MASTER THESIS

THE IMPACT OF THE BELT AND ROAD INITIATIVE ON SOCIETAL OUTCOMES

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Abstract:

The Belt and Road Initiative (BRI) by the Chinese government has received widespread attention as a large-scale global infrastructure project aimed at stimulating trade and connectivity. This research explores the effects of BRI on education and gender inequality, by employing a quantitative approach using panel data in combination with fixed effects, Difference-in-Difference estimator and propensity score matching. Drawing on data from World Bank and the Human Development Program, a negative effect of the BRI on secondary school enrolment was found whereas the impact on gender inequality remained small and insignificant. When removing the countries that participate in the initiative after 2013 from the sample completely, a positive effect of the BRI on female and overall primary school enrolment emerges, whereas the policy effect of the BRI on secondary school enrolment and gender inequality remained negative.

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1. INTRODUCTION

Education has always been regarded as one of the fundamental drivers for human development and societal progress. It teaches individuals necessary knowledge and skills that can improve their quality of life and contribute to society in many ways. In the famous neoclassical growth theories, education has been an important factor for economic growth. Investing in education can increase human capital present in the workforce, resulting in improved labor productivity and driving the transition towards a higher output level (Mankiw et al., 1992). Education is not only proven to increase economic growth but is also a crucial determinant of economic well-being (Hanushek & Woessmann, 2010), which relates to the positive effect of income on overall well-being. Based on the academic findings and the consensus that good education is essential for any society, the United Nations aims to ensure that all children complete primary and secondary education by 2030 globally[1].

Another societal outcome that is closely related to education and has become a prominent focus of attention in the last few decades is Gender Inequality. Worldwide, 1 in 4 girls between the ages of 15 and 19 are neither employed nor in education compared to 1 in 10 boys[2]. Klasen (2002) found that gender inequality in education significantly reduces economic growth, especially apparent in sub-Saharan Africa. UNICEF is partnering with health sectors to increase the quality and access to maternal care and supporting female participation in the workforce. The United Nations are also actively reducing gender inequality and officially announced to eliminate all forms of discrimination, violence, harmful practices against women and girls globally and ensuring equal opportunities, rights and resources for all women and girls worldwide[3].

Education and Gender equality have been a central topic for decades as both have been recognized by the United Nations as important drivers for economic growth and are embedded in the seventeen Sustainable Development Goals (SDGs) by the United Nations. They are social phenomena that require close attention and monitoring as their effects on economic growth are significant and extremely relevant for today's society. Policies play a significant role in shaping and influencing both education and gender equality, through implementation of strategies by governments and allocation of resources. Therefore, policies should not only be evaluated from economic standpoints, instead the societal outcomes should also be considered when judging the overall success of a policy.

[1] https://www.undp.org/sustainable-development-goals/quality-education
[2] https://www.unicef.org/gender-equality
[3] https://www.undp.org/sustainable-development-goals/gender-equality

One of the largest global initiatives, The Belt and Road Initiative (BRI), also known as One Belt One Road (OBOR), is a fitting example of how policies can drive connectivity, economic growth, and impacting societies and economies on a global scale. In fact, The Economic Analysis and Policy Division (EAPD) of the United Nations Department of Economic and Social Affairs (UNDESA) is implementing a project to strengthen national capacities for jointly building the Belt and Road towards the Sustainable Development Goals[4].

The Belt and Road Initiative is a large-scale development infrastructure project launched by the Chinese government in 2013[5]. China proposed the Belt and Road Initiative to improve connectivity and cooperation on a transcontinental scale (World bank, 2018). The plan consists of two parts: the overland Silk Road Economic Belt and the Maritime Silk Road. The overland route encompasses important economic corridors and crosses through central Asia, the Middle East and Eastern Europe. The maritime route is focused on developing key seaports that connect to land-based transportation routes. The initiative defines five major priorities: policy coordination, infrastructure connectivity, unimpeded trade, financial integration and the connecting of people[6]. In addition to physical infrastructure, China has funded hundreds of economic zones, and industrial areas designed to create jobs, and encouraged countries to embrace its tech offerings (council of foreign relations, 2023).

The Belt and Road initiative has been named by academics as China's greatest international economic ambition (Huang, 2016) and it will have a significant impact on the future of global trade (Ascensão et al, 2018). Motives suggested for the launch of the BRI is to counter the slowdown of domestic growth in China by exporting its model of exponential growth to neighboring states[7] and that China is looking to take advantage of the shift in world powers and impose its power and influence in today's world. The roots of this initiative are deeply connected with China's history, dating back centuries ago to the historic and renowned Silk Road, in which the motives of peace and development stood central[8]. The Western-centered world order has contributed to human progress significantly; however, the US-led world order now lies in the past. This illustrates that the Initiative represents more than just a global phenomenon; it is a pivotal element within the larger canvas of the changing world order.

[4] https://www.brisdgs.org
[5] https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative
[6] https://www.ebrd.com/what-we-do/belt-and-road/overview.html
[7] https://hir.harvard.edu/what-does-the-belt-and-road-initiative-mean-for-the-future-of-the-international-integration-system/
[8] https://www.nbr.org/publication/a-guide-to-the-belt-and-road-initiative/

Building upon the existing literature, this research aims to dive deeper into the social spillovers of the BRI on education, gender equality, and societal progress. By examining the social spillovers of the BRI, this research aims to contribute to the broader understanding of the BRI's impact and its potential to shape the education and gender equality outcomes in participating nations. Naturally, the research question has been phrased as follows to address the societal impact of the BRI.

1.1 Research Question

What is the impact of The One Belt One Road Initiative on societal outcomes such as education and gender inequality in participating countries?

The five major priorities of the initiative as stated by President Xi are: "policy, infrastructure, trade, financial, and people-to-people connectivity." People-to-people connectivity involves education, cultural and scientific exchanges to help other countries learn from China's development experience. Based on official documents of BRI[9], one of the policy aims include conducting "extensive international co-operation in the areas of education, science, technology, culture, sports, tourism, environmental protection, health care, and traditional Chinese medicine." In line with the Sustainable Development Goals initiated by the United Nations, President Xi stated that: "Educational co-operation should be boosted, more exchange students should be encouraged and the performance of cooperatively run schools should be enhanced. In addition, efforts should be made to establish think tank networks, partnerships and co-operation in cultural, sports and health sectors". China has also offered scholarships to students from BRI countries to study in Chinese universities, through channels such as the China Scholarship Council and China Belt and Road Scholarship[10]. These scholarships promote students from the participating countries to study in China, covering all tuition fees and accommodation, therefore motivating, and giving the local children a powerful incentive to study. It can be argued that many children in participating countries will attend primary and secondary school to be able to study (tertiary education) in China in the future.

[9]https://www.oecd.org/finance/Chinas-Belt-and-Road-Initiative-in-the-global-trade-investment-and-finance-landscape.pdf
[10] https://www.china-scholar.com/scholarships/belt-and-road-initiative-scholarships-bri/

The BRI can potentially promote gender equality by supporting women's entrepreneurship, employment, and education. For example, China has launched a Women's Entrepreneurship Cooperation and Development Forum to promote women's entrepreneurship in China[11]. This program aims to promote gender equality, women's access to labor market and a general economic empowerment of women with respect to men. The foundation has pledged to take an active part in the Belt and Road Initiative, hence leading to potential spillovers effects in the BRI countries. The British Embassy in China conducted research on how China and the United Kingdom can work together to map the opportunities to embed gender equality norms through and throughout China's Belt and Road[12]. More importantly, it is stressed that it is China's international obligation to make sure the BRI and its implementation is in accordance with the gender equality and women's rights these treaties protect. These treaties are extensively set out in the official document of the British Embassy, and all share the common goal to significantly decrease gender inequality.

Overall, based on the project by EAPD and UNDESA, BRI and SDGs are seamlessly connected, meaning that achieving higher education and lowering gender inequality in the context of BRI is a relationship worthwhile investigating. Based on these motives, the following hypotheses are formed that can formally be tested, using econometrical techniques. The first hypothesis addresses the expected positive relationship between the initiative and the various enrolment ratios of the participating countries. The second hypothesis describes the expected negative effect of the initiative on the gender inequality index of the participating countries. With these two hypotheses, this research aims to create a holistic view of the societal impact the initiative has on the participating countries.

1.2 Hypotheses

Hypothesis 1: *The Belt and Road Initiative increases primary and secondary gross school (female) enrollment (%) in the participating countries.*

Hypothesis 2: *The Belt and Road Initiative decreases the Gender Inequality Index of the participating countries.*

[11] https://www.womenofchina.cn

[12] https://www.britishcouncil.cn/en/programmes/society/BRI

1.3 Effect of Belt Road Initiative on non-economical outcomes

In the introduction, it is already hinted that when evaluating a policy, the impact on societal outcomes should be considered just as much as the economical outcomes. When examining the existing academic literature and news coverage on the Belt Road Initiative, which will be more touched upon in section two, most of it is about the effect of Belt Road Initiative on economical outcomes. In this subsection, the motivation of investigating the impact of BRI on societal outcomes is continued by delving deeper into official documents and policy aims of the BRI.

According to the official website of the BRI, Belt and Road Portal, the Ministry of Education of the People's Republic of China issued the Education Action Plan[13] for the Belt and Road Initiative. In this plan, they state that they will *"*gradually scale up educational assistance, focusing on investing in the people, assisting the people, and benefitting the people." The Chinese Government will take an important role of education assistance, increasing the level of support that goes to participating countries, particularly the least-developed countries along the routes. Furthermore, the Education Action Plan states by coordinating governmental and nongovernmental educational resources and the education system, they will educate and train teachers, scholars, and technicians with different specializations for countries in the region. In addition, they will actively undertake measures to provide education assistance packages that incorporate high-quality teaching equipment, teaching schemes, and teacher training for the participating countries. By combining government funding, private financing, and public donations, this plan aims to broaden the funding sources for education, encourage students to study, and achieve shared development in education.

When looking at Gender Inequality, the research commissioned by the Cultural and Education Section of the British Embassy in China, recognizes that there are no specific policies specially tailored at reducing Gender Inequality in BRI participating countries in place yet[14], apart from the general commitment of China in reducing gender inequality worldwide. They stress that without a specific gender inequality policy for the Belt Road Initiative, China is expected to face irregularities in gender issues during the implementation of BRI. According to them, this is caused by the scale of the BRI and the involvement of so many private and public actors combined with every participating country having a different starting level of gender inequality. Whereas education already has policies that are specifically targeted at increasing education levels in participating countries, gender inequality still lacks concrete policies in this aspect. Therefore, this research aims to unravel the indirect effects that BRI has on societal outcomes and adds value to the current state of societal progress development in the participating countries that can be attributed to BRI.

[13] https://www.beltandroad.gov.hk/visionandactions.html
[14] https://www.britishcouncil.cn/sites/default/files/en_final.pdf

In section one, the relevance and novelty of the impact of BRI on non-economical outcomes has been set out together with the research question, motivation of hypotheses and the introduction of the research. In addition, this section covered the policy background, the primary objectives of the Belt Road Initiative, its strategies and the hypothesized impact on education and gender inequality outcomes. In section two, a thorough review of the existing literature on place-based education policies, gender inequality and the Belt Road Initiative will be conducted. The review indicates the current state of knowledge in the field and identifies gaps that can be investigated. In the third and fourth section, an outline of the research methodology will be given with a detailed description of data sources, econometric techniques and the Difference-in-Difference estimator that will be used to assess the impact of the policy on the societal outcomes. In the fifth section, the findings and analysis will be presented based on the data collected and examined to assess the policy's overall effectiveness in improving non-economical outcomes. Patterns, trends, and relationships that emerged from the findings will be discussed. In the sixth section, various robustness tests will be conducted to check the robustness of the results and provide more insight into the overall quality of the research. In the last section, a concise summary of the research findings, their implications and limitations will be provided.

2. LITERATURE REVIEW

In this section, several academic papers will be discussed that are relevant to this research. The section is divided into three sections, which form the basis of the analysis and provide the reader with a representative indication of the current state of research conducted on these three subjects.

2.1 Education

Every World Development Report published annually by the World Bank has recognized, in one form or another, the importance of primary schooling as an input to the social and economic progress of poor countries. In the past, much academic literature was focused on the direct effect of building schools on school enrolment rates. Handa (2002) estimates the change in primary school enrolment caused by interventions such as building a few schools in specific regions of Mozambique. Their results indicate that school availability has a significant impact on enrolment rates. Reducing the travel time to the nearest school will increase enrolment rates for both sexes by 17 – 20 percentage points. In addition, they found that construction of a village school will increase enrolment more among poorer households. Specifically for girls, the authors also found a positive interaction of enrolment and household income, if the schools are built with cement and the quality of teachers on the school enrolment.

Recently, many studies have been conducted to assess the impact of the Universal Primary Education policy, that is part of the Millennium Development Goals by the United Nations, to increase education access and quality around the world from 1970s to early 2000s. Nishimura et al. (2019), estimated the impact of UPE on overall educational attainment and delayed-enrolment rates at primary education level in Uganda. The UPE policy seems to have decreased delayed enrolment in primary school and achieved higher educational attainment at least up to grade 4 for boys and grade 5 for girls in primary education. As a result, the UPE policy has positive impacts on the poor, especially girls, in improving their access to school. Asankha and Takashi (2011) also examined the educational landscape of Uganda but investigated the effect of USE (Universal Secondary Education) policy on secondary education. They found that that USE policy has increased the student enrollments of public secondary schools in Uganda, particularly for girls from poorer households. Both findings strengthen the first hypothesis regarding the positive relationship between policy and school enrolment and justify that it can be fruitful to investigate primary and secondary education separately.

Moussa and Omoeva (2022) examined the long-term effects of UPE on Ethiopia, Malawi and provided evidence that the UPE policies implemented in these countries have increased educational attainment and lowered negative adolescent outcomes such as early marriage. Specifically for Malawi, the authors found

that employment shifts away from the informal sector to primary education, showing potential interaction effects between education and unemployment. Aromolaran (2006) investigated the impact of the free universal basic education program introduced by the Nigerian government in 1999 on schooling. He examined the relationship between primary and secondary enrolment rates and private returns to schooling and found that the decline in schooling returns estimates might have accounted for the decline in enrolment rates in Nigeria around 1999. With this finding, he pointed out that increasing public spending to increase enrolment rates is only justifiable when these investments also yield higher private returns.

Sifuna (2007) shows how the UPE affected education quality from 1970s to early 2000s in Kenya and Tanzania. The results indicate that that even though the policy has increased enrolment rates in these countries, the quality and performance of education and the students seemed to stagnate or even decline. This provides more insight into the consequences of policymaking, that even though the enrolment rates might increase the overall quality of education can suffer from it.

2.2 Gender Inequality

Similarly, gender equality has also been targeted by various policies and many academics have examined the effectiveness of these policies regarding gender inequality reduction.

Debusscher and Ansoms (2013) reviewed Rwanda's gender equality commitments and its transformative potential. They concluded that transformative potential of gender inequality policies in Rwanda was limited, which can be attributed to several factors. One of the main reasons is that when achieving policy goals, economic growth is often valued at a much greater extent than gender inequality. The authors give the example of women who must match the relevant skills and industry requirements to contribute to the society, placing the emphasis more on economic effectiveness rather than providing equal rights to men and women. Another reason that gender inequality policies might not always reduce gender inequality, according to Debusscher and Ansoms (2013) is that those policies are set up to be formalistic to attract donors and funding rather than having concrete plans to transform gender relations.

Goetz (1998) discusses institutional changes which can enhance women's participation in politics and development decision-making, drawing on evidence from Uganda and South Africa. The authors make a clear distinction between the presence of a woman in the parliament, compared to her actual voice being heard and valued. Thus, Goetz (1998) thinks that it is not about women's capacity to participate in politics and influence decision- making, but the degree to which it promotes and implements policies on social equality. One of the biggest achievements of gender-sensitive development policies in Uganda and South Africa, is that violence in gender relations has become a development and justice issue, rather than a private

matter. This illustrates that women have politicized an issue which their male counterparts have, historically, failed to take as seriously as women do (Goetz, 1998).

Pascall and Lewis (2004) address implications for gender equality and gender policy at European and national levels of transformations in family, economy, and politics. Based on their analysis, they conclude that policies directed at paid work have been remarkably successful in most European countries, given that they increased women's access to income and more voice in personal relationships and public politics. Policies enabling individual women to achieve equality with individual men – policies against sex discrimination, for parental leave, for equal opportunities – have brought women into the labor market and supported their ability to care for children (Pascall and Lewis, 2004). It remains a challenge to formulate gender policies on a household-level as some women might deliberately choose for staying at home and taking care of children, and many families in European countries differ in ethnic, religious, and personal aspects.

2.3 Belt and Road Initiative

As touched upon earlier, the existing academic literature on BRI is mostly built on its effect on economic outcomes. Soyres et al. (2018) investigated the direct effect of BRI on trade time and trade costs and found that the average reduction in global shipment time will range between 1.2 and 2.5 percent, leading to reduction of aggregate trade costs between 1.1 and 2.2 percent. For Belt and Road economies, the change in shipment times and trade costs will range between 1.7 and 3.2 percent and 1.5 and 2.8 percent, respectively. Belt and Road economies located along the corridors where projects are built experience the largest gains (Soyres et al., 2018).

Hurley et al. (2019) assess the likelihood of debt problems in 68 countries identified as potential BRI borrowers, and whether BRI raises the risk of debt distress in these participating countries. According to their analysis, 8 countries out of their total sample are likely to suffer from debt distress measured by the Debt/GDP ratio and relative Chinese debt. Even though there is unlikely to be wide-scale debt problems for the BRI, the authors recommend the World Bank and Multilateral Development Banks to work with the Chinese government regarding lending standards, specifically Paris Club and G20.

Du and Zhang (2018) analyzed the impact of BRI on overseas direct investment by China and found that China's cross-border acquisitions rose significantly in the land-based belt-road countries. They also made a distinction between State Owned and non-State-Owned Enterprises, while both acquired significantly more

companies in the land-based BRI countries after the announcement of BRI, State Owned Enterprises focused more on target firms in infrastructure sectors compared to non-State-Owned Enterprises.

Ascensão et al (2018) point out the importance of the environmental effects of BRI and emphasize that all environmental impacts should strategically be addressed before the project begins, as they state that environmental-friendly projects benefit local communities and agriculture significantly more. Rafique et al. (2022) provide insights on how to develop a secure supply of renewable energy while meeting the increasing energy demand for countries along BRI. Next to the importance of increasing financial investments into low-carbon energies and having efficient regulations for the shift towards renewable energy, they also mention how a lack of woman empowerment in the main layers of the society may delay the implementation of environmental plans, and the shift towards renewables (Rafique et al, 2022). This finding shows that gender equality not only benefits economic growth but is also a driver for the transition to renewable energy, illustrating that gender inequality has far-reaching positive externalities.

The strategic and political aspects of the BRI have also been addressed by researchers, such as Clarke (2017) and He (2019). Clarke (2017) discusses the potential strategic motives of China behind the BRI and considers it to achieve domestic security and economic development in a manner that minimizes the risk of a U.S. counterreaction. He also touches upon how the BRI can allow China to extend its influence and power beyond its borders, especially in unstable regions as it can act as a threat to the interests and sovereignty of those countries. He (2019) states that many BRI routes over land can reduce China's reliance on its current maritime routes, where other naval powers such as the US have a large and dominant presence. He (2019) also considers the negative effects of the fact that regions are politically volatile, as there can be security concerns and an elevated level of uncertainty that can lead to high unexpected costs.

Only a handful of studies have mentioned BRI considering non-economical outcomes. Including the Belt and Road in the UN sustainable development agenda can create mutual positive synergies (Lewis et al., 2021). Their work is relevant in the context of this research as it is one of the first studies that connect BRI with various societal outcomes. The authors think that the realization of synergies depends on several variables, ranging from geopolitical to investment strategies and requires openness from all the parties involved in BRI. This finding also justifies the project by EAPD, where BRI is connected with SDGs and their synergies are optimized in the participating countries. This research will attempt to shed light on whether BRI positively influences education and gender inequality in the participating countries and more importantly, to quantify the effects of BRI on societal outcomes for which the entire process will be explained in the following sections.

3 DATA

In this section, the different data sources, and variables necessary to examine the effect of BRI on social indicators of the participating countries will be discussed in detail. First, there needs to be a definite list of participating countries for assigning the treatment and control groups, which will be used to serve as the main explanatory variable. To decide which countries should be defined as participating countries, several steps have been taken to ensure that these countries have the highest likelihood of experiencing a change in either enrolment or gender inequality caused by the initiative.

A recent list of countries participating in BRI can be extracted from the Green Finance and Development Centre (part of Fudan University), with information provided by the Belt and Road Portal that is operated by the Chinese Government. In March 2022, the number of countries that have joined the Belt and Road Initiative (BRI) by signing a Memorandum of Understanding (MoU) with China is 147[15]. The decision to participate in the BRI is made by individual countries, based on their own assessment of the potential benefits and risks associated with joining the initiative. This is because by signing a MoU or cooperation agreement, countries can officially join the initiative (Sacks, 2021).

However, the list compiles the total number of countries that have joined the initiative and includes countries that signed the MoU in different periods. To establish a distinct cutoff year that enables the definition of pre- and post-years with clarity, the 147 countries need to be reduced. Based on previous academic papers, Bao et al. (2022), Ashraf et al. (2022), and Jiang et al. (2021) all have a different number of participating countries, ranging from 35 participating countries used in Bao et al. (2022) to 86 participating countries recognized by Ashraf et al. (2022), which might be explained by their nature of research, specific research question and their observed time period. This paper decides to take the 56 participating countries used in the analysis by Li et al. (2020) as it is an average of all the papers where the authors also measure an indirect effect of the initiative. Li et al. (2020) stated that 56 countries participating in BRI in early 2013 are considered part of the initiative, the authors state that they extracted this information from the official website of BRI (Belt and Road Portal). As a robustness test, countries that join the initiative after 2013 will be entirely removed from the sample. However, for the main analysis, the countries that have not joined in 2013 are able to join the control group. As another robustness check, the 35 countries by Bao et al. (2022) will also be examined regarding the development of school enrolment and gender inequality. The impact of BRI on enrollment and gender inequality are also likely to only form over time, by using a concise and limited list of participating countries at the start of the initiative only ensures

[15] https://greenfdc.org/countries-of-the-belt-and-road-initiative-bri/

that there is a higher chance to observe the effect of interest. However, using too few treated countries in the analysis might not capture the whole impact of the policy on education and enrolment, hence the 56 countries by Li et al. (2020) is considered as average and will be used until further notice.

3.1 Definition of dependent variables

Below, the dependent variables that will quantify the social impact of BRI need to be thoroughly discussed. The school enrolment indicators are extracted from the World Development Indicators databases operated by the World Bank. The Gender Inequality Index is extracted from the United Nations Development Program, which publishes yearly reports to keep track of changes in Gender Inequality for all countries. In the following section, each of the dependent variables will be dissected and looked at with respect to its internal mechanisms and definitions.

3.1.1 School enrolment

Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music (World Bank Data, 2020). Secondary education completes the provision of basic education that began at the primary level and aims at laying the foundations for lifelong learning and human development, by offering a more subject- or skill-oriented curriculum using more specialized teachers (World Bank Data, 2020). There are two measures for school enrolment, gross school enrolment ratio and net school enrolment ratio. Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown which can vary across countries (World Bank Data, 2020). In addition, the net enrolment rate excludes students not in this age group (under- and overage students). This also explains why gross school enrolment ratios can surpass 100% as it may reflect a substantial number of students outside the corresponding age group, which can be caused by repetition or late entry. This research deliberately chooses for gross enrolment, as the age of the students is not relevant. In addition, the effect of the initiative on enrolment indicators should not be limited to an age group as overage students going to school after the initiative is also a desirable effect.

The two enrollment ratios are collected for primary and secondary schools of all countries and is calculated by dividing the number of students enrolled in primary/secondary education regardless of age/ within the corresponding age by the population of the age group which officially corresponds to primary/secondary education and multiplying by 100. In case an academic school year spans to calendar years, the reference year refers to the year in which the school year ended. Hence, it clarifies which year is being referred to when the school year does not align with the calendar year.

Data on education is collected by the UNESCO Institute for Statistics from official annual education survey responses. World Bank states that all the data are mapped to the International Standard Classification of Education (ISCED) to ensure the comparability of education programs at the international level (World Bank Data, 2020). By using a single source for population data, the World Bank can ensure that everyone is using the same definitions, estimations, and methods to calculate population numbers. Therefore, having a consistent data source across countries helps to make the population data more reliable and comparable, hence the World Bank is the preferred data source regarding national data.

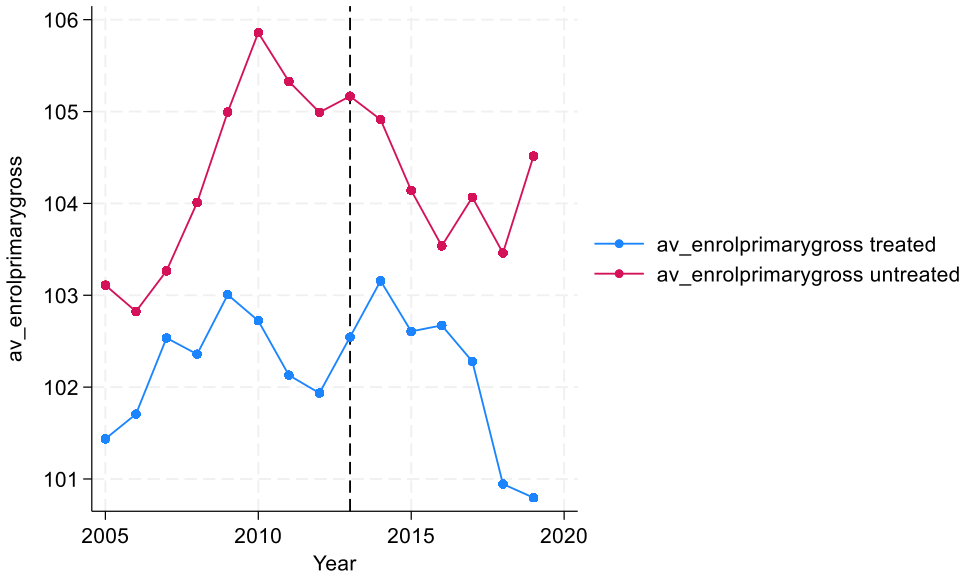

Figure 1. *Graph of average gross primary school enrolment % for treated and untreated countries from 2005-2019.*

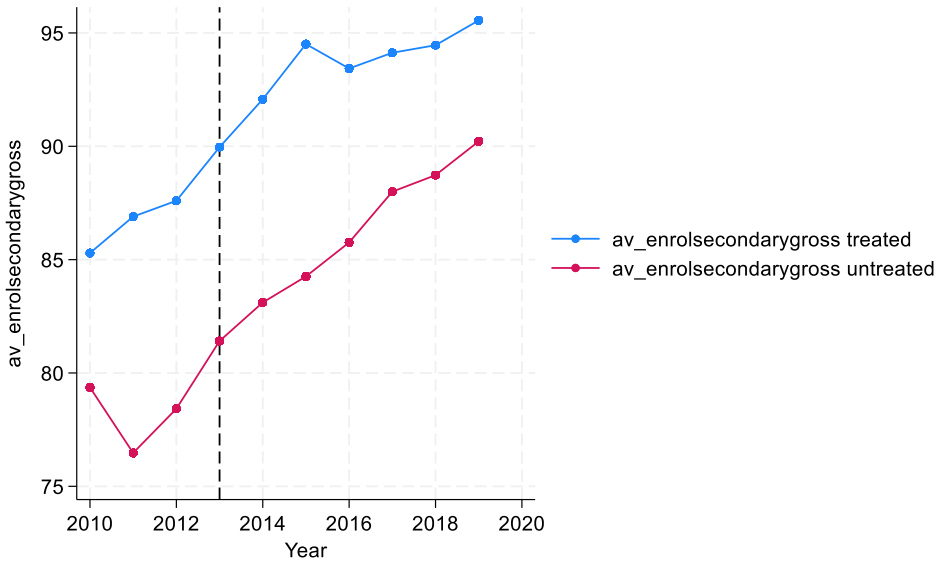

Figure 2. *Graph of average gross secondary school enrolment % for treated and untreated countries from 2005-2019.*

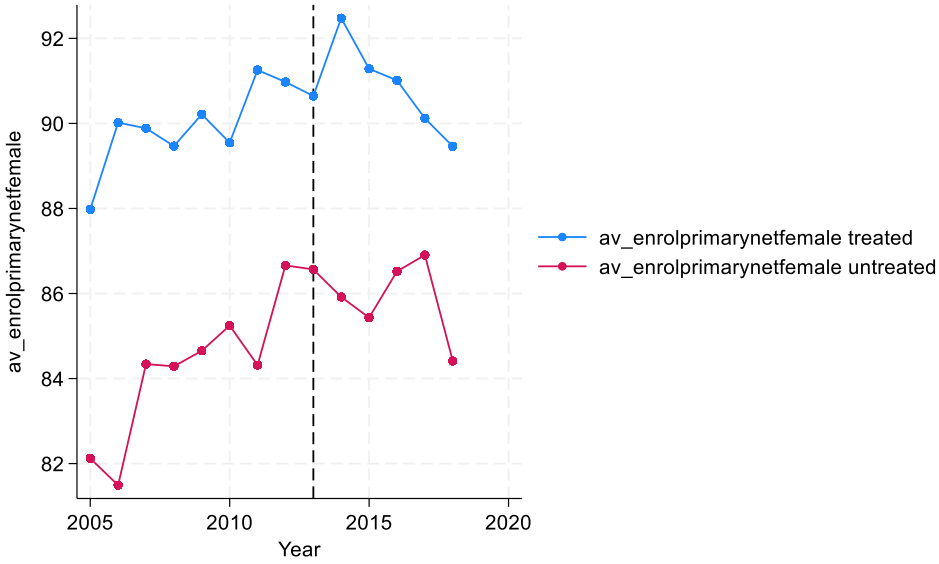

Figure 3. *Graph of average net female primary school enrolment % for treated and untreated countries from 2005-2018.*

According to figures 1, 2 and 3, the pre-trends of the average enrolment rates for the treated compared to the untreated countries show similar patterns. Compared to the pre-trends of these variables, the net enrolment ratios for primary, secondary, and secondary female are excluded as their pre-trends diverge significantly more than the variables represented in the figures. Hence, the gross primary and secondary enrolment rates with the net female primary enrolment rates will be used as dependent variables further in the analysis.

3.1.2. Gender Inequality Index

In the research[16] conducted by the British Embassy in China regarding the relationship between BRI and Gender Inequality, they touched upon the Gender Inequality Index (GII) measure that can be used to monitor Gender Inequality. Therefore, in this research this specific measure will be used for estimating the effect of BRI on Gender Inequality. For data on gender inequality, The United Nations Development Program publishes yearly data concerning the gender inequality index (GII) from 1990 to 2020 for every country. GII is a composite metric of gender inequality using three dimensions: reproductive health, empowerment, and the labor market[17]. The reproductive health dimension consists of maternal mortality ratio and the adolescent birth rate indicators. The empowerment dimension consists out of female and male population with at least secondary education and female and male shares of parliamentary seats. The labor market dimension (LFPR) is indicated by female and male labor force participation rates. Each of the indicators containing information regarding female/male empowerment is related to their respective dimension indexes.

There are several steps that need to be taken to calculate the GII, which has been set out in the Appendix (Human Development Reports, n.d.). According to the Data Center of Human Development Reports (n.d.), GII values are computed using the association-sensitive inequality measure suggested by Seth (2009). In the research by Seth (2009), the indicators for each dimension are first averaged using a geometric mean separately for women and men (Gf and Gm). Next, these means are aggregated using a harmonic mean, which is specifically suited for the averaging of ratios to arrive at the equally distributed gender index (HARM (Gf, Gm)). Thereafter, the geometric mean of the arithmetic means for each indicator is calculated (Gf,m). As a result, one minus the equally distributed gender index divided by the geometric mean yields the Gender Inequality Index. This measure by Seth (2019) is designed to build a gender inequality measure

[16] https://www.britishcouncil.cn/en/programmes/society/BRI
[17] https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indicies/GII

that is not only the sum of inequalities of different dimensions, but also allows for interplay between these dimensions.

$$HARM(G_F, G_M) = [\frac{(G_F)^{-1} + (G_M)^{-1}}{2}]^{-1}$$

$$G_{F,M=}\sqrt[3]{Health * Empowerment * LFPR}$$

$$GII = 1 - \frac{HARM(G_F\ , G_M\ )}{G_{F,M}}$$

Table 1. *Gender Inequality Index*

Dimension	**Health**		**Empowerment**		**Labor market**	
Indicators	Maternal mortality ratio	Adolescent birth rate	Female and male population with at least secondary education	Female and male shares of parliamentary seats	Female and male labor force participation rates	
Dimension Index	Female reproductive health index		Female empowerment index	Female labor market index	Male empowerment index	Male labor market index
Index	Female Gender Index				Male Gender Index	
Gender Inequality Index (GII)						

A low GII value indicates low inequality between women and men and vice-versa. It ranges from 0, where women and men are considered equal to 1, where one gender significantly lacks in all measured dimensions. The GII shows the loss in potential human development due to inequality between female and male achievements in these dimensions. This makes the index well suited for examining the gender-related impacts of the BRI by measuring gender disparities in participating countries as it provides a standardized measure that allows for cross-country comparisons of gender inequality.

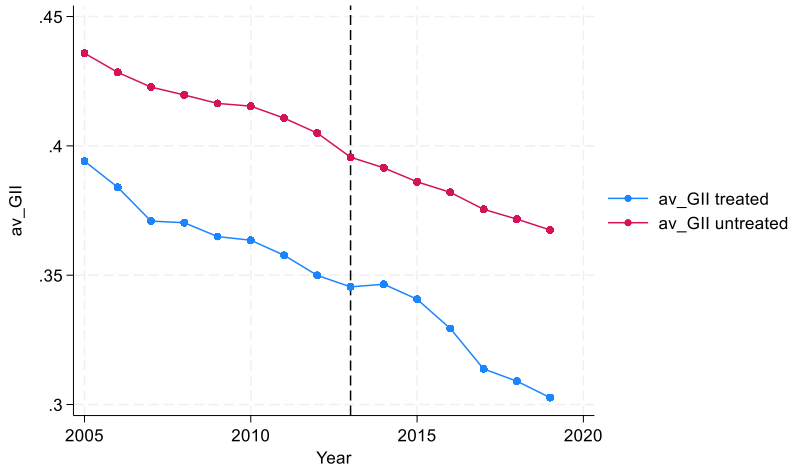

Figure 4. *Graph of average Gender Inequality Index for treated and untreated countries from 2005-2019*

Based on Figure 4, both the average GII for treated and untreated countries show parallel trends before the announcement year of BRI, whereas after 2013, the GII of the treated countries decrease more compared to the untreated countries. As this is a visual representation of raw data, the parallel trends will formally be tested in section 4.2. In table 2, the main variables are stated with their respective source and definitions to maintain clarity and comprehensiveness throughout the research.

Table 2. *Key variables and definitions*

Variable	*Source*	*Definitions*
Participating Countries	Li, T., Shi, H., Yang, Z., & Ren, Y. (2020) / Belt and Road Portal	Countries that are officially part of the Belt Road Initiative as widely regarded by academic researchers
Enrolment Ratios	World Bank	Gross/net Primary and Secondary (female) school enrolment ratios of all countries in the world
Gender Inequality Index	Human Development Reports	Composite metric of gender inequality using three dimensions of gender equality (0 to 1)

Human Development Index (HDI)	Human Development Reports	Summary measure of average achievement in key dimensions of human development (0 to 1)
Gender Development Index	Human Development Reports	Ratio of female to male HDI values
(ln) GDP (per capita)	World Bank	(Logarithmic) GDP in dollars (per capita)
Access to electricity	World Bank	Access to electricity is the percentage of population with access to electricity
Population	World Bank	Total Population in numbers
Unemployment	International Labor Organization	Modeled estimates of the share of the labor force that is without work but available for and seeking employment.

The control variables are population, GDP per capita, unemployment, the Human Development Index, and Access to electricity. Population counts all residents regardless of legal status or citizenship. GDP per capita is defined as the ratio of the sum of gross value added by all residents over the midyear population, which approximates the population size at the middle of the year. Unemployment is the ratio of residents without or looking for unemployment over the total workforce, which is a modeled estimate projected by the International Labor Organization. Access to electricity is the percentage of population with access to electricity, with electrification data mostly collected by surveys. All the definitions of the variables are taken from World Bank Data[18]. Lastly, the Human Development Index is taken from the United Nations Development Reports and indicates the average achievement in key dimensions of human development. Like the Gender Inequality Index, it calculates the geometric mean across dimensions measuring life expectancy, years of schooling, and gross national income per capita. This definition can be found in an elaborate manner on the official page of the United Nations Development Program (2023). It is important to note that all data extracted from The World Bank database ranges from 1970 to 2021, whereas the indexes extracted from the Human Development Reports range from 1990 to 2021. The motivation of selecting these control variables can be found in the methodology section.

[18] https://data.worldbank.org/

3.2 Descriptive Statistics

Taken from the descriptive statistics, there are 10,608 observations in total. The total amount of countries adds up to 204 due to regions such as St Martin (French Part) and Macau SAR China having their own specific data in the World Bank database but are officially not recognized as independent countries. This allows for better comparability between smaller countries as they can potentially be matched with these regions during propensity score matching. The range between the minimum and maximum school enrolment ratios is substantial and indicates a great variability between different time periods and countries. The mean of primary gross school enrolment ratios is close to 100%, meaning that the average enrolment ratios across countries and time is close to full capacity of the primary education system. Over time and across different countries, the secondary gross school enrolment ratios, in comparison to primary school, typically achieve only 66% of their maximum capacity. When neglecting the over- and underage students, 85% of the full primary education capacity is reached on average over time and across countries. The net secondary school enrolment is similar to its gross counterpart. The percentage of net female primary school enrolment refers to the ratio of female children of official school age who are enrolled in primary school, compared to the population of female children of the corresponding official school age. When only looking at female students enrolling in primary and secondary education, the net enrolment ratios show that on average over time and across countries 85% and 65%, respectively, is enrolled compared to their official age group.

Unemployment shows an average of 8% of the labor force without work or searching for employment over time and across countries, ranging from 1% to 39%. For the indexes, HDI and GII also vary significantly over time and across countries. HDI has an average of 0.67 indicating that on average over time and across countries there is medium human development (according to the Human Development Report (n.d.), a HDI between 0.550–0.699 is defined as medium). GII has an average of 0.41 over time and across countries suggesting that there are still significant gender disparities and inequities present, which depends on the country as it can range from 0.013 to 0.822 in this dataset. Lastly, the access to electricity measure shows that roughly 80% of the total population of countries over time have access to electricity, ranging from 53% to 100% across countries over time.

Table 3. *Descriptive Statistics*

Variable	Obs	Mean	Std. dev.	Min	Max
		Dependent variables			
Primary School Enrolment (% gross)	7,798	97.46526	21.95265	2.83066	221.8482
Secondary School Enrolment (% gross)	6,481	65.95118	34.49784	0.18674	166.1359
Primary School Enrolment (% net)	4,271	85.00006	17.27842	10.0546	100
Secondary School Enrolment (% net)	2,729	65.45728	26.92459	0.09823	99.91164
Primary School Enrolment Female (% net)	3,156	80.51399	20.21579	4.90081	99.98995
Secondary School Enrolment Female (% net)	2,589	66.15061	27.87944	0.0517	100
Gender Inequality Index	4,889	.4133915	.1990313	0.013	0.822
		Control variables			
Unemployment (%)	5,671	8.051187	6.025789	0.1	38.8
Access to electricity (%)	5,531	80.1392	30.02799	.5338985	100
Population	10,608	2.81e+07	1.13e+08	5802	1.41E+09
GDPpercapita	8,973	9556.522	18319.08	20.03866	234315.5
Human Development Index	5,553	.6699512	.1648056	0.216	0.962
		Other variables			
lnGDP	8,973	23.17127	2.507602	15.99304	30.78012
Countries	10,608			1	204
Year	10,608	1995	15	1970	2021
GDP	8,973	2.10E+11	1.06E+12	8824448	2.33E+13
Gender Development Index	4,876	.9213981	.0828593	0.485	1.072
BRI	10,608	.2696078	.443777	0	1
Postyear	10,608	.1730769	.3783316	0	1

4 METHODOLOGY

To investigate the impact of the Belt and Road Initiative (BRI) on social indicators such as unemployment, school enrolment, and gender equality, the difference-in-differences (DID) analysis will be used on panel data with fixed effects. This type of analysis has been used before in the context of policy changes, particularly with the Belt and Road Initiative. Bao et al. (2022) used Propensity Score Matching (PSM)-Difference in Difference (DID) approach to evaluate the impact of BRI on external debts of participating countries. To quantitatively examine the effects of the BRI policy initiative on Chinese outward mergers and acquisitions, Du & Zhang (2018) have employed a Difference-in-Differences setting to estimate this effect. In establishing the impact of BRI on green economic growth, Jiang et al. (2021) combined a difference in difference model with propensity score matching and found convincing evidence in support of energy-saving and emissions-reduction effects.

DID (Difference in Difference) is a quasi-experimental design that makes use of panel data from treatment and control groups to obtain an appropriate counterfactual to estimate a causal effect. This type of analysis can be used to estimate the effect of a specific intervention/policy by comparing changes in outcomes over time between the treatment group and control group. In the context of the BRI, it can compare changes in social indicators over time between countries that have been exposed to the BRI and those that are not part of the BRI. By comparing changes in the treatment group before and after the introduction of the BRI with changes in the control group over the same period, we can estimate the (causal) effect of the BRI on social indicators, hence derive the impact of BRI on our dependent variables of interest.

For the DID approach with country and yearly fixed effects, the basic regression model is as follows:

$$Y\_it = \alpha + Country\ Fixed\ Effects + Yearly\ Fixed\ Effects + \gamma * i.BRI\ x\ i.Post\_t + \varepsilon\_it$$

Where *Y_it* represents the outcome variable of interest (e.g., school enrolment, gender equality) for country i in year t. *BRI_i* is a binary variable indicating whether country i is part of the Belt and Road Initiative (BRI=1) or not (BRI=0). *Post_t* is a binary variable indicating whether the observation is in the post-intervention period (Post=1) or the pre-intervention period (Post=0). The DID estimate of the BRI effect is obtained by taking the difference-in-differences coefficient γ, which represents the average treatment effect of the BRI on the outcome variable.

Fixed effects models are often applied to panel data, where it can control for unobserved heterogeneity or time-invariant characteristics specific to each country. By including country fixed effects, the issue of time-invariant unobserved factors that might influence enrollment and gender inequality across countries can be captured. Similarly, yearly fixed effects can capture time-specific factors affecting all countries equally but

might vary over time, hence controlling for time-specific shocks and trends. In addition, the DID method can capture the time varying observed factors, hence only the strict exogeneity assumption is left which will be tested by examining parallel trends.

The control group will be selected by using the Propensity Score Matching method (PSM). The selection of the control group is important to ensure that any differences in social indicators between the treatment and control groups prior to the introduction of the BRI are due to factors other than the BRI. Propensity score matching (PSM) is a quasi-experimental method in which statistical techniques are used to construct an artificial control group by matching each treated unit with a non-treated unit of similar characteristics[19]. The control group must be matched on a set of observable characteristics related to the participating countries and the outcome variables. By including countries with similar characteristics to the experimental group in the control group through a PSM stage, the PSM-DID model can produce more reliable results than the standard DID system (Bao et al., 2022).

Using the following regression equations, the hypotheses will be tested. The inclusion of population, GDP per capita and unemployment is based on existing academic literature on the impact of BRI (Bao et al, (2022), Jiang et al. (2021)). Controlling for population helps account for the size and demographic composition of the participating countries. Including GDP per capita as a control variable captures the economic development and overall wealth of the participating countries. Unemployment controls for labor market conditions within the participating countries. These are used to ensure that any observed differences in gender inequality and school enrolment between BRI and non-BRI countries can more likely be attributed to the initiative, rather than underlying economic differences. In general, using access to electricity as a control variable captures the infrastructure and energy availability in the participating countries. HDI can account for overall development trends and help to understand gender disparities, as it can capture structural factors that might influence both BRI and the outcome variables.

Finally, including access to electricity can cover the impact of energy infrastructure and its potential influence on GII and school enrolment. Previous research by Alam et al. (2018) has shown that access to electricity has a positive and long-lasting effect on labor productivity and living standards.

[19] https://dimewiki.worldbank.org/Propensity_Score_Matching#:~:text=Propensity%20score%20matching%20(PSM)%20is,the%20impact%20of%20an%20intervention.

Hence, including all five variables controls for the socio-economic, developmental, demographic, and economic factors to isolate the effect of BRI on GII and school enrolment. For consistency, the control variables remain unchanged in both regressions.

$$\textit{Enrolment} = \alpha + \textit{Country Fixed Effects} + \textit{Yearly Fixed Effects} + \beta 1 * \text{Population} + \beta 2 * \text{GDP per capita} + \beta 3\ \text{Unemployment} + \beta 4 * \text{HDI} + \beta 5 * \text{Access to electricity} + \gamma * (\text{BRI\_i x Post\_t}) + \varepsilon\_it$$

$$\textit{Gender Inequality} = \alpha + \textit{Country Fixed Effects} + \textit{Yearly Fixed Effects} + \beta 1 * \text{Population} + \beta 2 * \text{GDP per capita} + \beta 3\ \text{Unemployment} + \beta 4 * \text{HDI} + \beta 5 * \text{Access to electricity} + \gamma * (\text{BRI\_i x Post\_t}) + \varepsilon\_it$$

4.1 Propensity score matching

The observable characteristics are based on existing academic literature combined with this research's own insights. Jiang et al. (2021) selected these characteristics based on the relevancy to the relationship between BRI and green economic growth and used the total population, urbanization, GDP per capita, labor force, energy structure and FDI. Bao et al. (2022) used economic size, GNI, export value index, population growth rate, lnGDP (Logarithm of GDP), CPI, balance of payments, FDI, rural population proportion and per capita energy consumption as matching criteria to create a control group for their DiD model that examines the relationship between BRI and the debt in participating countries. In the paper by Li et al. (2020), they examined the impact of BRI on the tourism industry and used passengers by air transport, population, urban population, and lnGDP as characteristic variables.

For this paper, lnGDP, Population, Unemployment, Gender Development Index and Access to electricity are used as observable characteristics of creating a control group using PSM. The selection of lnGDP and population is largely based on previous academic literature as it is widely regarded to reduce the sample size in an appropriate manner based on the economic status and the size of a country. Unemployment is chosen as a covariate, as it can indicate economic stability, which has a considerable effect on families investing in education and opportunities for women in the labor force. In addition, countries will share similar job availability and competition, hence providing a more similar landscape to investigate the impact of BRI on societal outcomes. By including GDI as a covariate, gender-related aspects of development and inequality is incorporated in the matching process which means that the control group will adequately represent the treated group in terms of gender differences. Lastly, access to electricity is also included as a covariate because it gives a good indication of the socioeconomic development of a country and the infrastructure. In addition, electricity is also linked to the use of modern technology, such as the use of mobile phones, and increases learning opportunities and access to information.

As PSM needs to be applied in one year to ensure that the treatment and control groups do not change, 2012 is chosen as the period where the countries are matched to each other. The matching process is carried out by comparing the estimated propensity scores of the treated and control units. It ensures that each treated country is matched with a single control country within a specified caliper width of 0.05. This interval denotes the maximum distance allowed for matching between treated and control units based on the observable characteristics and STATA. Observations within this caliper width will be considered as potential matches. The resulting matched sample can be used to estimate the (causal) effect of the BRI on education and gender inequality.

Table 4. PSM sensitivity analysis with different number of neighbors on the DID coefficients.

γ * DiD for	N=1	N=3	N=5
Primary school enrolment rate gross%	-1.885058	-1.045659	-1.340065
Secondary school enrolment rate gross%	-5.67302***	-5.050927**	-4.973616***
Female school enrolment rate net%	.5025766	-.0450503	-.2851833
Gender Inequality Index	-.0040923	-.0033844	-.0043721

Fixed Caliper width = 0.05, *** p < 0.01, ** p < 0.05, *p<0.10.

Table 5. PSM sensitivity analysis with different caliper widths on the DID coefficients.

γ * DiD for	Caliper=0.05	Caliper=0.25	Caliper=0.45
Primary school enrolment rate gross%	-1.885058	-1.317248	-1.374534
Secondary school enrolment rate gross%	-5.67302***	-5.039677**	-5.260515***
Female school enrolment rate net%	.5025766	.5325914	.538452
Gender Inequality Index	-.0040923	-.0036143	-.0031276

Fixed Neighbors = 1, *** p < 0.01, ** p < 0.05, * p<0.10.

The sensitivity analysis above shows how the coefficient of the treatment effect changes when adjusting the control group through the number of neighbors and caliper widths. When relaxing the criteria for PSM, either through more nearest neighbors or allowing a greater caliper width, the number of observations automatically increases. As can be seen from the table, most of the coefficients of DiD act similarly regardless of the variation in PSM. Notable takeaways include the change in sign of the treatment effect on female school enrolment net rate when allowing more matched neighbors. This indicates that by introducing greater heterogeneity in the control group, the initiative creates a negative effect on the female school enrolment net rate, making the treatment effect on female school enrolment highly volatile. Apart from the female school enrolment rates, most coefficients decrease in magnitude after increasing the number of neighbors and caliper width, this can be referred to as the dilution effect.

In Figure 5, the propensity scores based on the five covariates of the treated countries according to Li et al. (2020) and the untreated countries before PSM, are mapped against each other. The red dotted line is for the control group and the blue continuous line is for the treated group. The differences in the propensity score distribution before matching is substantial, indicating notable disparities between the treated and non-treated. This highlights the importance of matching to improve the comparability between these two groups. After matching each treated country to its nearest neighbor with a caliper width of 0.05, the propensity scores of the control group and the treatment group share a similar kernel density as can be seen in figure 6. This indicates that the matching process has been effective in creating comparable pairs of treated and control countries. The similarity in propensity score distribution illustrates that the matched control group provides a more suitable counterfactual for estimating the effect of BRI on the outcome variables. Hence, the results of the regressions are likely to be more accurate with propensity score matching than without.

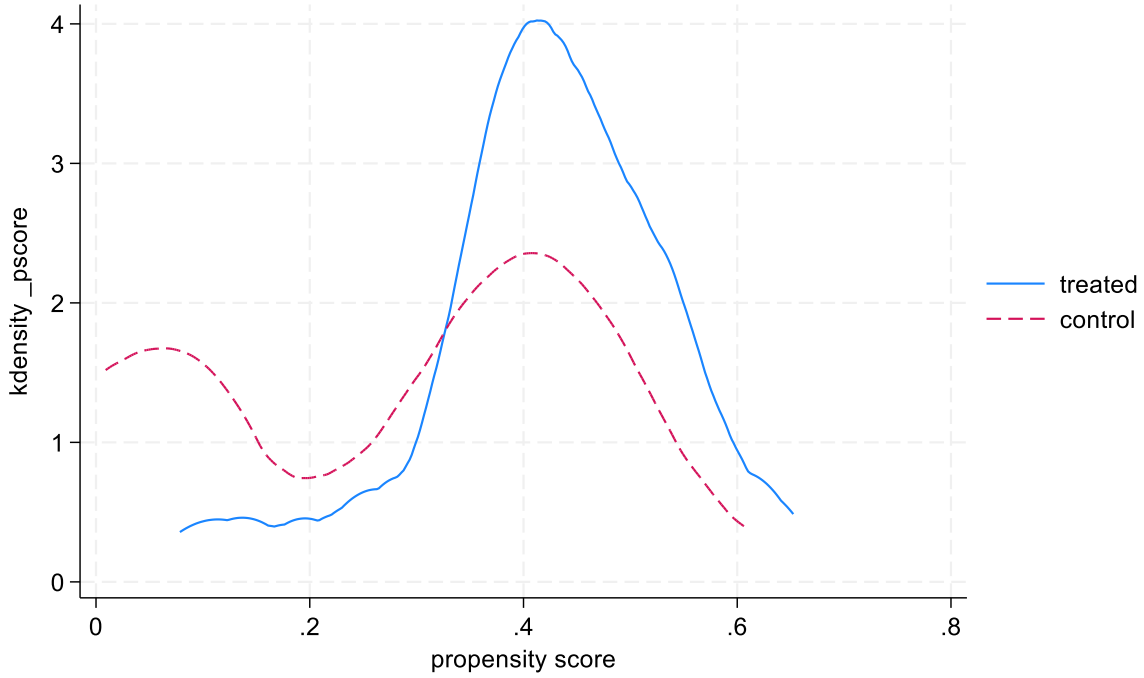

Figure 5. *Graph of propensity scores of treated and control group before matching.*

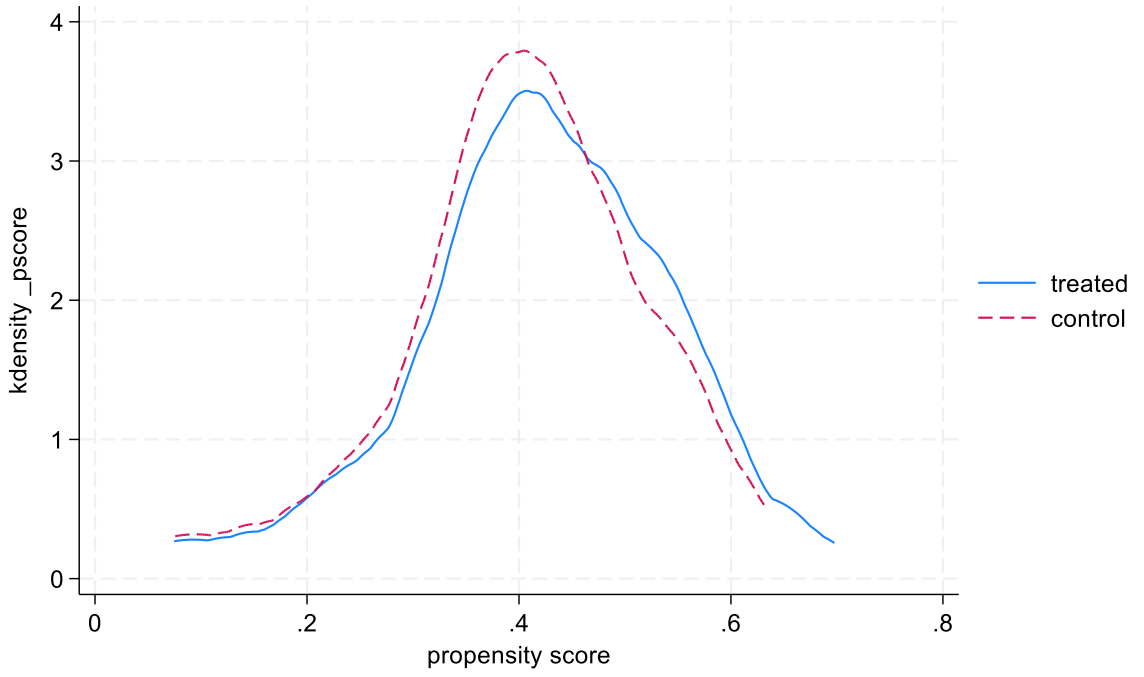

Figure 6. *Graph of propensity scores of treated and control group after matching.*

4.2 Parallel Trends test

The key assumption of using DID method is the parallel trend hypothesis of the treated and control groups before the OBOR initiative was implemented, whether there is a common trend between the two groups of treated and control during the pre-cutoff period. To officially test whether the treatment group and control group share a common growth trend regarding the outcome variables (enrolment and gender inequality), the period 2005–2020 is examined, before the implementation of BRI in 2013 to test this hypothesis.

Table 6. *Coefficient table for primary school enrolment gross % (with PSM) with interaction effects between each year from 2005-2020 with the treatment variable.*

Regression results

PrimarySchoolEnrol ~s	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
BRI_2005	-1.405	1.015	-1.38	.169	-3.419	.609	
BRI_2006	-1.938	1.115	-1.74	.085	-4.152	.276	*
BRI_2007	-1.483	1.263	-1.17	.244	-3.991	1.025	
BRI_2008	-1.688	1.331	-1.27	.208	-4.33	.954	
BRI_2009	-1.64	1.396	-1.17	.243	-4.411	1.132	
BRI_2010	-1.455	1.513	-0.96	.339	-4.458	1.548	
BRI_2011	-2.415	1.658	-1.46	.148	-5.707	.876	
BRI_2012	-2.848	1.674	-1.70	.092	-6.171	.474	*
BRI_2013	-2.889	1.722	-1.68	.097	-6.307	.53	*
BRI_2014	-2.69	1.752	-1.54	.128	-6.167	.788	
BRI_2015	-3.396	1.864	-1.82	.072	-7.097	.304	*
BRI_2016	-3.352	1.95	-1.72	.089	-7.223	.519	*
BRI_2017	-4.145	2.04	-2.03	.045	-8.195	-.096	**
BRI_2018	-4.849	2.114	-2.29	.024	-9.046	-.651	**
BRI_2019	-5.912	2.265	-2.61	.011	-10.41	-1.415	**
BRI_2020	-7.07	2.104	-3.36	.001	-11.247	-2.892	***
BRI_2021	0						
Population	7.22e-09	9.11e-08	0.08	.937	-1.74e-07	1.88e-07	
GDPpercapita	-.0000164	.0000421	-0.39	.698	-.0001001	.0000673	
HumanDevelopmentindex	32.174	15.424	2.09	.04	1.554	62.794	**
Accesstoelectricity	.068	.093	0.74	.463	-.116	.253	
Unemployment	-.077	.1	-0.77	.443	-.276	.122	
Constant	75.23339	12.03597	6.25	0	51.354	99.131	**

Mean dependent var	103.624	SD dependent var	9.310
R-squared	0.055	Number of obs	2239
F-test	1.766	Prob > F	0.036
Akaike crit. (AIC)	14224.341	Bayesian crit. (BIC)	14344.330

**** p<.01, ** p<.05, *p<.10*

By creating interaction effects of each year (dummy year) and the treatment variable (BRI), pre- and post-period, the parallel trends assumption can be formally tested. As seen in table 6, the significance of the interaction effect tends to increase over time which is a finding in favor of the existence of parallel trends based on a significance level of 10%.

The evidence supporting the parallel trends assumption is the strongest for gross primary school enrolment rates. Regarding other dependent variables, there is no compelling evidence that the parallel trends assumption is likely to hold (see Appendix), therefore, the results for these regressions should be addressed with its limitations. As seen in Figure 7, the interaction effects between BRI and the year-dummy variables center around 0 before 2013 for primary school enrolment rate. Once after the announcement of BRI, the coefficients increase in confidence intervals and diverge away from 0 displaying a negative interaction effect. Only for the primary school female enrolment rates (Figure 8), an argument can be made that the parallel trends assumption might also hold, however this cannot be supported by the regression results that interact BRI and year-dummy variables on female enrolment, as the interaction effects do not appear to be significant for any year. The large confidence interval of HDI and the significant non-zero mean is most likely due to it being a continuous measure ranging from 0 to 1, that is not standardized, which causes a greater degree of variability and dispersion in the data. This is not necessarily a problem as the inclusion is solely based on controlling for overall human development and the exact magnitude of the coefficient is not of interest.

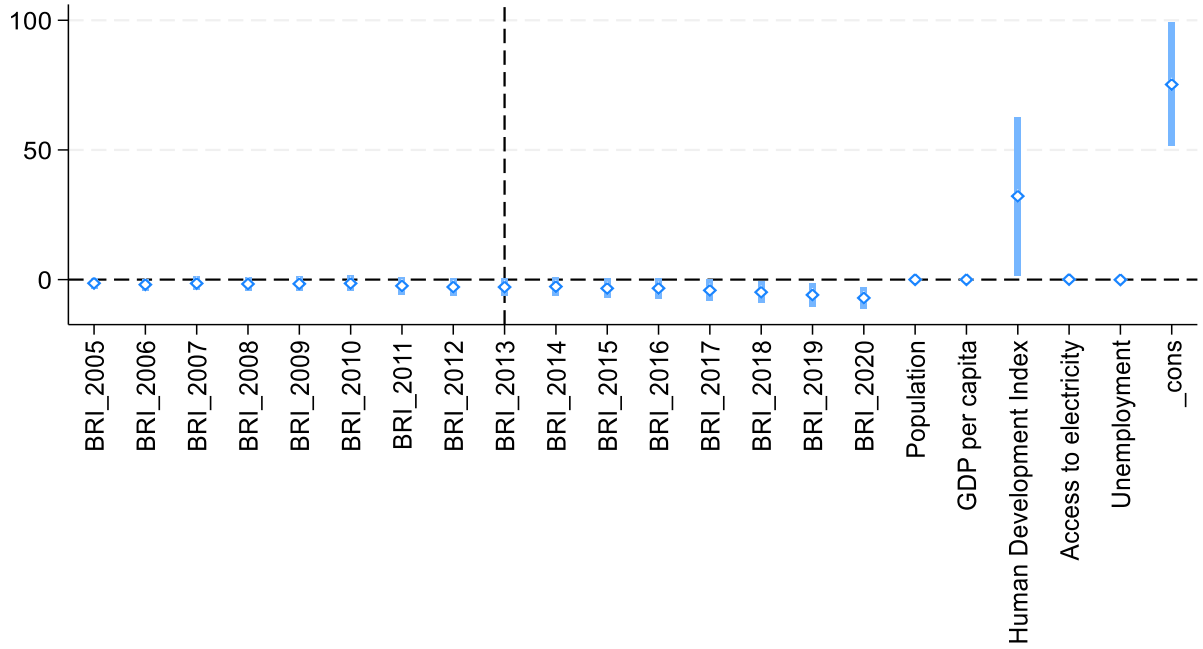

Figure 7. *Primary school enrolment gross rate PSM-DID regression coefplot.*

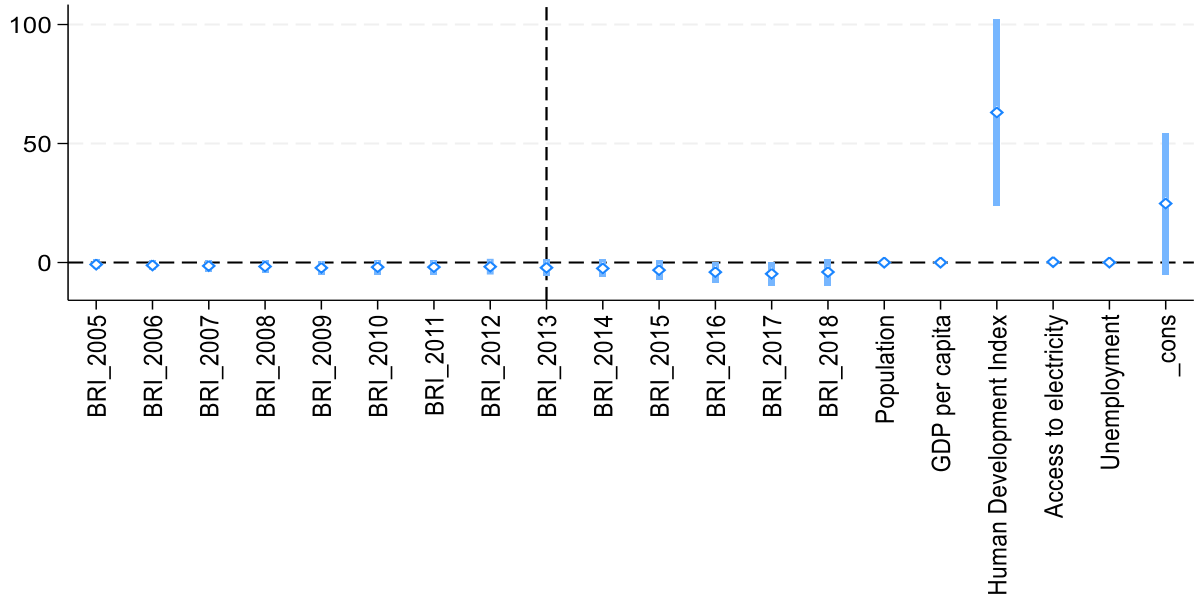

Figure 8. *Primary school enrolment net female rate PSM-DID regression coefplot.*

5 RESULTS

In this section, the findings are discussed for the four main dependent variables that represent the impact of BRI on education and gender inequality. Each table is presented in a progressively more restrictive manner by adding additional variables step by step. Initially, the tables include a limited set of core variables, aiming to capture the basic effect of BRI on the outcome variable. Through the addition of more control variables step by step, the final model incorporates all the relevant control variables in the regression and aims to provide the most comprehensive analysis. In all the tables, the "treatment effect" shows the coefficient that quantifies the impact of BRI on the dependent variable, hence most of the interpretation will be centered around this coefficient. Be aware that due to the violation of parallel trends assumption for GII, secondary school enrolment rates and arguably female school enrolment rates, these results should be interpreted considering its limitations.

Table 7 shows that the BRI has a negative effect on the primary school enrolment gross %, indicating that the primary school enrolment rate has decreased after the initiative has been implemented in the participating countries. For the final propensity score matched model including all the control variables, the coefficient of -2.16 indicates that on average, primary school enrolment gross % decreases by 2.16 percentage points holding other factors in the model fixed when a country is part of the BRI compared to an untreated country after 2013. However, this effect is not significant on a 10% significance level. The final model is also compared to the non-matched counterpart, in which there does seem to be a negative and significant effect of the initiative on primary school enrolment. For the final unmatched model including all the control variables, the coefficient of -4.15 indicates that on average, primary school enrolment gross % decreases by 4.15 percentage points ceteris paribus when a country is part of the BRI compared to an untreated country after 2013. The difference in magnitude and significance of the DiD coefficient between the PSM-DID and classic DID model is noteworthy, because it indicates that the classic model overestimates the effect. When having a similar control group based on relevant characteristics, the negative effect of BRI on primary school enrolment seems to dissipate.

Other notable relationships include the positive and significant effect of HDI on the enrolment ratios, indicating that higher human development is associated with an increase in enrolment ratios. As years of schooling is used as a proxy in HDI, this effect is expected. Regarding unemployment, the coefficient is negative which means that more unemployment is associated with a lower primary school enrolment rate, however this effect is insignificant at a 10% level. For all other control variables, the magnitude of the coefficients and the lack of statistical significance means that the correlation that exists is negligible.

Table 7. *Regression output for primary school enrolment gross % with propensity score matching.*

	Dependent variable: Primary School enrolment gross %					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Unmatched model 5**
Population		1.11e-07	4.46e-08	7.06e-08	4.75e-08	-2.71e-08*
		(6.70e-08)	(9.63e-08)	(9.73e-08)	(1.07e-07)	(1.54e-08)
GDP per capita		-.0002073**	-.0000358	.0000509	.0000757	-.0000876
		(.0000897)	(.0000678)	(.0000616)	(.0000495)	(.0000576)
Unemployment			-.1621078	-.098837	-.0027288	.0829766
			(.1300712)	(.1248593)	(.107831)	(.1067751)
HDI				109.0472***	89.04522 ***	166.7323***
				(29.77898)	(25.68863)	(26.01643)
Access to electricity					.0772345	.062618
					(.0921278)	(.0733411)
Treatment effect	-1.055767	-2.256251	-2.123392	-3.113352*	-1.885058	-4.145127**
	(2.467399)	(2.322007)	(1.771964)	(1.671923)	(1.607141)	(1.567874)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,661	3,661	2,498	2,447	2,238	3,851
Constant	83.92453	83.79989	101.3593	29.79923	35.33049	-5.457031
	(4.989697)	(4.657736)	(2.338433)	(20.10786)	(19.20038)	(15.24422)
R-squared	0.1285	0.1631	0.0367	0.0995	0.0892	0.1955
F-Test	4.06	4.65	1.86	2.18	2.49	3.09
Prob > F	0.000	0.0000	0.0101	0.0016	0.0003	0.0000

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p<0.10$.

Table 8 shows a negative and significant effect of the BRI on secondary school enrolment gross %. For the final propensity score matched model including all the control variables, the coefficient of -4.95 indicates that on average, primary school enrolment gross % decreases by 4.95 percentage points holding all other factors in the model fixed for a BRI country compared to a non-BRI country after 2013. Also, for the unmatched sample, BRI also seems to have a negative and significant effect on secondary school enrolment. Furthermore, unlike primary school enrolment, other variables in the model do influence secondary school enrolment. Based on the regression results, an increase in GDP per capita is associated with lower secondary school enrolment. This finding is counter intuitive as one would suggest that higher GDP per capita means a more advanced economy, hence more individuals would attend secondary school. However, the effect of GDP per capita on secondary school enrolment is exceedingly small, which means it is not significant from

an economical perspective. A higher HDI is associated with higher secondary school enrolment, indicating that countries with better overall human development have higher secondary school enrolment holding other factors in the model fixed. In contrast to primary school enrolment, the more households have access to electricity, the more likely these areas have higher secondary school enrolment rates. Indicating that having more access to electricity is more relevant for secondary school students than primary school students. However due to the lacking evidence in favor of the parallel trends assumption, all these effects should be interpreted with caution.

Table 8. *Regression output for secondary school enrolment gross % with propensity score matching.*

	Dependent variable: Secondary School enrolment gross %					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 5 (unmatched)**
Population		-1.26e-08	1.71e-07	1.78e-07	1.66e-07	-1.65e-08
		(8.37e-08)	(1.18e-07)	(8.97e-08)	(8.09e-08)	(1.06e-08)
GDP per capita		-.0002853***	-.0003907**	-.0002671***	-.0001738**	-.0001034
		(.000076)	(.0001039)	(.000083)	(.0000813)	(.0000666)
Unemployment			-.0087518	.1794247	.1454178	.117775
			(.1635684)	(.1702291)	(.1266723)	(.1073766)
HDI				231.1949***	208.6701 ***	160.2925***
				(35.24691)	(36.08626)	(22.31173)
Access to electricity					.2053079***	.2779714***
					(.0598473)	(.0455799)
Treatment effect	-2.60269	-4.160654	-3.863914	-6.822741 ***	-5.67302***	-3.519527**
	(3.20583)	(3.096436)	(2.650172)	(2.3353)	(2.111568)	(1.389918)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,183	3,183	2,119	2,085	1,943	3,251
Constant	40.39037	42.05888	71.38906	-84.27916	-86.40319	-54.84278
	(1.748543)	(2.060264)	(3.321742)	(23.60908)	(22.40301)	(13.24851)
R-squared	0.6941	0.7061	0.4929	0.5974	0.5958	0.6025
F-Test	23.18	27.13	8.65	18.97	31.44	35.87
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p<0.10.

Table 9 shows that BRI has a positive impact on female school enrolment rate; on average, the coefficient of 0.50 indicates that on average, primary school enrolment gross % increases by 0.50 percentage points holding other factors in the model fixed when a country is part of the BRI compared to an untreated country after 2013, however this effect is insignificant at the 10% significance level. Like the primary school enrolment rate, the control group matters significantly for the estimated interaction effect, with the classic DID model showing a significant and negative effect of the interaction effect on secondary school enrolment.

When using a more representative control group for the treatment countries, the negative effect of the unmatched model disappears and is replaced by a positive but insignificant effect. Again, HDI and Access to Electricity have a positive and significant effect on female primary school enrolment at the 10% significance level. Surprisingly, the coefficient for Population has become negative, indicating that an increase in population has a negative effect on female primary school enrolment rates. If an increase in population is likely to increase overall primary school enrolment, but decreases female primary school enrolment, there is likely to be gender disparity present in the education system. Above all, the results for female primary school enrolment are different than the other dependent variables in the sense that the treatment effect varies when controlling for more factors. As Model 5 should give the most representative and comprehensive idea of the policy effect, it seems that the policy has a positive effect on female primary school enrolment.

Table 9. *Regression output for primary school enrolment female net % with propensity score matching*

	Dependent variable: Primary School enrolment net female %					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 5 (unmatched)**
Population		2.87e-08	-1.59e-08	-2.24e-08	-5.60e-08	3.66e-08
		(6.25e-08)	(1.08e-07)	(1.17e-07)	(1.35e-07)	(4.80e-08)
GDPpercapita		-.0002467**	-.00016	-.000102	-.0000229	-.0001416**
		(.0001014)	(.0000983)	(.000086)	(.0000593)	(.0000668)
Unemployment			-.0329638	.0589292	.0773281	.153022
			(.1268109)	(.1038253)	(.1010181)	(.1097564)
HDI				94.90139 **	81.21883**	184.795***
				(40.48324)	(35.83418)	(34.47858)
Access to electricity					.1938698*	.103513
					(.1148429)	(.0865953)
Treatment effect	-.2789396	.1033992	.3039909	-.0786815	.5025766	-3.062325*
	(2.13345)	(1.919531)	(2.025168)	(1.918851)	(1.704574)	(1.576593)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,557	1,557	1,102	1,086	1,031	1,855
Constant	65.10763	66.08914	84.40645	22.58276	18.2196	-37.40444
	(2.916893)	(2.934849)	(3.092306)	(26.47947)	(24.59325)	(19.44565)
R-squared	0.3746	0.4103	0.2139	0.2817	0.3065	0.4371
F-Test	9.79	16.78	1.83	2.43	3.05	3.89
Prob > F	0.0000	0.0000	0.0153	0.0006	0.0000	0.0000

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p<0.10.

Regarding gender inequality, there does not seem to be a significant effect of BRI on GII. The lack of statistical significance means that it is not possible to confidently attribute the potential negative effect of BRI on GII. However, unemployment is negatively associated with GII and this effect is significant at the 10% significance level. Therefore, the lower the unemployment rate in a country, the less gender inequality is present which means that higher employment is likely to be associated with more female representation in the workforce hence lowering one dimension of gender inequality. HDI has a negative and significant effect on GII, which is expected as these two indexes are negatively correlated, as HDI also encompasses some gender-related issues.

The lack of support from the parallel trend assumption regarding GII, means that the changes in Gender Inequality Index cannot be claimed by the impact of BRI. The only variable with a significant coefficient is HDI, which is intuitive as it indicates the overall human development in a country and an increase in human development is associated with a decrease in gender inequality. The magnitude of the treatment effect also appears to be very small, indicating that the efficiency of the initiative in decreasing gender inequality is negligible.

Table 10. *Regression output for gender inequality index % with propensity score matching*

	Dependent variable: Gender inequality index					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 5 (unmatched)**
Population		1.37e-11	3.24e-11	1.12e-11	1.54e-10	-1.46e-11
		(4.90e-10)	(4.85e-10)	(4.65e-10)	(4.13e-10)	(7.96e-11)
GDP per capita		3.63e-07	2.84e-07	1.53e-07	3.80e-07	2.25e-07
		(5.64e-07)	(5.79e-07)	(5.33e-07)	(5.25e-07)	(2.71e-07)
Unemployment			-.0011033	-.0013207*	-.0013117*	-.0012406**
			(.0008447)	(.0007842)	(.0006813)	(.0005556)
HDI				-.5551783**	-.5463606***	-.3975851***
				(.1474126)	(.1678827)	(.0874284)
Access to electricity					.0004227	.0002463
					(.00043)	(.000324)
Treatment effect	-.0142339	-.0136219	-.0148758	-.0037086	-.0040923	-.0104884
	(.0114579)	(.0114587)	(.0114546)	(.0118128)	(.0115333)	(.007787)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,709	2,709	2,641	2,619	2,348	4,123
Constant	.4675255	.465383	.4702644	.8304696	.778736	.721403
	(.0066935)	(.0136037)	(.0156851)	(.0984394)	(.102585)	(.049771)
R-squared	0.6503	0.6509	0.6458	0.6628	0.6265	0.6368
F-Test	21.00	-	-	-	-	-
Prob > F	0.0000	-	-	-	-	-

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p<0.10.

6 ROBUSTNESS TEST

6.3 Removal of participating countries after 2013

To ensure the consistency of the policy implementation year, countries that enter the initiative after 2013 should be removed from the control group. For the main analysis, some countries that have joined the initiative after 2013 are able to be in the control group, which can influence the policy effect. According to the Belt and Road Portal[20], there are 144 countries participating in the initiative as of 2021. Considering there are 204 countries (including smaller states not recognized by UN) in the dataset, there will only be 60 countries left to select from that can act as a control group.

Table 11 shows the regression results for the classic DID model, the first two columns, and the PSM-DID model, the last two columns for primary school enrolment rate. An interesting finding emerges after removing the countries that join the initiative after 2013, and that is the positive coefficient of the treatment effect on primary school enrolment. Whereas the classic DID model show that the policy still has a negative effect, although this effect became insignificant at the 10% significance level, on primary school enrolment. When applying PSM to the new sample, to create a more similar control group for the treated countries, the results indicate that the policy increases the primary school enrolment rates in contrast to when BRI countries are present in the model after 2013. However, as this result is also insignificant at the 10% significance level and when visually analyzing figure 9, the parallel trends assumption does not seem to hold for the new model, hence it is difficult to say with certainty that BRI increases primary school education after removing countries that became part of the BRI after 2013.

For secondary school enrolment and GII, the regression results with/without BRI countries after 2013 in the dataset are similar. This indicates that only for (female) primary school enrolment rates, correcting the sample by removing the participating countries joining after 2013 has a considerable effect. See table 15 and 16 in the Appendix.

[20] https://eng.yidaiyilu.gov.cn/list/c/10076

Table 11. *Regression output for primary school enrolment gross % without BRI countries after 2013 in the dataset as robustness check.*

	Dependent variable: Primary School enrolment gross %			
	Model 5 excluding BRI countries after 2013	**Model 5 including BRI countries after 2013**	**Model 5 (PSM) excluding BRI countries after 2013**	**Model 5 (PSM) including BRI countries after 2013**
Population	-5.52e-09	-2.71e-08*	-1.14e-08	4.75e-08
	(1.32e-08)	(1.54e-08)	(1.15e-07)	(1.07e-07)
GDP per capita	.0000429	-.0000876	.0000833	.0000757
	(.0000512)	(.0000576)	(.0000591)	(.0000495)
Unemployment	.2127571	.0829766	.1703726	-.0027288
	(.1135235)	(.1067751)	(.1117307)	(.107831)
HDI	105.0502 **	166.7323***	98.64815**	89.04522 **
	(27.49212)	(26.01643)	(23.39805)	(25.68863)
Access to electricity	.0277026	.062618	.0076669	.0772345
	(.0828629)	(.0733411)	(.1084484)	(.0921278)
Treatment effect	-1.745645	-4.145127**	1.186081	-1.885058
	(1.809654)	(1.567874)	(2.234484)	(1.607046)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,434	3,851	1,465	2,239
Constant	29.90557	-5.457031	38.31635	35.34813
	(17.38646)	(15.24422)	(16.09536)	(19.19518)
R-squared	0.0809	0.1955	0.0849	0.0892
F-Test	2.63	3.09	2.99	2.49
Prob > F	0.0001	0.0000	0.0001	0.0003

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p<0.10.

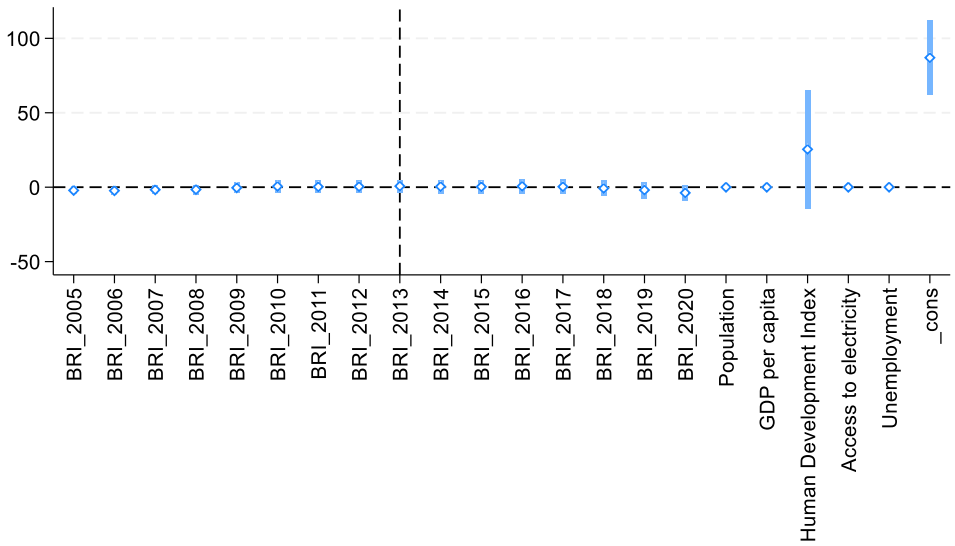

Figure 9. *Primary school enrolment gross % coefplot.*

According to table 12, the policy effect on female primary school enrolment rate is positive and significant at the 10% significance level. Table 12 provides evidence that the results for female primary school enrolment are highly dependent on the selection of the control group, this finding is not a surprise as in the main analysis the treatment effect of female enrolment was already volatile. Column 3 should represent the "true" treatment effect as it has removed the countries from the dataset that join after 2013 and use PSM to create a control group based on the countries that are left. Assuming this shows the true effect of the policy on female school enrolment, one can think that BRI has indeed improved access to schools primarily for female students. This result is in line with the findings by Nishimura et al. (2019), who concluded that UPE especially improved the access to schools for girls. Through this increase in female enrolment in primary schools, it might also reduce gender inequality, and that the incentives to enroll for girls after the start of the Belt and Road Initiative is larger compared to the overall primary school enrolment. However, as can be seen from figure 10 and the small sample size of 725 observations, this statement should be interpreted with its limitations.

Table 12. *Regression output for primary school enrolment net female % without BRI countries after 2013 in the dataset as robustness check.*

	Dependent variable: Primary School enrolment net female %			
	Final Model excluding BRI countries after 2013	**Final Model including BRI countries after 2013**	**Final Model (PSM) excluding BRI countries after 2013**	**Final Model (PSM) including BRI countries after 2013**
Population	3.81e-08	3.66e-08	-7.24e-08	-5.60e-08
	(3.71e-08)	(4.80e-08)	(9.33e-08)	(1.35e-07)
GDP per capita	-8.61e-07	-.0001416**	.0000296	-.0000229
	(.0000586)	(.0000668)	(.0000666)	(.0000593)
Unemployment	.2284667	.153022	.2459854**	.0773281
	(.1714056)	(.1097564)	(.1088679)	(.1010181)
HDI	97.48191**	184.795***	85.69528***	81.21883**
	(42.27674)	(34.47858)	(29.22906)	(35.83418)
Access to electricity	.0979704	.103513	.0957947	.1938698*
	(.1031646)	(.0865953)	(.0973692)	(.1148429)
Treatment effect	-.9436577	-3.062325*	2.524533*	.5025766
	(1.930237)	(1.576593)	(1.472796)	(1.704574)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,434	1,855	725	1,031
Constant	12.99821	-37.40444	26.57979	18.2196
	(26.2698)	(19.44565)	(20.20691)	(24.59325)
R-squared	0.2364		0.2832	
F-Test	2.08	0.4371	5.01	0.3065
Prob > F	0.0030	3.89	0.0000	3.05

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p<0.10.

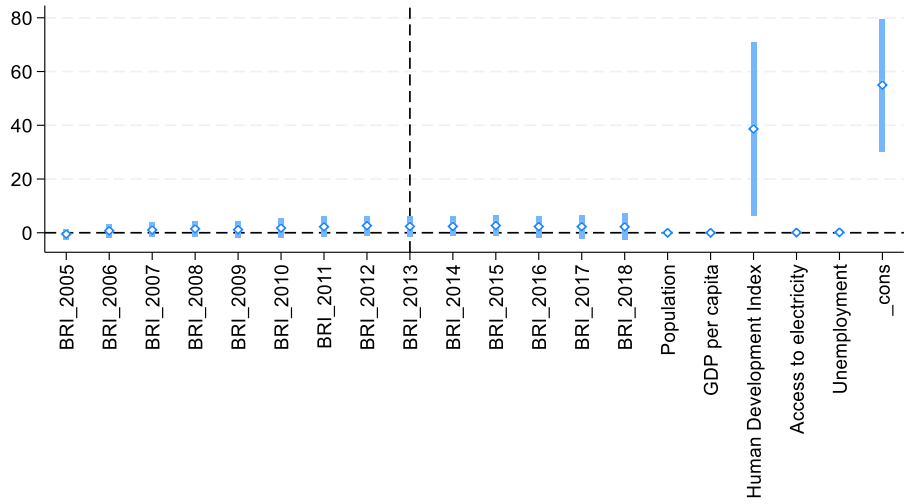

Figure 10. *Primary school enrolment female % net coefplot*

6.4 Other set of treated countries based on academic literature

As mentioned in the data section, the number of treated countries can vary across time and academic papers. Therefore, as another robustness test, this section of the research is aimed at investigating whether a different set of treated countries yield comparable results as the main analysis. In the sensitivity analysis, relaxing the propensity score matching restrictions meant increasing the control group's size, so the coefficients of the interaction term between BRI and Post remained stable across the different variations. This is why the 35 participating countries of Bao et al. (2022) are used as it restricts the sample and tests if the results also hold with fewer treated countries.

As can be seen from table 11, the results show similar effects of BRI on primary school enrolment gross %. The more restricted the sample is, the larger the magnitude of the DID coefficient while remaining significant at the 5% significance level. For the final unmatched model including all the control variables, the coefficient of –6.32 indicates that on average, primary school enrolment gross % decreases by 6.32 percentage points ceteris paribus when a country is part of the BRI after 2013 compared to an untreated country before 2013. This effect is 2 percentage points larger compared to DiD effect using the treated countries according to Li et al. (2020).

When applying PSM to the smaller data sample by Bao et al. (2022), the effect of BRI on primary school enrolment gross % is also insignificant and negative. This means that the negative effect found in this

research's analysis is robust to variations in treated countries used in different time periods and academic papers. Similarly, table 12 shows the regression results on GII and the effect of the policy on GII stays negative while remaining insignificant. Therefore, restricting the sample size of treated countries in 2013 does not change the treatment effect significantly.

Table 11. *Regression output for primary school enrolment gross % with different set of treatment countries as robustness check*

Dependent variable: Primary School enrolment gross %				
	Bao et al. unmatched	Li et al. unmatched	Bao et al. PSM	Li et al. PSM
Population	-1.62e-08	-2.71e-08	-3.07e-08	4.75e-08
	(1.60e-08)	(1.54e-08)	(7.65e-08)	(1.07e-07)
GDPpercapita	-.00009	-.0000876	.00007	.0000757
	(.000056)	(.0000576)	(.0000451)	(.0000495)
Unemployment	.1074641	.0829766	.0649393	-.0027288
	(.103054)	(.1067751)	(.1482938)	(.107831)
HDI	169.2437 ***	166.7323**	83.33712	89.04522 **
	(25.62192)	(26.01643)	(35.82577)	(25.68863)
Access to electricity	.0847115	.062618	.101062	.0772345
	(.0702652)	(.0733411)	(.1062685)	(.0921278)
Treatment effect	-6.310443***	-4.145127**	-1.057871	-1.885058
	(1.798077)	(1.567874)	(2.281409)	(1.607046)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,851	3,851	1,464	2,239
Constant	-9.151539	-5.457031	41.8117	35.34813
	(15.22025)	(15.24422)	(24.92019)	(19.19518)

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, *p<0.10

Table 12. *Regression output for Gender Inequality Index with different set of treatment countries as robustness check*

	Dependent variable: Gender inequality index			
	Bao et al. unmatched	Li et al. unmatched	Bao et al. PSM	Li et al. PSM
Population	9.06e-12	-1.46e-11	5.17e-10	1.54e-10
	(7.48e-11)	(7.96e-11)	(3.29e-10)	(4.13e-10)
GDP per capita	2.25e-07	2.25e-07	6.46e-07*	3.80e-07
	(2.65e-07)	(2.71e-07)	(2.62e-07)	(5.25e-07)
Unemployment	-.0011683*	-.0012406	-.0015116	-.0013117
	(.0005595)	(.0005556)	(.0015528)	(.0006813)
HDI	-.4055681**	-.3975851	-.6117811**	-.5463606**
	(.0835332)	(.0874284)	(.1997451)	(.1678827)
Access to electricity	.0002994	.0002463	.000154	.0004227
	(.000325)	(.000324)	(.0004793)	(.00043)
Treatment effect	-.0130081	-.0104884	-.0019231	-.0040923
	(.0083951)	(.007787)	(.0141892)	(.0115333)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	4,123	4,123	1,469	2,348
Constant	.7210732	.721403	.8327278	.778736
	(.0485301)	(.049771)	(.1155532)	(.102585)
R-squared	0.6370	0.6368	0.6078	0.6265
F-Test	-	-	-	-
Prob > F	-	-	-	-

Note: Standard errors in parentheses. ** p < 0.01, * p < 0.05, *p<0.10

Above all, it is important to note that the first robustness check is stronger than the second robustness check, as participating countries are removed completely from the data sample. When applying PSM both to Bao et al. (2022) participating countries and Li et al. (202) countries in the second robustness check, the treatment effect is much smaller than the unmatched samples and insignificant. This finding contributes to the notion that the policy does not confidently decrease the enrolment rates, and that (female) primary enrolment rates can even increase in the participating countries after the initiative was launched.

7 CONCLUSION

The Belt and Road Initiative (BRI), launched by the Chinese government in 2013, is a major development infrastructure project aimed at enhancing connectivity and cooperation on a global scale. It consists of the Silk Road Economic Belt and the Maritime Silk Road, focusing on policy coordination, infrastructure connectivity, unimpeded trade, financial integration, and people-to-people connections.

Along with the rising power of China, this initiative is multifaceted and offers many research opportunities. Existing research on the initiative includes the effect of the BRI on trade, debt, environment, its strategic implications, and many other areas. Recognizing the importance of education and gender inequality in the 21st century, this research is the first to dive deeper into the effect of the BRI on school enrolment and gender inequality.

Using a fixed effects model with a Difference-in-Difference estimator applied to panel data from 1970 to 2021, combined with propensity score matching, this research tried to quantify the effects of the BRI on three measures of school enrolment (World Bank) and the gender inequality index (Human Development Program). This approach allowed them to compare changes over time in participating countries with those that were not part of the BRI in 2013, while controlling for other factors such as Population, GDP per capita, Unemployment, HDI and Access to electricity.

Contrary to the initial hypotheses, the findings suggest a negative and significant effect of the BRI on secondary school enrolment. This suggests that, on average, participating countries experienced a decline in secondary school enrolment, which needs to be interpreted considering its limitations. However, when controlling for the countries joining the initiative after 2013, a positive association between the policy and (female) primary school enrolment emerges. For secondary school enrolment, the policy has a significant and negative effect on students enrolling for secondary school, indicating that students might choose to immediately work after primary school. Therefore, it seems that the BRI increases female primary school enrolment but decreases secondary school enrolment. The effect of BRI on gender inequality is likely to be negative, but due to the violation of parallel trends pre-treatment and insignificance of results, this effect remains an association and not causation.

Overall, this research provides important insights into the effects of BRI on education outcomes and highlights the need for further studies to fully understand the impact of BRI. It demonstrates the complexity of evaluating societal outcomes of large-scale worldwide projects and the importance of conducting longitudinal studies and monitoring the effects closely.

7.1 Implications

The negative effect of the BRI on education can potentially be attributed to the increase in demand of labor, which is associated with the initiative regarding building infrastructure, railways, roads, etc. Child-forced labor has reportedly increased in the BRI construction areas[21]. Chinese firms have relied on local labor in some areas specifically for low-skilled jobs[22]. Whereas Chinese people occupy top management roles, much of the energy-intensive work such as roadbuilding and mining is local. Even though there is no direct influence on school enrolment, one pathway that can explain the negative effect on education is that children are more likely to help their parents with low-skilled work and gain experience in the field. However, this is merely a speculation at this level and should be investigated thoroughly. Nevertheless, after reducing the control group to countries that have not joined the BRI as of 2021, the policy effect on (female) primary school enrolment is positive whereas the effect on secondary school enrolment remains negative. Therefore, the argument for child labor is based on children directly entering the workforce after completing primary school.

Another implication of this research is that the long-term effects of the BRI on socio-economic outcomes such as education and gender inequality might form over time and are now masked with short-term achievements in terms of building the essential infrastructure for the BRI. Although intuitive, it provides insights into policy implementation and the time it takes for effects to realize. It highlights the need for longitudinal studies and frequent monitoring of those outcomes over a longer period to capture the long-term effects. Therefore, it is incredibly important that projects combining the BRI and SDG such as the one initiated by the EAPD and UNDESA are launched and recognized by various institutions. In addition, much of the recent news on the BRI is centered around the developments within Africa. For future research, it is worthwhile to dive deeper into the mechanisms that are happening in Africa and how it affects not only education and gender inequality, but also strategic and political implications.

[21] https://www.state.gov/wp-content/uploads/2022/07/Forced-Labor-The-Hidden-Cost-of-Chinas-Belt-and-Road-Initiative.pdf

[22] https://www.cfr.org/blog/who-built-labor-and-belt-and-road-initiative

7.2 Limitations

This research does not go without limitations. One potential caveat that all papers researching BRI need to consider is to recognize the possibility of positive spillover effects into neighboring countries. Ashraf et al. (2022) pointed out that BRI had a positive spillover effect on Economic Growth in the BRI allied countries according to their analysis. This phenomenon is inevitable and does not necessarily mean that studies on BRI become less reliable, in contrast it should only add another layer to the multifaceted initiative and offer more research opportunities. One can also mention the use of country data as a limitation as regional data might produce more valuable insights and allow for variation within countries. However, due to the lack of regional data, this can only be possible if more data is collected and made public. This asks for the transparency of all parties involved in BRI to provide accurate data periodically so the societal progress can be tracked optimally. Given that more data will be collected on BRI in the future, it is crucial that there will continue to be research conducted on the impact of BRI on the world.

8 REFERENCES

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9 APPENDIX

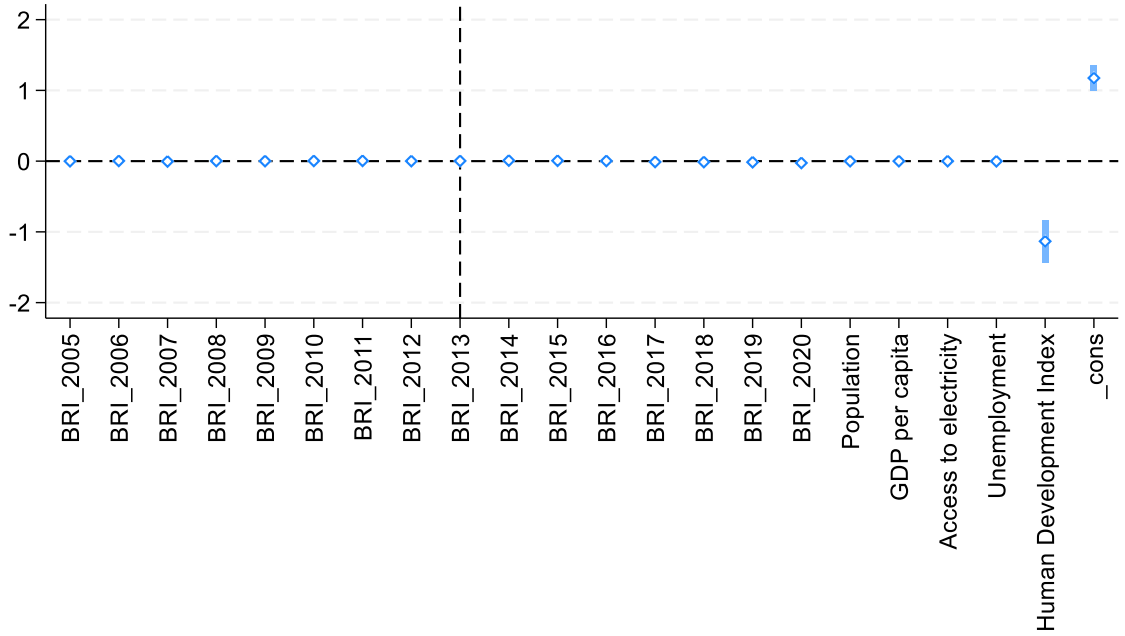

Figure 11. *Coefplot of the PSM-DID regression on Gender Inequality Index controlling for all variables.*

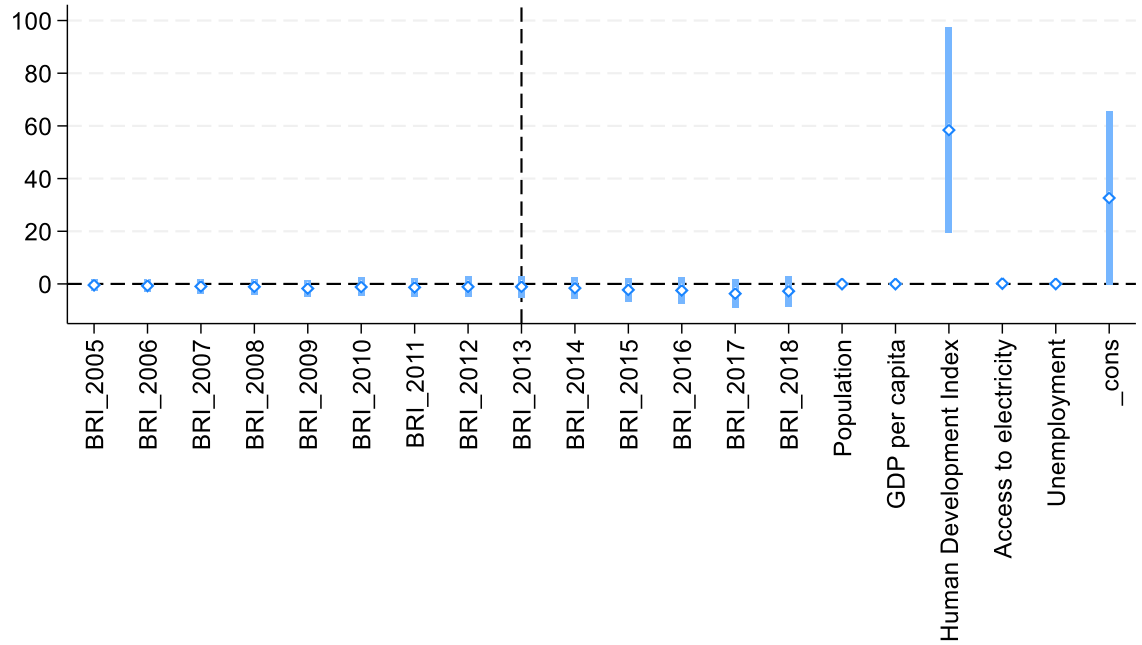

Figure 12. *Coefplot of the PSM-DID regression on Primary school enrolment net female % controlling for all variables.*

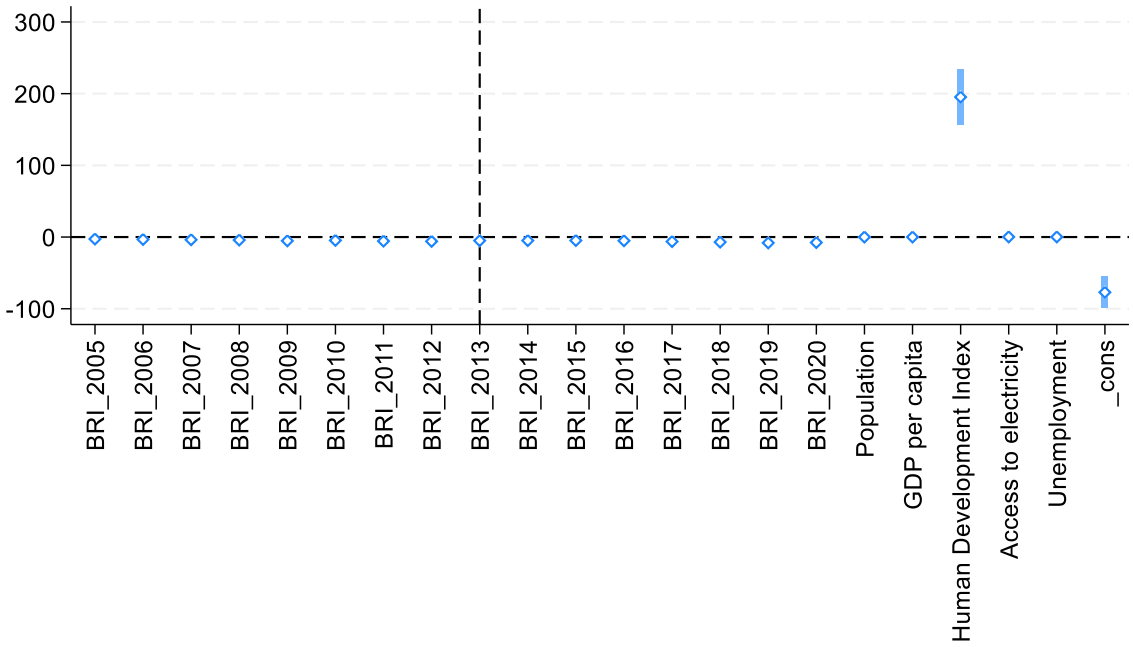

Figure 13. *Coefplot of the PSM-DID regression on Secondary school enrolment gross % controlling for all variables.*

Table 13. *List of participating countries used for robustness check.*

List of participating countries according to Bao et al. (2022)				
Kazakhstan	Bulgaria	Georgia	Maldives	Turkey
Kyrgyzstan	Myanmar	Laos	Malaysia	Turkmenistan
Mongolia	Jordan	Bangladesh	Moldova	Sri Lanka
Tajikistan	Montenegro	Uzbekistan	Thailand	Nepal
Armenia	Cambodia	Bhutan	India	Lebanon
Pakistan	Azerbaijan	Philippines	Ukraine	Afghanistan
Serbia	Belarus	Romania	Vietnam	Albania

Table 14. *Pairwise correlations.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) countryID	1.000									
(2) Year1	0.000	1.000								
(3) PrimarySchoolE~s	0.072	0.245	1.000							
(4) SecondarySchoo~r	-0.029	0.470	0.471	1.000						
(5) PrimarySchoolE~t	0.097	0.278	0.853	0.735	1.000					
(6) SecondarySchoo~e	0.056	0.374	0.307	0.958	0.726	1.000				
(7) PrimarySchoolE~a	0.083	0.269	0.857	0.761	0.985	0.744	1.000			
(8) SecondarySchoo~e	0.070	0.358	0.317	0.955	0.738	0.994	0.758	1.000		
(9) Unemployment	-0.030	-0.035	0.060	0.100	0.031	0.115	0.082	0.127	1.000	
(10) HumanDevelopm~x	-0.009	0.246	0.306	0.918	0.729	0.928	0.763	0.928	0.056	1.000
(11) GenderDevelop~x	0.026	0.240	0.421	0.715	0.627	0.668	0.720	0.708	0.113	0.721
(12) GenderInequal~x	0.005	-0.227	-0.184	-0.811	-0.595	-0.826	-0.637	-0.820	-0.071	-0.851
(13) GDP	0.060	0.123	0.043	0.199	0.122	0.187	0.116	0.184	-0.059	0.236
(14) Accesstoelect~y	-0.032	0.033	0.184	0.828	0.674	0.872	0.690	0.874	0.127	0.867
(15) Population	-0.041	0.054	0.036	-0.024	0.048	0.019	0.043	0.020	-0.078	-0.031
(16) BRI	0.041	0.000	0.058	0.161	0.128	0.131	0.116	0.127	0.008	0.120
(17) Postyear	0.000	0.655	0.122	0.288	0.139	0.186	0.144	0.165	-0.035	0.191
(18) GDPpercapita	0.000	0.287	0.113	0.532	0.300	0.501	0.326	0.491	-0.122	0.650
(19) lnGDP	0.022	0.322	0.181	0.520	0.418	0.534	0.427	0.517	-0.103	0.529

Variables	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) countryID									
(2) Year1									
(3) PrimarySchoolE~s									
(4) SecondarySchoo~r									
(5) PrimarySchoolE~t									
(6) SecondarySchoo~e									
(7) PrimarySchoolE~a									
(8) SecondarySchoo~e									
(9) Unemployment									
(10) HumanDevelopm~x									
(11) GenderDevelop~x	1.000								
(12) GenderInequal~x	-0.691	1.000							
(13) GDP	0.130	-0.222	1.000						
(14) Accesstoelect~y	0.604	-0.665	0.141	1.000					
(15) Population	-0.092	0.021	0.392	0.019	1.000				
(16) BRI	0.054	-0.083	-0.061	0.253	-0.010	1.000			
(17) Postyear	0.184	-0.182	0.096	0.078	0.036	0.000	1.000		
(18) GDPpercapita	0.380	-0.646	0.212	0.376	-0.042	-0.093	0.198	1.000	
(19) lnGDP	0.283	-0.496	0.408	0.351	0.345	0.169	0.211	0.310	1.000

Source: Data Center, Human Development Reports
GII Calculation

$$G_{f=}\sqrt[3]{\left(\frac{10}{MMR}*\frac{1}{ABR}\right)^{\frac{1}{2}}*\left(PR_f*SE_F\right)^{\frac{1}{2}}*LFPR_F}$$

$$G_{M=}\sqrt[3]{1*(PR_M*SE_M)^{1/2}*LFPR_M}$$

$$HARM(G_F,G_M)=[\frac{(G_F)^{-1}+(G_M)^{-1}}{2}]^{-1}$$

$$G_{F,M=}\sqrt[3]{Health*Empowerment*LFPR}$$

$$Health=\sqrt[3]{\frac{\left(\frac{10}{MMR}*\frac{1}{ABR}+1\right)}{2}}$$

$$Empowerment=\frac{\sqrt{PR_f*SE_F}\ +\sqrt{PR_M*SE_M}}{2}$$

$$LFPR=\frac{LFPR_F+LFPR_M}{2}$$

$$GII=1-\frac{HARM(G_F\ ,G_M\ )}{G_{F,M}}$$

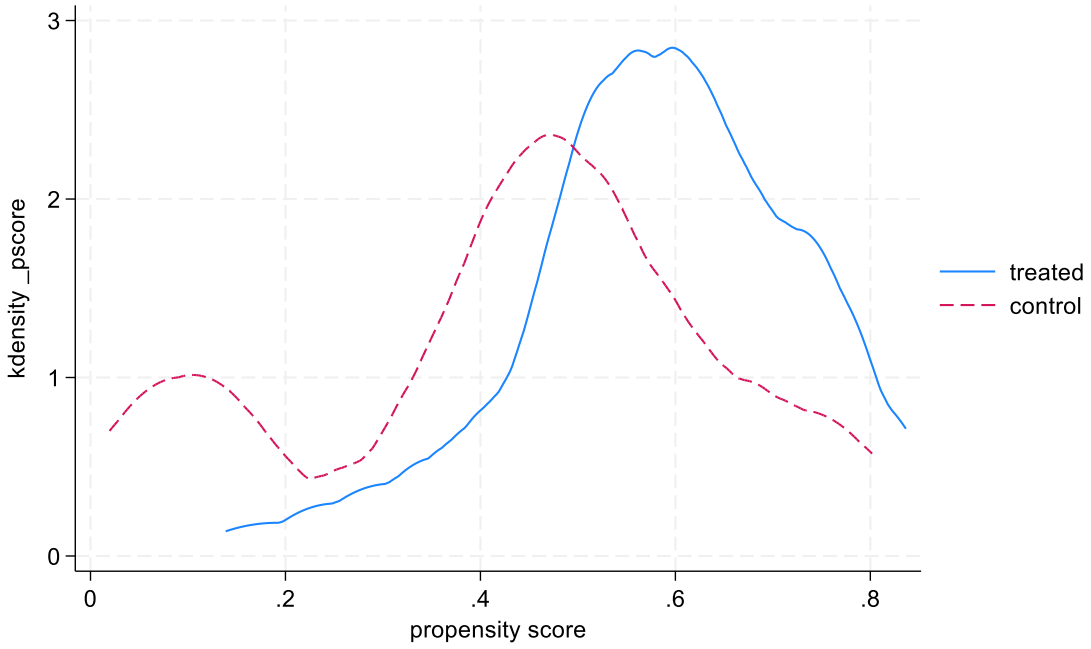

Figure 14. *Propensity score distribution of treated and control group before matching, based on the data sample excluding BRI countries that joined after 2013.*

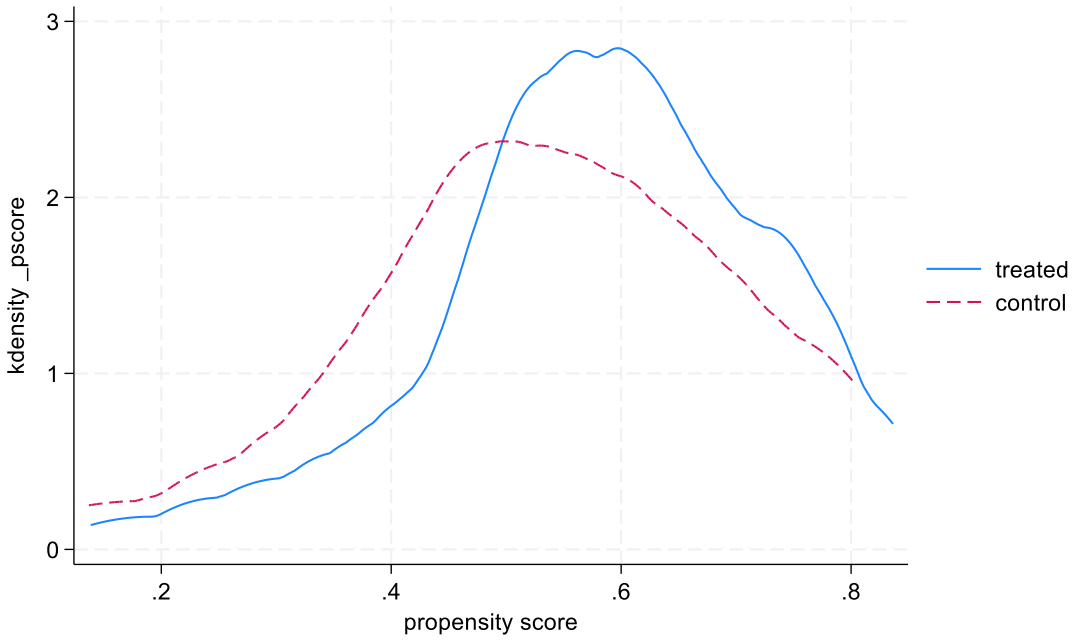

Figure 15. *Propensity score distribution of treated and control group after matching, based on the data sample excluding BRI countries that joined after 2013.*

Table 15. *Regression output for Gender Inequality Index without BRI countries after 2013 in the dataset as robustness check.*

	Dependent variable: Gender inequality index			
	Final Model excluding BRI countries after 2013	**Final Model including BRI countries after 2013**	**Final Model (PSM) excluding BRI countries after 2013**	**Final Model (PSM) including BRI countries after 2013**
Population	-5.49e-11	-1.46e-11	3.78e-11	1.54e-10
	(7.18e-11)	(7.96e-11)	(3.87e-10)	(4.13e-10)
GDP per capita	2.55e-07	2.25e-07	9.02e-07***	3.80e-07
	(3.69e-07)	(2.71e-07)	(2.92e-07)	(5.25e-07)
Unemployment	-.0009495	-.0012406	-.0009024	-.0013117
	(.0006739)	(.0005556)	(.0006625)	(.0006813)
HDI	-.394119***	-.3975851	-.2940663***	-.5463606***
	(.1114246)	(.0874284)	(.1051424)	(.1678827)
Access to electricity	.0001779	.0002463	-.0001902	.0004227
	(.0003037)	(.000324)	(.0003767)	(.00043)
Treatment effect	-.0213043**	-.0104884	-.0011328	-.0040923
	(.0081593)	(.007787)	(.0086292)	(.0115333)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,631	4,123	1,483	2,348
Constant	.6951615	.721403	.6441419	.778736
	(.0645998)	(.049771)	(.0668275)	(.102585)
R-squared	0.6892	0.6368	0.7488	0.6265
F-Test	-	-	-	-
Prob > F	-	-	-	-

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, *p<0.10

Table 16. *Regression output for Secondary School enrolment gross % without BRI countries after 2013 in the dataset as robustness check*

	Dependent variable: Secondary School enrolment gross %			
	Final Model excluding BRI countries after 2013	**Final Model including BRI countries after 2013**	**Final Model (PSM) excluding BRI countries after 2013**	**Final Model (PSM) including BRI countries after 2013**
Population	-1.48e-08	-1.65e-08	-5.70e-10	1.66e-07 (8.09e-
	(1.34e-08)	(1.06e-08)	(7.73e-08)	08)
GDP per capita	-.0001156	-.0001034	-.0001232	-.0001738**
	(.000077)	(.0000666)	(-.0001232)	(.0000813)
Unemployment	.1579278	.117775	.0122197	.1454178
	(.1036016)	(.1073766)	(.1350641)	(.1266723)
HDI	167.6614***	160.2925***	152.2384***	208.6701 ***
	(29.90826)	(22.31173)	(47.96414)	(36.08626)
Access to electricity	.3028204***	.2779714***	.3082258***	.2053079***
	(.0521907)	(.0455799)	(.0763262)	(.0598473)
Treatment effect	-3.806195*	-3.519527**	-4.489965	-5.67302***
	(1.94917)	(1.389918)	(3.047681)	(2.111568)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	2,116	3,251	1,251	1,943
Constant	-62.31869	-54.84278	-53.14122	-86.40319
	(18.35405)	(13.24851)	(29.2163)	(22.40301)
R-squared	0.5577	0.6025	0.5596	0.5958
F-Test	20.64	35.87	21.83	31.44
Prob > F	0.0000	0.0000	0.0000	0.0000

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, *p<0.10

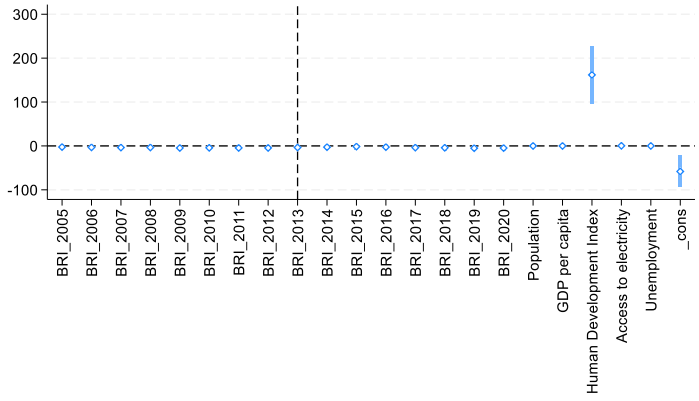

Figure 13. *Coefplot of the PSM-DID regression on Secondary school enrolment gross % controlling for all variables exclusing all BRI countries that joined after 2013.*