral trade, proved the model's applicability. They included as well not just relative trade costs, but also multilateral trade-resistance terms; the latter helped explain why two countries will trade less, when surrounded by large trading ones (World Trade Organization, 2012). The authors' study also changed the way in which the Ordinary Least Squares (OLS) method is used for estimating the coefficients of the gravity model in its loglinear form. The plain OLS method was considered flawed, and its use has been limited, with interaction effects being introduced to recent studies, although the choice will obviously reside the analysis and data involved (Kepaptsoglou et al., 2010). Since studies using gravity models can adopt either a panel data or a sectional data approach, Kepaptsoglou et al. (2010) consider that since panel data usually combine cross-sectional and time-series dimensions, it allows researchers to better capture links between variables in time and understand individual effects between partners. As for sectional data, as it focusses on a specific point in time and on multiple subjects, the authors believe it can create unstable results, hence the preference for panel data methods in many gravity model studies.

The gravity model has also been used by other authors in accordance with existing trade theories. Eaton & Kortum (1997) built the gravity model, through a Ricardian framework. Deardorff (1998) derived it from a factor-proportions trade theory, and Helpman et al. (2008) used an international trade model that considered differentiated goods and firm heterogeneity. Bergstrand (1985, 1989) found that the gravity model was linked to monopolistic competition. And Krugman (1980) applied the New Trade Theory to the gravity model, that could now be used to also understand intra-industry trade and industrial agglomeration. Although the theoretical justification for these models seems to have been addressed, empirical issues remain, mainly those related to estimation and specification techniques (Kabir et al., 2017, p.66). Still, the basic premises of gravity models are usually observed in different empirical studies, showing that trade can indeed depend on GDP and geographic distance.

As referred above, there is still a gap in research as regards the object of this study – the trade potential created by the BRI in Pakistan. The gravity model has mostly been applied to investigate trade patterns and trade potential in South Asia, and specifically to analyse trade flows under the BRI. However, previous studies have focused mainly on bilateral trade between China and BRI countries, with, for instance, Abed at al. (2025) expanding the model to include railway and maritime infrastructures' variables, to assess the impact of improved infrastructure in trade between the analysed countries. Others have analysed different BRI corridors or specific sectors, with Chaudhry et al. (2017) examining the impact of CPEC on the fruits' exports of Pakistan and including production per capita as a core variable to their gravity model. Di Stefano et al. (2021) used a gravity model to analyse trade flows along the different economic corridors created under the BRI, with the purpose of understanding whether infrastructural improvements could contribute to an increase in trade flows. The authors incorporated an index of revealed trade preferences to their model to be able to go beyond the traditional size variables of the gravity model. Their conclusion supported the idea that if countries succeed in coordinating infrastructure projects, bilateral flows between BRI countries will intensify. Finally, there are also studies, that use gravity models, on South Asian countries that do not look at the BRI, but that analyse trade created by Free Trade Agreements in the area (Wani & Mir, 2023; Abbas & Waheed, 2019).

Besides GDP and geographic distance, other variables are usually added to gravity models, to explain bilateral trade flows more accurately, depending on the aim of each specific study. Explanatory variables can depend on factors related to demand and supply – GDP per capita, income levels, population, etc., and on factors that affect trade in a positive or negative manner – transportations costs, quality of infrastructure, remoteness, FTAs, and certain characteristics like culture, language, and historical ties (Kepaptsoglou et al., 2010). In panel gravity models, main and interaction effects were also added, which translate into exporter, importer and time effects, and a country-pair effect (Kabir et al., 2017, p.64).

Also, looking beyond geographic distance, Ghemawat (2001) suggested that the CAGE framework could be used to explain the impact cultural, administrative/political, and economic distances have on trade. The next sub-section presents a quick explanation of each of those distances.

Geographic distance is one of the basic variables of any gravity model. It can be related to physical distance, but also to infrastructure and even access to the sea (Ghemawat,

2001). The bigger the physical distance between two countries, the smaller their trade flows will be. That is so, mainly because of higher costs associated with trade (Guan & Sheong, 2020; Martínez-Zarzoso & Suárez-Burguet, 2005; Segarra-Blasco et al., 2023). Infrastructure equally influences trade costs, particularly maritime infrastructure. If countries have developed infrastructure and use it efficiently, they may be able to decrease costs and trade more (Baniya et al., 2020; Martínez-Zarzoso & Suárez-Burguet, 2005). Furthermore, authors like Chen et al. (2023) or Segarra-Blasco et al. (2023) have also pointed to the importance of common borders. Indeed, countries that share a border tend to trade more with each other.

Moving away from geographic distance, one can start by understanding cultural distance. It corresponds to differences in language, religion, and culture between countries. Such differences are likely to have an impact on trade and trade costs (Ghemawat, 2001). Since in this work language will be part of the model's specifications, it seems pertinent to focus on that specific factor. Indeed, language has been thoroughly studied with most believing that when countries share it, it will have a positive influence on their trade flows (Castillo et al., 2016; Jan & Shaw, 2019; Melitz, 2007). However, authors like Jan & Shah (2019) found that its impact may not be significant. In their study on trade between Pakistan and the South Asian Association for Regional Cooperation countries, they found that, even though Pakistan traded more with countries with which it shared a similar language, that variable alone was not statistically significant.

Turning now to the administrative/political distance, when analysing trade flows, factors such as the existence of a common currency, shared historical ties – like having the same past colonizer, being part of a trade agreement, may all affect trade. Indeed, a common currency, by reducing transactions' costs, is expected to positively influence trade (Melitz, 2007; Rose, 2000; Stravytskyy et al., 2019). Rose (2000), on the issue of the Economic and Monetary European Union, considered that a volatile exchange rate has a negative effect on trade. By having the same currency, the commercial benefits for countries are higher. As for historical ties, decades after decolonization, former colonizer-colony relations continue to have an impact on trade. Indeed, by using a structural gravity model covering all colonizer-colony relationships, Sosu & Standaert (2026) concluded that former colonizers continue to trade in a beneficial way with former colonies. Lastly, looking at trade agreements, these are usually considered to increase trade flows, especially if properly implemented. Authors like Chen et al. (2023) and Guan & Sheong (2020) have determined that such agreements have a

positive and significant effect on trade, and that they are relevant to help increase bilateral trade flows. Still, the effect these agreements have may be undermined by other factors. Allayarov et al. (2018), for instance, analysed how an unstable economic union may not have positive and significant impacts on trade between its members.

Economic distance, in turn, relates to the use of certain economic indicators in gravity models. Most gravity models include GDP as one of the variables that help explain trade. Higher GDPs lead to more trade between countries (Krisztin & Fischer, 2015; Yamarik & Ghosh, 2005). Other authors prefer to use the GDP per capita, with higher values of the indicator corresponding to an increase in trade (Khayat, 2019; Segarra-Blasco et al., 2023). Moreover, and as an example, Segarra-Blasco et al. (2023) believe that GDP per capita influences both the exporter and importer countries, although having more advantages for the exporting country.

Finally, gravity models have also been extended as to include variables related to political stability and security. When instability is high, countries may show reluctance in trading with each other. Indeed, Goswami & Panthamit (2020) found that political instability and military involvement act as trade deterrents. Others have focussed on the impact armed conflict has on trade, and on its potential to disrupt trade flows. Nitsch & Schumacher (2004) presented a gravity model that had variables linked to terrorism, instability and external conflict. Their results showed that bilateral trade falls when terrorism strikes. The same conclusion was reached by Blomberg & Hess (2006), whose study considered that terrorism alongside internal and external conflicts had a trade cost that could be compared to that of a tariff. Also, Glick & Taylor (2010) demonstrated that war can disrupt trade and its impact lasts in time, with indirect effects on the economy.

As for security, it can influence trade positively, when considering relationships that reduce uncertainty, and negatively, when threats exist. Morrow et al. (2014) evaluated how international politics, shared interests, regime types and alliances influence trade between two countries. Their findings indicated that sharing political interests and democratic governance help increase bilateral trade flows. Bagozzi & Landis (2015) equally found that diplomatic missions and military alliances enhance trade. According to the authors, it happens because there is more confidence between trade partners, more transparency, and reduced instability.

The literature clearly reveals an evolution in the gravity model, with models now including variables that go beyond GDPs and geographic distance. The new variables help explaining trade more thoroughly and give new insights into trade patterns between different countries.

3. Methodology and Data

In this section, the methodology to be used in the current study will be presented. Sub-section 3.1 tackles the model's specification. Sub-section 3.2 contains the dataset of the model, *i.e.*, the characterization of the sample and variables of the study.

3.1 Model's specifications

The aim of the study is that of evaluating the trade potential created by the infrastructure developed under the BRI in Pakistan. Since there is still a lack of studies on the issue, as discussed in sub-section 2.3, the current work expects to add new results to the study on the effects of the BRI in the case of Pakistan's trade.

To empirically analyze the trade potential of Pakistan within the BRI framework, this study employs a gravity model - an econometric approach widely used in international economics when studying trade potential and trade patterns between countries[6].

The basic equation of the gravity model is the following (Africano et al., 2018):

$$T_{ij} = A \times Y_i \times \frac{Y_j}{D_{ij}} \tag{1}$$

By turning it into an econometric relationship based on a natural logarithm, one gets the following expression:

$$\ln(T_{ij}) = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) - \beta_3 \ln(D_{ij}) + \varepsilon_{ij} \tag{2}$$

[6] See sub-section 2.3 on the gravity model.

In both equations, T_{ij} is bilateral trade flow between countries i and j, with Y_i and Y_j corresponding to the real GDP of the two countries. A is a constant, in equation 1, and D_{ij} corresponds to the physical distance between the countries under analysis. Bilateral trade flows are negatively influenced by distance, and positively by GDP, as seen in 2.3.

In this work, the gravity model will be expanded to incorporate other factors – infrastructure, security, and exchange rates – that, together with traditional gravity models' variables, allow to better understand whether participating in the BRI may have a significant effect on Pakistan's trade potential. In particular, the following two models will be estimated:

$$\begin{aligned}\ln(exp_{ijt}) = \beta_0 \; + \; & \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) - \; \beta_3 \ln(GeoDist) + \beta_4 \text{BRIpart} \\ & + \beta_5 \ln(ExRat_{it}) + \beta_6 \ln(ExRat_{jt}) + \beta_7 \text{ComBor} + \beta_8 \text{ComCol} \\ & + \beta_9 \text{ComLang} + \beta_{10} \ln(LPI_{it}) + \beta_{11} \ln(LPI_{jt}) + \beta_{12} \ln(GPI_{it}) \\ & + \beta_{13} \ln(GPI_{jt}) + \sum_{\kappa=2003}^{2022} \delta_\kappa \, Year_\kappa \; + \varepsilon_{ijt}\end{aligned} \tag{3}$$

$$\begin{aligned}\ln(imp_{ijt}) = \beta_0 \; + \; & \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) - \; \beta_3 \ln(GeoDist) + \beta_4 \text{BRIpart} \\ & + \beta_5 \ln(ExRat_{it}) + \beta_6 \ln(ExRat_{jt}) + \beta_7 \text{ComBor} + \beta_8 \text{ComCol} \\ & + \beta_9 \text{ComLang} + \beta_{10} \ln(LPI_{it}) + \beta_{11} \ln(LPI_{jt}) + \beta_{12} \ln(GPI_{it}) \\ & + \beta_{13} \ln(GPI_{jt}) + \sum_{\kappa=2003}^{2022} \delta_\kappa \, Year_\kappa \; + \varepsilon_{ijt}\end{aligned} \tag{4}$$

Specification 3 corresponds to the exports from Pakistan to a given partner country, whereas specification 4 corresponds to the imports of Pakistan from a given partner country. In both specifications, *i* corresponds to Pakistan, *j* to the partner country, and *t* to the specific year under analysis. Also, δ_κ represents the coefficient for each year's dummy, and $Year_\kappa$ is the year's dummy of year κ.

To understand the impact of the BRI on the country's trade flows (exports and imports), the focus will be on a dummy variable on BRI participation (BRIpart). Other

control variables are equally taken into consideration. The usual gravity model variables, such as GDPs and geographic distance (GeoDist) are included in this study, alongside others that help assess the role that common borders (ComBor), common past colonizers (ComCol), and common languages (ComLang) have on trade. Then, since currency also impacts trade, the exchange rates (ExRat) are to be part of the model, as well. Finally, two other variables are added: the Logistics Performance Index (LPI) – that connects to the quality of infrastructure in a country, and the Global Peace Index (GPI) – which establishes the level of security and stability of each country.

3.2 Dataset

To understand the impact infrastructure development under the BRI can have in Pakistan's trade potential, the trade flows of the country will be analysed for the period of 2003 until 2023. The trade partners considered will include participants and non-participants of the BRI. An analysis of Pakistan's top trading partners (Workman, 2025) alongside the need for geographic heterogeneity led to the choice of the following 35 countries: Afghanistan, Australia, Austria, Bangladesh, Belgium, Canada, China, Denmark, France, Germany, India, Indonesia, Iran, Ireland, Kazakhstan, Kenya, Kuwait, Malaysia, Netherlands, Poland, Qatar, Republic of Korea, Saudi Arabia, Singapore, Spain, Sri Lanka, Sweden, Thailand, Turkey, Turkmenistan, United Arab Emirates, United Kingdom, United States, Uzbekistan, and Vietnam.

The dependent variables are exports from Pakistan to the partner country, and imports of Pakistan from the partner country. Exports and imports are analysed in US thousand dollars.

As for the independent variables, the model includes a dummy variable indicating whether a country belongs to the Belt and Road Initiative (BRIpart), which is the key explanatory variable and the focus of the current study. Then, there is a set of control variables, which were selected based on the literature review on section 2 and on data availability. The control variables include: the GDPs of Pakistan (GDPpak) and the partner under analysis (GDPcountry) – measured in US dollars, and geographic distance (GeoDist), which corresponds to the distance between capital cities in kilometres. Variables like

common language (ComLang), common borders (ComBor), and common past colonizer (ComCol) are dummy variables, taking the value of 1 if they exist between Pakistan and the partner country, and 0 otherwise. The official exchange rates of both Pakistan (ExRatpak) and the partner country (ExRatcountry) are equally part of the model, and they are measured in local currency units relative to 1 US dollar. Also, the Logistics Performance Index of Pakistan (LPIpak) and the partner country (LPIcountry), that can help evaluate, for instance, the quality of trade and transport-related infrastructure, will be included. Finally, a variable related to security – the overall indicator of the Global Peace Index (GPI) – is to be incorporated in the model. The index is based on three domains – ongoing domestic and international conflict, societal safety and security, and militarisation. The overall GPI for the partner country (GPIcountry) will be used, as it reflects a composite of several different indicators.

The data was taken from different databases. For GDP, Official Exchange Rate, and the LPI the World Bank database was consulted. As for the Geographic Distance, Common Language, Common Borders, and Common Past Colonizer, data from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) was used. Then, the Green Finance and Development Center was applied to search for the list of countries that belong to the BRI. Finally, the GPI was taken from Vision of Humanity.

The following table presents the variables to be used in the gravity model, with the unities, databases and expected effects (positive or negative based on previous considerations found in sub-section 2.3) indicated, as well:

Table 1: Gravity Model Variables

Variable	**Code**	**Unity**	**Database**	**Expected Effect**
BRI partner	BRIpart	Dummy Variable (1 when the country is part of the BRI, otherwise 0)	Green Finance and Development Center	?
Gross Domestic Product	GDP	US dollars	World Bank	+
Geographic Distance	GeoDist	Distance between	CEPII	–

		capital cities in kilometres		
Common Language	ComLang	Dummy Variable (1 when there is common language, otherwise 0)	CEPII	+
Common Borders	ComBor	Dummy Variable (1 when there is common border, otherwise 0)	CEPII	+
Common past colonizer	ComCol	Dummy Variable (1 when there is common past colonizer, otherwise 0)	CEPII	+
Official Exchange Rate	ExRat	Exchange rate in local currency units relative to 1 US dollar	World Bank	+
Logistics Performance Index – overall indicator	LPI	Values between 1 (low) and 5 (high)	World Bank	+
Global Peace Index – overall indicator	GPI	Values between 1 (more peaceful) and 5 (less peaceful)	Vision of Humanity	+

4. Results analysis and discussion

In this section the estimated results of the gravity model will be presented and discussed, considering also the above-presented literature review. All estimations were performed using OLS with time-fixed effects. Country-fixed effects were not considered because they are already captured by time-invariant control variables, such as geographic distance and common border, language and colonizer.

The analysis will first look at the results on exports' regressions, and it will, afterwards, consider those on the imports' regressions. In both cases, four regressions, each with the same variables in the exports and imports' side, are presented. The first regression – the baseline model – includes only four variables – BRIpart, GDPpak, GDPcountry, and GeoDist. In the second one, geographic distance was replaced by other types of distance – common border, common past colonizer, and common language, in accordance with what was explained in sub-section 2.3. Then, the third regression adds new variables to the baseline model, namely: exchange rates of the partner countries, LPI of the partner countries, and GPI of the partner countries – to the first. The final, fourth regression adds this same set of new variables to the second regression, in which geographic distance was, again, substituted by other types of distance[7].

Before looking at the results, several points should be made here. The first regards some of the specifications' variables. The exchange rate of Pakistan (ExRatpak) was omitted because of multicollinearity, with only the exchange rates of the partner countries being used (ExRatcountry). The same is true for the regressions that include the LPI (LPIcountry) and the GPI (GPIcountry) of the partner country, in which the variables for Pakistan (LPIpak and GPIpak) were not added. The following table shows exactly that:

Table 2: Multicollinearity

Exports and Imports	
3rd regression	ExRatpak VIF = 236.21
w/ExRatpak, LPIpak	LPIpak VIF = 25.06
and GPIpak	GPIpak VIF = 6.44
	Mean VIF = 52.68

[7] In the third and fourth regressions the number of observations decreases, as will be presented afterwards, due to a lack of available data regarding some of the years of the analysis.

4th regression w/ExRatpak, LPIpak and GPIpak	ExRatpak VIF = 237.27 LPIpak VIF = 25.19 GPIpak VIF = 6.47 Mean VIF = 44.28

After removing the above-presented variables, the highest VIF became that of LPIcountry, with a value of 5.03 in the third regression, and one of 5.11 in the fourth regression. All other variables present low to moderate collinearity, with mean VIFs of 2.14, in the third regression, and 1.97, in the fourth regression.

Tables 3 and 4 present the descriptive statistics of the model's variables – Table 3 corresponds to the dependent variables, whereas Table 4 shows the statistics for the explanatory variables.

Table 3: Descriptive statistics – dependent variables

	Obs.	**Mean**	**Std. dev.**	**Min.**	**Max.**
ln_exp	734	12.05731	1.83078	1.098612	15.65209
ln_imp	735	12.58083	1.865828	3.970292	16.84591

Table 4: Descriptive statistics – explanatory variables

	Obs.	**Mean**	**Std. dev.**	**Min.**	**Max.**
BRIpart	735	0.2517007	0 .4342857	0	1
ln_GDPcountry	734	19.88629	1.596383	15.32423	24.02987
ln_GDPpak	735	19.29465	0.3485383	18.53732	19.74214
ln_GeoDist	735	8.18707	0.7371032	5.925998	9.340734
ln_ExRatcountry	701	2.450014	3.145528	-1.313682	10.64542
ln_LPIcountry	238	1.208521	0.1937134	0.1906204	1.458615
ln_GPIcountry	560	0.5982718	0.2177352	0.1906204	1.272566
ComBor	735	0.1142857	0.3183746	0	1
ComCol	735	0.2571429	0.4373564	0	1
ComLang	735	0.2285714	0.4201985	0	1

When interpreting the above-given statistics, some conclusions should be drawn. Firstly, there is a maximum of 735 observations, although the number changes across variables mainly due to missing data – specifically in the case of LPIcountry and GPIcountry. One should bear that in mind because it will reduce the estimation sample in the regressions. Then, the BRIpart variable with a mean of 0.252 indicates that approximately 25% of the observations relate to BRI participating countries. Also, when considering the other binary

variables, one can say that approximately 11% of the observations share a common border with Pakistan, 25% a common past colonizer, and 22% a common language. It is equally interesting to notice that the GDPcountry presents a large standard deviation, meaning that the economic size of the countries in the sample varies considerably. Finally, the results shown in Table 3 seem to point to some heterogeneity in Pakistan's trade flows across its different trade partners.

4.1 Exports' Analysis

Moving on to the analysis of the model's results, and starting with those on exports, Table 5 presents the estimations' results for each of the previously specified four regressions:

Table 5: Exports' Regressions

Independent variables	Reg1	Reg2	Reg3	Reg4
BRIpart	0.346*	0.075	-0.160	-0.395
	(0.346)	(0.185)	(0.282)	(0.295)
GDPcountry	0.569***	0.658***	0.196*	0.362***
	(0.048)	(0.042)	(0.117)	(0.118)
GDPpak	-0.184	-0.141	0.185	0.233
	(0.376)	(0.367)	(0.627)	(0.624)
GeoDist	0.011		0.307	
	(0.011)		(0.220)	
ExRatcountry			-0.140***	-0.140***
			(0.043)	(0.044)
LPIcountry			1.505	1.454
			(1.361)	(1.360)
GPIcountry			3.498***	3.357***
			(0.785)	(0.745)
ComBor		0.217		-0.504
		(0.185)		(0.395)
ComCol		0.839***		0.436*
		(0.149)		(0.268)
ComLang		-0.358**		-0.551**
		(0.154)		(0.267)
R^2	0.2468	0.2806	0.2829	0.3028
F-stat	10.10***	11.03***	6.63***	6.11***
Observations	733	733	197	197

Notes:

Standard errors are reported in brackets.

For *p*-values:

* Denotes the level of significance for 10%

** Denotes the level of significance for 5%

*** Denotes the level of significance for 1%

When looking at the main explanatory variable in this work – BRIpart – there is weak evidence suggesting that a country participating in the BRI contributes to an increase in Pakistani exports. In other words, given that the model's variable of interest is only significant at the 10% level in one of the four regressions, Pakistani exports cannot be said to be much influenced by the initiative. This result may be explained by the possibility that Pakistan's integration in the BRI was, so far, implemented with the purpose of turning the country into a hub, especially through the development of maritime infrastructure – in particular, the Gwadar Port[8]. At the same time, although in the BRI framework Pakistan has gained more access to infrastructure and supply chains, it may have not yet been able to profit from those gains for developing its export performance. One probable cause for this failure may reside in the country's internal deficiencies, such as those related to a lack of technological progress, weak infrastructures, a weak business environment and energy shortages, previously referred in sub-section 2.2.

As for the control variables, most results present the expected signs, meaning that they are in accordance with what economic theory predicts. Indeed, the GDP of the partner country has a positive coefficient, meaning that larger countries tend to import more from Pakistan. Also, having a common past colonizer variable has a positive impact on Pakistani exports. As for the exchange rate of the partner country, it has a significant positive effect, implying that an increase in the exchange rates leads to a decrease in Pakistani exports, as expected.

Some results are, however, surprising. On the one hand, neither the GDP of Pakistan nor the geographic distance are statistically significant: the former probably because the

[8] See sub-section 2.2.

model uses year dummies, hence absorbing yearly variation of the country's GDP; the latter probably because the usually observed distance effect may be overcome by the other variables included in the regressions. On the other hand, Pakistani exports to countries with a shared language are 30 – 42% lower than to other countries, the variable ComLang being significant at 5% (see *Appendix 1*). These results may be conditioned by Pakistan's trading structure and by the sample composition. Then, the GPI of the partner country equally shows that countries with higher GPIs import more from Pakistan. That is to say that countries with more instability import a lot from Pakistan, which is unusual in theoretical terms, but one must consider that South Asia is an unstable region – take the example of countries like Afghanistan or India. Unstable countries tend to sometimes import more foreign goods, due to their own lack of domestic production or broken supply chains. Moreover, it is relevant to notice that the sample countries have, in general, high GPIs, so the results are not that dubious.

Pakistan's poor exporting capacity inside the BRI is a structural issue that needs to be addressed. The BRI could, in fact, bring some advantages to the country, with its infrastructure creating new opportunities for economic growth and development, and for better connections and trade relationships with other countries. The obtained results may imply that Pakistan has not yet been able to efficiently absorb the gains that could come from integrating the BRI. Additionally, it should be kept in mind that some of Pakistan's biggest trade partners – such as the United States, the United Kingdom, and many that belong to the European Union (France, Germany, the Netherlands and Spain). Maintaining international trade with these countries may overshadow the relevance of trading with BRI participating countries.

4.2 Imports' Analysis

Turning now to the results on imports, Table 6 presents the estimations' results for each of the previously specified four regressions:

Table 6: Imports' Regressions

Independent variables	Reg1	Reg2	Reg3	Reg4

BRIpart	0.781***	0.268*	0.682**	0.227
	(0.173)	(0.156)	(0.279)	(0.257)
GDPcountry	0.725***	0.816***	0.438***	0.499***
	(0.046)	(0.036)	(0.115)	(0.103)
GDPpak	0.014	0.182	-0.430	-0.064
	(0.358)	(0.310)	(0.619)	(0.543)
GeoDist	-0.245***		-0.351*	
	(0.097)		(0.217)	
ExRatcountry			-0.044	-0.010
			(0.042)	(0.038)
LPIcountry			3.611***	4.238***
			(1.344)	(1.184)
GPIcountry			2.249***	2.114***
			(0.775)	(0.649)
ComBor		1.070***		1.129***
		(0.155)		(0.344)
ComCol		1.781***		1.635***
		(0.126)		(0.233)
ComLang		-0.482***		-0.625***
		(0.130)		(0.233)
R^2	0.3422	0.5067	0.3180	0.4843
F-stat	16.06***	29.09***	7.84***	13.22***
Observations	734	734	197	197

Notes:

Standard errors are reported in brackets.

For *p*-values:

* Denotes the level of significance for 10%

** Denotes the level of significance for 5%

*** Denotes the level of significance for 1%

The results show that the main explanatory variable – BRIpart – has a relevant positive impact on Pakistani imports, being statistically significant at 1%, 5% and 10% in three of the four regressions. Depending on the model specification, Pakistan's imports from countries that are part of BRI, are between 30% to 118% higher than from countries that have not joined the initiative (see *Appendix 3*). These results corroborate the evidence on the

country's trade patterns presented in previous studies[9] and that pointed to Pakistan as a more import-oriented country. The observed difference in the BRI impact on Pakistan's exports and imports may be also due to the increased demand – generated within the CPEC-related development – for certain construction materials and heavy machinery that are not produced domestically and therefore had to be imported from other countries.

Under these specifications, the control variables present expected results. The GDP of the partner country has positive values, with larger countries exporting more to Pakistan. Also, the common colonizer variable shows that having a common past colonizer has a positive impact in Pakistani imports. Equally, the common border variable indicates that Pakistan imports more from neighbouring countries – one must not forget that its biggest trade partner is China. As infrastructure connects with the BRI, and unlike the results on exports where the variable was not significant, the LPI of the partner country in these regressions presents positive and significant values at the 1% level. This indicates that Pakistan imports more from countries that have higher infrastructural quality, with some of those countries being also participants of the BRI.

Just as happened with exports, the unexpected results are most likely related to the dimension and composition of the sample. The GDP of Pakistan continues to not be statistically significant, which can again be related to the use of year dummies. Also, the ComLang variable shows that Pakistan imports between approximately 38 – 46.5% less from countries sharing a language with it (see *Appendix 2*), probably because of the sample's composition. Finally, the GPI of the partner country in imports' regressions behaves as in the exports' regressions – countries with higher GPIs export more to Pakistan.

According to the results, inside the framework of the BRI, Pakistan seems to maintain its trade patterns – that of a country that is likely dependent on imports for reasons related to structural issues and lack of domestic production, that equally contribute to the previously-discussed weak export-performance of Pakistan.

[9] See the analysis in Section 2, sub-section 2.2.

5. Concluding remarks

The current study aimed at understanding the trade potential created by the BRI in Pakistan. Through the estimation of a gravity model, the country's trade flows with BRI participant and non-participant countries were analysed, to see if the initiative had had a measurable impact on Pakistan's trade performance.

As has been discussed, the BRI and the CPEC can be a growth opportunity for a developing country such as Pakistan. By looking at the results of the estimated model, however, there is an asymmetric effect in the way the initiative influences the country's trade flows. While Pakistan does not export significantly more to BRI participating countries, it does, in comparison, import more from them. This finding is in accordance with what the literature says about Pakistan's trading patterns. In fact, the country is more import-oriented, having weak exporting performance, caused by, for instance, low firm competitiveness, import duties, and poor infrastructure. This study's results also seem to indicate that participating in the BRI has not yet enabled Pakistan to overcome those structural issues; instead, the country continues to import more, even inside the BRI framework, hence maintaining its persistent trade deficit.

These conclusions carry several policy implications. To begin with, they suggest that developing infrastructure – which is one of the main pillars of the BRI – does not yet appear sufficient to change Pakistan's trade patterns. Consequently, it should not be assumed that participating in such connectivity projects automatically boosts the exporting performance of the involved countries. Without proper domestic reforms, the potential created by an initiative such as the BRI seems to be underutilized. Indeed, Pakistan's trade deficit should also be addressed, with complementary reforms – to those introduced by the BRI – related to improvements in the business environment, foreign exchange market stability and even energy sector reliability being crucial to help the country develop its exporting capacity. Finally, Pakistan may equally need to, on a more diplomatic level, renegotiate certain aspects of BRI/CPEC cooperation. Instead of only undertaking infrastructure development projects that require import-related engagement, Pakistan could, through negotiations, try to capture more technology transfers and export-oriented investments.

Notwithstanding the results achieved in this study, one must consider that there were some limitations that ought to be acknowledged. Firstly, the sample included only 35 countries over a 20 year-period. A larger sample, both in terms of countries and timespan, could allow for verification of the results and further deepen the conclusion drawn in this work. Secondly, certain variables that could be interesting to assess connectivity inside the BRI – particularly related to transport infrastructure and infrastructure quantity – could not be included in this study, due to a lack of available data. Lastly, even though the BRI was started in 2013, it is still being implemented in its participating countries and the results in the current study should not underestimate the long-term effects of the initiative.

Considering the limitations found in this work, future research may enlarge the sample and create variables related to physical infrastructure and its quantity, depending on data availability, to measure more accurately the impact of the BRI in Pakistan and the initiative's effects in the long run. Moreover, new studies could equally focus on the specific role of the CPEC, especially considering Pakistan's new trade policy, to evaluate whether the corridor helped, alongside other complementary policies, the country to boost its export performance and to integrate more into regional and global value-chains. At the same time, it could be relevant to equally analyse how Pakistan could negotiate with China new ways for cooperation that could involve a level of investment and engagement turned more to technology and to the development of the country's exporting capacity. In closing, comparative studies on other BRI-participating developing countries facing similar challenges as those of Pakistan can also help understand the wider effects an initiative like the BRI may have on developing countries and on their ability to overcome domestic issues – when existing – to profit from the initiative.

Appendix

1. ComLang on the 2nd and 4th exports regressions

   $(e^{-0.358} - 1) \times 100 = -30.1\%$

   $(e^{-0.551} - 1) \times 100 = -42.4\%$

2. ComLang on the 2nd and 4th imports regressions

   $(e^{-0.482} - 1) \times 100 = -38.2\%$

   $(e^{-0.625} - 1) \times 100 = -46.5\%$

3. BRIpart on the 1st, 2nd, 3rd and 4th imports regressions

   $(e^{0.781} - 1) \times 100 = 118.4\%$

   $(e^{0.268} - 1) \times 100 = 30.7\%$

   $(e^{0.682} - 1) \times 100 = 97.8\%$

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