

UNIVERSITY OF HELSINKI

The Effects of Economic Integration

Examining the Impact of the Belt and Road Initiative on the Economic Development of the European Union

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Abstract

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Abstract: This thesis investigates the economic impact of the Chinese Belt and Road Initiative (BRI) on member states of the European Union (EU) by inspecting the divergence of GDP per capita and broader economic indicators of participating countries in contrast to other member states of the EU. This thesis also examines the political implications of joining the BRI to provide a comprehensive understanding of its role in shaping the geopolitical positioning of EU member states. Using a difference-in-differences (DiD) approach, the analysis compares BRI-participating EU countries with suitable control groups. The DiD analysis is also consolidated by a logistic regression (logit) model to identify any heterogeneous factors that may determine a country's participation in the BRI. The findings suggest that participation in the BRI may have some marginal short-term effects on GDP per capita in the EU. However, the positive effects only become visible after three years of participation. The analyses of broader economic indicators show shifts in trade composition, particularly an increase in export-to-import ratios, despite no clear increase in total trade volumes or foreign direct investment. The results of the logistic regression highlight that countries with greater trade openness, lower institutional quality, and weaker domestic investment are more likely to join the BRI, suggesting participation is driven more by the underlying economic environment of the host country. These findings contribute to a more nuanced understanding of the BRI's role in developed regions and provide policy-relevant insights into the strategic motivations behind engagement with Chinese investment initiatives.

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1 Introduction

The Chinese Belt and Road Initiative (BRI), launched in 2013, is a flagship investment program that aims to facilitate Chinese investments and exports globally. This is achieved primarily through infrastructure investments, particularly in Southern and Central Asia and Africa, with a portion also directed to Europe and Latin America (Jackson & Shepotylo, 2021; Mobley, 2019). Most contemporary academic literature examines the impact of Chinese investment on developing countries in Africa and Asia, where most of the BRI funds have been allocated. These studies generally conclude that the BRI positively impacts economic development by improving infrastructure, which enhances connectivity, trade, and competitiveness, and facilitates knowledge and technological spillovers, especially in developing countries (Li et al., 2017; Komakech and Ombati, 2023; Deng et al., 2020; Ma, 2022). However, research on the impact of the BRI on developed economies remains sparse.

In order to fill this gap in academic discourse, this study will expand on the current body of literature that concerns the BRI by directing the focus solely on the high-income and developed economies of the EU. This study is therefore highly significant in the contemporary context of academic discussion, as it helps build towards a clearer understanding of whether high-income economies can leverage the BRI as an avenue to improve their geopolitical and economic position and improve their competitiveness. This research is particularly important in the context of the EU, which continues to grapple with issues of economic stagnation and competitiveness, having fallen behind other large global economies such as the United States, especially since the financial crisis of 2008 and subsequent European sovereign debt crisis (Ark, Chen & Jäger, 2013; Cuadrado-Roura, Martin & Rodríguez-Pose, 2016).

To reach a comprehensive level of understanding about the impact of the BRI on developed economies, the study will attempt to address the following research question: *To what extent is the Belt and Road Initiative a viable strategy for promoting economic development in EU member states?* For this thesis, 'economic development' will be measured using several different variables such as the real GDP per capita of a country, trade volume, and government debt levels. The different dependent and control variables will be fully explored in the *Data* section.

To investigate the question, the study applies an empirical difference-in-differences (DiD) strategy, incorporating both a dynamic specification to evaluate the timing of any potential effects and a logistic regression (logit) model to examine the structural factors that influence the decision to participate in the BRI. The regressions will also be accompanied by the relevant robustness checks required to evaluate the legitimacy of these results. In addition to the empirical study, this thesis will assess the contemporary academic literature surrounding the political risks that the BRI might impose on host economies to gain a robust understanding of the geopolitical complexities of the initiative.

Ultimately, this study finds that while the BRI has had limited and delayed effects on GDP per capita within the EU in the short run, it can contribute to

subtle shifts in other economic indicators such as trade composition. Specifically, while the baseline and dynamic DiD models reveal no immediate or robust average treatment effect on economic growth, a modest positive impact can be seen after a three-year lag, suggesting that the potential economic benefits of the BRI may take time to be realised. Moreover, the DiD model shows modest impacts on the short-run GDP development of participating countries when controlling for the heterogenous recovery tracks of individual economies from the 2008 financial crisis. Furthermore, BRI appears to influence trade balances through an increase in the export-to-import ratio, although the effect is not coupled with significant expansions in total trade volume or total foreign direct investment (FDI).

The accompanying logit model, used in the study to consolidate the findings of the DiD models, uncovers deeper structural motivations for participation in the BRI. There motivations include openness to trade and investment gaps both domestically and internationally. Moreover, the logit model reveals that countries with lower institutional quality and higher trade openness are more likely to engage with the BRI, underlining that participation is, as expected, not random, but instead driven by the structural requirements of an economy and other underlying economic conditions that a country faces.

These findings suggest that, within the context of the EU, the BRI could operate more as an investment tool for marginal shifts in trade balances, with little evidence that it can work as a catalyst for rapid economic change. Moreover, the implications of the logistic regression model is that the effects of the BRI are heavily dependent on the specific economic profile of the host country, so it is implausible to infer any wide-reaching impacts of the BRI as a whole, and future policies regarding participation in the BRI should reflect the heterogeneity of participant nations.

The structure of this study is as follows: first, we will go over the current literature about the BRI that includes the empirical studies evaluating its economic impacts on host countries, and an introduction of the theoretical framework behind the economic growth that the BRI facilitates. The literature review will also discuss the potential adverse effects that the BRI can have on host countries both from an economic and a political perspective. Second, we will explore the empirical strategy employed in this study. Specifically, we will discuss the DiD models used in this study and explore the underlying assumptions that need to be fulfilled to obtain credible results from the DiD models. Therefore, this section will also explore the robustness checks that are employed to ensure that these underlying assumptions are met. After this, the section will also discuss the logit model used in the study, and cover the data used and the sample selection criteria applied in order to improve the reliability of the study. Third, we will analyse the results of these models and infer the credibility of the findings. Fourth, we will discuss the findings of the models, contrast them to previous studies, address some of the limitations in the study, and explore the avenues for future research. Finally, we will discuss the policy recommendations that can be derived from the findings.

2 Literature Review

This section summarises some of the empirical studies that have been performed on the effects of the BRI on a multitude of different outcomes and variables to establish the current understanding of the initiative's impact. It focuses on the influence of the BRI on key indicators of economic development, including economic growth, infrastructure development, trade connectivity, and spillover effects, while introducing the underlying theoretical frameworks informing these outcomes. Moreover, this section will outline some of the contemporary academic discussions concerning the political implications of the BRI, such as the concept of debt politics.

2.1 The Belt and Road Initiative: An Overview

Since its conception, the BRI has been eluding specific definitions, leading an anonymous Beijing-based European diplomat to note: 'Everyone asks me about OBOR (BRI), but we don't even know what it is' (Wong & Lau, 2017). Therefore, before examining the different effects of the BRI, it is important to gain a general understanding of what the BRI is, what it represents to China, and how it seeks to impact globalisation and the economic development of the host country.

The BRI, originally termed the One-Belt-One-Road (OBOR) initiative, is a comprehensive investment program proposed by the President of The People's Republic of China, Xi Jinping, in an attempt to revive the historic Silk Road (Johnston, 2018; Mobley, 2019; Dunford & Liu, 2019). The purpose of the BRI is to coordinate development policies, forge infrastructure and facilities networks, strengthen investment and trade relations, improve financial cooperation, and deepen social and cultural exchanges (Johnston, 2018). In practice, the BRI translates into China acting as a financier for projects aimed at improving the development of transit (road, rail, air, maritime), energy, information, and telecommunication infrastructure (Dunford & Liu, 2019), leveraging China's strengths in infrastructure development to address key constraints on economic growth (Johnston, 2018; Dunford & Liu, 2019).

The BRI is an extensive investment initiative, having more than 130 countries and international organisations participating in it by 2018 (Dunford & Liu, 2019). Within government rhetoric, the BRI is often described as a facilitator of friendly cooperation and positive economic outcomes for participant countries. President Xi Jingping often discusses the BRI in the context of a *Pareto Improvement*, calling it a win-win scenario for everyone, while China's Premier, Li Keqiang, invokes the *Silk Road Spirit*, or the existence of harmony and peace, cooperation, openness, inclusiveness, mutual learning and mutual benefit of the project (Dunford & Liu, 2019; Chan, 2018). However, the academic discourse surrounding the BRI is far from univocal, with growing concerns about the efficacy of the BRI driving meaningful economic growth in developed countries and criticism being raised about the politics surrounding the BRI.

2.2 Belt and Road Impacts: Economic Growth

The EU has been struggling with stagnant growth and an underperforming economy since the 2008 financial crisis and the subsequent Eurozone debt crisis, and as a result of this prolonged period of low growth, often referred to as secular stagnation, the economic performance of the EU has lagged behind that of other major economies, such as the United States (Ark, Chen & Jäger, 2013; Cuadrado-Roura, Martin & Rodríguez-Pose, 2016). Due to stagnant growth in the region, it is important for the EU to explore different avenues that can be employed to stimulate the economy. The BRI can be seen as an attractive option that can potentially help address the economic shortcomings.

A comprehensive difference-in-differences study by Shengan Ma (2022) found that participation in the BRI was associated with higher economic growth from the host country, with the effects being particularly significant in low-income economies. Similarly, Lu et al. (2024) demonstrated that the BRI, while having positive effects on participants as a whole, also contribute to a narrowing effect of income levels between high- and low-income countries, due to the disparity of the net effects the BRI has on these two groups. These findings align with the modeling completed by the World Bank, which estimates that investments under the BRI can lead to an average of 3.4% increase in the GDP of the host countries (Ruta et al., 2019).

However, these generally optimistic findings are often found in studies that focus on developing countries or the BRI participants as a whole. The results of the studies can therefore be skewed, creating overgeneralised projections pertaining to the benefits of the BRI when applied to high-income countries, such as those in the EU. The over-representation of low-income countries among BRI members, as well as the disproportionately small share of BRI investments received by developed nations (Jackson & Sheptoylo, 2021), reinforces the issue of skewed results. For instance, Ma (2022) observed that after controlling for income levels, the impact of the BRI on the log GDP per capita of the participant countries declined significantly from 0.072 to 0.025, while losing some statistical significance. Although the results are still positive, they underscore the disparity between the net effects gained by low- and high-income countries. These findings are similar in the study by Lu et al. (2024), who emphasise the idea that the impacts of the BRI are very heterogeneous and highly dependent on host-country conditions. Therefore, creating narratives of monolithic positive impacts of the BRI on all participants can be problematic.

2.2.1 Infrastructure

One of the underlying reasons for heterogeneity in the impacts of the BRI is the structure of its investments. The initiative is primarily infrastructure-focused to enhance the economic integration of China and the BRI participants bilaterally (Mobley, 2019). Consequently, the marginal returns of the project are often higher in developing countries, where BRI can assist in their underdeveloped infrastructure and constrained market access (Komakesh and Ombati, 2023; Deng

et al., 2020). In contrast, the impact of the BRI in more developed high-income countries, such as EU member states, tends to be more modest. Developed nations already possess advanced infrastructure, so additional investments in this sector yield diminishing marginal returns (Lu et al., 2024).

However, the academic discussion surrounding the impact of infrastructure investments in developed nations does not eliminate the role that it can play in enhancing a region's productive capacity. Munnell (1992) discusses how well developed infrastructure can reduce production costs by improving accessibility, reducing travel time, and minimising the damage incurred by production inputs during travel. Moreover, Aschauer (1990) argues that infrastructure constitutes to productivity growth by direct input effects as well as marginal returns to private capital, thus encouraging greater capital accumulation.

Infrastructure investments can therefore enable companies to operate more efficiently at a lower cost, raising the overall productivity in an economy. In particular, econometric evidence using both time series and cross-regional data shows a positive and statistically significant relationship between infrastructure investment and measures of economic performance, such as productivity (Munnell, 1992; Aschauer, 1990).

Alternatively, there is some discussion related to the magnitude of the effect that infrastructure-related investments have on sustained economic growth. In particular, it seems that from a theoretical basis the effect of infrastructure is highly dependent on the applied theoretical growth model. Exogenous economic models suggest that infrastructure investments only yield transitory growth effects, and the shocks in investment caused by infrastructure investments can only lead to short-term economic growth. However, because long-term economic growth in exogenous models is solely based on exogenous technological progression, the economy will eventually regress to its long-term steady state without permanent changes in the growth rate of the economy (Solow, 1957; Romp& de Haan, 2007).

On the other hand, endogenous growth models posit that infrastructure can contribute to permanent increases in steady-state income per capita, as it allows infrastructure to exert a permanent influence on the growth rate of an economy. In such modelling, public capital such as infrastructure is viewed as a complementary input to private capital and labour in the production function, therefore enabling infrastructure to generate sustained growth effects by enhancing incentives for private investment (Barro, 1990; Romp & de Haan, 2007).

In the context of the EU, the public investment gap in infrastructure has increased since 2009 following the financial crisis. Although there have been positive improvements on infrastructure investments since 2015, the current levels of investment still falls short of pre-crisis norms of the 2000's (Zachariadis, 2018). Given the academic discussion pertaining to the positive effect of infrastructure investments on economic growth, the BRI can be seen as an attractive solution that directly responds to the apparent investment gap that the EU has regarding infrastructure investment.

2.2.2 Trade and Connectivity

The impact of infrastructure investments on the reduction of transport time and cost also has a positive effect on the aspects of trade and connectivity of a nation. Trade enables countries to leverage comparative advantages, access larger markets, and channel capital to achieve greater economic growth (Berrill, 1960; Ruta et al., 2019). This notion is supported by Alstadt et al. (2012), who found that the elimination of trade-related frictions can substantially improve regional productivity and business concentration. Alstadt et al. discuss how improvements that are made in areas that expand labour market reach and improve intermodal connectivity can allow businesses to more efficiently match supply chains and broaden customer bases, thereby fostering scale efficiencies and accumulating industry in an economy, leading to sustained growth.

Inspecting the effects of the BRI in Europe specifically, Jackson and Shepotylo (2021) note that the increase in trade and connectivity are the main compounding factors that can generate significant welfare improvements for both the EU and China. Enhanced infrastructure and expanded trade routes reduce costs and accelerate exchanges, producing welfare benefits comparable to those achieved through a major free trade agreement. Moreover, Ma et al. (2019) conclude that the effects that the BRI has on bilateral trade between China and the EU are generally positive, although potentially one-sided, as the BRI resulted in an increase on Chinese exports to the EU and a decrease of EU exports to China.

Historically, increasing trade relations has worked well between China and the EU, with China being able to produce labour-intensive products cheaply and supplying these products to the EU. The integrated trade relationship has translated to increased competitiveness in domestic production for the EU, as importing cheap intermediate goods could lower the cost of production, and specialising in high-quality and technology-intensive goods and services meant domestic firms would not lose market share (Jackson and Shepotylo, 2021).

However, due to the increase in labour costs in China, the export-driven growth derived from labour-intensive capital has dwindled since the 2010s, prompting China to adopt a 'Made in China 2025' strategy to upgrade their industrial capability and move up the value chain, leveraging state subsidies and investments directed towards research and development (Dunford and Liu, 2019; Chan, 2018; Huang, 2016). The increase in technological capability in China can lead to a situation where the inclusion of EU states in the BRI could lead to a reduction of entry barriers for Chinese companies in the domestic market, enabling them to sell their technologically advanced products cheaper than domestic producers can supply them, resulting in a decrease in the market share of local companies, and a decrease in competitiveness in the country (Bellora & Jean, 2016; Himaz, 2019; Markusen & Venables, 1999).

Wu and Chen (2019) inspected the impact of the BRI on trade volumes of 64 signatory countries and found that while Chinese investments have a net positive impact on imports in the host country, they also found a net negative impact on their exports. The study also compared these impacts by differentiating low-

income and high-income countries, and found similar trends for all participants over multiple time periods. These findings correspond to fears that China, with high production but low domestic consumption, has the ability to dump their overproduction to other countries to boost their economy at the detriment of producers in other countries.

Specifically in the context of the EU, the problem of low-cost and advanced technology is highlighted by the dispute over solar panels between China and the EU. The EU, which became the world's largest market for solar panels amid their green-energy transition, was surpassed by China as the leading solar panel manufacturer. This led to a complaints from the Association for European Solar Manufacturers (Prosun) that Chinese government subsidies gave an unfair competitive advantage for Chinese companies within Europe. The competitive advantage led to the crowding out of European manufacturers and prompted the EU to place anti-dumping measures on Chinese solar panels (Chen, 2015). Although the dispute was later settled (Goron, 2018; Chen, 2015), it underscores the threat of Chinese movement up the value chain for local companies within the EU.

2.2.3 Spillovers

The EU has grappled with a slowdown in productivity growth, the extent of which varies between countries and sectors (van Ark, Chen & Jäger, 2013). Filippetti and Peyrache (2013) highlight the disparity between productivity capabilities across EU members, which are largely attributable to differing levels of technological progression of their economies. Although the EU has provided extensive resources to regions in a lagging position to improve their research and development (Filipetti & Peyrache, 2016), further technological integration through initiatives like the BRI may complement these efforts through potential knowledge and technology spillovers.

The theoretical framework surrounding the technological spillovers of FDI is robust. Countries that receive FDI often benefit from significant positive technological spillovers, which enhance total factor productivity at both firm and industry levels (Fan, 2003; Liu, 2008; Bournakis, Christopoulos & Mallick, 2017). These spillovers occur as multinational corporations (MNCs) demonstrate new technologies, train local workers who later move to domestic firms, and exert competitive pressure that compels local firms to innovate and operate more efficiently (Kokko, 1994; Fan, 2003). Moreover, FDI-related projects typically lead to increased bilateral trade between the investor and the host country, facilitating the integration of local businesses into global supply chains. This integration exposes local firms to new technologies and knowledge that may otherwise have been inaccessible, further boosting productivity, economic growth, and global competitiveness (Markusen & Venables, 1999; Ali et al., 2021; Kokko, 1994).

The supply chain integration channel is supported by economic reasoning: the *Solow Model*, introduced by Robert Solow in 1957, posits that capital accumulation in a country has to be coupled with human capital and technological

gains in order to realise long-run growth. As discussed previously, the investments of the BRI can bring a temporary increase to the capital stock of the economy via an injection of investments into infrastructure, in the long run the effect of such a shock would be negligible and the economic growth of the host country would converge to its steady-state. However, advances in human capital and technology can improve the efficiency of production systems, which can facilitate long-term sustainable growth of the economy (Solow, 1957; Kohl, 2019).

Inspecting the impact of the BRI specifically, this theoretical framework is consolidated by a host of empirical evidence. Deng et al. (2020) found that the introduction of the BRI led to statistically significant technological gains in host nations with some expected time lag, as well as a significant shift in the structure of their economies. Razzaq, An and Delpachitra (2021) found that an increased technological gap increases FDI spillovers and improves productivity growth, and Liu et al. (2024), found that the BRI introduced large industrial parks to developing host nations, which increased the technological spillovers amassed. However, these studies also highlight the larger implications for developing countries, with the effects on developed countries of high income being less extensive. Therefore, it seems that the marginal effects of these spillovers tend to be more limited in developed economies, where much of the technological base has already been established (Liu, 2008; Fan, 2003; Kokko, 1994). Therefore, the impact of productivity growth gains from the BRI within the context of the EU remains tenuous.

2.2.4 Italy's Involvement in the BRI

Anecdotally, the case of Italy is one that underlines the disparity in the expected economic gain and the realised outcome from the BRI within the borders of the EU as has been outlined so far. Despite joining the BRI in 2019, Italy withdrew from the initiative in 2023 after domestic debates on the perceived lack of economic benefits gained the initiative (Insisa, 2023). However, it is important to keep in mind that other factors were also likely contributors to Italy's decision to rescind their participation from the initiative. The beginning of the COVID-19 pandemic was less than a year away from Italy's decision to join the BRI, which could have absorbed a lot of the effect that Italy was to gain from the BRI. Moreover, Italy's government had open discourse on the security threat of handing over the control of strategic sectors in Italy (Insisa, 2023), which furthered their wishes to withdraw. This also highlights an extremely important factor when discussing the impacts of the BRI: its extensive political implications.

2.3 Belt and Road Impacts: Political Influence and Geopolitics

Gunnar Myrndal emphasises that economics cannot be separated from politics by highlighting how economic theories and policies can often be influenced by

political factors in his 1953 book, *The Political Element in the Development of Economic Theory*. This notion remains relevant today when inspecting the BRI. The geopolitical ambitions of China have raised some concerns about the political leverage gained in BRI participants (Li et al., 2021), which can impact policies, as highlighted in the case of Italy. Therefore, it is important to assess whether there is legitimacy in the concern of growing Chinese influence, as the political climate surrounding the BRI presents a complex landscape, characterised by region-specific political responses and a diverse range of academic interpretations.

2.3.1 Debt Politics

One concern among academics of the BRI is China's ability to leverage the BRI for political gain by exercising debt politics. Debt politics is a way for China to gain political control or influence within the decision-making organ of another sovereign nation by leveraging the government debt that this country has with China. However, the concept of debt politics seems to play a larger role in the developing world, where internal political and economic weaknesses restrict options of outside financing (Mobley, 2019; Hurley, Morris & Portelance, 2018), and the evidence of debt politics being employed with developed high-income economies is not apparent (Zhang, Jian, & Hou, 2024).

The avenue of research directed towards unsustainable debt of the BRI countries notes widely heterogeneous effects depending on the host country. Some research has shown that the BRI has had a positive effect on debt sustainability, or the ability of a country to control their level of debt-to-GDP ratio, by bringing high fiscal revenue to the host country (Zhang, Jian, & Hou, 2024). Moreover, some academics argue that debt diplomacy is not an issue with China, as there are instances where they have renegotiated the terms of loan repayments and even written off interest-free loans (Dunford & Liu, 2019). Alternatively, other evidence suggests that the debt risk presented by the BRI may be concentrated in some countries, depending on the size of the loan relative to the size of the GDP (Ruta et al., 2019; Hurley, Morris & Portelance, 2018). For example, Montenegro and Sri Lanka both saw an increase in the risk of debt sustainability driven by infrastructure development projects financed by the BRI, sparking international criticism on the matter. Especially in the case of Sri Lanka, who did not see any economic gains from the financed projects, their repayment difficulties were resolved by granting Chinese state-owned enterprises (SOEs) 70% stake in two joint ventures that will manage the commercial and administrative operations of a large local port. This prompted wide criticism of the debt politics conducted by China (Onjala, 2018; Assef, 2018; Dunford & Liu, 2019).

In the European context, the Montenegrin highway project highlights the issue of debt politics well. Montenegro signed an agreement with China to build a highway after the EU rejected their proposal (Grgić, 2017). The highway project had an estimated cost equal to half of Montenegro's GDP, and the loan size ended up amounting to one fifth of the country's GDP (Grgić, 2017; Dunsby, 2023). As the highway project lacked economic feasibility, the Montenegrin gov-

ernment was tied in debt with an inability to complete the highway, prompting the EU to voice their concerns specifically about the lack of transparency of the contract with China as well as their debt sustainability issues (Dunsby, 2023).

Therefore, the issue of debt sustainability within the BRI in the context of the EU is seen as two-sided: on the one hand, most countries that participate in the BRI have no debt-sustainability issues, especially when coupled with high institutional quality, and the BRI can even help alleviate debt pressures by facilitating economic growth. On the other hand, some countries can be very negatively affected, especially when economies with weaker institutions take in loans that outweigh their own GDP by a large margin, which can lead to political pressures and loss of strategic assets (Ruta et al., 2019; Dunsby, 2023).

2.3.2 Other Political Concerns

Although not strictly addressed in the thesis, the political implications of the BRI should also be studied beyond debt politics, in order to reach a comprehensive understanding of the geopolitical landscape that surrounds the BRI and hence reach more concise and appropriate policy recommendations. One of the most prominent issues of the BRI is the acquisition of strategic infrastructure assets by Chinese state-owned enterprises (SOEs), which has raised concerns regarding the sovereignty and long-term strategic dependence of the EU on China. The 2016 acquisition of Greece's Port of Piraeus by a Chinese SOE is a notable example that raised anxieties over Chinese control of critical logistics infrastructure within the EU (Skala-Kuhmann, 2019; Mohan, 2018). Although the acquisition was framed as a mutually beneficial trade development, these transactions are often interpreted as part of a broader geopolitical strategy that may enable China to exert influence over critical economic sectors in liberal democracies (Skala-Kuhmann, 2019).

Another important aspect of political influence concerns the potential soft power gains China may seek through the BRI. However, while some feared that deeper economic ties would translate into increased diplomatic alignment with China, evidence from UN voting patterns indicates no significant shift in the foreign policy positions of democratic states, particularly within the EU (Steinert & Weyrauch, 2024). Instead, countries with strong institutions appear capable of maintaining independent political stances, suggesting that the BRI's political influence is not uniformly effective and remains dependent on domestic governance structures.

3 Empirical Analysis

As can be seen from the *Literature Review* section, the different impacts of the BRI both economically and politically are very complex and appear to be very dependent on a plethora of variables, notably the underlying conditions in the host country. This strengthens the requirement to inspect the effects of the BRI on specifically the EU in order to infer the policy recommendations which best

suit the macroeconomic context under which they operate in. This section will explore the empirical strategy of this study and thoroughly analyse the results obtained from the DiD and logistic regressions employed.

3.1 Methodology

This section of the thesis will cover the empirical strategy employed to answer the central question of this thesis: To what extent is the Belt and Road Initiative a viable strategy for promoting economic development in EU member states? Specifically, it will introduce the DiD model, a supporting logit model, and address the underlying assumptions and robustness checks that accompany these. Moreover, this section will introduce the dataset and the key variables that will be inspected in the models.

3.1.1 Difference-in-Differences

In order to fully understand the impact that the BRI has on the development of EU member states, a DiD analysis will be implemented. The DiD is a common econometric technique that allows one to estimate the causal effect of a policy intervention by comparing changes in outcomes between a treatment group, or a group that is affected by a certain policy, and a control group, or a group that is not affected by the policy. This study will build on the empirical strategy of Ma (2022), who 'compares changes in local economic growth between 2008 and 2019 across countries that were differentially affected by the B&R (BRI)'.

The treatment variable that will be inspected is defined by a country's decision to sign the BRI agreement with China. The model spans from 2009 to 2022, with the post-treatment period defined as the years following the signing of the BRI. Thus, the treatment group consists of EU member states that joined the BRI, whilst the control group will consist of EU member states that did not. The identification strategy for which EU member states will be taken into account will be covered in further depth in the *Sample Selection* section.

The baseline DiD equation used to inspect average differences in economic growth between the treatment and control groups is specified as:

$$Y_{it} = \beta_0 + \delta \left(Treat_i \times Post_t \right) + X'_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where Y_{it} is the dependent variable examined for country i at time t. $Treat_i$ is a binary variable that assumes the value one if a country i participates in the BRI and zero otherwise. $Post_t$ is another binary variable that assumes the value one in the post-treatment period and zero otherwise at time t. $Treat_i \times Post_t$ is the interaction term of these two binary variables, while δ captures the average treatment effect. $X'_{it}\gamma$ represents a vector of control variables with their respective coefficients, including unemployment, human capital, government size, and openness. All variables used are fully introduced in the *Variables* section alongside the measures used for each. μ_i represent the region-fixed effects for country i, which allows us to control for region-specific unobserved characteristics that may have an impact on the growth of a country. λ_t represents the fixed effects

of time t, which allows us to control for time-dependent trends in the growth of all countries, such as global economic shocks. Finally, ε_{it} represents the standard error term, which is clustered by country in all regressions to account for the correlation within countries over time, ensuring a more accurate statistical inference in the panel data settings.

To capture potential lagged or dynamic effects of the BRI, a dynamic DiD model will also be estimated, which inspects the yearly evolution of the treatment effect and potential divergences between the control and treatment groups. This helps us determine if the effects are immediate, delayed, or varied over the years after a country has joined the BRI, and brings clarity to the thesis with a visualisation of the effects. The equation for the dynamic DiD is defined as:

$$Y_{it} = \beta_0 + \delta_1 P_{it}^{-10} + \delta_2 P_{it}^{-9} + \cdots + \delta_{14} P_{it}^{+3} + X'_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \qquad (2)$$

which can be simplified to:

$$Y_{it} = \beta_0 + \sum_{j=-10}^{-1} \delta_n P_{it}^{-j} + \sum_{j=1}^{3} \delta_n P_{it}^{+j} + X'_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \qquad (3)$$

where, similar to Equation 1, Y_{it} represents the dependent variable and $X'_{it}\gamma$ represents the effect of a vector of control variables. P_{it} is a set of participation binary variables indicating the relative year of treatment. Specifically, P^{-j} is equal to one if country i is j years away from joining the BRI in year t, while P^{+j} is equal to one if country i is j years past joining the BRI. The year immediately prior to the year of the beginning of the treatment is excluded as this equation will assess the dynamic effect of participation in the BRI relative to it. δ_n represents the coefficient of the treatment effect for each year n. Similarly to Equation 1, μ_i and λ_i are the region and year fixed effects, respectively, controlling for country-specific and time-specific unobserved factors, and ε_{it} represents the standard error term clustered by region.

3.1.2 Assumption 1: Parallel Trends

In order to execute the DiD model in a satisfactory manner, it is imperative that some key underlying assumptions pertaining to the subjects of the analysis be met. First, it is important that the *parallel trends* assumption holds. The parallel trends assumption posits that the development of the dependent variable of the participating countries would follow the same trend in the absence of the BRI.

In order to satisfy the parallel trends assumption, the dependent variable of both the treatment group and the control group should follow the same trajectory before the treatment effect occurs. If the pre-treatment trends of the dependent variable are similar between the two groups, we can assume that the development of the dependent variable for each participating country would have continued to follow a similar path after the treatment effect, *ceteris paribus*.

The parallel trends assumption will be tested in two ways. First, the dynamic DiD introduced in Equation 3 will show the disparity of the dependent variable between the treatment and control groups annually, both before and after treatment takes effect. We can use dynamic DiD to indirectly assess the validity of the parallel trends assumption by examining the statistical significance of the coefficients δ in any year j prior to the treatment year. If these pre-treatment coefficients are statistically significant, it indicates a divergence in trends prior to the BRI, and the parallel trends assumption would not hold.

Another way to test the parallel trends assumption is by using an event study regression. This method directly compares the difference in the dependent variable between the treatment and control groups for each year prior to the treatment year and tests whether these differences are statistically significant. The event study regression equation is as follows:

$$Y_{it} = \beta_0 + \sum_{t=-10}^{-1} \delta_t (Year_t \times Treat_i) + X'_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \tag{4}$$

where Y_{it} represents the dependent variable and δ_t represents the coefficient that is associated with each $Year_t \times Treat_i$ interaction for each year t prior to the BRI treatment. $Year_t$ is a binary variable that equals one if the observation corresponds to the year t and zero otherwise, allowing for year-specific effects. For instance, $Year_{-10} = 1$ only if the data corresponds to the year 2009. The variables $Treat_i$, $X'_{it}\gamma$, μ_i, λ_t, and ε_{it} have remained unchanged from Equation 1.

3.1.3 Assumption 2: Anticipatory Effects

The second assumption in the DiD model is that there should be no anticipatory effects of treatment in either group. The assumption ensures that the results of the treatment effect are not distorted by anticipatory actions made by economic agents, which can absorb the effect of the treatment effect. Intuitively, as the BRI impacts trade relations, infrastructure, market access, and technological and knowledge spillovers from supply chain integration, firms within treatment countries cannot act in advance to benefit from these changes and will only begin to benefit once the agreement is signed and implemented.

The intuition of the lack of anticipatory effects will also be tested using two methods. First, we will employ the dynamic DiD the same way as we did for the parallel trends assumption. If the dynamic DiD reveals a statistically significant difference in the dependent variable in the years immediately preceding the signing of the BRI, we can infer that some anticipatory effects occurred, violating the assumption.

Secondly, the anticipatory effects assumption will be tested by conducting a placebo test. The placebo model is identical to the DiD model in Equation 1, except that it is assumed that treatment begins in an earlier placebo year. In other words, the effect of the treatment is artificially shifted back to a year

prior to the actual signing of the BRI to test whether any effects are mistakenly attributed to the treatment. The placebo test equation is as follows:

$$Y_{it} = \beta_0 + \delta\, Treat_i \times Placebo_t + X'_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \tag{5}$$

The equation for the placebo test is structurally identical to Equation 1, with the exception of $Placebo_t$, which is a binary variable that assumes the value one in the placebo post-treatment period and zero otherwise at time t. If the coefficient δ is statistically significant, we can conclude that anticipatory effects occurred before the official BRI signing, suggesting that the assumption does not hold.

3.1.4 Assumption 3: Simultaneous Policy Changes

The third assumption is that there should not be any simultaneous policy changes in the control or treatment groups that can affect the dependent variable during the observed timeline of the DiD analysis. If either group experiences policy changes that independently influence the outcome variable, the resulting effects may be wrongly attributed to the treatment, thus biasing the estimated impact of the BRI.

The assumption is challenging to completely satisfy, as the model examines a large number of EU member states over a wide time span. Each country operates under their own sovereign governments, and their respective policy decisions vary in response to shifting political conditions and national economic strategies. Therefore, it is impractical to try to identify and account for each policy change across all countries and years covered by the model.

In addition, the onset of COVID-19 occurs just one year after the beginning of the BRI for many of the participants. Although COVID-19 had significant impacts on all countries, its severity and economic impact differed significantly across countries, depending on infection rates and structural factors. For example, countries with a larger tertiary sector may have experienced milder economic disruption due to the ability to work remotely, while countries reliant on primary and secondary sectors may not have had this opportunity to the same extent. Moreover, these countries would be more affected by the decline of global trade (Khan, Khan & Shafiq, 2021). The impacts were even more prolific in the hospitality sector, as tourism and travel declined radically (Lu et al., 2021). This can create heterogeneous effects on different countries depending on the relative revenue they gain from tourism.

Given the challenges, such as the complexity of local governance and the heterogeneity of COVID-19 effects, the simultaneous policy change assumption will be addressed through several practical measures. First, a wide range of control variables will be included to capture the differences in national policies, economic developments, and the severity of COVID-19 across countries. Second, the model focuses only on EU member states, meaning that any EU-level policies will apply uniformly to all countries in the sample, reducing the risk of asymmetric effects. Third, a logit model will be used to investigate whether

there are systematic economic differences between countries in the treatment and control groups. Although the logit model does not directly combat the simultaneous policy assumption, it does allow for a clearer understanding of potential structural biases and the limitations of the DiD model, which can be taken into account in the analysis.

3.1.5 Assumption 4: Exogeneity

Finally, an important assumption required for the DiD model to yield valid estimates is that there is no endogeneity in the model. Endogeneity, or the correlation between the explanatory variables and the error term, can arise through two primary channels in the model: selection bias and reverse causality.

Selection bias occurs if countries that are more likely to benefit from joining the BRI are also more likely to sign the agreement, while those that do not perceive value in joining opt out. Alternatively, it is possible that some countries can be more attractive options for China to engage with in terms of the BRI. In either case, selection bias implies that the treatment group (BRI signatories) is not randomly assigned, and may instead be systematically correlated with unobserved characteristics that also affect GDP growth, such as lower export-to-import ratios or a higher government debt burden, which can lead to biased estimates of the effect of treatment.

In addition to selection bias, reverse causality also presents a risk. If weaker economic conditions motivate countries to join the BRI in the hope of stimulating growth, then economic stagnation, rather than the BRI itself, may be responsible for subsequent trends in GDP. Reverse causality would lead to misattribution of economic outcomes to the BRI rather than any underlying variance in the initial economic condition. In such cases, the estimated treatment effect may misleadingly suggest that the BRI caused economic growth, when in reality, the decision to join was a response to existing economic weakness, and the effect of the BRI would not be the same in countries who are in a stronger economic position.

The problem of exogeneity must also be overcome for the DiD estimation, which can be done by using several strategies. First, the analysis includes multiple dependent variables, allowing for a broader assessment of the BRI's impacts across different economic dimensions. Second, the model incorporates a wide set of covariates to control for observable differences between the treated and control countries that may influence both the treatment status and the outcome. Third, fixed effects for countries are included to account for time-invariant, country-specific factors, whereas time-fixed effects will capture broad global economic shocks that may affect all countries similarly. The use of an event study regression, which tests the parallel trends assumption, also strengthens the confidence that underlying economic differences should not be a major driver in the results.

However, these do not entirely eliminate the risk of selection bias. It remains possible that some of the observed treatment effect stems from structural economic variation between countries, rather than the BRI itself. Therefore, in order to complete a more robust analysis of the effect of the BRI and to assist

in the policy implication portion of this study, a logit model will be employed to discern what underlying economic reasons a country would have to sign the BRI.

3.1.6 Logistic Regression Model

After the DiD models and the relevant robustness checks are completed, a logit model will be employed to investigate potential selection bias in the models. A logit model estimates the probability that a binary outcome occurs as a function of several explanatory variables, such as the GDP per capita, trade openness, government size, and institutional quality. In the logit model, the dependent variable is whether a country signed the BRI or not. The equation for the logit model is as follows:

$$\log\left(\frac{\Pr(Treat_i = 1)}{1 - \Pr(Treat_i = 1)}\right) = \alpha + X'_{it}\beta \tag{6}$$

which can be rearranged into the probability form:

$$\Pr(Treat_i = 1) = \frac{1}{1 + e^{-(\alpha + X'_{it}\beta)}} \tag{7}$$

where $Pr(Treat_i = 1)$ represents the probability, Pr, that a country i signs the BRI ($Treat_i = 1$), which is a binary outcome. The binary outcome variable assumes the value of zero if the country did not sign the BRI, and one if the country signed the BRI. e signifies Euler's number, a mathematical constant. α is the intercept, which represents the baseline log-odds of signing the BRI when all explanatory variables are equal to zero. X'_{it} represents the vector of explanatory variables for each country i at time t, and β represents the vector of coefficients for each explanatory variable.

The logit model serves multiple purposes in this study. If none of the coefficients β are statistically significant (an unlikely outcome), it would suggest that the decision to sign the BRI is completely exogenous and random, which supports the validity of the DiD analysis. However, in the much more likely outcome that one or more of the coefficients are statistically significant, this will reveal that certain country-level characteristics systematically influenced the decision to join the BRI, thereby pointing to possible selection bias.

Rather than being a limitation, the insight gained from the logit model can help enrich the analysis of the data. By identifying which economic factors are associated with the participation of BRI, the logit model offers an additional explanatory layer to the DiD analysis. Specifically, it helps clarify whether the treatment effect found in the DiD models could be partially driven by underlying structural differences between treatment and control countries. The information gained from the logit model can also be leveraged in the policy implications section of the thesis to assess which types of country are more likely to engage with and gain from the BRI.

3.2 Data

Next, we can move on to the data description of the study. The primary source of the data is gathered from Eurostat, with supplemental data gathered from the IMF, the World Bank, and the UN Trade and Development (UNCTAD) database. Finally, information on BRI participant countries is collected from the Green Finance and Development Center (GFDC) research institute within the Fanhai International School of Finance at the Fudan University in Shanghai. The GFDC provides comprehensive data on BRI agreements and partnerships, making it a reliable source for identifying the treatment and control groups of used in the study.

3.2.1 Sample Selection

Although the original data set was built by including all 27 EU member states from 2009 to 2022 to ensure the robustness of the data, not all countries were included in the final DiD analysis. This section outlines the sample selection criteria used when constructing the dataset.

First, as per the fourth assumption outlined in the *Methodology* section, it is essential to ensure that the sample countries do not have pre-existing political alignments that could influence their decision to participate in the BRI, as this may skew results by introducing selection bias. Therefore, all countries that are or have been participants in the *Cooperation between China and Central and Eastern European Countries* (China-CEE) initiative at any point are unilaterally eliminated from the dataset. These countries include: Bulgaria, Estonia, Czechia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia (Xin, 2020; Matura, 2019).

Empirically, participation of the China-CEE initiative is a strong predictor of BRI participation which violates the policy exogeneity assumption of the DiD model. Of the 17 EU countries that participate in the BRI, 11 of these are members of China-CEE. Furthermore, of the China-CEE members that are also in the EU, all have joined the BRI. Moreover, inclusion in the China-CEE initiative may lead to increased investment and trade with China regardless of the affiliation of the BRI (Matura, 2019). For example, in 2013, the China-Central and Eastern Europe Investment Cooperation Fund was founded to invest in energy, education, healthcare, telecommunications, and manufacturing sectors in the region (Dunford & Liu, 2019). Therefore, the inclusion of these countries also violates the assumptions of parallel trends.

Second, countries that have atypical economic trajectories, such as Luxembourg and Ireland, will be removed from the data set. In particular, Luxembourg has an exceptionally high GDP per capita relative to other EU members, while Ireland has a highly volatile GDP growth path that diverges significantly in comparison to other EU members. These deviations also violate assumption of parallel trends, and can distort baseline comparisons in the DiD model.

Figure 1 illustrates how Luxembourg and Ireland deviate from the average GDP trajectory of other EU members (excluding China-CEE countries). As can

be seen, Luxembourg has a consistently elevated log GDP per capita compared to other EU member states. Meanwhile, Ireland demonstrates a sharp sustained increase in their per capita GDP after 2013, likely due to changes in corporate tax policies, which attracted large multinational firms to relocate profits and operations to the country (Conefrey & FitzGerald, 2011).

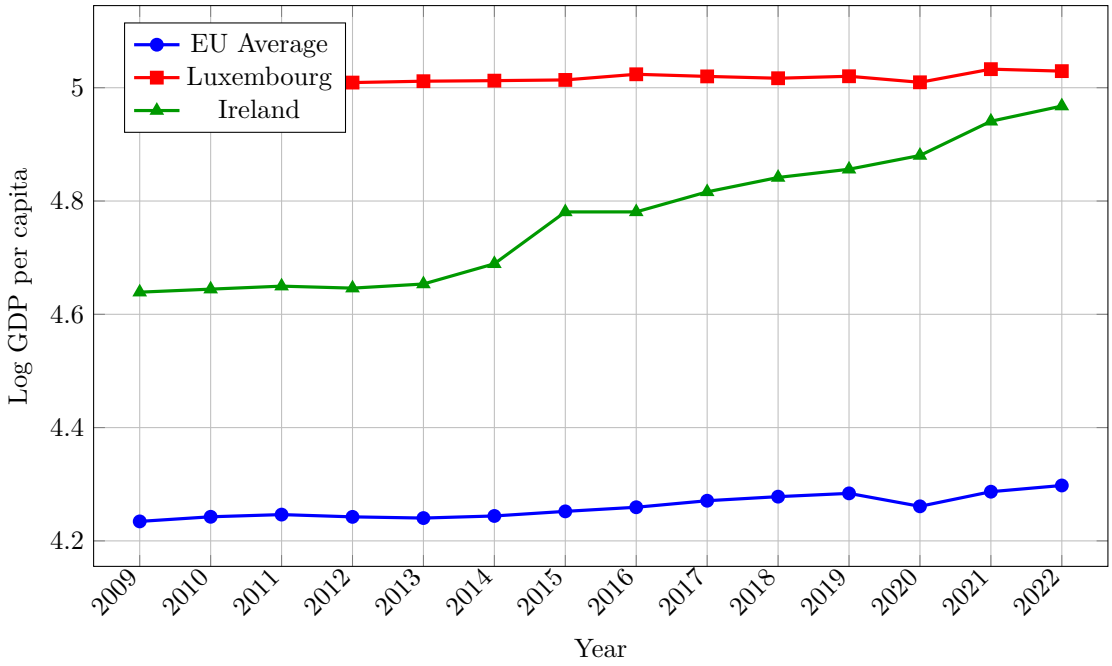

Figure 1: Comparison of Log GDP per Capita: Average of Participant EU Countries vs. Luxembourg and Ireland

Third, after excluding China-CEE countries, Luxembourg, and Ireland, the remaining BRI participants in the dataset are Austria, Cyprus, Italy, and Portugal. All of these countries joined the BRI in 2019, except Portugal, which joined in 2018. To ensure a clear and consistent pre- and post-treatment window, the analysis focuses only on countries that signed the BRI in 2019. Restricting the analysis to countries with the same treatment year provides a clear pre-treatment period (2009-2019) and post-treatment period (2019-2022), thereby simplifying the analytical framework without a large loss of sample data. Additionally, controlling the treatment timing helps to account for larger global shocks, such as the COVID-19 pandemic, by aligning treatment timing across all participating countries.

3.2.2 Variables

This section will introduce the variables used throughout the study. Table 1 presents the complete list of variables used, their corresponding data sources, and the number of observations. Following the sample selection process discussed above, the number of observations was reduced from 378 to 168. Among the dependent variables, the main outcome of interest in the baseline DiD model is the logarithmic GDP per capita of each country. The remaining dependent variables are used in additional specifications to explore how participation in the BRI can influence other aspects of economic performance.

The main explanatory variable is participation in the BRI, captured by the interaction term $Treat \times Post$. The number of country-year observations for treated countries ($Treat = 1$) is 42, and the number of post-treatment country-year observations across all countries ($Post = 1$) is 48.

The control variables largely follow those proposed by Ma (2022) with some caveats. First, the variable "total natural resources rent as a share of GDP" was omitted, as it was consistently near zero for all EU countries. This is due to the fact that EU countries are all high- or upper-middle-income countries, with limited dependence on natural resource extraction. Therefore, including the natural resource variable would introduce unnecessary noise into the regression.

Second, the control variable "broad money as a share of GDP" was also omitted due to the absence of country-level monetary data within the EU. Because the EU functions as a single monetary union, broad money aggregates are only available at the EU level, making it infeasible to include a nation-specific broad money variable in the regression.

Third, after the removal of these control variables, additional variables were included to strengthen the model: inflation, measured through purchasing power parity adjustments, and unemployment, measured by the unemployment rate, both of which are standard proxies for economic conditions and growth potential. For the purchasing power parity (PPP) variable, the average of the 27 EU countries in the year 2020 serves as the base measurement (2020 = 1). In addition, a control for the impact of COVID-19 is included, proxied by COVID-related deaths per 1,000 people.

Human capital is proxied by the share of the population attaining upper secondary, post-secondary non-tertiary, and tertiary education levels. Government size is measured by general government expenditure as a share of GDP. Institutional quality is proxied by an average of the six World Governance Indicators (WGI) compiled by the World Bank, which includes but is not limited to: regulatory quality, political stability, government effectiveness, and control of corruption. Each individual WGI indicator ranges from -2.5 to 2.5. Domestic investment is measured by gross capital formation as a share of GDP, and openness is proxied by trade as a share of GDP.

Table 1: Variable Overview – DiD Model

Variable	Measurement	Source	Observations
Dependent variables			
Per capita GDP	Logarithmic real GDP per capita	Eurostat	168
Exports	Export volume as share of GDP	Eurostat	168
Government debt	Gross general government debt as share of GDP	Eurostat	168
Trade balance	Export-to-import ratio	Eurostat	168
FDI stock	Inward FDI stock as a share of global FDI stock	UNCTAD	168
Main explanatory variable			
Participation in BRI (Treat × Post)	Participation of BRI	GFDC	168
Treat	Countries participate in BRI	GFDC	42
Post	Years after BRI participation	GFDC	48
Control variables			
Inflation	Purchasing Power Parity indicator	Eurostat	168
Unemployment	Unemployment rate	Eurostat	168
Human capital	Upper secondary, post-secondary non-tertiary and tertiary education attainment	Eurostat	168
Government size	General government expenditure as share of GDP	Eurostat	168
Institution	Worldwide Governance Indicators (WGI)	World Bank	168
Domestic investment	Capital formation as a share of GDP	Eurostat	168
Openness	Trade as a share of GDP	World Bank	168
COVID-19	COVID-related deaths per 1,000 people	Eurostat	36

Note: 'Treat' refers to country-year observations where countries participate in the BRI. 'Post' refers to country-year observations after treatment. The interaction term 'Treat × Post' equals 1 for 105 observations.

3.3 Data Analysis: Results

This section will go through the results obtained from the models. The primary dependent variable in this study is GDP per capita. By using the equations outlined in the *Methodology and Data* section, we will begin by completing the required event study to check for the parallel trend assumption, the DiD models alongside robustness checks for this variable first. We will then move on to the analysis of the secondary dependent variables such as exports, government debt, trade balance and stock of FDI. Finally, we will move on to complete the logit model.

3.3.1 Event Study

Following Equation 4, the event study is regressed on all participating countries. Table 2 presents the results, showing the estimated differences in log GDP per capita between treated and control countries for each year prior to treatment relative to 2018. This model controls for covariates.

The event window spans from 2009 to 2017, as treatment begins in 2019. Thus, each coefficient represents the interaction between treatment assignment and a specific pre-treatment year, with 2018 serving as the baseline.

The table shows that none of the interaction terms for the years 2009 to 2017 are statistically significant at conventional levels ($p > 0.1$). The lack of statistical significance does not provide evidence of systematic differences in GDP per capita between the treated and control groups prior to participation in the BRI.

The results for control variables are also reported in Table 2. Among these, unemployment and government size are statistically significant at the levels 10% and 5%, respectively, with negative coefficient estimates. This implies a negative relationship between these variables and GDP per capita. Specifically, a one percentage point increase in the unemployment rate is associated with a

0.38% decrease GDP per capita. Similarly, a one percentage point increase in government expenditure as a share of GDP is associated with a 0.18% decrease in GDP per capita.

In contrast, human capital, institutional quality, and domestic investment are statistically significant at the 1%, 5%, and 10% levels, respectively, with positive coefficient estimates. This indicates a positive association between these variables and GDP per capita. In other words, countries with a higher share of the population that attains higher secondary or higher education, stronger institutional frameworks, and higher levels of capital formation as a share of GDP tend to see higher economic output. The magnitudes of these coefficients suggest that improvements in education, governance, and investment are meaningfully associated with increases in GDP per capita, consistent with conventional economic theory.

Table 2: Event Study Regression Results

Year	**Estimate**	**Std. Error**	**t-value**	**Pr(>|t|)**	**Signif.**
2009	0.005186	0.009795	0.529478	0.6069941	
2010	-0.005867	0.011560	-0.507539	0.6217978	
2011	-0.001302	0.012487	-0.104237	0.9188573	
2012	0.000047	0.008750	0.005421	0.9957718	
2013	-0.006841	0.013713	-0.498886	0.6276859	
2014	-0.006388	0.008072	-0.791373	0.4454555	
2015	-0.008498	0.007268	-1.169237	0.2670210	
2016	-0.006937	0.008807	-0.787635	0.4475502	
2017	-0.010054	0.008833	-1.138230	0.2792080	
Controls					
Inflation	0.007063	0.005529	1.277510	0.2277261	
Unemployment	-0.003816	0.001877	-2.033338	0.0668660	.
Human capital	0.006801	0.002020	3.367058	0.0062849	**
Government size	-0.001786	0.000764	-2.337978	0.0393123	*
Institution	0.076168	0.027810	2.738845	0.0192712	*
Domestic Investment	0.002557	0.001228	2.082667	0.0614144	.
Openness	-0.000349	0.000208	-1.674028	0.1222899	

Note: The table shows the estimated divergence of the log GDP per capita for each year leading up to the beginning of the treatment. The 'COVID-19' variable is omitted as the data only spans from 2009–2017. *Significance levels:* ** $p < 0.01$, * $p < 0.05$, . $p < 0.1$

3.3.2 Baseline DiD Model

After confirming the parallel trends assumption using the event study, we will proceed to the baseline DiD model to estimate the average treatment effect of BRI participation on the economic growth of EU member states. Following Ma's study (2022), Table 3 shows the results of two model specifications: the first column excludes control variables, and the second column includes the full set of covariates as specified in Equation 1. In both specifications, the interaction

term $Treat \times Post$, which captures the average effect of treatment on GDP per capita, is not statistically significant. This indicates that joining the BRI does not have a detectable impact on the GDP per capita of the treatment group relative to the control group.

Among the control variables, unemployment, government size and the impact of COVID-19 display negative statistically significant coefficients at the 10%, 10%, and 5% levels, respectively. This implies that higher unemployment, government size, and the impact of COVID-19 are associated with lower levels of GDP per capita. Specifically, a one percentage point increase in the unemployment rate is associated with a 0.38% decrease in GDP per capita, while a one percentage point increase in government expenditure as a share of GDP results in a 0.25% decrease. The COVID-19 variable indicates that for each additional death related to COVID-19 per 1,000 people, there is a 2.04% decrease in GDP per capita. This may seem like a large coefficient, however an increase on 1 death per 1,000 in for example Italy would translate into approximately 60,000 additional fatalities.

In contrast, human capital and domestic investment are positively correlated with GDP per capita at the 10% level of significance. A unit increase in educational attainment corresponds to a 0.45% increase in GDP per capita, while a one percentage point increase in domestic investment corresponds to a 0.25% increase. The results gathered are consistent with economic theoretical expectations, as domestic investments and educational attainment are considered key drivers for long-term economic growth.

Table 3: Difference-in-Differences Regression Results

Variable	**Without Controls**	**With Controls**
Treat × Post	-0.0042 (0.0192)	0.0085 (0.0092)
Inflation		0.0108 (0.0063)
Unemployment		-0.0038· (0.0020)
Human capital		0.0045· (0.0022)
Government size		-0.0023· (0.0011)
Institution		-0.0277 (0.0200)
Domestic investment		0.0025· (0.0012)
Openness		-0.0003 (0.0002)
COVID-19		-0.0204* (0.0080)
Fixed Effects	Region, Year	Region, Year
Observations	168	168
R^2	0.97397	0.99256
Within R^2	0.00188	0.71489

Note: The table shows the estimated coefficients for each variable, representing the variance of the effect that each variable had on the GDP per capita of treated countries versus control countries. Robust standard errors are shown in parentheses. *Significance levels:* * $p < 0.05$, · $p < 0.1$.

3.3.3 Dynamic DiD

After completing the baseline DiD model, we now turn to the dynamic DiD specification, which provides us with a more granular view of the evolution of the relative GDP per capita development between the treatment and control groups in each year of the study. The dynamic DiD model follows the specification of Equation 3, and the results are presented in Table 4. The table shows the relative differences yearly in logarithmic GDP per capita between the treatment and control groups and uses 2018, the year immediately preceding the participation of BRI, as the reference year. As can be seen in the significance column of the table, none of the relative years prior to 2018 exhibit statistically significant differences, which confirms the parallel trends assumption. This finding aligns with the results of the event study, thereby strengthening the internal validity of the DiD design.

Similarly to the baseline DiD regression, the relative years 0 to +2 also do not show significant variance in the dependent variable, suggesting that there is no immediate treatment effect of the BRI. However, in the relative year +3 (2022), the coefficient estimate becomes statistically significant at the 10% level, suggesting a modest lagged positive impact of the BRI on GDP development for the treatment group.

The control variables follow a pattern similar to that in the baseline DiD model. However, because of the yearly interaction structure of the dynamic model, some changes in statistical significance are observed. For example, the unemployment coefficient remains negative, but loses its previous significance at the 10% level, while the size of the government has increased its statistical significance from 10% to the 5% level. These subtle shifts are expected, given the structural differences between Equation 1 and Equation 3.

Figure 2 visualises the estimated treatment effects over time. Although estimated differences in GDP per capita vary slightly in previous years, particularly between years −10 and −7, they remain statistically insignificant. More importantly, the figure reveals a consistent upward trend in the effect of treatment between years +1 and +3.

Table 4: Dynamic Difference-in-Differences Regression Results

Relative Year	**Estimate**	**Std. Error**	**t-value**	**Pr(>|t|)**	**Signif.**
−10	0.015237	0.010931	1.393867	0.190876	
−9	0.006750	0.011673	0.578262	0.574735	
−8	0.003721	0.011034	0.337273	0.742259	
−7	0.008195	0.008430	0.972142	0.351872	
−6	-0.003222	0.012379	-0.260313	0.799431	
−5	-0.001243	0.005381	-0.230970	0.821578	
−4	-0.006825	0.007628	-0.894823	0.390042	
−3	-0.007074	0.009859	-0.717566	0.487984	
−2	-0.008254	0.008383	-0.984645	0.345961	
0	0.002533	0.002546	0.994685	0.341267	
+1	-0.000610	0.008397	-0.072670	0.943373	
+2	0.012321	0.009045	1.362109	0.200404	
+3	0.022630	0.010483	2.158745	0.053822	.
Controls					
Inflation	0.009421	0.007231	1.302911	0.219220	
Unemployment	-0.003152	0.001796	-1.754954	0.107041	
Human Capital	0.004436	0.002302	1.927085	0.080183	.
Government size	-0.002512	0.001107	-2.269884	0.044317	*
Institution	-0.027339	0.023167	-1.180053	0.262870	
Domestic investment	0.002158	0.001159	1.861592	0.089574	.
Openness	-0.000279	0.000215	-1.295743	0.221594	
COVID-19	-0.022419	0.008872	-2.527030	0.028122	*

Note: The table shows the result of the dynamic DiD. The estimate column shows the effect of the BRI on the log GDP per capita for each year relative to the beginning of the treatment (Relative Year = 0 = 2019). The controls section outlines the impact that each control variable had on log GDP per capita throughout the study. *Significance levels:* ***** $p < 0.05$, **.** $p < 0.1$

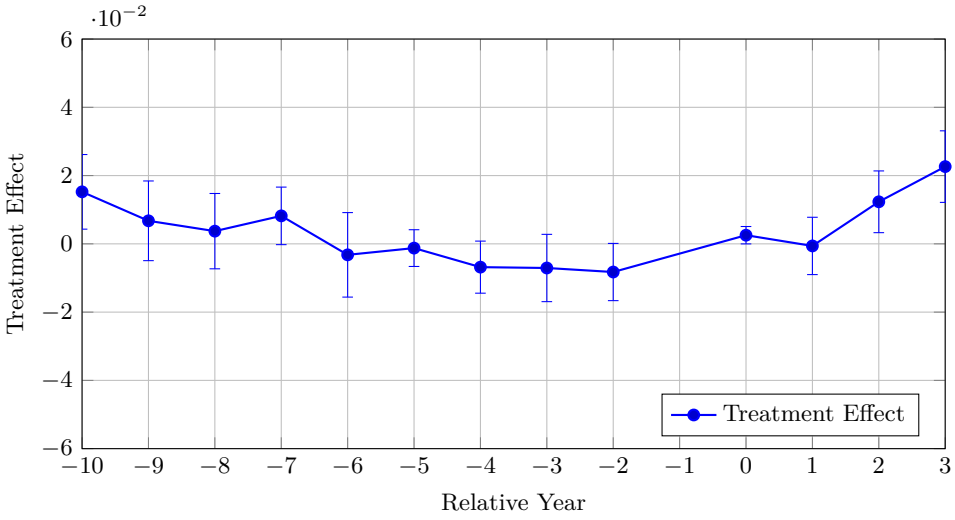

Figure 2: Estimated Treatment Effects Over Time with Confidence Intervals

3.3.4 Robustness Check: Varying Sample Size

In order to validate the results of the baseline and dynamic DiD models, we will complete a set of robustness checks. Firstly, we examine whether the estimated treatment effect is sensitive to the exclusion criteria applied in the *Sample Selection* section. This is done by systematically reintroducing the excluded groups, China-CEE members and Luxembourg, Ireland and Portugal, first separately and then jointly.

As Table 5 shows, including Luxembourg, Ireland and Portugal while excluding the China-CEE countries (Column 2) maintains the original finding of no statistically significant treatment effect. This same non-significant effect can be found when including all 27 EU member states (Column 4). However, when including China-CEE countries without the presence of Luxembourg, Ireland and Portugal (Column 3), the BRI has a statistically significant and positive treatment effect on the treatment group. Specifically, participation in the BRI resulted in an average of 2% increase in the GDP per capita of a country once China-CEE countries are accounted for.

In addition to these issues, column (3) also suffers from a low within R^2 value. The within R^2 represents how much of the variance can be explained by the model, and a within R^2 value of 0.47 means that only 47% of the variance is explained. Together, these limitations suggest that while the treatment effect observed in column (3) may be noteworthy, it is not likely to reflect a robust and reliable outcome.

Table 5: Robustness Check - Varying Sample Sizes

Variable	(1)	(2)	(3)	(4)
Treat × Post	0.0085 (0.0092)	-0.0146 (0.0138)	0.0200 · (0.0107)	0.0085 (0.0113)
Inflation	0.0108 (0.0063)	0.0118 (0.0071)	0.0005 · (0.0003)	0.0005* (0.0002)
Unemployment	-0.0038 · (0.0020)	-0.0052* (0.0024)	-0.0072*** (0.0016)	-0.0074*** (0.0015)
Human capital	0.0045 · (0.0022)	0.0019 (0.0021)	0.0018 (0.0032)	-0.0004 (0.0028)
Government size	-0.0023 · (0.0011)	-0.0041*** (0.0008)	-0.0017* (0.0008)	-0.0034** (0.0010)
Institution	-0.0277 (0.0200)	-0.0604 (0.0512)	0.0113 (0.0575)	-0.0027 (0.0510)
Domestic investment	0.0025 · (0.0012)	0.0004 (0.0012)	-0.0003 (0.0019)	9.39e-5 (0.0009)
Openness	-0.0003 (0.0002)	0.0002 (0.0003)	-0.0004 (0.0003)	-0.0001 (0.0003)
COVID-19	-0.0204* (0.0080)	-0.0246* (0.0106)	0.0069 (0.0042)	0.0067 (0.0053)
Fixed Effects: Region	Yes	Yes	Yes	Yes
Fixed Effects: Year	Yes	Yes	Yes	Yes
Observations	168	210	336	378
R^2	0.99256	0.99110	0.99330	0.99324
Within R^2	0.71489	0.66150	0.46852	0.46652

Note: The table presents the results of sample-specific robustness checks. Column (1) presents the baseline DiD model for reference. Column (2) includes Luxembourg, Ireland, and Portugal, but excludes China-CEE countries. Column (3) includes China-CEE countries, but excludes Luxembourg, Ireland, and Portugal. Column (4) includes all 27 EU members. All models follow the specifications of Equation 1 with the variation in sample sizes indicated in the *Observations* row. Robust standard deviations are shown in parenthesis. *Significance codes:* $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$.

3.3.5 Robustness Check: Placebo Test

Another unobserved factor that may have an impact on the effect of the model is anticipatory behaviour, which can be tested using a placebo robustness check. Furthermore, the placebo test serves as an indicator of whether the model specification is appropriate. If the effect of placebo treatment is statistically significant, one must question the causal interpretation of the DiD analysis, as there are likely to be omitted variables or underlying trends that can skew the results. The placebo test will follow the specification of Equation 1, with the caveat that the beginning of the treatment is artificially shifted to 2016.

The results are shown in Table 6. This shows that not only is the placebo treatment statistically insignificant, it has also lost nearly the entire value of the original coefficient, decreasing from 0.0085 in the baseline model to -0.00051. This implies that there are no signs of anticipatory effects or issues of omitted variable biases, supporting the validity of the model specification. Furthermore, the placebo test did not have any impact on the statistical significance or magnitude of the coefficients of the control variables, where changes in estimates are negligible, as expected.

However, it is important to note that because even the baseline DiD model did not show statistical significance, the placebo test is less powerful as a robustness check. While it supports the stability of the model, it does not rule out the possibility that omitted variables are preventing the full effects of the BRI from being captured in the baseline DiD estimation.

Table 6: Placebo Regression Results

Variable	Estimate	Std. Error	t-value	Pr(> |t|)	Signif.
Placebo Treatment	-0.000514	0.006860	-0.074937	0.941610	
Inflation	0.009553	0.006341	1.506586	0.160084	
Unemployment	-0.003704	0.002083	-1.777993	0.103024	.
Human Capital	0.004379	0.002091	2.094835	0.060135	.
Government size	-0.002200	0.001147	-2.191253	0.050857	.
Institution	-0.030771	0.022258	-1.382495	0.194244	
Domestic Investment	0.002575	0.001374	2.004779	0.070226	.
Openness	-0.000226	0.000221	-1.023461	0.328071	
COVID-19	-0.018327	0.007058	-2.595561	0.024846	*

Note: The table shows the result of the placebo DiD. The estimate column represents the variance of the effect that each variable had on the GDP per capita of treated countries versus control countries. *Significance levels:* * $p < 0.05$, . $p < 0.1$

3.3.6 Robustness Check: Time Restriction

Another robustness check performed in this study assesses whether other global economic shocks may have influenced the baseline DiD model. Countries may have experienced heterogeneous recovery trajectories from the 2008 financial crisis, which could skew the results. Therefore, the sample period is restricted by shifting the starting year from 2009 to 2014 to exclude the immediate aftermath of the financial crisis. The model specification otherwise follows Equation 1.

The results are shown in Table 7. As shown, the treatment effect becomes positive and statistically significant at the 10% level, indicating that within the restricted sample, participation in the BRI is associated with an increase of 1.1% in GDP per capita between treated countries, although this result is coupled by a relatively large standard deviation. Nonetheless, the resulting impact that the BRI has on GDP in the time-restricted model implies that including years during which countries were still recovering from the financial crisis may have suppressed the effect in the baseline DiD model. Based on these findings, subsequent models in the study will also include time-restricted samples to ensure consistency and robustness.

Among the control variables, unemployment and human capital maintain similar coefficient magnitudes and statistical significance levels relative to the baseline model. However, some notable differences arise in other control variables. The impact of government size, while maintaining a negative coefficient, is now statistically significant at the 1% level, improving from the 10% significance in the baseline model. Institutional quality also becomes statistically significant at the 10% level with a coefficient of -0.051, implying that an increase of one unit in the WGI statistics corresponds to a 5% decrease in GDP per capita. Although this result appears counterintuitive, it is likely driven by the limited variation in institutional quality between EU countries. The WGI statistics range from -2.5 to 2.5, but EU members tend to cluster within a narrow range of approximately 0.48 to 1.87, with a median of 1.36 and a standard deviation of 0.4. This means that a one-unit increase in the WGI represents an

unusually large shift within the EU context, likely overestimating the effect.

Domestic investment, which was marginally significant in the baseline model, completely loses its statistical significance. The COVID-19 control variable remains statistically significant, but the magnitude of the coefficient decreases from -0.204 to -0.118, suggesting a marginally smaller negative effect in the time-restricted sample.

Table 7: Restricted Difference-in-Differences Regression Results

Variable	**Estimate**	**Std. Error**	**t-value**	**Pr(>|t|)**	**Signif.**
BRI Participation	0.011385	0.006269	1.815934	0.096707	$^{\cdot}$
Inflation	0.005262	0.005393	0.975744	0.350614	
Unemployment	-0.002272	0.001126	-2.016922	0.068788	$^{\cdot}$
Human Capital	0.003010	0.001489	2.020759	0.068272	$^{\cdot}$
Government Size	-0.002637	0.000738	-3.574814	0.004358	**
Institution	-0.051401	0.024766	-2.075497	0.062180	$^{\cdot}$
Domestic Investment	0.000664	0.001101	0.602844	0.558836	
Openness	0.000172	0.000209	0.824382	0.427237	
COVID-19	-0.011794	0.004545	-2.594835	0.024922	*

Note: The table shows the variance in the effect of each variable in the treated countries versus the control countries. *Significance codes:* $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$.

3.3.7 Robustness Check: Geographical and Economic Similarity

Another robustness check is conducted to examine whether the impact of the BRI varies when applying the model to smaller, geographically, and economically homogeneous samples. The EU encompasses diverse cultures and economic structures, which can introduce heterogeneity and increase the noise in the model. By further restricting the sample sizes, we may reduce the power of the model but gain valuable insight into how the BRI might affect countries with similar economic structures.

In this instance, we inspect the effect of the BRI on the treated countries individually and compare these results to countries that are geograhically and economically similar. Of the three treated countries (Italy, Austria and Cyprus), Italy and Austria offer the most viable comparison opportunities. This is because Cyprus is a small island nation without bordering countries and is highly dependent on imports compared to other EU countries, so there are no valid countries within the EU which can be used to create a meaningful comparison.

For Italy, the comparison countries used are Spain and France, and for Austria, the comparison countries used will be Germany, Sweden, and Finland. Restricting comparison countries to direct neighbours proved impractical, as both Austria and Italy share a border with only one neighbour that is not excluded from the analysis portion of the study for reasons outlined in the *Sample Selection* section. Therefore, countries which are also economically similar to the treatments are included, such as Sweden and Finland for Austria and Spain and France for Italy, as they show similar per capita GDP trends.

Tables 8 and 9 show the results of the geographically restricted models. In both tables, the first column shows the results gained from the baseline DiD for reference. The second column shows the results gained from the regressions with each respective regional restriction placed, and the third column shows the results of the regressions that are both regionally restricted and also restricted by time. The region and time restriction is included to consolidate the data with the information gained from the time restriction robustness check of the original model.

As shown in the within R^2 results of Table 8, restricting the sample to countries similar to Austria increased the explanatory power of the model: 81.4% of the variance in the per capita GDP is explained in column (2), compared to 71.5% in the baseline model. However, the explanatory power of the model decreases significantly to 61% in column (3), probably due to the extremely restricted sample size following the dual restrictions of both region and time.

From Table 8 we can see that the treatment effect of BRI participation remains statistically insignificant across all three columns and that the magnitude of the coefficient is reduced in the restricted models. The control variables, on the other hand, show more noticeable changes. In column (3), none of the explanatory variables, except for government size, retain any statistical significance, reinforcing the conclusion from the reduced within R^2 that the sample size may be too limited to yield a meaningful model.

Column (2) of Table 8 shows that the inflation coefficient decreases slightly, from 0.0108 to 0.0079, but becomes statistically significant at the 1% level. A similar pattern can be found in government size. In contrast, unemployment and COVID-19 lose their statistical significance, but maintain their negative coefficients.

Human capital remains statistically significant at the 10% level in column (2), but the sign on its coefficient reverses from 0.045 to -0.0024, implying that a one unit increase in educational attainment corresponds to a 0.24% decrease in GDP per capita. This result counters economic theory, which posits that improvements in human capital contributes positively to economic growth. However, Austria, Germany, Sweden, and Finland already have high levels of educational attainment with relatively little variation across countries. As such, the model may be extrapolating effects from a smaller range of values. It is also possible that this negative relationship reflects spurious correlation or reverse causality, where a lower GDP per capita is associated with lower educational outcomes rather than education levels, causing reduced output. Therefore, the counterintuitive sign is likely a product of the limited sample size and lower statistical power of the model, which can exaggerate the effect of minor variations in educational attainment and distort coefficient estimates.

Table 9 shows the effect of the DiD model that uses Italy as the treatment country and France and Spain as the control group. Interestingly, the within R^2 increases substantially in the restricted models: from 0.71 in the baseline DiD in column (1) to 0.94 in column (2) and 0.96 in column (3). This indicates that the models explanatory power improves when focusing on countries similar to Italy, although the sample is even more restricted than in the Austria specification,

with the number of control countries reduced from three to two. Despite this increase in model fit, the treatment effect of the BRI fails to reach statistical significance. In fact, the coefficient estimate decreases in magnitude across columns, reinforcing the conclusion that there is no robust evidence of an impact of the BRI on GDP per capita, even in more homogeneous regional comparisons.

In Table 9, the control variables exhibit less volatility than in the Austria specification. Unemployment becomes statistically significant in column (2), but this decreases to 10% in column (3) as it was in the baseline DiD. These findings align with the economic literature, which posits that higher unemployment correlates with lower per capita GDP. However, the human capital variable loses its statistical significance in both restricted models, likely due to limited within-group variation.

Government size maintains its negative coefficient throughout, but varies in statistical significance. Openness and inflation are both weakly significant in column (2), but lose their significance in column (3). Inflation, in particular, is notable for becoming negative and marginally significant in column (2). This is counterintuitive, as the inflation levels seem to be relatively stable across the three regions, but may reflect some inflation volatility in Italy, which would disproportionately affect the real incomes and investment decisions in comparison to the relative control groups between 2009 and 2022. This result could also be an issue of small sample size and limited variation, where effects can be amplified within the model.

Another interesting result is the effect of domestic investment. Its coefficient increases and becomes highly statistically significant at the 1% level in both restricted models. This can reflect the idea that differences in the levels of capital formation within more homogeneous countries can be more indicative of economic growth.

Table 8: BRI Treatment Effect on Austria

Variable	**(1)**	**(2)**	**(3)**
BRI Participation	0.0085 (0.0092)	0.0019 (0.0016)	-0.0002 (0.0029)
Inflation	0.0108 (0.0063)	0.0079** (0.0011)	0.0038 (0.0049)
Unemployment	-0.0038$^{\cdot}$ (0.0020)	-0.0052 (0.0024)	-0.0029 (0.0037)
Human Capital	0.0045$^{\cdot}$ (0.0022)	-0.0024$^{\cdot}$ (0.0009)	-0.0002 (0.0010)
Government Size	-0.0023$^{\cdot}$ (0.0011)	-0.0029* (0.0007)	-0.0024$^{\cdot}$ (0.0009)
Institution	-0.0277 (0.0200)	-0.0220 (0.0134)	-0.0477 (0.0549)
Domestic Investment	0.0025$^{\cdot}$ (0.0012)	0.0030 (0.0017)	0.0009 (0.0033)
Openness	-0.0003 (0.0002)	-0.0004 (0.0003)	-0.0004 (0.0007)
COVID-19	-0.0204* (0.0080)	-0.0045 (0.0054)	-0.0050 (0.0085)
Fixed Effects	Yes (region, year)	Yes (region, year)	Yes (region, year)
Observations	168	56	36
R^2	0.99256	0.98544	0.98533
Within R^2	0.71489	0.81418	0.61010

Note: The table shows the different effects of the BRI on Austria compared to Germany, Finland, and Sweden. Column (1) shows the results of the baseline DiD model. Column (2) shows the result from the model restricted by region. Column (3) shows the result of the model when restricted by region and time. *Significance codes:* $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$.

Table 9: BRI Treatment Effect on Italy

Variable	**(1)**	**(2)**	**(3)**
BRI Participation (Treat × Post)	0.0085 (0.0092)	0.0039 (0.0027)	0.0021 (0.0026)
Inflation	0.0108 (0.0063)	-0.0890$^{\cdot}$ (0.0245)	-0.0498 (0.0974)
Unemployment	-0.0038$^{\cdot}$ (0.0020)	-0.0015* (0.0002)	-0.0028$^{\cdot}$ (0.0007)
Human Capital	0.0045$^{\cdot}$ (0.0022)	0.0036 (0.0013)	-0.0004 (0.0032)
Government Size	-0.0023$^{\cdot}$ (0.0011)	-0.0019* (0.0003)	-0.0028$^{\cdot}$ (0.0008)
Institution	-0.0277 (0.0200)	0.0439 (0.0181)	0.0278 (0.0263)
Domestic Investment	0.0025$^{\cdot}$ (0.0012)	0.0067*** (0.0002)	0.0070*** (0.0001)
Openness	-0.0003 (0.0002)	0.0011$^{\cdot}$ (0.0003)	0.0011 (0.0009)
COVID-19	-0.0204* (0.0080)	-0.0140$^{\cdot}$ (0.0039)	-0.0098 (0.0081)
Fixed Effects	Yes (region, year)	Yes (region, year)	Yes (region, year)
Observations	168	42	27
R^2	0.99256	0.99924	0.99971
Within R^2	0.71489	0.94285	0.95860

Note: The table shows the different effects of the BRI on Italy compared to Spain and France. Column (1) shows the results of the baseline DiD model. Column (2) shows the result from the model restricted by region. Column (3) shows the result of the model when restricted by region and time. *Significance codes:* $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$.

3.3.8 Additional Outcome Analysis

After completing the appropriate robustness checks for the baseline DiD model, we will move on to inspect the broader economic implications of BRI participation by exploring its impact on alternative outcome variables.

Table 10 shows the results of the regressions based on Equation 1. These models assess the BRI's influence on four economic indicators: FDI stock in

column (1), trade in column (2), export-import ratio in column (3), and the public debt-to-GDP ratio in column (4).

It is important to note that most of these models exhibited low explanatory power, with within R^2 values ranging from 0.11 to 0.62. To improve robustness, additional control variables were included from the dependent variable section of Table 1. Additionally, WGI was dropped from the first three models due to multicollinearity issues.

Additional Outcome Analysis: FDI Stock

Column (1) estimates the impact of the BRI on the FDI stock, measured as a percentage of total global FDI. No statistically significant effect of the BRI is found. Notably, from the control variables, government expenditure shows a positive effect on FDI significant at the 5% level, possibly reflecting investor confidence in stronger fiscal environments. Alternatively, this relationship may reflect reverse causality, where governments may increase spending during economic expansion when tax revenue increases, and foreign investors can be simultaneously drawn to the growth potential of booming economies. In contrast, COVID-19 appears to have a negative effect in the 10% level of significance, which coincides with the disruptions in production, lockdowns, and uncertainty created by the pandemic. Regardless, with a within R^2 of only 0.15, the model's reliability remains limited and likely suffers from omitted variable bias.

Additional Outcome Analysis: Openness

Column (2) explores the impact of BRI on trade as a share of GDP. Again, no significant treatment effect is detected, despite a relatively large and positive coefficient. The most robust determinant of trade in this model is the export-to-import ratio, which shows a strong and significant positive relationship, which signifies that countries within the EU that have relatively higher exports are more impacted by trade, as this is a larger portion of their GDP. Other variables do not contribute meaningfully. This model also suffers from the same issue of a low within R^2.

Additional Outcome Analysis: Export-to-Import Ratio

Column (3) shows the impact of the BRI on the export-to-import ratio of a country. This model has a relatively high within R^2 (0.79), and finds a positive and weakly statistically significant impact of the BRI on the export-to-import ratio. The coefficient 9.64 implies that participation in the BRI increased the ratio of export-to-imports by nearly 10 units, although this estimate is coupled with a very large standard error of 5.24. Several control variables exhibit intuitive and statistically significant effects. A one percent increase in unemployment is associated with a 1.28-point decrease in the export-to-import ratio, likely due to reduced domestic production capacity and increased import dependence. Similarly, higher human capital is associated with a lower export-

to-import ratio, which may reflect countries with well-developed service sectors relying more on imports and global value chains as domestic production may be insufficient to meet domestic demand. Government expenditure also shows a negative and significant effect, potentially capturing redistribution of income that may support consumption rather than export-led growth. The estimate of the coefficient and the statistical significance of the effect of trade on the export-to-import ratio are consistent with the findings in column (2), where a one-unit increase in trade coincides with a 0.63-unit increase in the export-to-import ratio at a significance level 5%. Finally, the effect of the debt-to-GDP level on the export-to-import ratio is positive and statistically significant at the 1% level. This suggests that countries with higher public debt burdens tend to exhibit higher export-to-import ratios. One potential explanation for this is that elevated debt levels can reflect or induce macroeconomic uncertainty or fiscal constraints, which can suppress domestic consumption and, by extension, import demand. In such situations, governments may also adopt policies that encourage exports in order to generate foreign exchange. As a result, the relative share of exports may increase compared to imports, increasing the export-to-import ratio.

Additional Outcome Analysis: Debt-to-GDP Ratio

Column (4) examines the debt-to-GDP ratio, and the effect of the BRI treatment remains statistically insignificant. However, GDP per capita appears to be highly negative and statistically significant, implying that wealthier countries tend to have more stable fiscal balances relative to their economic output. Unemployment is also negatively associated with public debt, which may reflect lower government borrowing during recessions. In contrast, human capital and the export-to-import ratio improve the debt-to-GDP ratio, possibly by supporting productive capacity and trade-driven fiscal stability in a nation. This model exhibits moderate explanatory power, with a within R^2 of 0.69.

Table 10: Alternative Specification: FDI, Trade, Export-Import Ratio, and Debt Models

Variable	**(1)**	**(2)**	**(3)**	**(4)**
BRI Participation	-0.0180 (0.9730)	3.524 (3.432)	9.641$^{\cdot}$ (5.242)	1.678 (4.382)
Log GDP per capita	22.65 (18.50)	85.14 (125.6)	-237.5 (137.9)	-348.6*** (75.59)
Unemployment	0.1667 (0.1824)	0.5898 (0.4387)	-1.283** (0.4054)	-1.055* (0.4266)
Human Capital	-0.1958 (0.1925)	1.359 (0.7647)	-2.239* (0.7286)	2.305*** (0.2981)
Government Size	0.1603$^{\cdot}$ (0.0738)	-0.1469 (0.5055)	-1.632* (0.5352)	0.3341 (0.3822)
Domestic Investment	0.1057 (0.2217)	0.1662 (0.6052)	-1.090 (1.096)	-1.143 (0.7991)
COVID-19	-2.214$^{\cdot}$ (1.219)	-7.164 (7.504)	2.172 (6.079)	-7.455 (4.516)
FDI Stock	–	-0.0542 (0.5941)	-0.5231 (0.6122)	–
Openness (Trade)	-0.0045 (0.0482)	–	0.6301* (0.2196)	-0.1331 (0.1011)
Export-Import Ratio	-0.0307 (0.0486)	0.4453*** (0.0645)	–	0.2795** (0.0709)
Debt-to-GDP Ratio	0.0705 (0.0694)	-0.1418 (0.1678)	0.5298** (0.1351)	–
Institution (WGI)	–	–	–	-7.623 (14.90)
Fixed Effects		Region and Year		
Observations	168	168	168	168
R^2	0.34041	0.99393	0.90475	0.97030
Within R^2	0.14720	0.46330	0.78873	0.69136

Note: The table shows the results that the BRI has on alternate specifications. Column (1) shows the impact on FDI stock. Column (2) shows the impact on trade as a share of the GDP. Column (3) shows the impact on the export-to-import ratio of a participant country. Column (4) shows the impact on the debt-to-GDP ratio of a participant country.
Significance codes: $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

The additional outcome models with the sample period restricted to 2014-2022 to account for the effects of the 2008 financial crisis, visible in *Appendix 1*, largely corroborates these findings. There were no visible difference in the impacts of the BRI on the stock of FDI, export-to-import ratio, or government debt in this time-restricted sample. However, the time-restricted sample did show a positive impact of the BRI on trade.

3.3.9 Logit Model

As shown by the results of the DiD models, the BRI exhibits only a limited effect on certain economic indicators and no statistically significant effect on others. However, the differences in the performance of the control variables between the treatment group and the control group suggest some underlying economic differences that can affect the results. To explore this heterogeneity further, a logit model is estimated using Equation 7, aiming to identify the factors that predict the likelihood that a country joins the BRI. This analysis allows for a more nuanced interpretation of the DiD results by highlighting country-specific factors that can differentiate the treatment group from the control group.

The sample includes all countries used in the baseline DiD, excluding the China-CEE countries, Luxembourg, Portugal, and Ireland. Although the inclusion of the latter three could improve the model fit, they are omitted to maintain consistency with the baseline DiD results framework and to avoid introducing further regional or structural biases.

Table 11 displays the results of the logit regression. The intercept represents the natural logarithm of probability (log-odds) of BRI participation when

all independent variables are zero. Several variables emerge as statistically significant predictors of BRI participation: unemployment, human capital, FDI stock, openness, export-to-import ratio, domestic investment, and institutional quality. Notably, all significant variables except openness and human capital have negative coefficients, indicating that higher levels of these variables are associated with a reduced likelihood of joining the BRI.

In particular, countries with higher export-to-import ratios and greater domestic investment appear less inclined to join the BRI. Similarly, countries with stronger institutional quality are less likely to join the BRI. Notably, countries with higher unemployment are also less likely to join the BRI, as one might expect that countries struggling with unemployment would seek foreign investment as a mean of stimulating economic growth and employment.

In contrast, openness, measured by trade as a share of GDP, has a positive and statistically significant coefficient of 0.0103, suggesting that a one-unit increase in openness increases the chances of participating in the BRI by approximately 1.03%. Human capital also has a positive and statistically significant coefficient.

Table 11: Logistic Regression Results for BRI Participation

Variable	**Estimate**	**Std. Error**	**z value**	**Pr($>|z|$)**
Intercept	41.861	12.056	3.473	0.000515***
Log GDP per capita	-2.396	2.289	-1.047	0.2953
Inflation (PPP)	-0.0056	0.0179	-0.312	0.7550
Unemployment	-0.388	0.105	-3.687	0.000227***
Human Capital	0.059	0.028	2.091	0.0365*
Debt-to-GDP Ratio	-0.0177	0.0115	-1.542	0.1231
Government Size	0.0547	0.0492	1.111	0.2664
FDI Stock	-1.1588	0.3092	-3.748	0.000178***
Openness (Trade)	0.0103	0.0050	2.054	0.03997*
Export-Import Ratio	-0.1287	0.0298	-4.321	1.55e-05***
Capital Formation	-0.5489	0.1336	-4.110	3.96e-05***
Institution (WGI)	-7.090	1.5467	-4.584	4.56e-06***

Note: The table shows the estimated impact that each variable has on the probability that a country will join the BRI. The intercept shows the probability of joining if all variables are zero. *Significance codes:* $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

4 Discussion

The empirical analysis executed in the prior section suggests that the economic impact of participation on the BRI on GDP per capita in EU states is limited, although some moderate effects can be seen in a portion of the models featuring alternate specifications and restrictions. This section will outline and interpret these findings of the DiD and logit models and will contrast the results with the broader academic discourse on the BRI. The analysis proceeds in five parts: first,

the key results from the baseline and dynamic DiD models are summarised and contextualised. Second, the findings are compared with expectations gathered from the literature. Third, the heterogeneity in BRI participation and outcomes is explored through the logit model and the grouped DiD results. Fourth, results inspecting the impacts of the BRI on broader economic indicators are discussed, and finally, the political economic implications of the participation of BRI are reflected in the context of European sovereignty and China's global strategy.

4.1 Results from the Baseline DiD model

The baseline DiD model shows that the BRI did not have a visible effect on the development of the GDP per capita of the participating countries compared to the control countries. Although Table 1 shows a slight positive coefficient for the treatment of 0.0085, the associated standard deviation is so large that this result does not prove to be a statistically significant figure. This result suggests that, on average, BRI participation has not altered the short-term growth trajectory of participating EU member states in a statistically robust way.

However, since we added a time restriction in the regression to account for potential heterogeneity in the recovery of EU countries from the 2008 financial crisis, the BRI treatment coefficient became more pronounced at 0.0114, a result that is statistically significant at the 10% level. Given that the dependent variable is in logarithmic form, this means that participation in the BRI corresponds to a 1.14% increase in GDP per capita in the time restricted model. This suggests that early post-2008 financial crisis dynamics may have absorbed some treatment effects in the baseline specification, and after controlling for this the impact that the BRI had on the GDP of participant countries was marginally, albeit not very strongly, significant. This means that there is reason to believe that the BRI can have a small impact on the GDP development of participant countries, at least in the short term.

This tentative positive result is consolidated by the dynamic DiD model. When inspecting the effects of participation in the BRI yearly, a statistically significant impact emerges in the third post-treatment year. This is coupled with a visible linear upward trend in Figure 2, although this trend is not statistically significant. However, this result still reinforces the notion that the economic effects of the BRI may take several years to materialise, consistent with expectations given the time required to execute large-scale infrastructure and investment projects.

4.1.1 Robustness Checks

The validity of the results gained from the DiD is supported by the robustness checks performed. First, the sample size was increased to see whether the exclusion of countries had a large effect on the results. This was done by relaxing the selection criteria and reintroducing the China-CEE countries and Luxembourg, Portugal, and Ireland into the model first separately and then together. In all regressions expect one, the treatment variable did not reach statistical signifi-

cance. The sole exception to this was the regression that included China-CEE countries, but excluded Luxembourg, Portugal, and Ireland. This regression reached a positive coefficient of 0.02, statistically significant at the 10% level.

This means that for all EU countries including China-CEE countries but excluding Luxembourg, Portugal, and Ireland, the impact of the BRI resulted in an average 2% increase in the per capita GDP. This can be caused by the fact that China-CEE countries generally joined the BRI earlier, between 2015 and 2018, and therefore may have experienced the BRI effects before the economic disruptions caused by the COVID-19 pandemic. Moreover, due to them beginning their treatment earlier they would have had more time to realise the economic impacts that larger infrastructure projects may have.

Alternatively, the positive effect that China-CEE countries receive from the BRI can be well explained by same reason they were excluded in the first place. China-CEE countries were excluded for having strong pre-existing political and economic ties to China, which violated the exogeneity assumption that is crucial for DiD analysis. Although it can be argued that all countries have deep pre-existing economic ties to China given China's global economic position, the membership in the China-CEE initiative may have given countries exceptionally preferential access to Chinese investment and trade flows regardless of their participation in the BRI (Matura, 2019). This access to Chinese investment can impact the treatment effect, so therefore this statistically significant result cannot be prudently attributed solely to the BRI. However, it does highlight the impact that the BRI can have on the economy of a developed country if the infrastructure investments are coupled with other investments that can consolidate the effects of the BRI. However, this result remains speculative as the study does not explore the effect that other forms of investment can have on the efficacy of the BRI to improve the economic growth of EU countries.

Another robustness check used to check the validity of the DiD was the placebo test, which shifts the treatment period to a pre-intervention year to see if the results gained from the original model is a result of spurious correlation or misspecification of the model. As expected, the effect of the treatment is substantially reduced in the placebo model with the treatment coefficient dropping from the original 0.0085 to -0.00051. Such a reduction in the coefficient value indicates that there is no issue of misspecification or spurious correlation in the DiD, enforcing the validity of the DiD model.

4.2 Comparison to Previous Literature

4.2.1 Modest BRI Impact in the EU

As these findings from the baseline DiD show, the BRI can have moderate effects on participants at least in the short term. These mild effects are broadly consistent with the previous literature surrounding the effects of the BRI. Multiple studies have found a less extensive impact of the BRI on developed countries compared to developing nations (Lu et al., 2024; Ma, 2022). This disparity is often attributed to differences in baseline infrastructure conditions and market

integration. In many developing countries, BRI-related investments address critical bottlenecks in transport, energy, and logistics infrastructure, thus catalysing trade and productivity growth (Komakesh and Ombati, 2023; Deng et al., 2020).

In contrast, EU member states already benefit from extensive infrastructure and integrated markets. Additional investment in such contexts may generate only marginal gains as diminishing returns set in. From a theoretical standpoint this aligns with the predictions of endogenous growth theory, which suggests that infrastructure contributes most to growth when it complements human and physical capital in underdeveloped settings (Barro, 1990; Romp & de Haan, 2007).

4.2.2 Lagged Effects and COVID-19

The lagged effects visible in the dynamic models can stem from a multitude of factors. Firstly, it is important to note that BRI projects can take years to complete if the projects are focused on developing new infrastructure in a participating nation. Naturally, it would then take years for BRI economies to be able to realise the potential economic gains from these projects. Although it is true that this could be the case in Portugal, where BRI investments have been more broad and focused on a range of assets such as electricity, oil, financial services, and transportation (Skala-Kuhmann, 2019), the same cannot be said in the case of Greece, where China leased the already functional Port of Piraeus for 35 years (Ferrari & Tei, 2020).

Alternatively, it is possible that the COVID-19 global pandemic and the concurrent energy crisis caused by the war in Ukraine have absorbed the positive impacts of BRI, especially with trade-dependent countries, as the global economy faced a downturn. This could explain why the positive impacts of the BRI were only visible in 2022 when economic activity began to normalise after the shocks incurred by the pandemic and energy crisis. Therefore, it is not pertinent to completely disparage the BRI from the lack of economic impacts that is present in the data.

4.3 Heterogeneity and Structural Drivers

The logit model and differently grouped DiD models lend us insight as to which countries are more inclined to join the BRI and for what reasons, which can answer questions about selection biases that have not been excluded by the sample selection of the participant countries and support the identification of meaningful policy implications.

4.3.1 Insights from the Logit Model

From the results of the logit model outlined in Table 11, it can be seen that the global FDI stock that is directed to a country and the level of domestic capital formation both have a negative impact on the decision to join the BRI, which makes intuitive sense. If the underlying levels of investment both from global

and domestic financiers are low, this can prompt countries to seek investment aid from the BRI. Moreover, the institutional quality of the country also has a strong negative impact, which means that countries that possess lower institutional strength are more likely to join the BRI. The correlation of lower institutional strength and the probability of participating in the BRI could reflect political like-mindedness or a potential for corrupt leaders to personally gain from the BRI (Himaz, 2019; Li et al., 2021).

Human capital, measured as the level of educational attainment of the general public of a country, has a slight positive impact on a country's decision to join the BRI. This means that countries that have a larger percentage of their population attain an upper secondary or tertiary level of education are more likely to join the BRI. The academic discourse on this topic seems to converge on the idea that the higher the technological gap between the recipient and source economies, the higher the positive relationship is regarding spillovers (Fan, 2003), so the result that countries with a higher education would be more likely to join the BRI is counter-intuitive. It is possible that with a higher education level and technological capability, countries can be more receptive to new technology and hence would deem the BRI an attractive option to boost local production by sharing technological ability with China. Moreover, higher educated countries may have products and technology that could also benefit China, reversing the causality of this result.

Another seemingly counter-intuitive result is the negative relationship between unemployment and the BRI participation decision. Although other economic results focused on trade and investment signalled that countries with a weaker economic status are more likely to join the BRI, this relationship claims that a higher unemployment level in a country *decreases* their chances of joining the BRI. However, a political economy explanation of this could be that governments that face higher unemployment might be more unwilling to join the BRI as it can be seen as a tool of furthering the employment issue by taking away job opportunities. One way that this reduction of employment can happen is that inclusion in the BRI can effectively lower the barriers of entry for Chinese corporations to enter the domestic market of the participant country. This can lead to an influx of high-technology, low-cost products from China, which can crowd-out domestic production and have a negative impact on the already problematic employment position of the host country (Jackson & Shepotylo, 2021; Himaz, 2019).

Another reason why the unemployment level does not have a positive effect on a country's decision to join the BRI is due to the limited opportunities of domestic companies to get involved in these projects, which has been a point of scrutiny aimed towards the BRI. Li et al. (2021) point out that '89% of contractors in Chinese-funded transportation projects are Chinese companies and that both host-country firms and third-country multinational enterprises (MNEs) struggle to find the right strategies that allow them to take part in BRI projects'. Therefore, it can be ascertained that countries with high unemployment figures do not see the BRI as a vehicle to improve the often highly political issue of unemployment, as not only does the BRI not lend any short-

term employment to domestic contractors, it may also have negative long-term effects on domestic production and employment.

4.3.2 Results from Grouped Models

In order to combat the selection biases that were highlighted by the logit model, some more specific DiD models were run by comparing economies that are geographically and, to an extent, economically more homogeneous. Although this does not remove the problem of selection bias completely from the models, it can remove some of the outliers and focus the regression to find different effects in Southern, Central and Northern Europe. Both the Austrian and Italian comparison data failed to generate statistically significant coefficients for the treatment effect of the BRI, strengthening the findings of the baseline DiD model that the BRI has a limited capacity to boost per capita GDP. These grouped studies were also inspected with time restrictions, which also did not find a statistically significant impact of the BRI. Both of these models had a greater Within R^2 than the baseline DiD, meaning that the grouped models had a greater ability to explain the variance between the differences in GDP of all countries included in their respective models compared to the baseline DiD model. The higher Within R^2 therefore can be cautiously translated into better model fit. However, the Within R^2 decreased significantly in the time-restricted model of the grouped models, which was expected due to the heavily restricted number of observations caused by two significant restrictors.

4.4 Additional Economic Indicators: The Broader Picture

4.4.1 Trade Composition

Although the effect of the BRI is not as prominent in this study as it has been in the previous literature, some effects on the trade composition of the participant countries are visible. The export-to-import ratio of a participant country increases by approximately 9.64 for participants, although this is accompanied by a large standard deviation. The export-to-import ratio is calculated by dividing the exports with the imports, so there are three possible causes for this increase.

Firstly, an increase in a country's exports can lead to an increase in the export-to-import ratio. The BRI resulting in a total increase in exports of a country is supported by contemporary literature, as the BRI can increase the export competitiveness of goods from a participant country by reducing trade frictions, cost, and time taken to transport goods (Ruta et al., 2019; Baniya et al., 2020; Jackson and Sheptoylo, 2021). However, this is not as likely to be the case in this data. An increase in exports, *ceteris paribus*, would also increase the total trade volume of the participant country. The data does not suggest an increase in total trade volume as the coefficient for trade, while positive, is statistically insignificant.

Secondly, the export-to-import ratio can be increased by a decrease in a country's imports. However, the result that the BRI leads to a decrease in

the imports of a country is highly implausible, both from the perspective of literature surrounding the BRI and also from the academic literature concerning infrastructure and economic integration as a whole. Moreover, as discussed previously, there was no visible net effect on trade, which means that it is unlikely that a drop of imports is the only effect that has led to this result.

The third and most likely option is that the trade composition of the participating countries shifted, meaning that they increased exports while simultaneously decreasing imports, which is signalled by the null effect of the BRI on trade volumes. Furthermore, although the trade coefficient is not statistically significant, the coefficient is still positive, which suggests that there was a slightly larger increase in exports than a decrease in imports. However, because of the high standard of error in trade, it is also possible that this effect was reversed in some of the BRI countries.

This result is partly supported by the literature, as an increase in exports is one of the goals of countries participating in the BRI, and similar results on export improvements have been seen in multiple other countries (Ruta et al., 2019; Baniya et al., 2020; Jackson and Sheptoylo, 2021). However, it is counterintuitive that imports have also decreased, as there is limited evidence to show that the BRI would lead to some form of import-substitution or domestic demand decrease.

That said, it can be possible that because the BRI countries are in less economically favourable situations, the aggregate demand of these nations can also decrease due to some austerity policies put in place by the government, which would lead to a decrease in imports. However, this is merely conjecture, and the relationship between the BRI and imports should be further explored in the context of the EU to gain definite answers.

The data also suggests that participation in the BRI does not automatically cause a large influx of imports to the host country, which is a concern for many scholars (Bellora & Jean, 2016; Himaz, 2019). However, as the data does not deeply study the composition of the imports after participation in the BRI, it is unclear if some industrial sectors are more negatively affected by some different mode of imports such as higher technology products, or if a larger amount of imports are coming from China, which could result in a more concentrated import dependency. The data also do not differentiate the composition of the exports, which could give insight into which countries the exports are being channelled to. Therefore, it is important to study more deeply the effect of the BRI on the composition of trade, both by the products traded and by the trade partners, to gain a more robust understanding of the effects that the BRI can have on the trade composition of the EU.

4.4.2 Stock of FDI

Inclusion in the BRI also does not appear to have large effects on the global FDI stock that a country receives. This is a result which goes against the literature surrounding the BRI, as higher performing infrastructure would intuitively attract more FDI from other countries as well, as trade performance and ease

of transport are improved in the BRI countries (Lu et al., 2024). This does, however, support the hypothesis that in developed nations with pre-existing infrastructure and trade networks the realised gain from further investment in infrastructure is more marginal and therefore does not sway the interests of other investors. This result differs to investments made in countries where infrastructure is lacking, as increased investments into their infrastructure can attract larger amounts of FDI due to higher impacts on production capacity and market access.

Conversely, the effect that the BRI has on the FDI levels from other countries can be negative. The BRI is a foreign investment deal, which would mean that larger amounts of FDI is directed from China into the host country. If the global FDI stock this country received stays stable and the investments from China have increased, this would imply that the level of FDI from other countries actually has decreased. This shift in the composition of FDI implies a growing dependence on Chinese capital, which can increase the susceptibility of participating countries to strategic influences and political pressure. As economic dependencies deepen, they can translate into political leverage, raising concerns about the broader implications of BRI engagement for EU sovereignty and policy autonomy.

4.5 Political Economy and Strategic Considerations

Some evidence suggests that BRI participation may have a positive effect on bilateral relations between China and the host country exactly due to the growing economic dependence that was outlined previously. The motivation behind this is that the growing economic dependence through FDI creates incentives for BRI participants to avoid political disagreements with China, with the fear that economic retaliation can have a drastic effect on their economy (Lu, Gu & Zheng, 2021).

This political pressure is further evidenced by the bilateral political realignments that some countries have undergone after signing the BRI. A case study of Central American countries showed that BRI participants shifted their views on major political questions to better realign themselves with China, such as severing ties with Taiwan (Portada, Lem & Zheng, 2020). However, it is important to note that this study was performed in countries with poor institutional quality and it is uncertain if similar results would be found in liberal democratic states, which EU states often represent. This distinction reinforces the notion that the political impacts of the BRI are highly context-dependent.

Moreover, it is important to keep in mind that although the data can lend itself to the assumption that BRI participants may have growing dependencies to Chinese capital, the data also does not show any impacts of BRI participation on the debt-to-GDP ratio of the participant nations. The lack of increased debt sustainability issues aligns with the idea that debt politics have primarily been concentrated in a few outlier countries, and that states with stronger institutional quality and higher scrutiny over foreign investment are less likely to experience the adverse effects of debt politics (Ruta et al., 2019).

Therefore, the data does not lend itself directly to the idea that EU member state participation in the BRI has an adverse effect on their national sovereignty or translates into significant increases in Chinese soft power via debt politics. This interpretation is supported by empirical findings from UN voting behavior, which indicate that BRI participation among EU states has not led to greater alignment with China in international politics. Conversely, some countries appear to have distanced themselves from Chinese political positions, potentially as a signal from the host nation that their political motivations cannot be swayed by their economic relations (Steinert & Weyrauch, 2024). Furthermore, due to heightened scrutiny of Chinese investments in Europe, there are no substantial shifts in public or elite perceptions of China within the EU, especially when compared to observations from the global south, where the positive views towards China among leaders have increased (Comerma, 2024; Sun, Kapstein & Shapiro, 2024; Custern, Horigoshi & Marshall, 2024).

Nevertheless, several important political concerns regarding the BRI remain beyond the scope of this study and warrant further research. One such concern is the possibility that, while the overall debt burden has not increased, the composition of public debt may have shifted toward a higher share owed to China. This could heighten financial dependence and increase vulnerability to future economic coercion. Assessing the compositional shifts in both the source of FDI and government debt burden in BRI participating countries is essential for a more complete understanding of the long-term political risks that the BRI may impose on countries.

Another element of debt politics and the concern of BRI is the acquisition of strategic infrastructure assets by Chinese SOEs (Skala-Kuhmann, 2019; Mohan, 2018). In 2018, China has gained control over one-tenth of Europe's port capacity (Mohan, 2018), the most notable BRI acquisition being the Port of Piraeus in Greece in 2016. Although this was marketed as a contribution to Sino-European trade development, these acquisitions provoke anxiety over strategic dependence over China for critical logistics infrastructure (Skala-Kuhmann, 2019). Ultimately, the broader strategic concern of the BRI remains to be whether participation in the BRI compromises sovereignty by enabling the transfer of control over key assets to a non-democratic foreign power. The strategic asset issue represents one of the most visible and contentious aspects of Chinese economic influence within the EU, reinforcing the need for a coordinated EU-level strategy to manage and mitigate long-term geopolitical risks.

Steps have been taken towards such coordination within the EU. In response to the BRI, several EU institutions and member states have called for more stringent mechanisms to screen FDI, especially in more sensitive sectors, in order to remove some of the opacity surrounding the BRI contracts (Mohan, 2018). In 2018, the European Commission initiated a common framework for screening FDI, citing concerns about acquisitions of critical infrastructure and technologies by foreign entities. This framework was aimed at fostering a 'One Europe' approach to external investment, in response to China's 'divide and rule' tactics that exploit the heterogeneity of EU member state responses and strategic interests (Mohan, 2018).

Taken together, these issues that range from shifts in debt composition and strategic asset control to political alignment underscore the need for ongoing monitoring and tailored policy responses. While this study does not empirically evaluate these aspects, they should be central considerations in broader assessments of the BRI's implications for the EU.

4.6 Limitations of the Study and Paths to Future Research

There are some limitations to this study that can affect the results and give insights to what future research should be completed in complementarity to this study to make the findings more robust and reliable. These include the practical disadvantages of the method used, the timing of COVID-19, the relatively short post-treatment period, the complexity of the BRI, and the lack of granularity in the results.

4.6.1 Difference-in-Differences Analysis

One of the most striking limitations of this study is the appropriation of DiD as the method to inspect the impact that the BRI has on the EU. Although DiD is a pragmatic model that has its strengths, mainly its simplicity in execution and interpretation alongside its ability to control for time-invariant unobserved heterogeneity between treatment and control groups, it may not be the most robust method to examine general equilibrium effects that the BRI imposes on the EU.

The DiD framework has important limitations. First, it relies heavily on the parallel trends assumption, which can never be fully verified, especially in contexts with significant economic heterogeneity between countries. Second, DiD assumes that the treatment effect is homogeneous across treated units and over time, an assumption that may not hold given the highly variable nature of BRI projects and the economic diversity of EU member states. Third, DiD does not easily account for general equilibrium effects or broader macroeconomic feedback mechanisms that might be triggered by BRI participation, nor does it account for spillover effects, where one countries participation may affect the surrounding countries as well, which is an issue that is specifically alarming in the context of the EU where countries are heavily interlinked via trade, regulation and shared institutions.

Therefore, this study would be well served if it was consolidated with studies that focus on other methods of examining the general equilibrium effects of the BRI, such as Computable General Equilibrium (CGE) Models or Dynamic Stochastic General Equilibrium (DSGE) Models. However, these models were infeasible to use here due to the requirement of extensive data collection and modelling that is outside the scope of this thesis.

4.6.2 The Pandemic

As mentioned in the *Data Analysis* section, the emergence of COVID-19 has the potential to have large confounding effects on the results of this study. Although there was an attempt to control for COVID-19 within the study by controlling for COVID-19 deaths per 1,000 people within each country, this method is not without limitations. Although this control variable works as a proxy for the severity of the pandemic in each country, which in turn signals the extent of economic disruption, it does not differentiate between the heterogeneous economic impact that COVID-19 had across countries that may stem from structural differences. Countries that have larger tertiary sectors in the economy may not see as much a decrease in their productivity capacity, as many people can work from home regardless of lockdowns. However, countries more dependent on the primary and secondary sectors or tourism may see larger decreases in productivity as factories are shut down and intra- and inter-country travel is restricted for lockdown purposes. However, given the time-restriction and the availability of data, this was the most feasible method to control for COVID-19.

In addition, the COVID-19 control used could theoretically have a reverse effect as intended. Consider two hypothetical countries A and B. They both have the same rate of infection, but country A decides to place public health as a priority and country B decides to place the economy as a priority. This means that country A will see fewer COVID-related deaths, but a higher economic toll, while country B will see higher COVID-related deaths, but a lower economic toll. This is the reverse of the result that the proxy variable attempts to control for, which is that higher death tolls lead to higher lockdowns and hence higher economic losses. However, this issue is not as large within the context of the EU, where countries generally decided on the severity of their lockdowns depending on the daily infection rates. The only outlier in the EU was Sweden, who decided not to place any lockdowns, claiming that it is a constitutional issue (Ludvigsson, 2020).

Furthermore, it is very likely that each country saw heterogeneous recovery paths from the COVID-19 economic shock similar to other financial crises such as the 2008 financial crisis, which can skew the results further in years after COVID-19.

4.6.3 Short Post-Treatment Period

Another limitation of this study was the short post-treatment period, a limitation that is exacerbated by the effect of COVID-19. The post-treatment period for this study was only 3 years, with the economic shock of COVID-19 being present for at least the first two years, and to a lesser extent in the third year. As the results showed, there were some positive effects present in the third year of the treatment. Due to the fact that data was only reliably available up to 2022, with data for 2023 and 2024 being mostly estimates or non-existent, it was not possible to inspect the impacts of the BRI with a larger post-treatment

period, and it is uncertain whether the economic impact of the BRI was due to a short-term transitory effects or if the effects would translate to long-term growth. Therefore, it would be pertinent that the impact of the BRI is studied further once more data becomes available in the future.

4.6.4 Complexities of the BRI

Although it is true that only the countries that were implemented as the treatment group of this study have signed a BRI agreement with China, the BRI is a complicated entity that lacks strict definitions. Therefore, investments that are channelled to each BRI country can vary significantly by size or targeted infrastructure. Moreover, as was seen with the China-CEE initiative, the treaties and agreements between EU countries and China can also vary, with almost every EU country having some sort of agreement with China, ranging from the BRI to a 'Memorandum of Understanding', or other investment or fiscal agreements outside of these (Sielker and Kaufmann, 2020). Therefore, the relationship between the BRI and economic growth should be further studied while considering different investment streams from China. The reason why this was not controlled for in this study was the time restriction as well as the availability of uniform data that segregate countries of origin of investment streams for each individual EU member state.

4.6.5 Granularity of Results

Another limitation of the study is the lack of granularity of the results presented. As mentioned in the *Additional Economic Indicators: the Broader Picture* section, some of the results obtained are not as insightful as they could be. Although results such as the BRI not having large adverse effects on the government debt of the country is a positive outcome, it is not certain whether the debt to China has become a larger part of the total debt level.

The same can be said about the composition of trade, where it can only be inferred that the increase in export-to-import ratio was due to the concurrent increase in exports and decrease in imports due to the lack of expansion in total trade volumes. However, the specific figures of this remain elusive. Moreover, the data does not differentiate between different sectors of industry, as this would have gone beyond the scope of the study.

The lack of granularity in the data hinders the ability to arrive to robust conclusions and inferences of policy recommendations, and further exploration of the different effects of the BRI on a more granular level should be completed to consolidate the findings of this study.

5 Conclusion and Policy Recommendations

This study has examined the economic implications of participation in the BRI for EU member states, employing a DiD approach complemented by robustness checks and a logistic regression model to assess selection bias and gain a more

complete understanding of the economic and political ramifications, to answer the question *To what extent is the Belt and Road Initiative a viable strategy for promoting economic development in EU member states?*

Unlike some previous studies that found strong positive correlations between BRI participation and economic growth, this study found that the impact of the BRI on economic growth within the EU was only marginal, with no statistically significant effects detected in the baseline DiD model and modest effects visible in the model which controlled for the heterogenous recovery trajectories of the 2008 financial crisis. A small and delayed positive effect was visible in the dynamic DiD model after three years, suggesting that the benefits of participation in the BRI may be subject to a significant time lag or may have been absorbed by the external shocks of the COVID-19 pandemic. Therefore, the empirical results of this study does not find evidence that the BRI is a means to end secular stagnation in the EU. Moreover, the study does not find evidence of a unilateral positive impact that the BRI has on the economic development of EU member states, but a tentative impact reliant on the economic predisposition of the recipient country.

Specifically, the analysis of the logit model revealed that countries with weaker institutional quality, lower domestic investment, lower global FDI attraction, lower unemployment, and greater openness are more likely to join the BRI. This suggests that the BRI participation decision is not random and any positive GDP effects of countries can be dependent on underlying economic conditions. Interestingly, higher levels of human capital measured by educational attainment levels are positively correlated with participation in the BRI, suggesting that participating countries may seek to leverage the BRI to seek technological spillovers. However, the effect of the BRI on technological improvements is uncertain in this study.

The results of the time-restricted models provide some evidence of a modest effect of the BRI on the GDP per capita of participants, but the effect remains weak and statistically significant only at the 10% level. Due to the lack of data availability, it is uncertain whether this increase in GDP in the short term results in higher long-term growth. Additional robustness checks, including those that control for geographic and economic similarity, generally provide null findings. These results are consistent with previous literature that highlights the heterogeneity of the impact of the BRI. Previous studies have found particularly low marginal returns on infrastructure investments in highly developed economies with established trade and infrastructure networks compared to developing economies.

The economic results of the participation of the BRI on trade balance, FDI stock, and public debt further highlight the limited scope of the impact of the BRI on the EU. Although some shifts in export-import ratios were observed, they cannot be attributed to increased trade volume, and are more likely caused by a change in trade composition. The absence of significant effects on total trade and FDI inflows, suggests that EU participation in the BRI has not fundamentally altered the macroeconomic position of member states.

The study also does not find conclusive evidence of the adverse effects of

participation of the BRI. The study does not find any large impacts on participant imports, which means that the risk of domestic producers being crowded out of the market after deeper integration of Chinese companies into the trade network of the participant is not as pertinent. Furthermore, there is no perceivable detrimental impact on the debt sustainability of participants, mitigating the fear surrounding Chinese soft power increases within the confines of the EU. While these concerns persist in the global scope of the BRI, especially in less developed countries, it appears to be less salient in the context of the EU, where institutional safeguards and higher regulatory scrutiny mitigate these risks.

However, it is important to gain a deeper understanding of the increases in government debt that participating countries incur towards China to consolidate the conclusions drawn from this study. Furthermore, it is also important to note that the study did not address the strategic risk of forfeiting control of strategic assets such as ports to foreign actors. These political risks remain a variable that governments should be wary of when making decisions pertaining to the BRI.

5.1 Policy Recommendations

5.1.1 National Level Policies

From this study it is clear to see that the economic benefits of the BRI are not as automatic as previous literature suggests. Given the modest economic returns and potential strategic vulnerabilities, it is imperative that policymakers at the country level make their decision to participate in the BRI guided by rigorous cost-benefit analysis. This should be tailored to the specific economic needs and structures in place in each individual country, with more export-focused countries being more likely to see higher returns from the BRI. It is also important to note that there is no clear evidence that the BRI attracts more FDI to the host country, so countries should not leverage the BRI as a means of increasing investment levels.

Next, if a country decides to join the BRI, it is important that a level of transparency and oversight is upheld in the implementation in order to safeguard economic sovereignty and avoid public critique. Policymakers should seek to find resolutions where domestic contractors are leveraged in the planning and completion of infrastructure projects to ensure that projects do not result in any crowding-out effect and instead ensure that the BRI results in increased employment, by the least in the short term, and that the projects align with national development objectives.

5.1.2 EU-wide Policies

Although the decision to participate in the BRI should be left to the individual members of the EU depending on their economic requirements, a more coordinated and cohesive approach should still be undertaken at the EU level. China's approach to foreign policy, especially in regard to the EU, is to divide and rule,

and the heterogeneity of unilateral engagement at the national level of individual EU member states can undermine the leverage the EU can collectively have against China. The EU should leverage the *One Europe* framework to reach a more coordinated strategy to evaluate external infrastructure investments and achieve the desired outcomes for BRI projects. This framework would also work to ensure that short-term national gains do not come at the expense of coherence between EU member states.

Moreover, policies should be put in place in order to enhance the capacity for the EU to evaluate and monitor third-country investment projects such as the BRI. The EU should also seek to leverage their capacity with projects such as the *Global Gateway Initiative* to offer alternatives or complements to Chinese financing in order to maintain control of strategic assets and give countries more fiscal leniency to repay their debts, and therefore avoid falling victim to debt politics.

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Appendices

Appendix 1: Time Restricted Dynamic DiD

To corroborate the findings of the time restricted model, a dynamic DiD was conducted while restricting the sample size to 2014-2022. As can be seen from Table 12, the restriction of the data did not create any issues with the parallel trends assumption, as all coefficients prior to the beginning of the treatment are not statistically significant. Moreover, similar to the previous dynamic DiD, this restricted dynamic DiD only shows statistically significant positive impacts of the BRI treatment at year +3 (2022). Therefore, it can be inferred that although restricting the timespan of the data set has not severely altered the yearly treatment effects, these marginal differences have compounded into a shift in the statistical significance of the baseline DiD model.

Table 12: Dynamic Difference-in-Differences Regression Results

Relative Year	**Estimate**	**Std. Error**	**t-value**	**Pr($>\|t\|$)**	**Signif.**
-5	-0.000179	0.005889	-0.030323	0.9763530	
-4	-0.009357	0.009986	-0.937078	0.3688367	
-3	-0.007597	0.010117	-0.750905	0.4684697	
-2	-0.007437	0.007083	-1.049920	0.3162749	
0	0.003414	0.002894	1.179582	0.2630492	
$+1$	-0.001518	0.008817	-0.172164	0.8664351	
$+2$	0.008707	0.008606	1.011773	0.3333848	
$+3$	0.019754	0.010249	1.927336	0.0801483	.
Controls					
Inflation	0.005703	0.006116	0.932501	0.3710937	
Unemployment	-0.002313	0.001146	-2.017803	0.0686749	.
Human Capital	0.003099	0.001770	1.751068	0.1077320	
Government size	-0.002762	0.000806	-3.427171	0.0056512	**
Institution	-0.050317	0.026929	-1.868502	0.0885373	.
Domestic investment	0.000379	0.000780	0.485877	0.6365884	
Openness	0.000109	0.000245	0.444896	0.6650220	
COVID-19	-0.014981	0.004250	-3.525208	0.0047547	**

Note: The table shows the result of the time-restricted dynamic DiD. The estimate column shows the effect of the BRI on the log GDP per capita for each year relative to the beginning of the treatment (Relative Year = 0 = 2019). The controls section outlines the impact that each control variable had on log GDP per capita throughout the study. *Significance codes:* $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\cdot}p < 0.1$.

Appendix 2: Additional Outcomes Time-Restricted Model

Table 13 shows the effects of the BRI on the alternative economic variables of FDI, trade, export-to-import ratio and debt-to-GDP ratio. However, the sample period has been restricted to 2014-2022 to counteract the heterogeneous growth trajectories of the 2008 financial crisis. As a result of this restriction, the sample size is reduced from 168 to 108 observations. This reduction also

affects the explanatory power of the models, as reflected by the lower within R^2 values across all four specifications.

Despite these limitations, the results show largely similar effects of the BRI on the dependent variables as in the unrestricted models. One notable exception to this is that the BRI has a statistically significant and positive impact on trade, as shown in column (2). Specifically, the treatment effect indicates that participants of the BRI saw a 5.44 percentage point increase in trade as a share of GDP compared to the control group, significant at the 5% level.

Table 13: Restricted Models: FDI, Trade, Export-Import Ratio, and Debt-to-GDP

Variable	**(1)**	**(2)**	**(3)**	**(4)**
BRI Participation	0.2763 (1.290)	5.438$^{\cdot}$ (2.847)	4.680$^{\cdot}$ (2.460)	2.582 (3.239)
Log GDP per capita	–	-2.899 (206.9)	–	-333.2*** (50.64)
Unemployment	0.1742 (0.2471)	-0.3504 (0.8522)	-2.169** (0.6108)	-1.365** (0.3883)
Human Capital	-0.1555 (0.1720)	1.398* (0.5842)	-1.676 (0.6399)	1.058** (0.3016)
Government Size	0.1152 (0.1244)	-0.0401 (0.2448)	-0.8809* (0.3932)	0.1796 (0.2637)
Domestic Investment	0.1021 (0.1993)	0.3771 (0.2183)	-1.120 (1.058)	0.5190$^{\cdot}$ (0.2861)
COVID-19	-2.137 (1.628)	-8.277 (6.517)	1.499 (2.820)	-5.542 (3.839)
FDI Stock	–	0.1646 (0.4425)	-0.2587$^{\cdot}$ (0.1381)	–
Openness (Trade)	0.0240 (0.0742)	–	-0.0093 (0.0899)	-0.1336 (0.1094)
Export-Import Ratio	-0.0449 (0.0387)	-0.0116 (0.1379)	–	-0.0934 (0.0710)
Debt-to-GDP Ratio	0.0819 (0.1403)	-0.3543 (0.4177)	-0.0134 (0.1530)	–
Institution (WGI)	–	–	–	6.591 (8.102)
Fixed Effects		Region and Year		
Observations	108	108	108	108
R^2	0.31786	0.99567	0.75788	0.99038
Within R^2	0.15101	0.42490	0.49552	0.59645

Note: The table shows the results that the BRI has on alternate specifications with time-restriction. Column (1) shows the impact on FDI stock. Column (2) shows the impact on trade as a share of the GDP. Column (3) shows the impact on the export-to-import ratio of a participant country. Column (4) shows the impact on the debt-to-GDP ratio of a participant country. *Significance codes:* $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.