Financial Consequences of the Belt and Road Initiative

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Abstract

As the largest-ever infrastructure project, China's Belt and Road Initiative (BRI) is expected to reshape the global economy for the coming decades. This paper provides the first analysis of BRI's effects on financial markets and real economic activity in Europe. It exploits the opening of a subway tunnel under Istanbul's Bosporus Strait that geographically positions nearby countries on BRI's railway corridor. Governments of countries that gain access to BRI respond by sharply increasing sovereign debt issuance and devoting resources to collective consumption spending rather than much-needed infrastructure investments. In these countries, outlooks for inflation, financial stability, and economic uncertainty worsen, and sovereign yields surge. Businesses issue less debt, lower capital investments, and observe reductions in their valuations. Additional findings on foreign aid, international trade, and BRI program membership highlight China's growing footprint in corridor economies.

Keywords: Belt and Road Initiative, Sovereign Debt, Sovereign Risk, Investment
JEL-Codes: E22, F40, H63, H74, O16, G15, G21

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1 Introduction

The Belt and Road Initiative (BRI), commonly referred to as China's Marshall Plan or the modern-day Silk Road, aims to link China with Europe, Asia, and the Middle East through overland and maritime trade corridors. As of 2021, it encompasses 134 member nations that account for 39% of the world GDP and 62% of the world population.[1] BRI is expected to increase mobility and reduce freight times along its corridors by 12% on average, and increase trade and income by up to 9.7% and 3.4%, respectively.[2] These improvements demand infrastructure investments of up to $8 trillion, which make BRI the largest infrastructure project in history.[3] Nevertheless, academic literature has yet to document how these infrastructure investments are being financed by corridor countries and how financing them impacts business activities.

Theory suggests that countries that gain access to trade corridors should find it easier to issue debt (Bulow and Rogoff, 1989; Gibson and Sundaresan, 2005; Serfaty, 2021). The issuance of sovereign debt can reduce private credit and investments if the newly-issued debt gets absorbed by local financial institutions (Huang et al., 2020). On the other hand, if corridor countries gain access to foreign credit or developmental aid—e.g., from China—to help finance BRI-related infrastructure projects, this can free resources and increase private credit and investments (Williams, 2018). Additional factors such as political considerations (Acharya and Rajan, 2013), how newly-raised funds are utilized by governments, and the influence of international trade on local economic activity can also impact businesses by influencing competition, macroeconomic expectations, serviceability of debt, and public and private credit risk (Gennaioli et al., 2014; Almeida et al., 2017; Du and Schreger, 2022).

This paper studies BRI's effects on financial markets and real economic activity. I first examine how gaining access to BRI's economic corridor influences public and private debt issuance and sovereign risk. Next, I analyze the use of newly-issued government debt and developmental aid to finance infrastructure investments and various forms of collective consumption expenditure in BRI economies. I then provide insights on the consequences of BRI on capital and R&D investments and valuations of firms located along its economic corridor. It is difficult to empirically test the systematic interplay between access to BRI and these outcome variables, as endogeneity concerns plague potential studies that aim to provide causal interpretations. To identify directional effects, one would ideally want access to BRI to be assigned randomly, which is difficult for a project as vast and ambitious as BRI.

As an identification methodology, I use the launch of Marmaray, a subway service that connects Europe and Asia under the Bosporus Strait. My empirical strategy is decidedly pragmatic. I draw inferences between

[1] Data on BRI membership are from UN (https://bit.ly/3A96bJj), and data on population and GDP are from the World Bank. Identifiers for Population and GDP are SP.POP.TOTL and NY.GDP.MKTP.CD, respectively.

[2] See https://bit.ly/3A41mRe.

[3] See https://bit.ly/3K7afOR.

European countries in the east and west of Budapest, Hungary, before and after the opening of Marmaray.[4] I do so because countries in the east of Budapest gained access to a direct railway corridor with China for the first time after the opening of Marmaray, whereas countries in the west of Budapest already had access to a direct railway corridor with China through Russia. As a consequence of Marmaray, the freight time between China and Eastern Europe decreased from one month to 12 days, but given the distance between Western Europe and Istanbul, the freight time between Western Europe and China did not change much and remained close to the pre-existing period of 18 days.[5]

Marmaray's launch is helpful for estimating the directional effects of BRI for a number of reasons. First, Marmaray was primarily designed and built to tackle Istanbul's chronic traffic problems, and none of Turkey's neighbors had a first-order effect on Marmaray's financing or construction.[6] Second, Marmaray was announced nine years before BRI.[7] Third, Marmaray's construction timeline and opening date were dictated by unprecedented archaeological discoveries and one of the largest urban excavations in history rather than economic motivations or predictable events. Fourth, countries that get positioned on BRI's economic corridor due to Marmaray's opening vary considerably in terms of economic and business characteristics, and this gives rise to rich effect heterogeneity. For these reasons, the opening of Marmaray provides a useful laboratory for estimating the directional effects of BRI.

I start my empirical analyses by estimating a homogeneous average treatment effect on treated countries (ATT). This effect measures how gaining access to BRI influences economies along BRI's economic corridor on average, and it is therefore of economic interest. Using a difference-in-differences methodology with a two-way fixed effects (TWFE) structure, I estimate a 12.39% increase in government debt-to-GDP ratio and a 24.52% decrease in private debt-to-GDP ratio for the treated units.[8] The reduction in private debt is driven by a 22.43% decrease in corporate debt to GDP. These findings are robust to controlling for fixed characteristics at country and year levels. I show an abundance of evidence on dynamic treatment effects and support for the observable counterpart of the parallel trends assumption.

To address potential concerns related to anticipation of Marmaray, I also run synthetic difference-in-differences (SDID) regressions following Arkhangelsky et al. (2021) and estimate a local ATT after matching countries on a rich array of observable characteristics. Using the SDID methodology, I estimate a 16.95% increase in government debt to GDP, a 26.32% decrease in private debt to GDP, and a 24.94% decrease in corporate debt to GDP. Overall, the SDID strategy weakens this paper's reliance on the parallel trends

[4]Figure 3 presents the treated and control units more accurately.

[5]See https://bit.ly/3BrkZoD.

[6]Marmaray was financed by the Japan International Cooperation Agency (JICA) and the European Investment Bank (EBI). Turkey's neighbors do not have a large footprint in these institutions.

[7]The idea of a subway tunnel under the Bosporus was first introduced in 1860. See https://bit.ly/3CiRZQA for more information.

[8]Total sovereign debt issuance by treated countries amounted to $114.64 billion between 2007 and 2013, and $410.29 billion between 2014 and 2021. This suggests an increase of $295.65 billion after the opening of Marmaray.

assumption. I provide evidence that SDID does not give any of the control units, particularly high influence and the estimation achieves the desired synthetic parallel trends as in Arkhangelsky et al. (2021).

To understand what Eastern European governments do with newly-raised funds, I conduct a detailed analysis of their government expenditures by function. I examine infrastructure investments for railways, highways, airways, and seaways, along with collective consumption expenditures, wages, rents, and royalties. I find no evidence that infrastructure investments or fixed capital formation increase in treated countries. In fact, SDID estimates suggest a reduction of 1.47% in overall fixed asset formation. In contrast, I identify a 1.98% increase in collective consumption expenditures, which amounts to an increase of 8.37% relative to the sample mean. These results raise questions about the effectiveness of public spending by BRI countries after issuing large amounts of sovereign debt.

I examine how financial markets price newly-issued sovereign debt of treated countries by running regressions on issue-amount-weighted, mean, and median sovereign yields on a country-year panel. In doing so, I identify increases of 1.05% to 1.17% using the TWFE model and 1.54% to 1.97% using the SDID model after treatment. What do these yields compensate the investors for?[9] To answer this question, I utilize a novel dataset by Thomson Reuters MarketPsych Indices (TRMI) on news-based macroeconomic sentiment proxies for inflation, financial stability, and economic uncertainty, and identify reductions in macroeconomic sentiment and increases in perceived macroeconomic risk.

How does gaining access to BRI influence corporate outcomes? In line with the reduction in overall corporate debt issuance, I identify a 0.68% decrease in capital investments, a 2.98% decrease in R&D investments, and a 5% decrease in Tobin's Q for Eastern European firms on average. These findings are robust to firm, industry × year, and industry × country fixed effects, along with firm-level control variables.

Overall, countries that gain access to BRI issue large amounts of sovereign debt and use it to finance collective consumption rather than fixed capital formation. Businesses in these countries suffer from sharp increases in sovereign debt and risk, which limit their ability to finance investments and distort their valuations. Although these effects are estimated as homogeneous average treatment effects, they could vary across countries with varying exposures to BRI. For example, one could argue that the estimated effects of BRI should change depending on how the benefits of BRI (e.g., time savings in shipments) vary across countries.

For these reasons, I also estimate heterogeneous treatment effects by first running a triple-differences model. I do so by interacting the treatment from the TWFE specification with BRI-driven efficiency gains. To be able to conduct this analysis, I exploit city-level data on BRI-driven freight time reductions. These data also allow me to introduce stringent fixed-effects structures such as country × year or headquarter-city × industry fixed effects. Introducing country-year fixed effects allows me to compare firms from the same country-year with varying degrees of BRI-driven efficiency gains before and after Marmaray's opening. By

[9] One can argue for default, recovery rates, inflation, illiquidity, maturity and other mechanisms.

introducing city-industry fixed effects, I compare firms that are located in the same city and operate in the same industry but experience different BRI-driven efficiency gains before and after treatment. With the triple-difference estimation, I identify a 0.12% decrease in capital investments, a 0.93% decrease in R&D investments, and a 3.20% decrease in Tobin's Q for Eastern European firms on average per a standard deviation reduction in freight time to Beijing, China.

For inference, I exploit the fact that Eastern European countries did not have access to a direct railway system to China before Marmaray. There are several benefits of using this strategy. This said, if historical economic or political outcomes determine both the lack of railway systems and today's economic outcomes in Eastern Europe, my estimates could be confounded by such factors. Importantly, controlling for such factors in regressions does not debias the estimated treatment effect, because under this scenario the omitted variable bias is driven by measurement error related to the treatment assignment.[10]

I, therefore, model the treatment assignment as a function of potential confounders such as a country's historical inclusion in the Orient Express train line between Europe and the Ottoman Empire and distance from Turkey. By using a partially linear regression (PLR) methodology following Robinson (1988) and Chernozhukov et al. (2016, 2017), I estimate a conditional average treatment effect (CATE) of gaining access to BRI. In doing so, I not only show that my findings are robust to the caveats described above but also provide empirical support for my earlier findings on effect heterogeneity. My findings from the PLR model suggest that a standard deviation change in BRI-driven time savings decreases capital investments by 0.22 standard deviations and Logged Tobin's Q by 0.96 standard deviations. These effects are statistically significant at the 5% level or better. Collectively, these results provide support for the hypothesis that the effects of BRI get stronger as BRI exposure increases across Europe.

Lastly, I provide empirical evidence also on how access to BRI changes the dynamics of international trade, development aid received from China or Western countries, and government membership in China's BRI program. Using the TWFE structure, I identify a 12% increase in the dollar value of good exports, a 77.12 units increase in export volume, and a 6.13% increase in merchandise exports to high-income economies (including the Middle East and Europe). The SDID estimates suggest that these effects amount to 17%, 44.34 units, and 3.07%, respectively. I also identify a 45% increase in BRI program membership on average after the opening of Marmaray and a 235% increase in total developmental aid received from China, which fails to replace an estimated decrease of 7% in total aid received by Eastern European countries. In the Appendix, I provide robustness tests and supplementary findings such as how logistics performances of treated countries increase after Marmaray's opening.

[10] Let Confounded treatment = True treatment + $\Theta(X)$. If $\Theta(X)$ is unobserved, it would show up in the error term in regressions. Even if I control for X in my regressions, $\Theta(X)$ could still complicate inference if it also drives the dependent variable.

Literature Review This paper contributes to the literature on sovereign debt issuance and sovereign risk. Papers on sovereign debt issuance argue that governments trade off costs of making timely debt payments against external and internal costs. The external costs include distortions in country reputation (Eaton and Gersovitz (1981)), international trade (Bulow and Rogoff (1989), Gibson and Sundaresan (2005), and Rose (2005)) and asset seizures. Internal costs include the transmission of sovereign risk to the private sector (Lee et al. (2016)), distortion of bank balance sheets (Gennaioli et al. (2014)) and firm activity (Almeida et al. (2017), and Williams (2018)). I contribute to the literature on sovereign debt issuance by providing novel evidence on the consequences of BRI on issuance of sovereign debt through the international trade channel. Since international trade is interrupted by sovereign default (Serfaty (2021)), countries that gain access to BRI will have more at stake if they default. Therefore, such countries should find it easier to issue debt. In line with this prediction, I show that countries that gain access to BRI's economic corridor through Marmaray issue significant amounts of sovereign debt. Importantly, I also provide evidence of rising sovereign yields after gaining access to BRI. I show that the rise in sovereign risk is related to unproductive government spending along with worsening market sentiments for inflation, financial stability, and economic uncertainty. This finding contributes to recent research in finance on drivers of sovereign risk (see, e.g., Lee et al. (2016), Chernov et al. (2020), Duffie et al. (2003), and Du et al. (2020)) by showing evidence on BRI-driven risks that are previously undocumented in the literature.

The second literature I contribute to studies corporate consequences of public debt issuance and fiscal policy. Huang et al. (2020) find that an increase in local public debt in China between 2006 and 2013 crowded out private investment in corresponding Chinese cities by inducing banks to tighten credit supply to local firms. The authors also identify a reallocation of capital from private firms to the local public sector. BRI's effects are very broad, and it's difficult to argue for a single mechanism. Therefore, I do not formally test a crowding-out story in this paper.[11] This being said, similar to Huang et al. (2020), I also exploit geographic segmentation in debt markets and identify reductions in private investments. Furthermore, my findings on BRI's distortionary effects on sovereign risk and corporate activity are in line with Almeida et al. (2017), who show that firms reduce investments after sovereign debt impairments, and they complement Acharya and Rajan (2013) by providing evidence on unproductive public spending and debt issuance by popularity-seeking governments.

This paper also contributes to the broader literature on the economics of mobility. Previous papers in this literature show that railroads decrease transportation costs (Donaldson (2018)), influence the distribution of economic activity (Jedwab and Moradi (2016)) and impact industrial and agricultural activity (Donaldson

[11] I provide coefficient estimates for reduced form and first-stage regressions that are sufficient to calculate the local treatment effect of public debt on firm investments using a two-stage least squares (2SLS) procedure that exploits Marmaray as an instrument. The main concern with running a 2SLS procedure however is the exclusion restriction. It is likely that gaining access to BRI impacts corporate investments through channels other than public debt issuance.

and Hornbeck (2016) and Baum-Snow et al. (2017)), and highways impact trade (Duranton et al. (2014)), industrial output (Faber (2014)), and manufacturing activity (Ghani et al. (2016)). Hummels and Schaur (2013) show that each day in transit is equivalent to an ad valorem tariff of 0.6% to 2.1%, and Djankov et al. (2010) find that each day a product is delayed prior to being shipped reduces trade by more than 1%.[12] Eaton and Kortum (2002) examine the role of trade in spreading the benefits of new technology.[13] My findings complement findings of these papers by highlighting effects of BRI-driven mobility gains on business activity. As an economic mechanism, I study increased sovereign debt issuance driven by gaining access to BRI's economic corridor.

2 Background on Marmaray

This section provides essential information on Marmaray and its influence on countries in Eastern Europe. The Turkish government announced in 2004 that it was going to build a 3 km subway tunnel between Europe and Asia under Bosporus Strait to tackle Istanbul's chronic traffic problems. Based on a five-year research project that tracked 500,000 vehicles in Istanbul, Tanla et al. (2014) predict that Istanbulites were spending 3.5 years of their lives in traffic at the time.[14] The tunnel was planned 60 meters deep and 12 miles away from the earthquake fault line and it merged disjoint metro systems in Asian and European parts of Istanbul under the name of Marmaray (Sakaeda (2005)). It also ended up connecting European railways with Asian railways through Anatolia (see Figure 1), decreasing the freight time from China to Eastern Europe from one month to 12 days.

Marmaray project ended up being one of the largest urban excavations in history and resulted in major archaeological discoveries that made its construction timeline difficult to predict.[15] These discoveries were arguably exogenous, as depths and positions of the tunnel and subway stations (Figure A1) were based on earthquake risks, circulation of water under the Bosporus, quality of rocks and clay under the soil, but not on archaeological treasures unknown and difficult to locate at the time (Sakaeda (2005)), particularly because existing metro service in the area was fully above ground at the time.

The project was supposed to be fully completed in 2008, but the underground tunnel between Europe

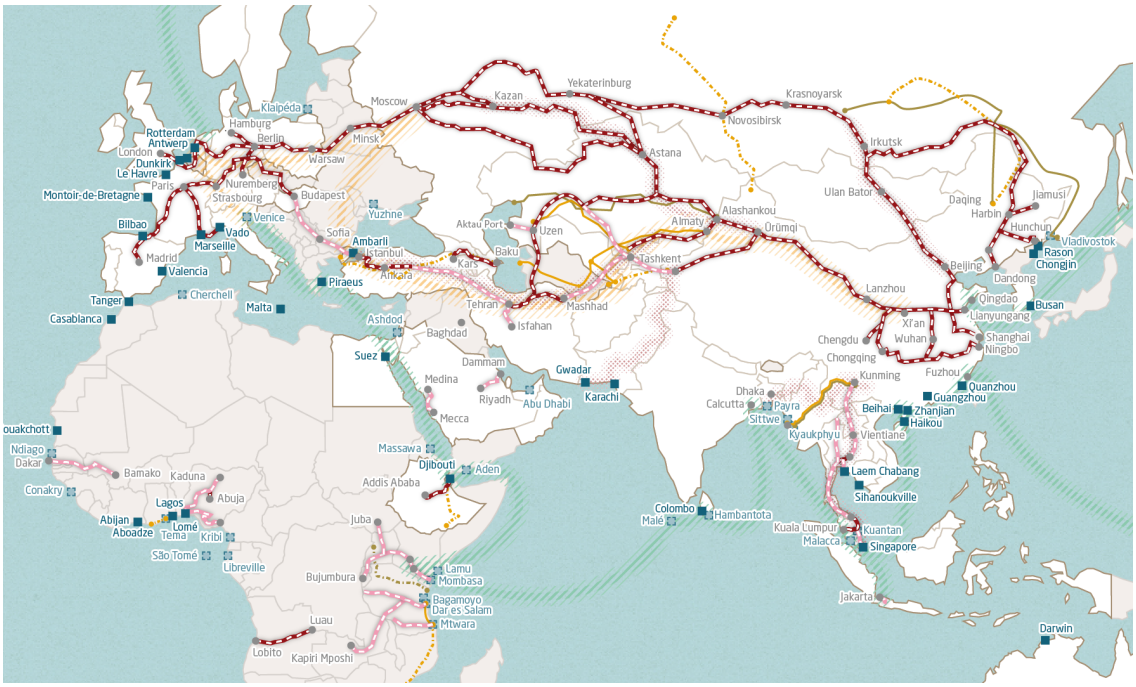
[12] Allen and Arkolakis (2014) find that that geographic location accounts for 24% of the observed spatial distribution of income. Redding and Sturm (2008) provide evidence on the causal importance of market access for economic development, and Glaeser and Mare (2001) study the relevance of geographic location on labor productivity and wages.

[13] Autor et al. (2013) examine the effect of rising Chinese import competition on US local labor markets and find that rising imports cause higher unemployment, lower labor force participation, and reduced wages in local labor markets that house import-competing manufacturing industries.

[14] Gridlock on Istanbul's bridges between Asia and Europe was commonplace even at midnight. See a related TV interview at https://bit.ly/3b9e1KB and see additional research on Istanbul's traffic problems at https://bit.ly/3zGAmZl.

[15] See Section A and https://bit.ly/3Q1cd4N on archaeological findings, and https://bit.ly/3zkevpf and https://cnn.it/3PVSdAU on construction delays.

Figure 1: **Railway Systems Between Europe and China**
This figure presents existing and planned freight rail systems between Europe and China. Red lines are existing fast-speed lines, and pink lines are existing railways that will get upgraded. Sources: Mercator Institute for China Studies and own data.

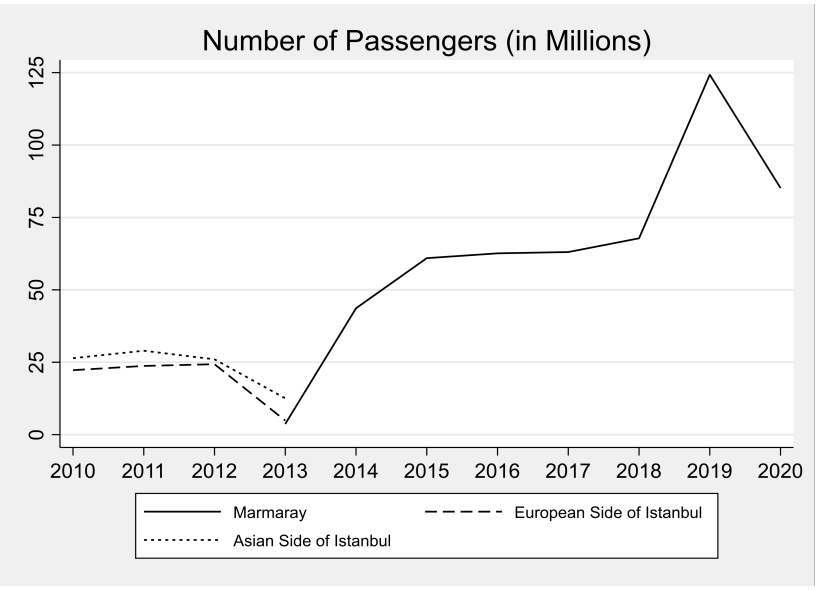


and Asia ended up opening in late October of 2013 due to the excavations.[16] After that, the rest of the railway system in Istanbul got upgraded, and faster and higher quality rails were installed. Figure 2 presents yearly railway passengers in Asian and European parts of Istanbul between 2010 and 2020 using hand-collected data from Turkish State Railways (TCDD).

As shown in Figure 2, the tunnel became operational fairly quickly and the number of yearly passengers that use Marmaray rapidly reached 50 million per year, which is close to the total amount of passengers that used to use the disjoint Asian and European railways in Istanbul before renovations during 2013. Over time, new subway stations were opened (passengers didn't need to take express bus service to previously built subway stations anymore), and high-speed (250 kmh or 155 mph) lines were built from Istanbul to first until Ankara and then until Sivas in Eastern Turkey. These lead to increases in the number of Marmaray passengers over time.[17] As the BRI program developed further in Asia, the first Chinese freight train crossed Marmaray towards Europe in 2019.[18] In 2019, 125 million Istanbulites used Marmaray, and during the Pandemic in 2020, more than 75 million Istanbulites used it.

[16] See https://bit.ly/3Jj0jBs.
[17] The rise in customers can also be attributed to the refugees moving to Istanbul. The point of this figure is to confirm that the railway lines are operational. Data on Istanbul ferry usage is not publicly available.
[18] See https://bit.ly/3Q3a6xz and https://bit.ly/3bhsqnR on Chinese freight trains.

Figure 2: **Yearly Railway Passengers in Istanbul**
This figure presents data on yearly railway passengers in Asian and European parts of Istanbul between 2010 and 2020. Asian and European subways merged under the name of Marmaray in October 2013. Data is drawn from Turkish State Railways (TCDD) annual reports at https://www.tcdd.gov.tr/kurumsal/istatistikler.



As shown in Figure 1, Marmaray allowed quick access to BRI's trade corridor for countries located in the east of Budapest, Hungary, and in the west of Istanbul, Turkey. By exploiting variation in geographic locations relative to Budapest and Istanbul, I form a treatment group of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Macedonia, Moldova, Montenegro, Romania, Serbia, and Slovenia, and a control group that contains the remaining European countries. Treatment and control assignments are shown in the Figure 3 on a map. I use these groups to estimate homogeneous and heterogeneous treatment effects of gaining access to BRI on treated units. The following section presents the empirical framework.

3 Research Design

The paper starts by estimating how gaining access to BRI's economic corridor through Marmaray affects the economies of Eastern European countries. This effect is estimated as a homogeneous treatment effect on treated units (ATT). Using Neyman-Rubin potential outcomes framework, ATT can be represented as:

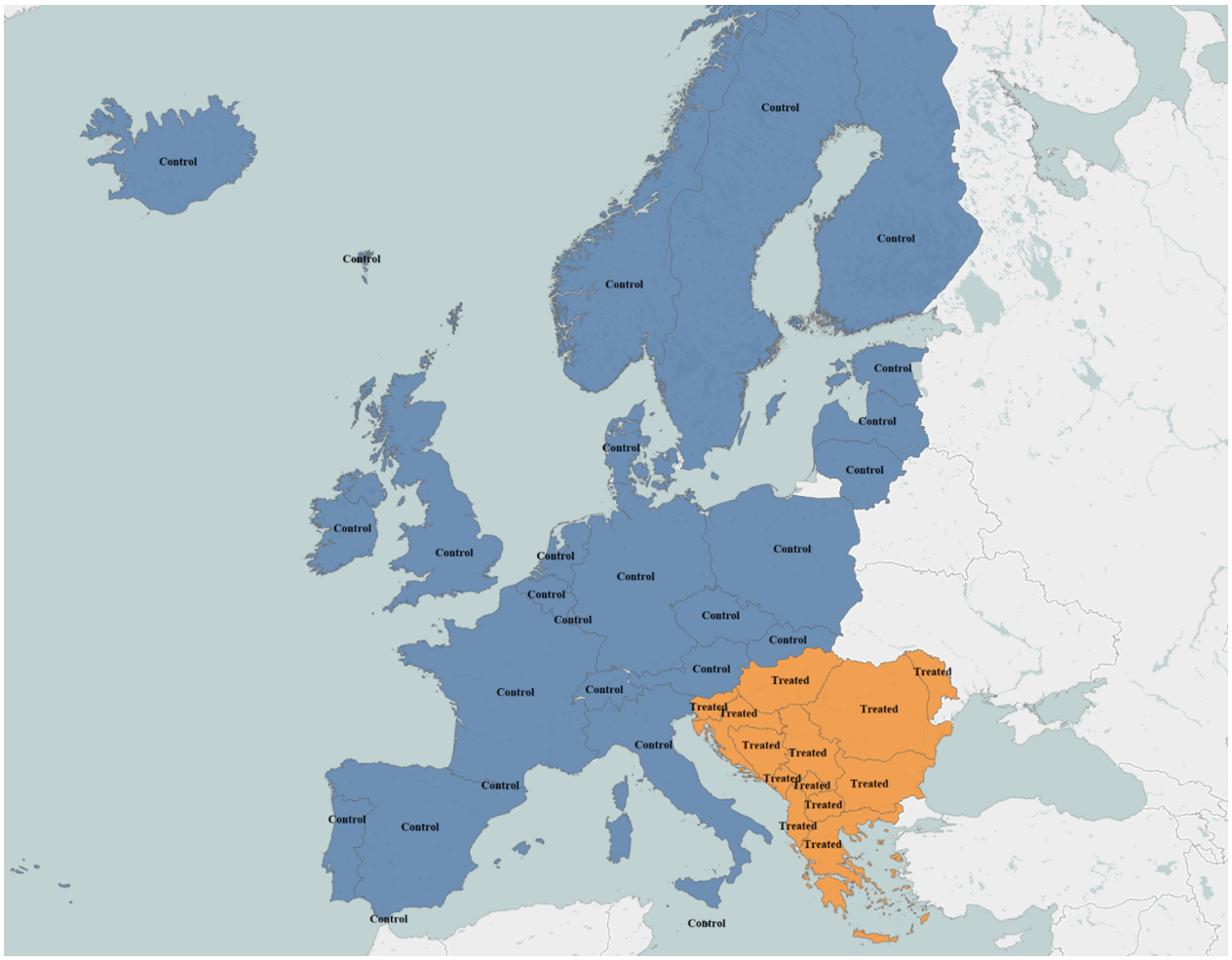
$$ATT = \tau = \mathbb{E}[Y_{Post}(1) - Y_{Post}(0) \mid T = 1], \tag{1}$$

and by the linearity of expectation,

$$\tau = \mathbb{E}[Y_{Post}(1) \mid T = 1] - \mathbb{E}[Y_{Post}(0) \mid T = 1]. \tag{2}$$

Figure 3: **Treated and control units**

This figure presents countries in treatment and control groups. Treated countries are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Kosovo, Macedonia, Moldova, Montenegro, Romania, Serbia, and Slovenia. Control countries are the remaining European nations.



This suggests $\mathbb{E}[Y_{Post}(1) \mid T = 1] = \tau + \mathbb{E}[Y_{Post}(0) \mid T = 1]$. The left-hand side of the equation contains a potential outcome variable that can be replaced by its observable counterpart $\mathbb{E}[Y_{Post} \mid T = 1]$ under the consistency assumption. As a benchmark counterfactual, I assume $\mathbb{E}[Y_{Post}(0) \mid T = 1] = \alpha_i + \delta_t$, containing fixed effects for cross-sectional units and time. Therefore, under parallel trends and no pre-trends assumptions:

$$\mathbb{E}[Y \mid T] = T \times \{ \tau + \alpha_i + \delta_t\} + (1 - T) \times \{ \alpha_i + \delta_t\}, \text{[19]} \tag{3}$$

and

$$\mathbb{E}[Y \mid T] = \tau \times T + \alpha_i + \delta_t. \tag{4}$$

This motivates the estimation of τ with a linear difference-in-differences regression using the two-way fixed effects (TWFE) structure below:

$$Y_{it} = \tau^{DD} \times T_{it} + \alpha_i + \delta_t + \epsilon_{it}. \tag{5}$$

The advantage of the above specification is that it provides a point estimate for τ^{DD}, while providing flexibility in terms of introducing covariates and additional fixed effects, and the ability to estimate dynamic treatment effects.[20] I run regressions on specification (5) at country-year and firm-year levels. Country-level outcome variables include yearly public/private debt as a % of the GDP, aggregated capital investments to assets, and sovereign yields, and firm-level outcome variables include yearly capital and R&D expenditures, and valuation ratios such as Tobin's Q and Market-to-book ratio. T_{it} is equal to one for Eastern European countries after the opening of Marmaray in 2014 and zero otherwise. α_i and δ_t denote country (or firm) and year fixed effects, respectively. In firm-level analyses, $\mathbb{E}[Y_{Post}(0) \mid T = 1]$ contains a rich array of fixed effect structures including firm, year, industry $\times$ year dummies along with nuisance variables such as logged book value of assets, cash flows to assets, logged firm age, long- and short-term leverage, depending on the outcome variable. I cluster the standard errors at the country level.

Challenges in identifying a homogeneous ATT One concern related to the estimation of τ^{DD} above is the potential violation of the unconfoundedness assumption. This can make the parallel trends assumption ($\mathbb{E}[Y_{Post}(1) - Y_{Pre}(0) \mid T = 1] = \mathbb{E}[Y_{Post}(1) - Y_{Pre}(0) \mid T = 0]$) unreliable.[21] What can violate unconfoundedness? Arguably, Marmaray is not built to influence economic activity in treated or control units. The motivation behind its construction was to solve Istanbul's traffic problem, and its opening date

[19] By definition, $\mathbb{E}[Y \mid T] = T \times \{ \mathbb{E}[Y_{Post}(1) \mid T]\} + (1 - T) \times \{ \mathbb{E}[Y_{Post}(0) \mid T]\}$.

[20] To eliminate the risk of W(control)-specific trends, the main regressions either do not control for nuisance variables or control for nuisance variables generated with data from the pre-treatment era.

[21] The trend in the treatment group should be matching the trend in the control group if the treatment group was not given treatment.

was mostly dependent on archaeological discoveries that could not be predicted ex-ante. These being said, a skeptic could still argue that governments of some European countries or some firms could have correctly anticipated the completion timeline of Marmaray and future changes in yields in certain years and endogenize these anticipations. Although I provide an abundance of evidence on the observed counterparts of the parallel trends assumption (see Figures 4 and 8 among others), the assumption itself is formally unverifiable, because it contains potential outcome variables even after the consistency assumption.

To tackle concerns related to anticipation or similar caveats, I run synthetic difference-in-differences (SDID) regressions following Arkhangelsky et al. (2021) and estimate a local ATT (τ^{SDID}) after matching countries on a rich array of observable characteristics. The variables I match on are inflation, foreign direct investment, gross fixed capital formation, GDP per capita, general government final consumption expenditure, households and nonprofit institutions serving households (NPISHs) final consumption expenditure, (total) final consumption expenditure, general government final consumption expenditure, current account balance, personal remittances received. As listed in Table A1 and summarized in Table A2, they are drawn from the World Bank and reported in % or $ terms.

SDID estimator puts more weight on non-Eastern European (control unit) countries and time periods (pre-treatment) that are on average more similar to the cross-sectional and times series characteristics of Eastern European countries.[22] I also provide a visual description of the treatment effects benchmarked against each country in the control group, similar to Figure 1 of Arkhangelsky et al. (2021), in order to highlight that the findings from SDID do not rely on the inclusion or exclusion of a particular control unit. Overall, the SDID strategy weakens this paper's reliance on parallel trends assumption.

Regional data and a DDD specification with country × year dummies The motivation behind estimating τ^{DD} and τ^{SDID} is to measure a homogeneous treatment effect on treated units. Once I estimate those, in order to provide evidence on the economic mechanism, I show how the treatment effect varies across treated units with respect to BRI-driven efficiency gains. To that end, I exploit Mbaye et al. (2018) data on BRI-driven time savings in international trade at the city level. Concentrating on the firm panel explained above, I estimate a DDD specification that highlights how treatment effects vary with respect to BRI-driven efficiencies and allows me to introduce rich fixed effects structures such as country × year or headquarter-city × industry fixed effects. These address some of the concerns mentioned above related to potential confounders, especially at the country-year level. They also help address potential concerns related to the violation of the implicit assumption of the TWFE model on homogeneous treatment effects in control

[22] In particular, unit weights are calculated so that the average outcome for Eastern European countries is parallel to the weighted average of non-Eastern European countries and time weights are calculated so that the average post-treatment outcome for each of the non-Eastern European countries differs by a constant from the weighted average of the pre-treatment outcomes for the same control units.

variables.[23]

Treatment assignment as a function of observables Under conditional unconfoundedness, I also consider the estimation of conditional average treatment effect (CATE) using a partially linear regression (PLR) model following Robinson (1988) and Chernozhukov et al. (2016, 2017). I model treatment as a function of confounders indicated as X. Confounders affect the treatment variable T via function $f(.)$ and the outcome variable via function $\theta(.)$ as follows:

$$T_i = f(X_i) + \eta_i, \tag{6}$$

and

$$\Delta Y_i = \theta(X_i) \cdot T_i + g(X_i, W_i) + \epsilon_i. \tag{7}$$

The above specification allows me to estimate the CATE of gaining access to BRI's economic corridor in Europe. Importantly, if $T_i = f(X_i) + \eta_i$ holds but it is not controlled for empirically, $f(X_i)$ would end up in the error term and cause bias because it would be a confounder between Y_i and X_i.

Here I collapse the time series information first into pre- and post-Marmaray periods and then take a difference (see, e.g., Bertrand et al. (2004)). The unit of observation i refers to countries or firms, and the outcome variables are the same as the ones that are previously introduced in this section. $\theta(X)$ contains variables such as BRI-driven time savings, reduction in freight times due to trade facilitation, historical inclusion in the Orient Express train line between Europe and Turkey, active trade agreements with Middle Eastern and Asian countries the year before Marmaray opens, and the logged distance (in km) from Turkey. W contains firm-level control variables that are previously explained (e.g., Lagged book value of assets, Lagged cash flows to assets, etc.).

The identifiability assumptions of the above specification are $\mathbb{E}[\epsilon \mid X, W] = 0$ and $\mathbb{E}[\eta \mid X] = 0$ for the initial stages of the estimation, and $\mathbb{E}[\epsilon \times \eta \mid X, W] = 0$ for the final stage. In addition to these, I make structural assumptions on $f(.)$ and $\theta(.)$. I estimate the outcome variable with weighted lasso and treatment with logistic regression and use three-fold cross-validation. This being said, I also use a wide variety of non-parametric methods to weaken the reliance on model specifications.

[23] Let $\mathbb{E}[Y_{Post}(1) \mid T = 1]$ and $\mathbb{E}[Y_{Pre}(0) \mid T = 1]$ depend on control variable W. Name the respective coefficients as θ_1 and θ_2. Under this scenario, $\tau = \tau^{DD} + (\theta_1 - \theta_2) \cdot X \neq \tau^{DD}$ unless θ's cancel out and τ^{DD} will end up being a biased estimate of τ

4 Summary Statistics

I gather data from several resources. I use data on public and private debt from IMF's Global Debt Database (GDD), new sovereign bond issuance from Thomson Reuters Refinitiv, corporate outcomes from Thomson Reuters Worldscope, and shipment data from de Soyres et al. (2018). Chinese aid data is drawn from https://www.aiddata.org/datasets. I also use country-level data from Eurostat, World Bank, and OECD. The countries covered in the above datasets vary and I use the maximum number of countries available in each dataset above. See, e.g., Appendix Figure A3 on the countries that are included in the GDD dataset. I report key summary statistics on the data below. Details on data collection and variable descriptions are presented in greater detail in Appendix Section B.

Table 1 presents key information on variables of interest. Panel A presents summary statistics of variables at the country level, and Panel B presents summary statistics of variables at the firm level. As shown in Panel A, mean (median) government debt to GDP ratio equals 60.81% (53.02%), mean (median) private debt to GDP ratio equals 218.73% (207.30%), and mean (median) non-financial corporate debt to GDP ratio equals 154.80% (137.24%).

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Table A3 of the Appendix complements Figure 4 and Table 1 by presenting additional important information on newly issued sovereign debt. As shown in Table A3, Romania's public debt increased by $128B in total after Marmaray, which constitutes a 16.36-fold increase relative to the total value of newly issued debt before Marmaray. Bulgaria, Hungary, and Serbia issued 19.62-fold, 5.38-fold, and 164.91-fold more debt after Marmaray compared to pre-Marmaray levels. Collectively, these figures suggest unprecedented increases in public debt issuance in treated countries.[24]

As shown in Panel A of Table 1, dollar-amount-weighted (labeled VW), mean, and median yields of newly issued sovereign debt are 1.31%, 1.24%, and 1.26% on average. I plot distributions of sovereign yields for treated and control units in Figure A6. I do so because the averages reported in Table 1 are attenuated

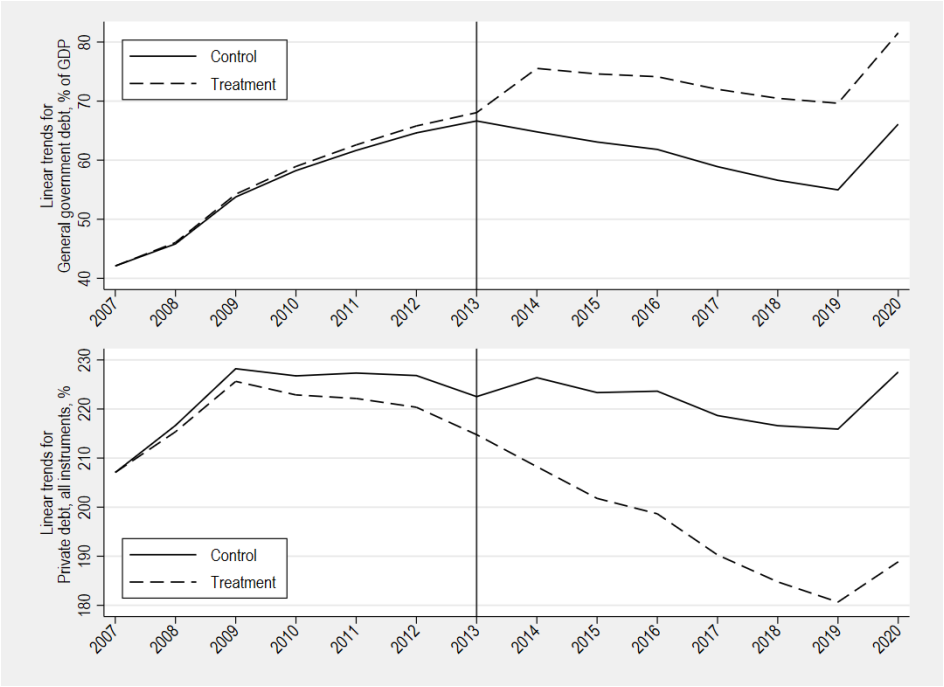
[24] Albania's, Hungary's, and Serbia's public debt to GDP ratios grew by around 5% per year. Montenegro's and Romania's public debt ratios grew by around 10% per year.

Table 1: **Summary Statistics**

This table presents summary statistics on key country- and firm-level variables. In panel A, *Government debt to GDP, %* is total stock of debt issued by the general government and *Private debt to GDP, %* is total stock of debt issued by households and nonfinancial corporations, as a share of GDP. *Corporate Debt to GDP, %* is total stock of loans and debt issued by non-financial corporations, and *Household debt to GDP, %* is total stock of debt issued by households, as a share of GDP. *Capital Inv. to Assets, %* denotes total capital investments deflated by total book value of assets in 2013. *VW, EW, and Median Yield to Maturity* denote dollar-issue-amount-weighted, mean, and median yields to maturity of a given country's newly issued sovereign debt in a given year. *Collective consumption expenditure to GDP* refers to government expenditure for providing services simultaneously to all members of the community, *Capital transfers, wages, and rents on land to GDP* refers to total remuneration paid by government to its employees along with grants and rents, and *Collective consumption and capital transfers to GDP* is their sum. *Fixed Capital formation to GDP* is the acquisition of fixed capital, inventories, and valuables minus sales. *Rail, Road, Airport, Seaport expenditure to GDP* refers to corresponding infrastructure investments as a percentage of GDP. In Panel B, *Capex to assets* is item4601/item2999, *Logged BVA* is log of item2999, *CF/AT* is item1651/item2999, *LT Leverage* is item3255/item2999, *ST leverage* is item3051/item2999, *Tobin's Q* is (item7230+item7210-item7220)/item7230, and *Logged M/B* is item7210/item7230. *City-level Time Saving* is the upper bound of BRI-driven reduction in freight times to Beijing, China from de Soyres et al. (2018). Sampling period is 2007-2021.

	Panel A: Country-level data			
	N	**Mean**	**Median**	**Stdev.**
Government debt to GDP, %	504	60.81	53.02	34.81
Private debt to GDP, %	420	218.73	207.30	82.02
Corporate debt to GDP, %	420	154.80	137.24	67.69
Household debt to GDP, %	420	63.61	58.07	30.24
Capital Inv. to Assets, %	536	3.32	1.14	5.41
Yield to Maturity (VW)	480	1.31	1.00	1.77
Yield to Maturity (EW)	480	1.24	0.88	1.76
Yield to Maturity (Median)	480	1.26	0.93	1.76
Collective consumption expenditure to GDP	420	23.66	24.50	6.25
Capital transfers, wages, and rents on land to GDP	420	40.67	41.20	9.04
Collective consumption and capital transfers to GDP	420	64.33	63.75	12.33
Fixed Capital formation to GDP	420	11.06	10.90	3.41
Rail infrastructure expenditure to GDP, %	476	0.21	0.11	0.24
Road infrastructure expenditure to GDP, %	476	0.43	0.28	0.46
Airports infrastructure expenditure to GDP, %	476	0.03	0.01	0.07
Seaports infrastructure expenditure to GDP, %	476	0.04	0.00	0.11
	Panel B: Firm-level data			
	N	**Mean**	**Median**	**Stdev.**
Logged Q	33,952	0.93	0.81	0.47
Logged M/B	33,956	0.66	0.52	0.55
Capex to Assets (%)	37,668	2.22	0.20	4.82
Logged BVA	32,774	19.03	18.83	2.51
CF/AT (%)	32,337	0.02	0.72	3.85
LT Leverage	32,430	0.23	0.21	0.19
ST Leverage	29,106	0.41	0.33	0.31
City-level Time Saving	37,668	2.95	2.93	0.20

Figure 4: **Debt Issuance Trends**
This figure presents linear trends for public and private debt issuance by treated and control units before and after the opening of Marmaray. Data on new debt issuance is drawn from Thomson Reuters Refinitiv. Details on data collection and variable descriptions are presented in Appendix Section B.2.



by years of no sovereign debt issues that are labeled as zero for these variables and later controlled for using dummy variables in regressions. Figure A4 in the Appendix also provides important details on the characteristics of new sovereign debt issued by treated and control units, before and after the opening of Marmaray. It does so by using Venn diagrams that categorize debt issues across three dimensions: investment grade status, protection for inflation in the issuer country, and euro denomination. As shown, debt issues are categorized as investment grade, not-inflation protected and euro-denominated was 7.9% before the opening of Marmaray, and this number increased to 33.8% after Marmaray. This constitutes a surge of 328% relative to pre-Marmaray levels and is driven by the decrease in the percentage of *non*-investment-grade debt issues from 44.4% to 24.2%. The percentage of debt issues by controls units that are categorized as investment grade, not-inflation protected and euro-denominated was 49.3% before Marmaray, and this number decreased to 42.9% after the opening of Marmaray. This suggests treated countries observe a large increase in euro-denominated sovereign debt that is categorized as investment-grade and does not protect investors from inflation.

Figures A5, A6 and A7 provide useful information on the distributions of yearly issue amounts, durations of newly issued sovereign debt, and yields of newly issued debt by treated and control units, before and after the opening of Marmaray. As shown in Figure A5, there is a large increase in yearly issues of treated

countries. As shown in Figure A7, treated and control units both issue debt with longer durations than before. As shown in Figure A6, treated units observe higher yields after the opening of Marmaray, whereas control units do not experience such an increase. These figures, coupled with Figure A4, suggest that Moody's assigned investment-grade ratings to more sovereign debt issues by treated units even though issue amounts and yields were considerably higher on average. These being said, I do also find an increase in bond durations for treated units. The increase in durations also exists for control units, but their issue amounts and yields do not increase as much.

As shown in Panel A of Table 1, total capital investments at the country level deflated by total book value assets at the country level (i.e., value-weighted capital investments to assets) amount to 3.32% on average. Collective consumption expenditure is 23.66% of the GDP on average, and capital transfers (e.g., business grants), wages to government employees, and rents on land (not capital formation) amount to 64.33%. In contrast, fixed capital formation equals 11.06% on average. Delving deeper into capital formation, investments in railways, roads, airports, and seaports amount to 0.21%, 0.43%, 0.03%, and 0.04% on average. As shown in Panel B, the mean (median) Logged Tobin's Q ratio equals 0.93 (0.81). Average capital investments to book value assets equals 2.22%, and Logged book value of assets (in $) equals 19.03 on average.

5 Main Findings

This section presents the main findings of the paper. I start by demonstrating the ramifications of gaining access to BRI's economic corridor on public and private debt issuance, sovereign yields, and country-level capital investments in Section 5.1. In Section 5.2, I present my findings on ineffective government spending after gaining access to BRI's economic corridor by studying social investments and capital formation. Section 5.3 presents findings on firm-level investment and valuations.

5.1 Sovereign Debt Issuance and Rising Yields

In this section, I present the effects of access to BRI on public and private debt issuance by running DD and SDID regressions explained in detail in Section 3. As shown in Table 2, I identify a 12.39% (t-stat = 2.53) increase in government debt in Eastern European countries on average due to treatment. SDID estimates suggest that the increase amounts to 16.95% (t-stat = 5.15) after matching treated units with countries that have similar characteristics. These numbers reflect 20.37%(=12.39/60.81) and 27.87%(=16.95/60.81) increases relative to the sample mean. Figure 5 presents my findings on the dynamics of τ^{DD}. It provides evidence on the observable counterpart of the parallel trends assumption and underlines a persistent increase in public debt in the treatment period.

The remaining columns of Table 2 highlight economically and statistically significant reductions in

Figure 5: **Public and Private Debt to GDP in the Event Time**
This figure presents time-specific treatment effects in public and private debt to GDP ratios. Data is drawn from IMF's GDD dataset. Detailed variable descriptions are in Section B.1.

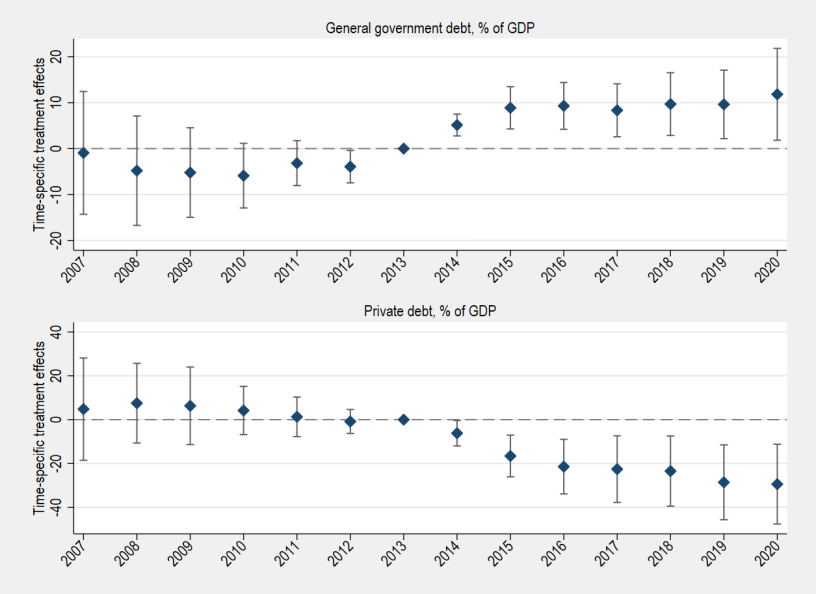


Figure 6: **Corporate and Household Debt to GDP in the Event Time**
This figure presents time-specific treatment effects in corporate and household debt to GDP ratios. Data is drawn from IMF's GDD dataset. Detailed variable descriptions are in Section B.1.

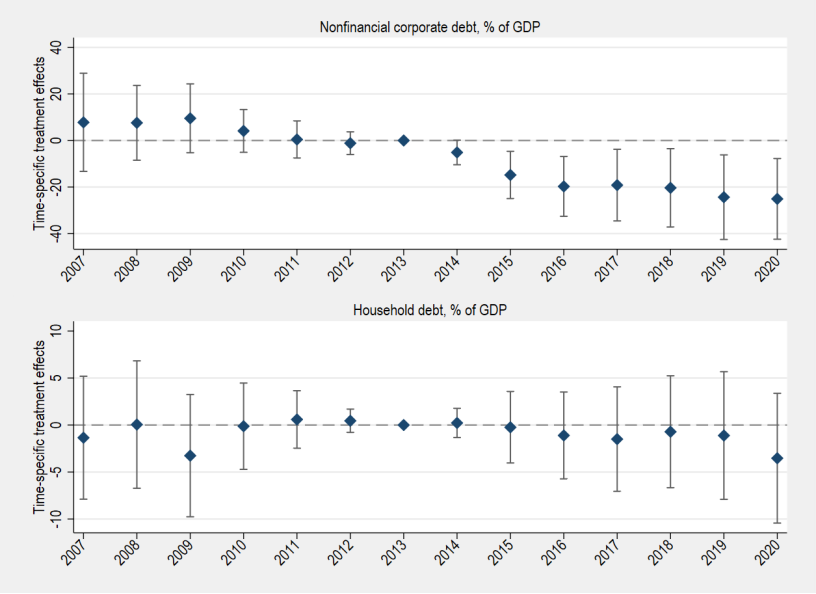


Figure 7: **Capital Investments in the Event Time**
This figure presents time-specific treatment effects in country-level capital investments to country-level book value of assets. Data is drawn from the Thomson Reuters Worldscope dataset. Detailed variable descriptions are in Section B.3.

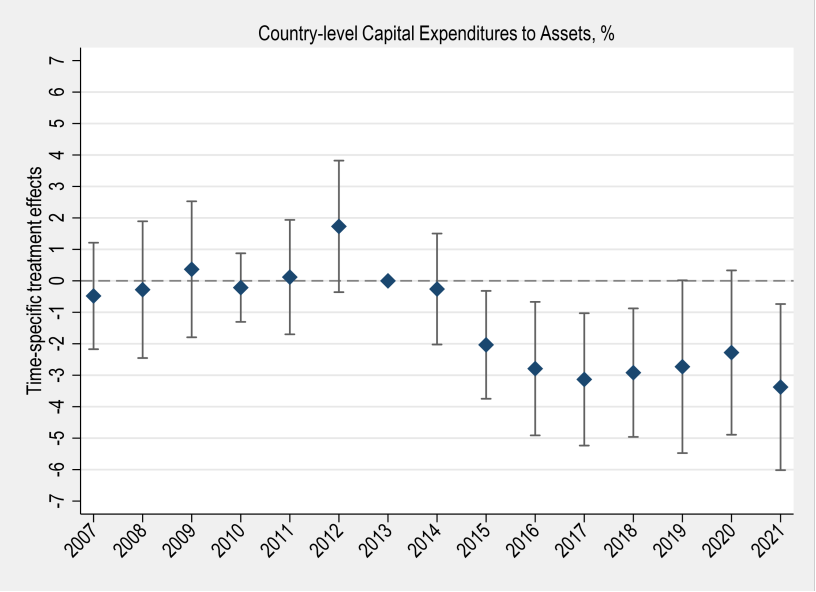


Figure 8: **Sovereign Yields in the Event Time**
This figure presents time-specific treatment effects on dollar-amount-weighted yields to maturity. Data is drawn from the Thomson Reuters Refinitiv dataset. Detailed variable descriptions are in Section B.2.

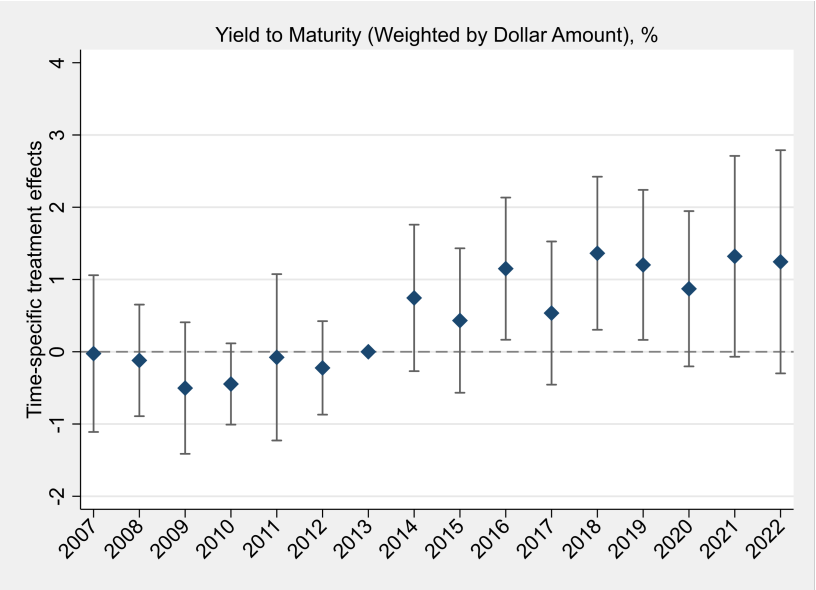


Table 2: **Debt to GDP**

Government debt to GDP, % is total stock of debt issued by the general government and *Private debt to GDP, %* is total stock of debt issued by households and nonfinancial corporations, as a share of GDP. *Corporate Debt to GDP, %* is total stock of loans and debt issued by non-financial corporations. *Capital Inv. to Assets, %* denotes total capital investments deflated by total book value of assets in 2013. Details on GDD data can be found in Section B.1 and details on corporate data can be found in Section B.3. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Government debt to GDP, %	**Private debt to GDP, %**	**Corporate Debt to GDP, %**	**Capital Inv. to Assets, %**
τ^{DD}	12.39**	-24.52**	-22.43**	-2.64***
	(2.53)	(-2.14)	(-2.08)	(-2.79)
τ^{SDID}	16.95***	-26.32**	-24.94***	-6.00***
	(5.15)	(-2.20)	(-2.76)	(-3.11)
N	504	420	420	420
R^2	0.916	0.915	0.893	0.926

private debt and capital expenditures. As shown, I identify a 24.52% (t-stat = 2.14) decline in private debt, which can be explained by the 22.43% (t-stat = 2.08) decrease in corporate debt. These figures amount to 11.21% (=24.52/218.73) and 14.49% (=22.43/154.80) reductions relative to sample averages. SDID effects are comparable economically (26.32% and 24.94%) and yield higher statistical significance with t-stats of 2.20 and 2.76. Figure 6 shows dynamic treatment effects and presents evidence once again supporting the idea that I don't have an unnatural experiment. I doing so, I also highlight that the effects on household debt are not economically significant. Importantly, in untabulated analyses, I find that time-specific treatment effects on GDP, the denominator, are insignificant and do not have a trend.

The results presented so far highlight a significant increase in public debt and a significant decrease in private debt that is driven by a large reduction in corporate debt. Does the reduction in corporate borrowing result in lower capital investments? As shown in the last column of Table 2, I identify a 6.64% (t-stat = 2.79) increase in government debt in Eastern European countries on average due to treatment. Figure 7 presents my findings on the dynamics of τ^{DD} and underlines a persistent decrease in capital investments in Eastern European countries during the treatment period. Once again, SDID estimates that depend less on the parallel trends assumption yield similar results. In particular, they suggest that the decrease in capital investments amounts to 6.00% (t-stat = 3.11) after matching treated units with countries that have similar characteristics.

The last piece of the empirical evidence presented in this section is on sovereign yields. Results so far highlight a rise in public debt and contractions in private debt and investments. These results however do not say much about how financial markets price newly issued sovereign debt by treated units (price takers in

sovereign debt markets) after getting access to BRI's economic corridor. If government debt issuance reduces the amount of capital investment by private firms, the long-run growth of the economy can decline. This risk can be significant if the newly issued debt is used to finance immediate consumption (e.g., social transfers) compared to productive longer-term investment (e.g., capital formation and education). Importantly, governments can reduce debt burden by raising inflation under the assumption that debt is issued in local currency. Transmission of sovereign risk to the financial sector can distort financial stability.

Table 3: **Rising Sovereign Yields and Worsening Macroeconomic Sentiment**

In Panel A, *VW, EW, and Median Yield to Maturity* denote dollar-issue-amount-weighted, mean, and median yields to maturity of a given country's newly issued sovereign debt in a given year. Control variables are *Macaulay Duration*, *% of issues listed as investment grade by Moody's*, *% of issues that are denominated in Euros*, *logged sum of last five years' debt issue amounts* and *% of issues that are inflation-protected*. These control variables are all dollar-issue-amount-weighted and calculated at the country-year level. For brevity, coefficient estimates for the control variables are reported in Table A4 and detailed variable descriptions are in B.2. In Panel B, news-based sentiment measures for Inflation Forecast, Financial Stability, and Economic Uncertainty are from Thomson Reuters MarketPsych Indices (TRMI). The sample contains Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Sweden, Switzerland, and United Kingdom. The sampling period is between 2007 and 2018. Sentiment scores are standardized to the unit interval between zero and one. Detailed explanations on sentiment scores are in Section B.6. In both panels, standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Panel A: Sovereign Yields		
	VW, %	**EW, %**	**Median, %**
τ^{DD}	1.17**	1.03**	1.05**
	(2.37)	(2.14)	(2.18)
τ^{SDID}	1.97***	1.71***	1.54***
	(4.40)	(4.49)	(3.71)
Controls	Yes	Yes	Yes
N	480	480	480
R^2	0.768	0.760	0.752
	Panel B: News-based Macroeconomic Sentiment		
	Inflation Forecast	**Financial Stability**	**Economic Uncertainty**
τ^{DD}	-0.08***	-0.04*	-0.04**
	(-2.99)	(-2.04)	(-2.65)
τ^{SDID}	-0.06***	-0.02***	-0.05***
	(-3.03)	(-2.82)	(-3.37)
N	300	300	300
R^2	0.684	0.512	0.321

Table 3 tackles these questions by analyzing newly-issued sovereign debt using a country-year panel. In Panel A, I analyze dollar-issue-amount-weighted, mean, and median sovereign yields in a given country-year.

In doing so, I find that the treated countries observe increases in sovereign yields across different specifications. As shown, τ^{DD} varies between 1.05% and 1.17% with t-stats of 2.14 to 2.37. SDID estimates suggest that the ATT is between 1.54% and 1.97% with t-stats between 3.71 and 4.40. In Panel B, I show significant reductions in news-based sentiment scores for inflation forecast, financial stability, and economic uncertainty. As shown, τ^{DD} varies between -4% and -8% with t-stats of -2.04 to -2.99, and SDID estimates suggest that the ATT is between -2% and 6% with t-stats between -2.82 and -3.37. Overall, the results presented in this section indicate a rise in public debt and reduction in private borrowing and investment behavior. Financial markets price the additional risks by requiring higher sovereign yields. I provide supplementary evidence on rising risks by using news-based sentiment indices.

5.2 Unproductive Government Spending

The results presented in the previous section indicate a rise in public debt and reductions in private borrowing and investment. Additional findings on sovereign yields and macroeconomic sentiment indicate increases in treated country sovereign risks after treatment. In this section, I provide supplementary evidence on these findings by analyzing government expenditures by function. To that end, I examine various dimensions of fixed capital formation and social expenditures. In particular, I analyze infrastructure investments into railways, highways, airways and seaways, and social expenditures such as collective consumption expenditures, wages, rents, and royalties.

Table 4: **Infrastructure Investments**

Rail, Road, Airport, Seaport expenditure to GDP refers to corresponding infrastructure investments in railways, roads, airports, and seaport as a percentage of GDP. Data is from International Transport Forum, OECD. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Railway expenditure to GDP, %	**Road expenditure to GDP, %**	**Airway expenditure to GDP, %**	**Seaway expenditure to GDP, %**
τ^{DD}	0.08**	0.07	-0.00	0.03
	(2.20)	(0.74)	(-0.14)	(1.55)
τ^{SDID}	-0.11	-0.16*	-0.02	0.03
	(-1.48)	(-1.72)	(-1.12)	(0.96)
N	476	476	476	476
R^2	0.774	0.731	0.296	0.295

Table 4 highlights that infrastructure investments do not significantly increase while governments of treated countries are issuing new debt with significantly higher yields. I identify increases of 0.08% (t-stat=2.20), 0.07% (t-stat=0.74) and 0.03% (t-stat=1.55) in railway, road, and seaway expenditures, while

airway expenditures remain stable. SDID estimates confirm that the ATT is insignificant statistically and economically.

As shown in Table 5, I identify a 1.58% (t-stat = 2.12) increase in collective consumption expenditures in Eastern European countries on average due to treatment. The SDID estimate suggests that the increase amounts to 1.98% (t-stat = 2.28) after matching treated units with countries that have similar characteristics. These numbers reflect 6.68%(=1.58/23.66) and 8.37%(=1.98/23.66) increases relative to the sample mean. Meanwhile, as shown in columns 2 and 3, I identify a 2.84% increase in capital transfers, wages, and rents on land, and a 4.42% increase in the sum of collective consumption and capital transfers, wages, and rents on land. Importantly, SDID estimates suggest a reduction of 1.47% (t-stat=-2.20). These results suggest increases in social consumption and transfers rather than productive investments.[25]

Table 5: **Social Spending and Capital Formation**

Collective consumption expenditure to GDP refers to government expenditure for providing services simultaneously to all members of the community, *Capital transfers, wages, and rents on land to GDP* refers to total remuneration paid by government to its employees along with grants and rents, and *Collective consumption and capital transfers to GDP* is their sum. *Fixed Capital formation to GDP* is the acquisition of fixed capital, inventories, and valuables minus sales of these items. Data on government expenditures are drawn from Eurostat. Detailed variable descriptions are presented in Section B.5. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Collective consumption expenditure to GDP, %	**Capital transfers, wages, and rents on land to GDP, %**	**Collective consumption and capital transfers to GDP, %**	**Fixed Capital formation to GDP, %**
τ^{DD}	1.58**	2.84*	4.42**	-0.53
	(2.12)	(1.77)	(2.21)	(-0.37)
τ^{SDID}	1.98**	2.81*	4.21*	-1.47**
	(2.28)	(1.78)	(1.92)	(-2.20)
N	420	420	420	420
R^2	0.937	0.907	0.901	0.629

5.3 Firm-level Investments and Valuations

Results presented in Sections 5.1 and 5.2 suggest that gaining access to BRI's economic corridor through Marmaray motivates Eastern European countries to issue large amounts of sovereign debt. I identify distortionary effects on private (in particular non-financial firm) debt issuance and investments at the country level along with increases in sovereign yields. I analyze government spending across different functions and do not find economically or statistically significant increases in capital formation. Yet, I identify significant

[25]The increase in collective consumption could be related to myopic government behaviour (Acharya and Rajan (2013)) or an income effect due to gaining access to BRI.)

increases in social spending such as total social consumption and rents.

In this section, I delve deeper into analyzing corporate outcomes. I start by providing empirical evidence on the effects of gaining access to BRI on capital expenditures, R&D expenditures, and firm valuations. In doing so, I utilize a firm-year panel and a TWFE structure that allows me to estimate a homogeneous ATT while controlling for firm, industry $\times$ year, and industry $\times$ country fixed effects. I then utilize data on BRI-related efficiency gains at the city level to estimate heterogeneous treatment effects on treated units. This enables me to control for heterogeneity at the country $\times$ year, and city $\times$ industry levels. I finish the section by providing evidence on effect heterogeneity across Europe (as opposed to Eastern Europe).

Table 6 presents my findings on homogeneous ATT using the TWFE structure presented in Section 3. As shown, I identify a 0.68% (t-stat = 2.08) decrease in capital investments, a 2.98% (t-stat = 3.78) decrease in R&D investments, and a 5% (t-stat = 2.42) decrease in Tobin's Q in Eastern European firms on average due to treatment. The results are robust to a rich array of fixed effects structures and complement contractions in private borrowing and (value-weighted) capital investments presented in Table 2.

Results presented in Table 6 suggest that treatment effects are homogeneous across treated units. To delve into potential effect heterogeneity, Figure 9 presents locations of European firms (using headquarter latitudes and longitudes) along with freight time reductions to/from Beijing, China for their locations. The areas of squares reflect the number of the firms in a given location and their colors reflect percentage time savings in freight times due to BRI, based on de Soyres et al. (2018) estimates. As shown, BRI-related time savings vary across Eastern Europe.

Table 7 complements Table 6 by presenting evidence on effect heterogeneity. In doing so, I also provide evidence on the economic channel. In particular, I present heterogeneous treatment effects on treated units by using intensive margins for BRI-related time savings. As shown in Table 7's first panel, I identify a 0.48% (t-stat = 2.50) decrease in capital investments, a 3.84% (t-stat = 5.58) decrease in R&D investments, and a 16% (t-stat = 11.43) decrease in Tobin's Q in Eastern European firms on average due to treatment and a unit change in city-level time savings due to BRI. The results are robust to controlling for firm and country-year fixed effects. As shown in Table 7's second panel, controlling for firm and city-industry interacted fixed effects produces similar results.

Table A8 presents additional evidence on the economic channel and heterogeneous treatment effects across Europe. As shown, I find that a standard deviation change in BRI-related time savings increases the government debt ratio by 2.98 standard deviations, decreases the corporate debt ratio by 2.21 standard deviations, and increases sovereign yields by 2.84 standard deviations. It also decreases capital investments by 0.22 standard deviations and Logged Tobin's Q by 0.96 standard deviations.

Table 6: **Firm-level Outcomes**

Capex to assets is item4601/item2999, *R&D expenditures to book value of assets* is item1201/item2999, *Tobin's Q* is (item7230+item7210-item7220)/item7230, and *Logged M/B* is item7210/item7230. Control variables for the first two columns are Logged BVA_{-1}, $CF2AT_{-1}$, LT $LEVERAGE_{-1}$, and ST $LEVERAGE_{-1}$, and control variables for the last two columns are Logged BVA_{-1}, Logged BVA^2_{-1}, and Logged Age_{-1}. For brevity, coefficient estimates for the control variables are reported in Table A5 and detailed variable descriptions are presented in B.3. Sampling period is 2007-2021. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Capex to Assets, %	**R&D Inv. to Assets, %**	**Logged Tobin's Q**	**Logged M/B**
τ^{DD}	-0.83**	-3.50***	-0.06**	-0.08*
	(-2.36)	(-3.59)	(-2.67)	(-1.85)
Fixed Effects		*Firm, Year*		
Controls	Yes	Yes	Yes	Yes
N	28,299	28,299	30,631	30,634
R^2	0.554	0.520	0.752	0.791
τ^{DD}	-0.75**	-3.09***	-0.05**	-0.07*
	(-2.28)	(-4.16)	(-2.48)	(-2.01)
Fixed Effects		*Firm, Industry* $\times$ *Year*		
Controls	Yes	Yes	Yes	Yes
N	28,292	28,292	30,622	30,625
R^2	0.575	0.546	0.766	0.806
τ^{DD}	-0.68**	-2.98***	-0.05**	-0.07*
	(-2.08)	(-3.78)	(-2.42)	(-1.93)
Fixed Effects		*Firm, Industry* $\times$ *Year, Industry* $\times$ *Country*		
Controls	Yes	Yes	Yes	Yes
N	28,288	28,288	30,619	30,622
R^2	0.584	0.553	0.769	0.809

Figure 9: **Reductions in Freight Times to Beijing, China**
This figure presents data on European businesses and their BRI-related efficiency gains. The sizes of the squares on the map and the width of the rectangles on the legend reflect numbers of the firms in a given latitude and longitude. The tones of squares on the map reflect BRI-related time savings in shipments to Beijing. Darker squares correspond to higher time-saving. The data are drawn from from de Soyres et al. (2018) and Thomson Reuters Worldscope. Details on data collection are provided in Appendix Sections B.3 and B.4.

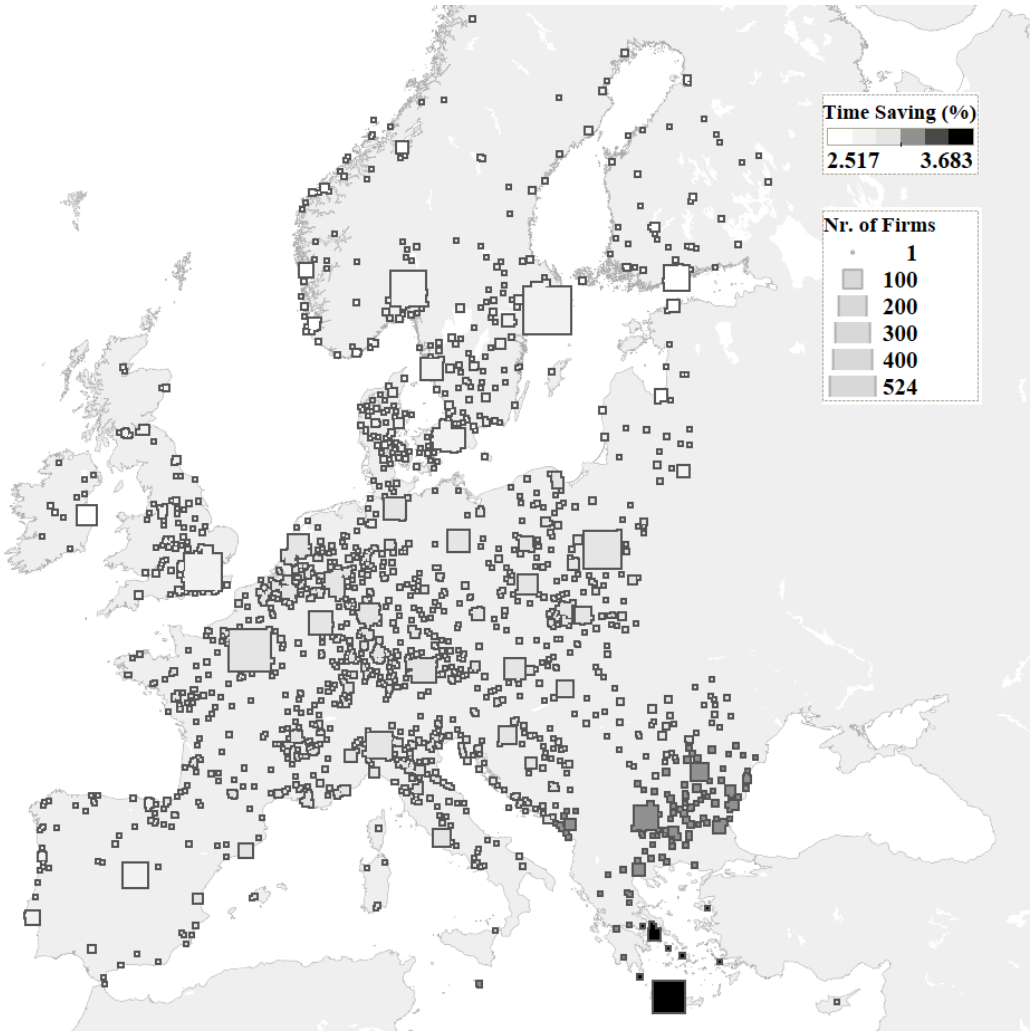


Table 7: **Firm-level Outcomes and Regional BRI Exposure**

Capex to assets is item4601/item2999, *R&D expenditures to book value of assets* is item1201/item2999, *Tobin's Q* is (item7230+item7210-item7220)/item7230, and *Logged M/B* is item7210/item7230. Control variables for the first two columns are Logged BVA_{-1}, $CF2AT_{-1}$, LT $LEVERAGE_{-1}$, and ST $LEVERAGE_{-1}$, and control variables for the last two columns are Logged BVA_{-1}, Logged BVA^2_{-1}, and Logged Age_{-1}. For brevity, coefficient estimates for the control variables are reported in Table A6 and detailed variable descriptions are presented in B.3. Sampling period is 2007-2021. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Capital Inv. to Assets, %	**R&D Inv. to Assets, %**	**Logged Tobin's Q**	**Logged M/B**
$\tau^{DD}\times$ City-level Time Saving	-0.48**	-3.84***	-0.16***	-0.16***
	(-2.50)	(-5.58)	(-11.43)	(-16.42)
Fixed Effects		*Firm, Country* $\times$ *Year*		
N	28,281	28,281	30,615	30,618
R^2	0.579	0.536	0.761	0.803
$\tau^{DD}\times$ City-level Time Saving	-0.58***	-4.64***	-0.17***	-0.18***
	(-3.11)	(-6.86)	(-9.89)	(-12.19)
Fixed Effects		*Firm, City* $\times$ *Industry*		
N	28,234	28,234	30,572	30,575
R^2	0.612	0.568	0.773	0.815

Table 8: **Effect Heterogeneity Across Europe**

This table presents results from running a partially linear regression (PLR) model following Robinson (1988) and Chernozhukov et al. (2016, 2017). Confounders X affect the treatment variable T via function $f(.)$ and the outcome variable via function $\theta(.)$ as:

$$T_i = f(X_i) + \eta_i \tag{8}$$

and

$$\Delta Y_i = \theta(X_i) \cdot T_i + g(X_i, W_i) + \epsilon_i. \tag{9}$$

Time series information is collapsed into pre- and post-Marmaray periods and first difference is taken for all variables. The unit of observation i refers to countries for columns 1 to 3 and firms in columns 4 and 5. $\theta(X)$ contains BRI-driven time savings, time savings due to trade facilitation, historical inclusion in the Orient Express train line between Europe and Turkey, active trade agreements with Middle Eastern and Asian countries the year before Marmaray opens, and the logged distance (in km) from Turkey. W contains firm-level control variables for *Capex to assets, %* and *Tobin's Q* as in 6. *Gov. debt to GDP, %* is total stock of debt issued by the general government and *Corp. Debt to GDP, %* is total stock of loans and debt issued by non-financial corporations. *Yield to Maturity, %* denotes dollar-issue-amount-weighted yield to maturity of a given country's newly issued sovereign debt in a given year. *Capex to assets, %* is item4601/item2999 and *Tobin's Q* is (item7230+item7210-item7220)/item7230. Details on GDD and Worldscope data can be found in Section B.1 and details on corporate data can be found in Section B.3 and B.3. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Δ Post Marmaray - Pre Marmaray				
	Gov. debt to GDP, %	**Corp. debt to GDP, %**	**Yield to Maturity, %**	**Capex to Assets, %**	**Logged Tobin's Q**
$\theta(X)$					
BRI time saving	2.98***	-2.21**	2.84***	-0.22**	-0.96***
	(-2.95)	(-2.12)	(-5.57)	(-2.24)	(-2.78)
Time savings due to	-0.84	-0.34	-1.6	-0.56	0.86*
trade facilitation	(-0.62)	(-0.32)	(-1.34)	(-1.32)	(-1.96)
Orient express	-1.42*	-0.24	1.15	-0.03	0.23
	(-1.91)	(-0.53)	(-1.18)	(-0.34)	(-1.17)
Trade agreements	2.41***	-0.59	0.76*	-0.31	-0.05
with Middle East and Asia	(-3.04)	(-0.52)	(-1.67)	(-1.35)	(-0.27)
Logged distance from Turkey	-0.29	-1.07	2.14	-0.25	0.24
	(-0.17)	(-0.56)	(-1.36)	(-1.11)	(-0.85)

6 Growing Chinese Influence over Europe

This section presents new evidence on how gaining access to BRI's economic corridor affects European governments' official membership in China's Belt and Road program, developmental aid received from China and other countries, and the dynamics of international trade between Europe and the Near East.

Table 9: **Government BRI Membership and Chinese Aid**

BRI Membership is equal to one if a country's government is a member of Belt and Road Initiative (BRI) in a given year. *Developmental Aid from China (Logged, $)* comprises Chinese grants, technical assistance, loans, buyer's credits, seller's credits, debt forgiveness, debt rescheduling, debt refinancing, scholarships, and training activities to a given recipient country in a given year. *Total Development Aid Received (Logged, $)* is total official development assistance received. Development assistance comprises grants or loans to developing countries and territories on the OECD/DAC list of aid recipients that are undertaken by the official sector with promotion of economic development and welfare as the main objective and at concessional financial terms. Chinese foreign aid data is from AidData and total official development assistance received is from Worldbank. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	BRI Membership	**Developmental Aid from China (Logged, $)**	**Total Development Aid Received (Logged, $)**
τ^{DD}	0.45***	2.35**	-0.07***
	(5.27)	(2.46)	(-3.29)
τ^{SDID}	0.50***	2.84***	-0.05***
	(3.70)	(3.18)	(-2.92)
N	512	528	645
R^2	0.644	0.753	0.791

Table 9 presents my findings on BRI membership and developmental aid. As shown, I identify a 45% (t-stat = 5.27) increase in BRI Membership in Eastern European countries on average due to treatment. The SDID estimate suggests that the increase amounts to 50% (t-stat = 3.70) after matching treated units with countries that have similar characteristics. As shown in Figure 10, there is perfect compliance in BRI membership by 2019 in the treatment group.

As shown in columns 2 and 3, I identify a 235% increase in total developmental aid received from China and a 7% decrease in total aid received by Eastern European countries. SDID estimates suggest an increase of 284% (t-stat=3.18) and a reduction of 5% (t-stat=-2.92), respectively. These results highlight the growing importance of China in Eastern Europe.

How does gaining access to BRI affect trading activities? Table 10 presents my findings on international trade. As shown, I identify a 12% (t-stat = 2.23) increase in the dollar value of good exports after treatment, a 77.12 units increase in export volume, and a 6.13% increase in merchandise exports to high-income economies (including the Middle East and Europe). The SDID estimate suggests that these figures amount to 17% (t-stat = 3.03), 44.34 (t-stat = 3.49) units, and 3.07% (t-stat = 2.94) after matching treated units with countries

Figure 10: **BRI Membership Over Time**

This figure presents the percentage of treated and control units that become an official members of China's Belt and Road program in a given year. The vertical line denotes the year Marmaray is opened. Treated units are Eastern European countries and control units are the remaining European countries.

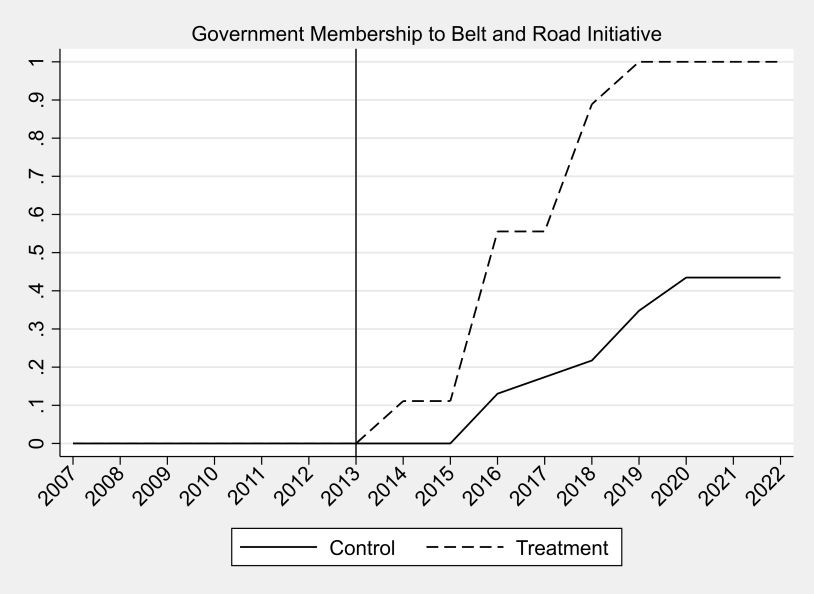


Table 10: **Marmaray and International Trade**

Goods exports (imports) refer to all movable goods including nonmonetary gold and net exports of goods under merchanting involved in a change of ownership from residents to nonresidents (from nonresidents to residents) in U.S. dollars. Export/Import volume indexes are from UNCTAD's volume index series. Merchandise exports to high-income economies and imports from the Near East are the sum of merchandise exports/imports by the reporting economy from high-income/Near East economies according to the World Bank classification of economies. Data are expressed as a percentage of total merchandise imports by the economy. Data are from Worldbank with the following identifiers: Goods exports is BX.GSR.MRCH.CD, Export volume index is TX.QTY.MRCH.XD.WD, Merchandise exports to high-income economies is TX.VAL.MRCH.HI.ZS, Goods imports is BX.GSR.MRCH.CD, Import volume index is TM.QTY.MRCH.XD.WD, and Merchandise imports from the Near East is TM.VAL.MRCH.AL.ZS. Standard errors are clustered at the country level. $\star\star\star$, $\star\star$, and $\star$ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Goods exports (Logged, $B)	**Export volume index**	**Merchandise exports to high-income countries (% of Merch.)**	**Goods imports (Logged, $B)**	**Import volume index**	**Merchandise imports from Near East (% of Merch.)**
τ^{DD}	0.12**	77.12***	6.13*	0.02	23.10*	0.95***
	(2.23)	(3.73)	(1.78)	(0.47)	(1.97)	(3.26)
τ^{SDID}	0.17***	44.34***	3.07***	-0.02	21.45***	0.89***
	(3.03)	(3.49)	(2.94)	(-0.69)	(2.76)	(3.54)
N	523	531	560	523	517	551
R^2	0.997	0.919	0.885	0.997	0.940	0.887

that have similar characteristics, respectively.

As shown in columns 3 to 6, I also obtain increases in import volume (but not economic magnitude, which suggests a cheaper unit cost of an import per volume) and increases in imports from the Near East (i.e. Middle East and South Western Asian countries). Collectively, these results suggest that economic and political ties between Asian and Eastern European countries gain momentum after the opening of Marmaray.

7 Conclusion

In 2013, BRI was announced by China as the project of the century. BRI, reminiscent of the Silk Road, is not only a massive and extremely promising infrastructure project but also a difficult finance problem to solve. In this paper, I provide the first analysis of BRI's effects on financial markets and real economic activity in Europe. I use the opening of Marmaray under Istanbul's Bosporus Strait for causal inference, because it geographically positions nearby countries on BRI's economic corridor. Using this methodology, I find that governments of countries that get placed on BRI's economic corridor sharply increase sovereign debt issuance and devote more resources to collective consumption spending rather than fixed capital formation.

Businesses in these countries issue less debt, lower capital investments, and observe reductions in their valuations. Overall, my findings highlight the distortionary effects of BRI on European businesses and raise concerns about the effectiveness of BRI-driven government spending in Europe. I provide additional findings on developmental aid, international trade, and BRI program membership that highlight China's growing footprint on European countries. While I focus on sovereign debt management and corporate outcomes, BRI's effects stretch far beyond those that I document in this paper. We have little information on the magnitude of BRI's effects on natural capital, ESG risks, labor market, and income distribution. I leave these extensions and considerations for future work.

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Internet Appendix

A Additional Details on the Marmaray Project

This section provides additional details on archaeological discoveries in Marmaray excavations. Tunnel and subway station constructions in Marmaray resulted in the discovery of the lost 4th-century Harbour of Theodosius, traces of the city wall of Constantine the Great, the remains of 1000-year-old ships, including the only early medieval galley ever discovered. Marmaray discoveries now constitute the world's largest medieval shipwreck collection, and as shown in Figure A2, some of the artifacts can be viewed today in Istanbul's Yenikapi Subway Station.

Archaeologists also uncovered the oldest evidence of settlement in Istanbul, with artefacts, including amphorae, pottery fragments, shells, pieces of bone and horse skulls, and nine human skulls found in a bag, dating back to 6,000 BCE. Glass artefacts and fragments dating from the Hellenistic, Roman, Byzantine and Ottoman periods were also found during excavations near Sirkeci terminal. See http://yenikapibatiklari.com/en/ for more information.

B Detailed Information on the Data

This subsection presents detailed information on the data used in the empirical analyses of this article. Subsection B.1 provides details on public and private debt data, subsection B.2 presents information on the sovereign bond issuance data, and subsection B.3 provides details on the corporate data used in the paper. In subsection B.4, I provide detailed explanations for the data I utilize on the effects of BRI on shipping times, and in subsection B.5, I provide information on the Chinese aid data along with data from World Bank, Eurostat, and OECD.

B.1 Public and Private Debt Data

The data on public and private debt come from IMF's Global Debt Database (GDD), which spans a rich array of 190 countries since the 1950s. The data collection process of GDD is explained in great detail by Mbaye et al. (2018). Here I provide definitions of the variables that are used in this paper. Figure A3 highlights which countries have data on which of the below variables. As shown in the figure, the GDD sample contains 490 observations for the 35 European countries on *General government debt, % of GDP* and 420 observations for the remaining variables. The countries with missing data on private debt are Albania, Bosnia, Macedonia, Montenegro, and Serbia.

- ***General government debt, % of GDP (gg)***: Total stock of debt liabilities issued by the general government as a share of GDP. It covers (i) loans, (ii) debt securities, (iii) currency and deposits,

(iv) insurance, pension, and standardized guarantee schemes, (v) other accounts payable, and (vi) and special drawing rights. To measure general government debt, GDD combines data from (i) national statistical sources, (ii) the UN's Statistical Yearbooks, (iii) International Financial Statistics (IFS) data on domestic bank lending to the government coupled with the World Bank's International Debt Statistics (IDS) data on external debt, (iv) Quarterly Public Sector Debt (QPSD) database jointly developed by the World Bank and International Monetary Fund, and (v) World Economic Outlook (WEO) database.

- ***Private debt, all instruments, % of GDP (pvdall)***: Total stock of debt liabilities issued by households and nonfinancial corporations, including all debt instruments, as a share of GDP. The data is drawn from (i) national accounts, (ii) bank loans to domestic households and nonfinancial corporations from IMF's Standardized Reporting Forms (SRFs) and International Financial Statistics (IFS), (iii) cross-border bank loans from BIS, and (iv) outstanding stock of debt securities issued (on the domestic and international markets) by non-financial corporations from Dealogic.
- ***Nonfinancial corporate debt, all instruments, % of GDP (nfcall)***: Total stock of loans and debt securities issued by nonfinancial corporations as a share of GDP.
- ***Household debt, all instruments, % of GDP (hhall)***: Total stock of debt liabilities issued by households, including all debt instruments, as a share of GDP.

B.2 Sovereign Bond Issurance Data

The data on sovereign bond issuance is manually collected from Thomson Reuters Refinitiv. The raw data sits under Refinitiv's Government and Corporate Bonds Universe with issuer names listed as the names of the 35 European governments as in Figure A3 (e.g., Issuer Only = "Slovak Republic (Government)"). The following filters are applied before the download: *Include* = "Government", *Bond type* = "Bonds", *Status* = "Active", *Sukuks* = "Exclude", *Rating* = "Moody's Long Term Issuer Rating (solicited and unsolicited)." After the download, I drop all debt issues with missing data on Refinitiv variables *PreferredRIC*, *ISIN*, *Ticker*, *YieldtoMaturity*, and *AmountIssuedUSD*. This leaves 1,889 unique debt issues (identified by the unique identifier *PreferredRIC*), 1,504 of which are issued in local juristictions (*Issuer* =*CountryofIssue*).

Using sovereign debt issues within local juristictions, I calculate mean, median, and value-weighted (using issue amounts) values of the main dependent variable, *YieldToMaturity* at the country-year level. As nuisance variables, I use Macaulay Duration (*MacDuration*), % of issues listed as investment grade by Moody's (calculated at the at the country-year level using issues with *BondGrade* ="Investment Grade"), % of issues that are denominated in Euros (calculated at the at the country-year level using issues with *PrincipalCurrency*= "Euro"), and % of issues that are inflation-protected (calculated at the at the country-

year level using issues with *InflationProtected* ="Yes"). These control variables are all amount-weighted (by *AmountIssuedUSD*) and calculated at the country-year level. As a final nuisance variable, I use the logged sum of last five years' debt issue amounts (*AmountIssuedUSD*).

Figure A4 provides details on the characteristics of new sovereign debt issued by treated and control units, before and after the opening of Marmaray. It does so by using Venn diagrams that categorize debt issues across three dimensions: investment grade status, protection for inflation in the issuer country and euro denomination. As shown, the percentage of debt issues by treated units that are categorized as investment grade, not-inflation protected and euro-denominated was 7.9% before the opening of Marmaray, and this number increased to 33.8% after Marmaray. This constitutes a surge of 328% relative to pre-Marmaray levels and is driven by the decrease in the percentage of *non*-investment-grade debt issues from 44.4% to 24.2%. The percentage of debt issues by controls units that are categorized as investment grade, not-inflation protected and euro-denominated was 49.3% before Marmaray, and this number decreased to 42.9% after the opening of Marmaray. This suggests treated countries observe a large increase in euro-denominated sovereign debt that is categorized as investment-grade and does not protect investors from inflation.

Figures A5, A6 and A7 provide useful information on the distributions of yearly issue amounts, durations of newly issued sovereign debt, and yields of newly issued debt by treated and control units, before and after the opening of Marmaray. As shown in Figure A5, there is a large increase in the yearly issues in treated countries. As shown in Figure A7, treated and control units both issue debt with longer durations than before. As shown in Figure A6, treated units observe higher yields after the opening of Marmaray, whereas control units do not experience such an increase. These figures, coupled with Figure A4, highlight that Moody's assigned investment-grade ratings to more sovereign debt issues by treated units even though issue amounts and yields were considerably higher on average. These being said, we do also observe an increase in durations in treated units.

B.3 Worldscope Data

The data on corporate variables is drawn from Thomson Reuters Worldscope database. The main variables of interest for the purposes of this paper are *Capital expenditures to book value of assets* (*item4601/ item2999*), *R&D expenditures to book value of assets* (*item1201/ item2999*), *Logged book value of assets* (log of *item2999*), *Cash flows to assets* (*item1651/ item2999*), *Leverage* (*item3255/ item2999*), *Short-term leverage* (*item3051/ item2999*), Tobin's Q *((item7230+item7210-item7220)/ item7230)*, and Market-to-book ratio (*item7210/item7230*). Except for the country-level capital expenditures ratio used in the beginning of the article, these variable are all calculated at the firm-year level. All numerators are therefore summed for each firm-year and deflated by the book value of firm assets from the year before the treatment, i.e., year

2013.

I geocode the European Worldscope data by finding longitude and latitude of each firm's headquarter. I do the geocoing by using *HERE Maps API* and *OpenCage Geocoder API*, respectively. Before geocoding, the European Worldscope sample contains 4794 unique cities. After geocoding, this number drops to 4,456. I do not use corporate data from Russian Federation, Belarus, Ukraine, Isle of Man, Liechtenstein, Monaco, and Moldova. I also drop all firms with zero capital expenditures during the sampling period of this article. The remaining sample contains 4,294 unique firms (based on the unique firm identifier *item6105*), 682 of which are from treated countries and 3,612 of which are from control countries.

How are these firms distributed over time and across Europe? Figure A8 presents information on the number of unique firm identifiers in each country for each year. Treated countries are tabulated using asterisks and blue (darker) squares, and control countries are tabulated using pink (lighter) squares. The size of each square increases with respect to the unique number firms a country has in a given year. As shown, treated countries have less firms on average and there is time series heterogeneity.

B.4 Belt and Road Initiative and Shipping Times

I use global and regional datasets provided by de Soyres et al. (2018) to proxy for BRI-driven time savings at country-to-country and city-to-city levels. The global dataset contains information based on an analysis of 1,000 cities in 191 countries and 47 sectors. The regional dataset focuses on 71 economies that are part of the Belt and Road Initiative and has a higher degree of granularity. In some of my empirical analyses, I merge the geocoded Worldscope data with regional de Soyres et al. (2018) data. For Worldscope cities with missing BRI time savings data, I use the BRI time savings data on the nearest city, identified by longitude and latitude information.

- ***Time Savings (ChangeTimeUpper, ChangeTimeLower)***: % decrease in shipping time between two locations. When using the Global data, I take China as the destination country, and when using the regional data, I take Beijing as the destination city. I exploit both upper and lower bounds for time savings.
- ***Time savings with trade facilitation (ChangeTimeUpperBdred, ChangeTimeLowerBdred)***: % decrease in shipping time between two locations with trade facilitation. When using the Global data, I take China as the destination country, and when using the regional data, I take Beijing as the destination city. I exploit both upper and lower bounds for time savings.

B.5 Eurostat, World Bank, OECD and Chinese Aid Data

I start this subsection by describing the Eurostat data. Data on General government expenditure by function (COFOG) from Eurostat is drawn from table `GOV_10A_EXP` at https://ec.europa.eu/. Below I provide descriptions of the main variables used in the empirical analyses of my paper.

- ***Collective consumption expenditure (P32)*** refers to government expenditure for providing services simultaneously to all members of the community. Households' use of such services is usually passive and does not require explicit agreement or active participation of all the households concerned and the provision of the service to one household does not reduce the services available to others.[26]
- ***Compensation of employees (D1)*** refers to the total remuneration paid by government to its employees. It includes wages and salaries and employers' actual and imputed social contributions. Employers' actual social contributions are actual payments into social security schemes and into funded autonomous pension schemes by government on behalf of its employees. Imputed contributions are the counterparts to future payments of social benefits minus actual contributions directly made by employers to their employees without involving any social security scheme or autonomous pension scheme.
- ***Property income (D.4)*** includes interest, rents on land, and payments by government of royalties for sub-soil assets and other non-produced assets. It is *not* capital formation.
- ***Capital transfers (D.92)*** refers to investment grants paid by government.
- ***Fixed capital formation (P.5)*** comprises the acquisition less sales (e.g., to the Chinese government) of (i) fixed capital (e.g. buildings, vehicles, machinery and weapons system), (ii) inventories (stocks of raw materials, certain work in progress and finished goods), and (iii) valuables (items held as stores of value, such as precious metals and art objects).

Infrastructure investments (e.g. *Railway expenditure to GDP, %*) are drawn from International Transport Forum, OECD. The variables are self explanatory but the interested reader can find detailed information at https://www.itf-oecd.org/road-transport-platform. Chinese foreign aid data is from AidData. This data covers Chinese grants, technical assistance, loans, buyer's credits, seller's credits, debt forgiveness, debt rescheduling, debt refinancing, scholarships, and training activities, and can be downloaded from https://www.aiddata.org/datasets. The only filter I apply after download is I keep all observations where *RecommendedForAggregates* is equal to `Yes`. Rest of the data utilized in this paper come from the World

[26] The split between individual (e.g., hospital services) and collective consumption is based on COFOG level II according to ESA 2010 paragraphs 3.104-3.107.

Bank Open Data at https://data.WorldBank.org/. I list all variables, data sources and varaible IDs in Table A1 below for the interested readers.

B.6 Thomson Reuters MarketPsych Indices (TRMI)

I utilize proprietary data from Thomson Reuters MarketPsych Indices (TRMI) on news-based sentiment for inflation, financial stability, and economic uncertainty. TRMI uses proprietary topic identification and natural language processing (NLP) techniques to measure the tone of written content in news media about macroeconomic outcome variables. To construct sentiment indices, TRMI utilizes rich text-analysis-based data from over 2 million articles coming from over 2,000 professional news agencies identified by Thomson Reuters News Feed Direct, Factiva News, and other third-party news sources. After content is read and scored at the article level, the scores are then aggregated and normalized by the total number of news on a given outcome variable, e.g., inflation. The following formula summarizes how the sentiment index for outcome variable X is obtained:

$$Sentiment_t(X) = (PositiveReferences_t(X) - NegativeReferences_t(X))/(Buzz_t(X)) \tag{10}$$

$PositiveReference_t(X)$ ($NegativeReference_t(X)$) is the sum of all positive (negative) terms and phrases about macroeconomic outcome X captured in news media at time t. $Buzz_t(X)$ captures the total number of references about the outcome X. I take yearly medians of each country's sentiment scores for inflation, financial stability, and economic uncertainty, and I drop countries with a minimum *Buzz* of less than 150. The countries that are dropped from my sample are Albania, Andorra, Estonia, Kosovo, Latvia, Lithuania, Luxembourg, Malta, Moldova, Montenegro, North Macedonia, Slovak Republic, and Slovenia. The remaining countries are Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Spain, Sweden, Switzerland, and United Kingdom. In total, I have a panel of 300 observations on 25 countries spanning a 12-year period between 2007 and 2018.

Table A1: **Additional Information on Data Sources**
This table lists country-level variables, their data sources, and variable IDs utilized in the empirical analyses of this article.

Variable	**Data Source**	**Variable ID**
Collective consumption and capital transfers to GDP,%	Eurostat	P32
Capital transfers, wages, and rents on land to GDP, %	Eurostat	D1+D4+D92
Fixed Capital formation to GDP, %	Eurostat	P5
Railway expenditure to GDP, %	OECD	RAIL
Road expenditure to GDP, %	OECD	ROAD
Airway expenditure to GDP, %	OECD	AIR
Seaway expenditure to GDP, %	OECD	SEA
Goods exports (logged)	World Bank	BX.GSR.MRCH.CD
Export volume index	World Bank	TX.QTY.MRCH.XD.WD
Merchandise exports to high-income economies	World Bank	TX.VAL.MRCH.HI.ZS
Goods imports (logged)	World Bank	BX.GSR.MRCH.CD
Import volume index	World Bank	TM.QTY.MRCH.XD.WD
Merchandise imports from the Near East	World Bank	TM.VAL.MRCH.AL.ZS
Developmental Assistance from China	AidData	AmountConstantUSD2017
Total Official Development Assistance Received	World Bank	DT.ODA.ODAT.CD
Inflation, GDP deflator (annual %)	World Bank	NYGDPDEFLKDZG
Foreign direct investment, net (BoP, current US)	World Bank	BNKLTDINVCD
Gross fixed capital formation (constant LCU)	World Bank	NEGDIFTOTKN
GDP per capita (current US)	World Bank	NYGDPPCAPCD
General government final consumption expenditure (current US)	World Bank	NECONGOVTKDZG
Households and NPISHs Final consumption expenditure (current US)	World Bank	NECONPRVTCD
Final consumption expenditure (current US)	World Bank	NECONTOTLCD
General government final consumption expenditure (annual % growth)	World Bank	NECONGOVTCD
Final consumption expenditure (annual % growth)	World Bank	NECONTOTLKDZG
Current account balance (% of GDP)	World Bank	BNCABXOKAGDZS
Personal remittances, received (%of GDP)	World Bank	BXTRFPWKRDTGDZS

Table A2: **Additional Summary Statistics**

This table presents summary statistics on additional country-level variables drawn from the Worldbank.

	N	**Mean**	**Median**	**Stdev.**
Inflation, GDP deflator (annual %)	476	2.22	1.8	2.66
Foreign direct investment, net (BoP, current US)	476	3.2	-0.67	33.33
Gross fixed capital formation (constant LCU)	476	4.71	1.12	13.25
GDP per capita (current US)	476	3.38	2.37	2.64
General government final consumption expenditure (current US)	476	1.15	0.41	1.86
Households and NPISHs Final consumption expenditure (current US)	476	3.11	1.17	5.13
Final consumption expenditure (current US)	476	4.26	1.59	6.96
General government final consumption expenditure (annual % growth)	476	1.37	1.31	2.48
Households and NPISHs Final consumption expenditure (current US)	476	0.93	1.2	3.98
Final consumption expenditure (annual % growth)	476	1.19	1.54	3.18
Foreign direct investment, net (BoP, current US)	476	3.2	-0.67	33.33
Current account balance (% of GDP)	476	-0.93	-0.24	7.17
Personal remittances, received (% of GDP)	476	2.49	0.96	3.29

Table A3: **Newly Issued Sovereign Debt**

This table lists total newly issued sovereign debt amounts before and after Marmaray. Data is drawn from Thomson Reuters Refinitiv. Variable descriptions are in subsection B.2. Diff. indicates the difference in total issues between pre- and post-Marmaray periods. The sampling period is from 2007 to 2021.

	Newly Issued Sovereign Debt Before and After Marmaray				
	Before($B)	**After($B)**	**Diff.($B)**	**Diff./GDP**	**Diff./Before**
Albania*	0.00	3.86	3.86	30.24	INF
Austria	71.04	210.05	139.00	32.31	1.96
Belgium	87.72	315.61	227.89	43.67	2.60
Bosnia*	0.21	0.07	-0.14	-0.78	-0.66
Bulgaria*	0.61	12.60	11.98	21.47	19.62
Croatia*	9.08	25.52	16.45	27.93	1.81
Czech Republic	19.76	80.04	60.28	28.47	3.05
Denmark	36.95	90.68	53.73	15.64	1.45
Estonia	0.00	1.61	1.61	6.41	INF
Finland	29.02	98.84	69.81	25.73	2.41
France	472.98	1,454.15	981.17	34.89	2.07
Germany	237.09	1,252.08	1,014.99	27.18	4.28
Greece*	70.89	83.90	13.01	5.45	0.18
Hungary*	12.85	82.00	69.15	50.94	5.38
Iceland	3.88	4.93	1.05	6.52	0.27
Ireland	104.55	135.35	30.80	12.93	0.29
Italy	318.11	1,806.96	1,488.86	69.51	4.68
Latvia	0.07	12.68	12.61	41.74	182.02
Lithuania	0.13	19.94	19.81	42.59	151.76
Luxembourg	3.27	10.95	7.67	11.77	2.34
Malta	1.20	5.71	4.51	42.77	3.76
Montenegro*	0.00	3.76	3.76	84.15	INF
Netherlands	72.13	238.88	166.75	19.01	2.31
Norway	9.38	49.02	39.65	7.58	4.23
Poland	40.53	175.37	134.84	25.88	3.33
Portugal	26.99	154.66	127.68	56.39	4.73
Romania*	7.86	136.55	128.68	67.44	16.36
Serbia*	0.15	25.69	25.54	52.77	164.91
Slovak Republic	12.12	41.84	29.72	30.15	2.45
Slovenia*	12.99	36.34	23.36	48.24	1.80
Spain	232.68	961.89	729.21	53.81	3.13
Sweden	26.12	96.81	70.69	12.05	2.71
Switzerland	21.58	30.46	8.88	1.25	0.41
United Kingdom	669.07	1,503.07	833.99	29.75	1.25

Table A4: **Controls for TWFE Regressions in Table 3**

This table presents coefficient estimates for the control variables in TWFE Regressions of Table 3. Standard errors are clustered at the country level. ⋆⋆⋆, ⋆⋆, and ⋆ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Sovereign Yields		
	VW, %	**EW, %**	**Median, %**
No yearly issue	-2.05***	-1.94***	-1.82***
	(-4.28)	(-3.83)	(-3.67)
Duration	0.04**	0.04*	0.05**
	(2.19)	(2.04)	(2.30)
Investment grade	-0.06	0.05	0.13
	(-0.19)	(0.15)	(0.39)
% Euro denominated issues (Pre-treatment)	0.54	0.64	0.70*
	(1.42)	(1.67)	(1.87)
% Inflation adjusted issues (Pre-treatment)	-4.07	-3.93	-3.73
	(-1.53)	(-1.54)	(-1.42)
No inflation adjusted debt	0.43	0.40	0.47
	(0.43)	(0.41)	(0.50)
% Investment grade issues (Pre-treatment)	-0.16	-0.29	-0.30
	(-0.34)	(-0.69)	(-0.74)
Logged Total Issue Amounts between t-1 and t-5	0.16	0.11	0.09
	(1.42)	(1.03)	(0.85)

Table A5: **Controls for TWFE Regressions in Table 6**

This table presents coefficient estimates for the control variables in TWFE Regressions of Table A5. Standard errors are clustered at the country level. ⋆⋆⋆, ⋆⋆, and ⋆ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Capital Inv. to Assets, %	**R&D Inv. to Assets, %**	**Logged Tobin's Q**	**Logged M/B**
Logged BVA_{-1}	1.03***	1.81***	-0.02	0.03
	(7.31)	(3.22)	(-0.79)	(0.89)
$CF2AT_{-1}$	0.04***	0.01		
	(4.12)	(0.19)		
LT $LEVERAGE_{-1}$	0.00	0.00		
	(0.80)	(0.89)		
ST $LEVERAGE_{-1}$	-0.48***	-1.97**		
	(-3.17)	(-2.38)		
Log BVA^2_{-1}			-0.00*	-0.00**
			(-1.84)	(-2.68)
Log Age_{-1}			-0.04*	-0.10**
			(-2.03)	(-2.63)
Logged BVA_{-1}	0.97***	1.61***	-0.03	0.02
	(9.21)	(3.90)	(-1.09)	(0.54)
$CF2AT_{-1}$	0.04***	0.02		
	(2.88)	(0.36)		
LT $LEVERAGE_{-1}$	0.00	0.00		
	(0.47)	(1.02)		
ST $LEVERAGE_{-1}$	-0.38**	-1.70**		
	(-2.49)	(-2.19)		
Logged BVA^2_{-1}			-0.00	-0.00**
			(-1.52)	(-2.31)
Logged Age_{-1}			-0.04**	-0.09***
			(-2.28)	(-2.85)
Logged BVA_{-1}	0.93***	1.38***	-0.03	0.02
	(8.95)	(3.37)	(-0.96)	(0.66)
$CF2AT_{-1}$	0.04***	0.02		
	(2.91)	(0.32)		
LT $LEVERAGE_{-1}$	0.00	0.00		
	(0.48)	(1.01)		
ST $LEVERAGE_{-1}$	-0.40**	-1.86**		
	(-2.62)	(-2.42)		
Logged BVA^2_{-1}			-0.00	-0.00**
			(-1.56)	(-2.34)
Logged Age_{-1}			-0.04**	-0.09***
			(-2.41)	(-2.93)

Table A6: **Controls for TWFE Regressions in Table 7**

This table presents coefficient estimates for the control variables in TWFE Regressions of Table A6. Standard errors are clustered at the country level. ⋆⋆⋆, ⋆⋆, and ⋆ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Capital Inv. to Assets, %	**R&D Inv. to Assets, %**	**Logged Tobin's Q**	**Logged M/B**
Logged BVA_{-1}	1.01***	1.62***	-0.02	0.03
	(7.61)	(3.19)	(-0.76)	(0.85)
$CF2AT_{-1}$	0.03***	0.00		
	(5.57)	(0.01)		
LT $LEVERAGE_{-1}$	0.00	0.00		
	(0.80)	(0.90)		
ST $LEVERAGE_{-1}$	-0.56***	-2.29**		
	(-3.42)	(-2.70)		
City-level Time Saving	5.43*	86.00	0.36	0.19
	(1.81)	(1.47)	(1.00)	(0.32)
Log BVA^2_{-1}			-0.00*	-0.00**
			(-1.80)	(-2.51)
Log Age_{-1}			-0.01	-0.05**
			(-0.94)	(-2.68)
Logged BVA_{-1}	0.84***	0.83*	-0.01	0.05
	(8.39)	(1.81)	(-0.25)	(1.29)
$CF2AT_{-1}$	0.04***	-0.06		
	(5.82)	(-0.81)		
LT $LEVERAGE_{-1}$	0.00	0.00		
	(0.86)	(0.67)		
ST $LEVERAGE_{-1}$	-0.51***	-1.88**		
	(-2.97)	(-2.20)		
Log BVA^2_{-1}			-0.00*	-0.00**
			(-1.97)	(-2.69)
Log Age_{-1}			-0.01	-0.06***
			(-1.00)	(-2.83)

Table A7: **Logistics Performance Before and After Marmaray**

Logistics performance indicators are drawn from the Worldbank. Standard errors are clustered at the country level. ⋆⋆⋆, ⋆⋆, and ⋆ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Logistics Performance Index		
	Time	**Custom Clearance**	**Competence**
τ^{DD}	0.13**	0.10**	0.08*
	(2.35)	(2.21)	(1.93)
N	212	212	212
R^2	0.798	0.916	0.926

Table A8: **Additional Results on Western Developmental Assistance**

Official development assistance data are drawn from the Worldbank. Standard errors are clustered at the country level. ⋆⋆⋆, ⋆⋆, and ⋆ indicate that the coefficient estimate is significantly different from zero at the 1%, 5%, and 10% levels, respectively.

	Net Official Development Assistance Received				
	% of GNI	**% of Gross Capital Form.**	**% of Imports of Goods Serv. & Prim. Inc.**	**% of Central Gov. Exp.**	**Aid from UN Agencies (Logged, $)**
τ^{DD}	-0.81***	-2.94***	-0.65***	-1.21*	-0.11***
	(-2.95)	(-3.24)	(-3.17)	(-1.82)	(-2.79)
N	645	645	645	645	645
R^2	0.717	0.730	0.723	0.763	0.780

Figure A1: **Bosporus and Marmaray**
This figure presents the satellite image of Bosporus. The red lines indicate Marmaray.

Figure A2: **Archaeological Discoveries in Marmaray Excavations**
This figure presents photos of archaeological discoveries near Yenikapi Subway Station. The first photo shows Yenikapi Subway Station during excavations. The second and third photos show artifacts found during the excavations and are currently being displayed at Yenikapi Subway Station. *Sources*: History of Istanbul from Antiquity to XXIst (online encyclopedia can be reached at http://bit.ly/3SavHWv) and wowTURKEY (also available online at https://bit.ly/3OGY0t0).

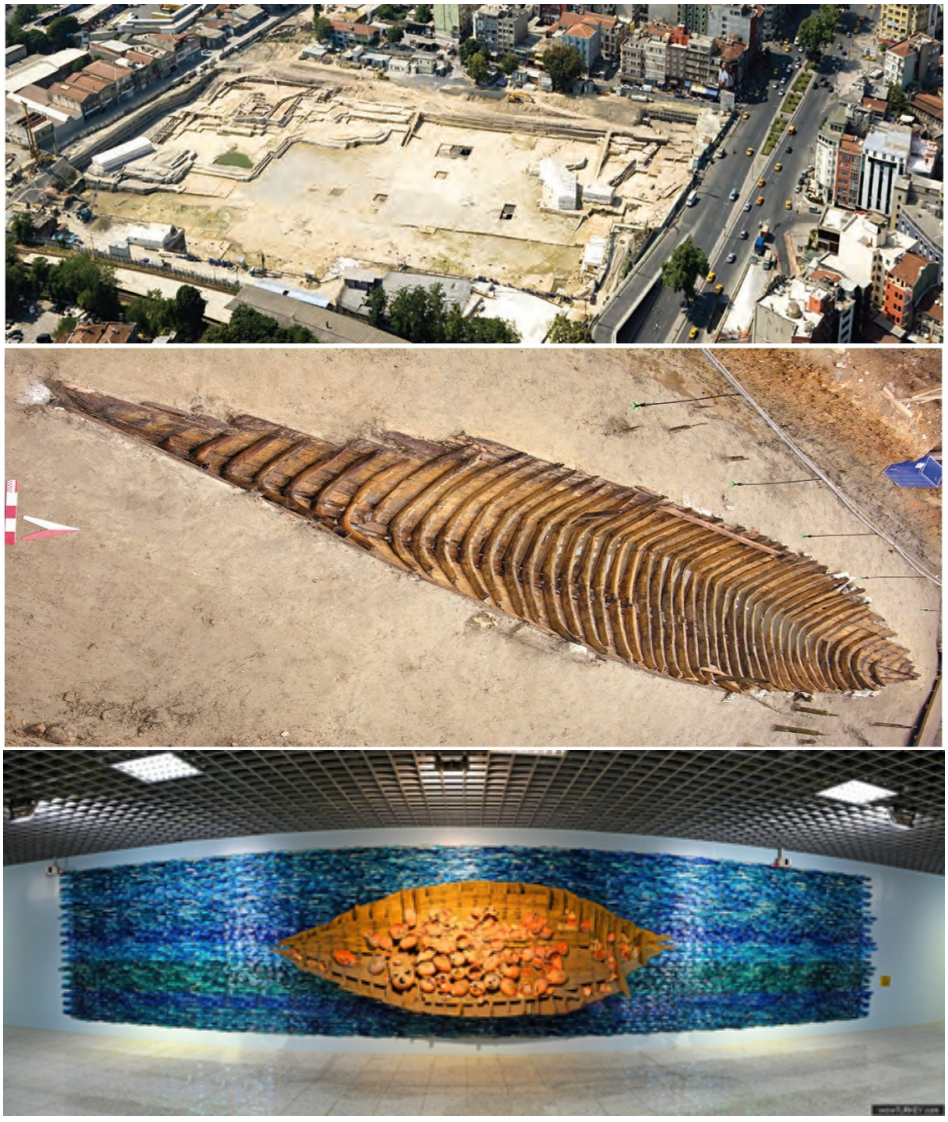


Figure A3: **GDD Data Coverage**

This figure shows the availability of IMF's GDD data across 35 European countries with non-missing data on general government debt. Squares denote full data coverage and dots denote missing data. Treated countries are denoted with asterisk and black squares, and control countries are denoted with gray squares. Full data coverage (for a given country) refers to having non-missing 14 yearly observations between 2007 and 2020. Missing data means GDD doesn't have any data on a given country for a given series.

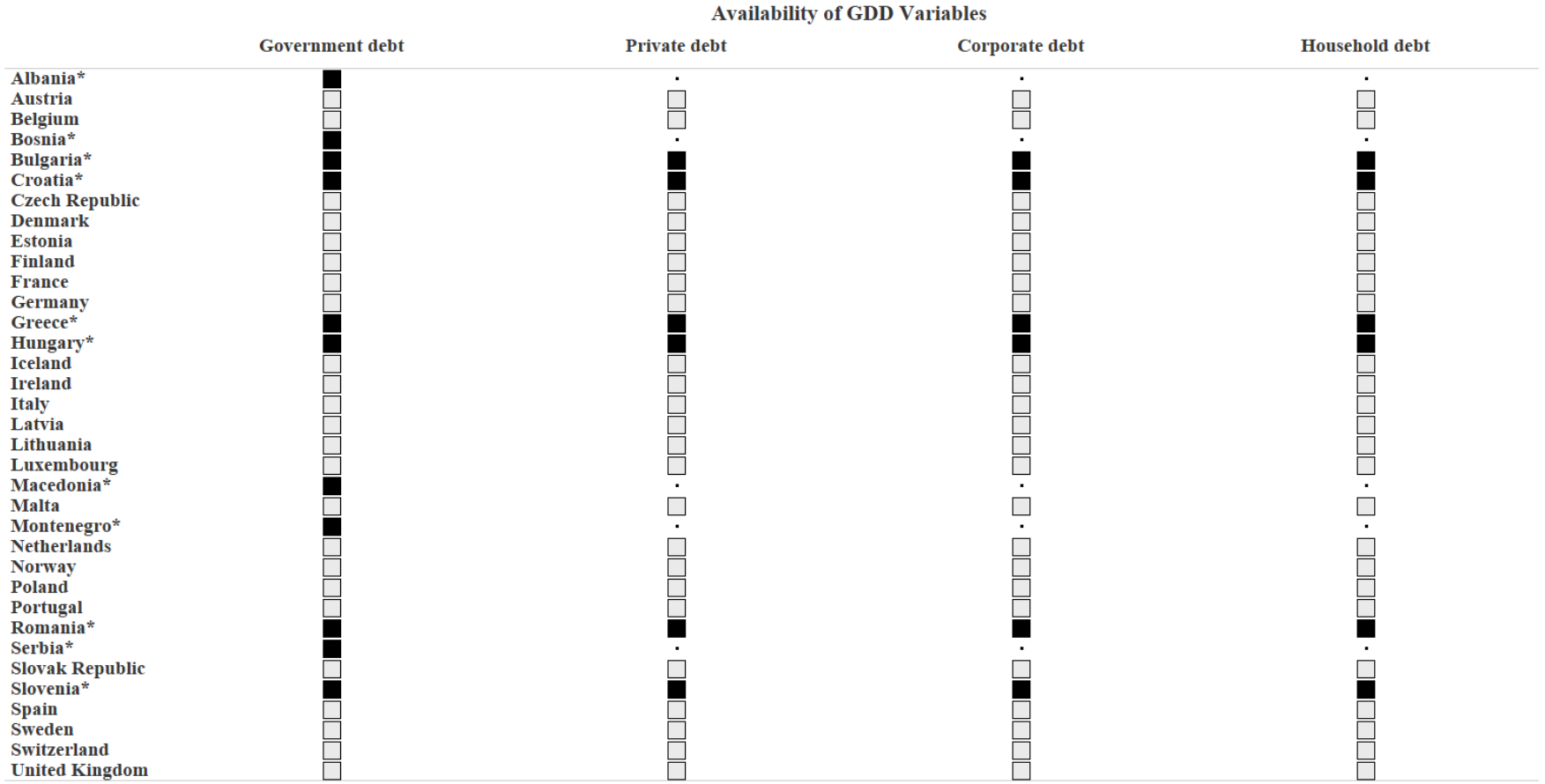
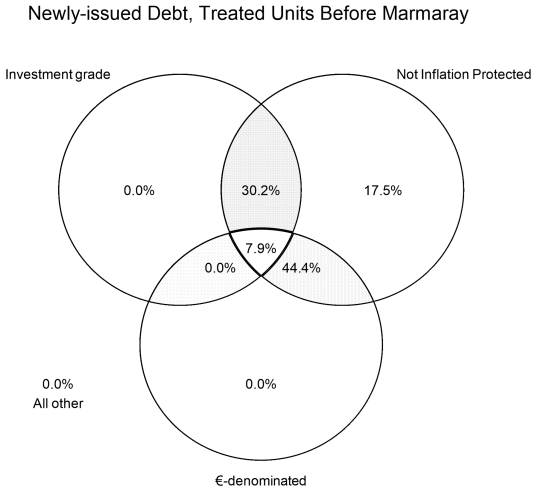
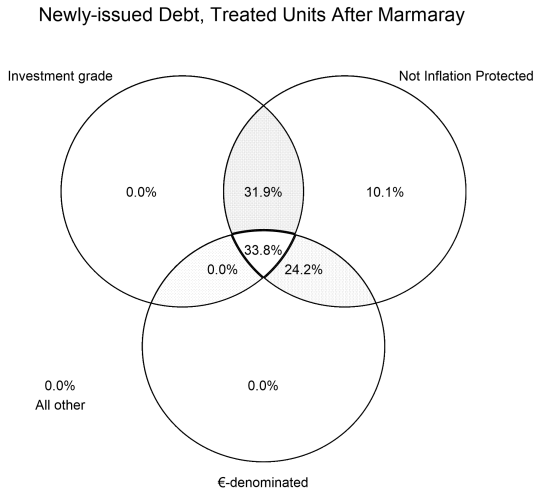
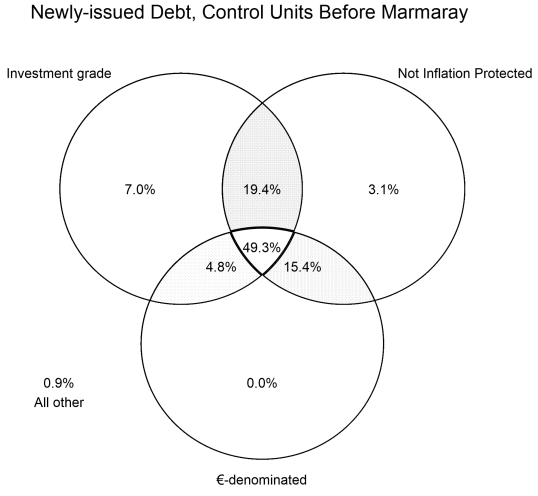


Figure A4: **Venn Diagrams of Newly Issued Debt**
This figure shows the composition of newly issued debt by treated and control units before and after the opening of Marmaray. Data is drawn from Thomson Reuters Refinitiv. Variable descriptions are in subsection B.2.







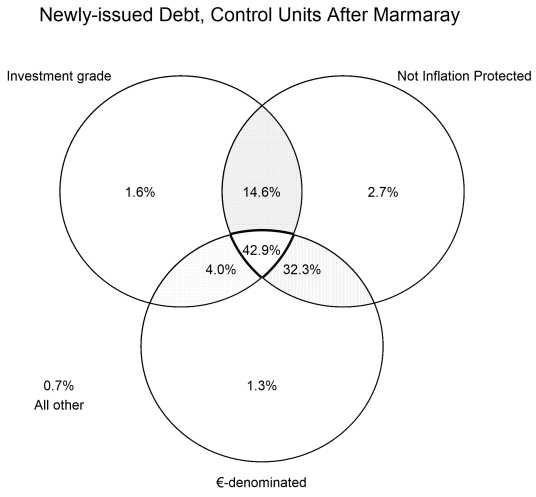


Figure A5: **Distributions of Yearly Issue Amounts**
This figure presents how yearly sovereign debt issue amounts of treated and control units vary before and after the opening of Marmaray. The yearly issue amounts are calculated in billions of U.S. dollars and then logged. Data is drawn from Thomson Reuters Refinitiv. Variable descriptions are in subsection B.2.

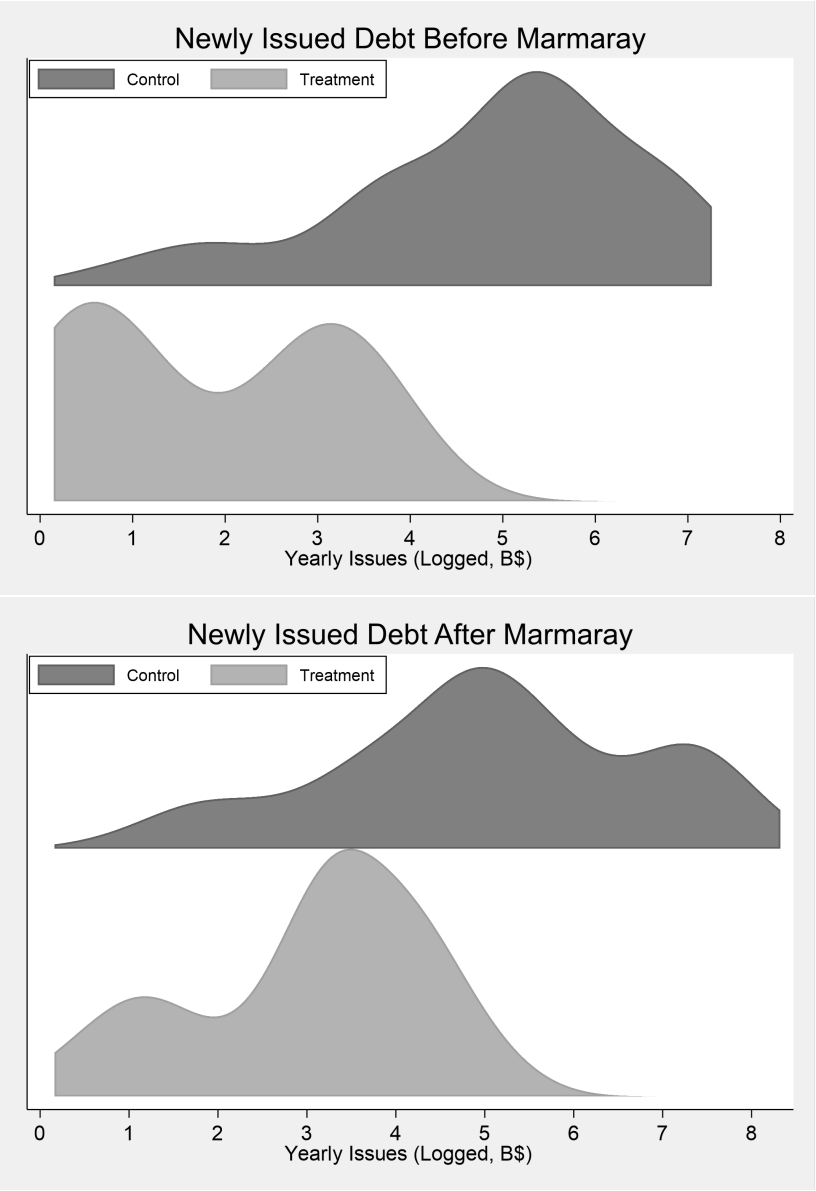


Figure A6: **Distributions of Yields to Maturity**
This figure presents how sovereign yields of newly issued debt by treated and control units vary before and after the opening of Marmaray. Data is drawn from Thomson Reuters Refinitiv. Variable descriptions are in subsection B.2.

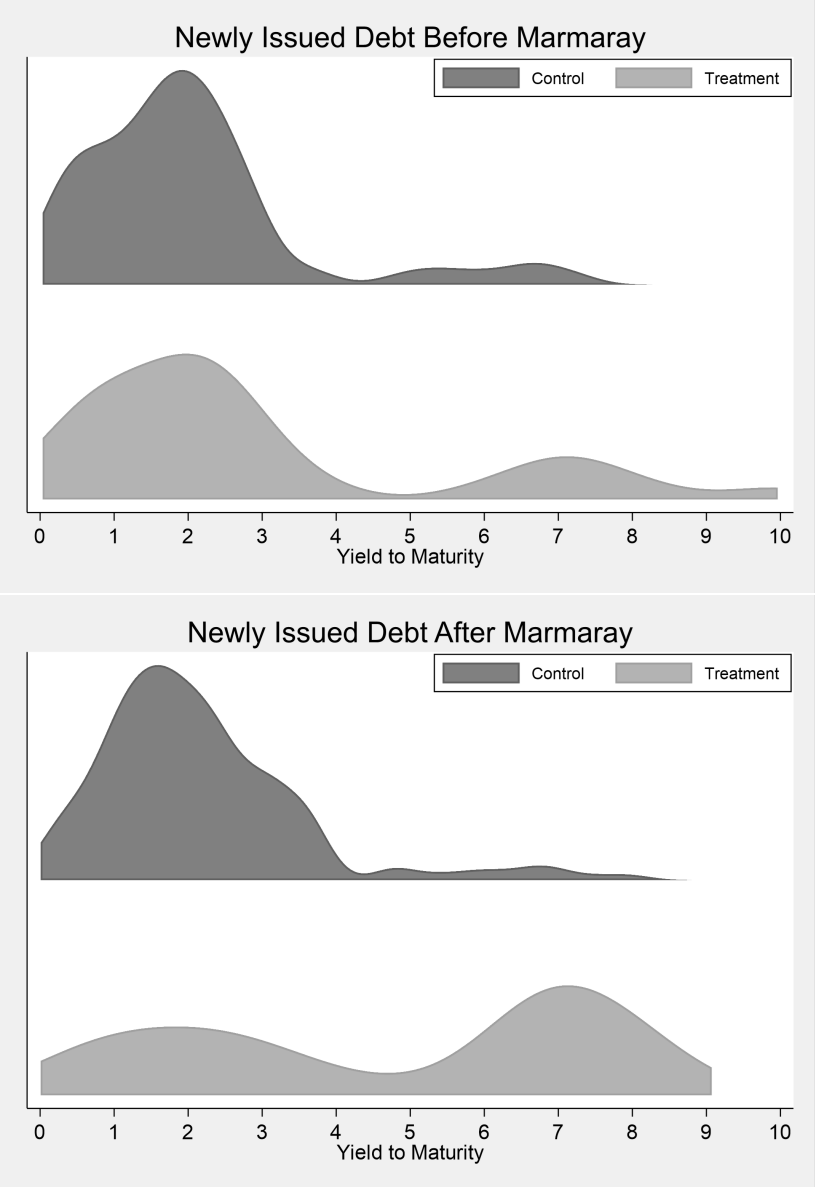


Figure A7: **Distributions of Macaulay Durations**
This figure presents how durations of newly issued debt by treated and control units vary before and after the opening of Marmaray. Data is drawn from Thomson Reuters Refinitiv. Variable descriptions are in subsection B.2.

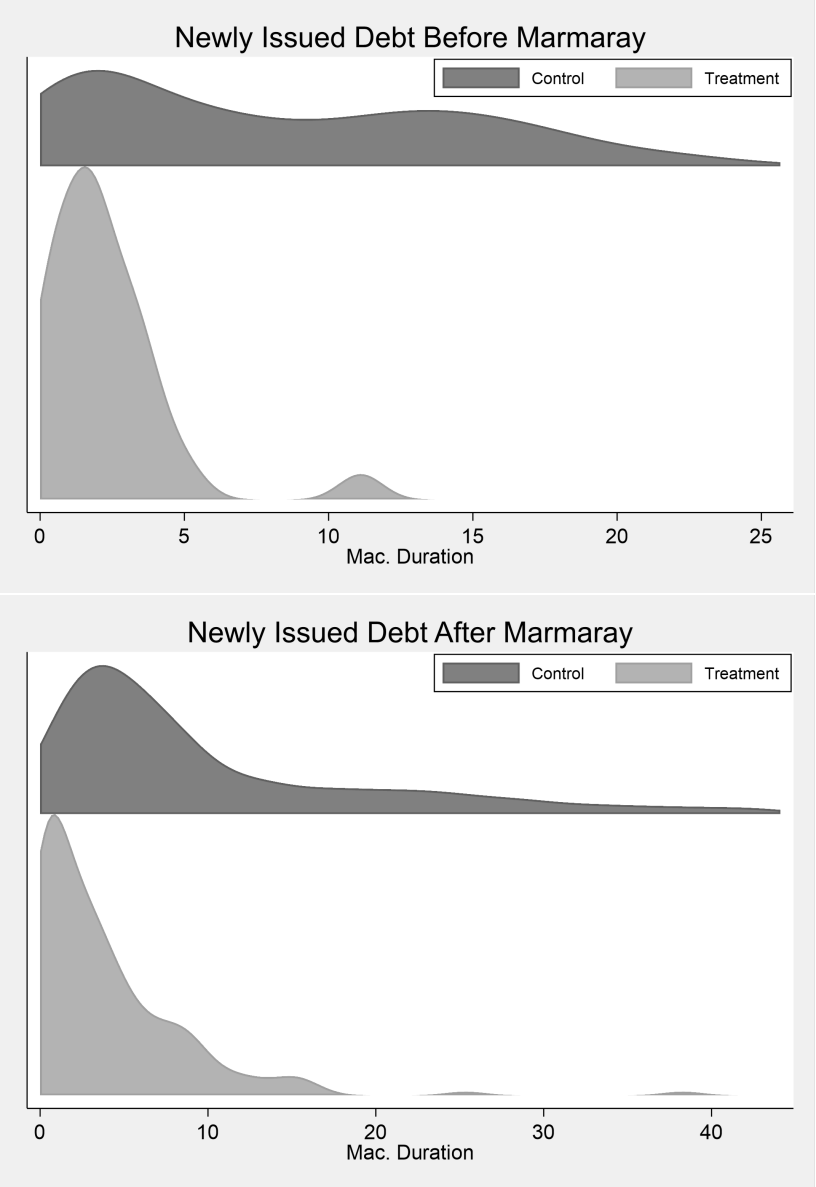


Figure A8: **Number of Unique Worldscope Firm Identifiers**

This figure presents the unique number of firm identifiers in treated and control countries between 2007 and 2021. Treated countries are denoted with asterisk and black squares, and control countries are denoted with gray squares. The square size is proportional to the number firms. Data is drawn from Thomson Reuters Worldscope. Variable descriptions are in subsection B.3.

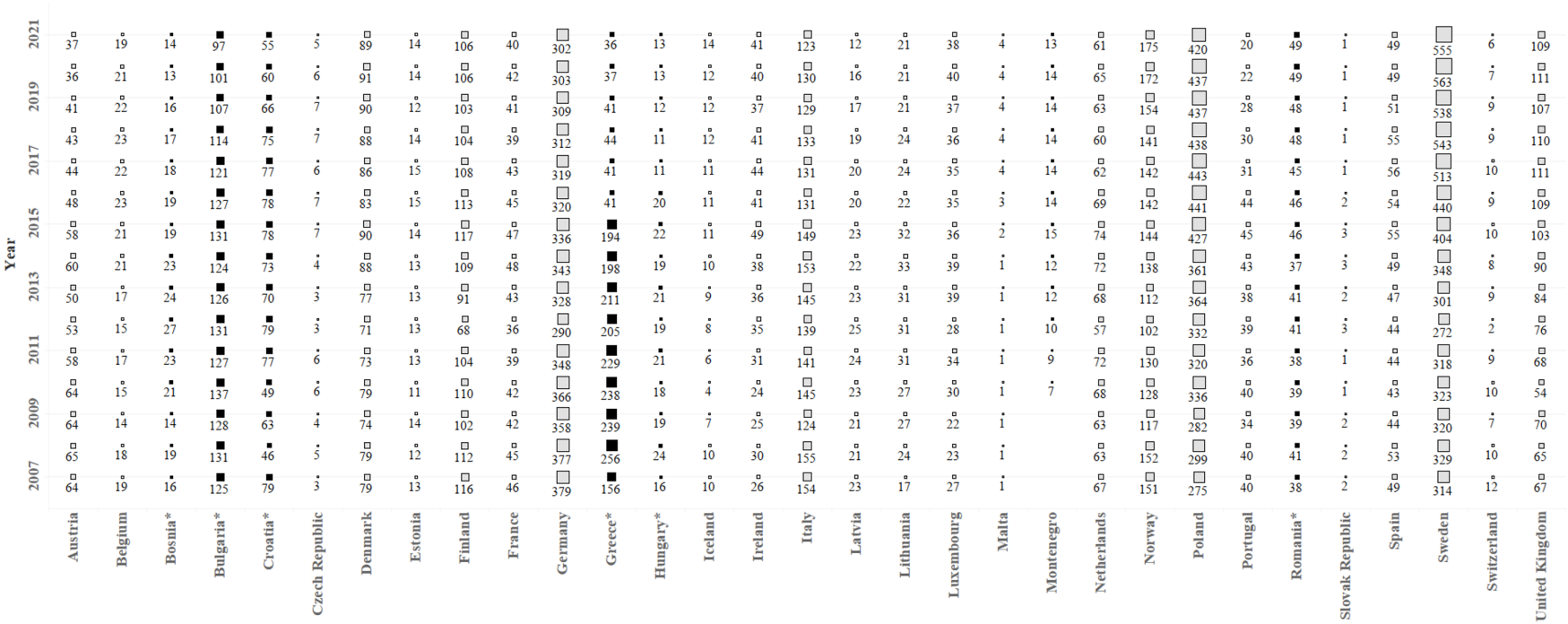
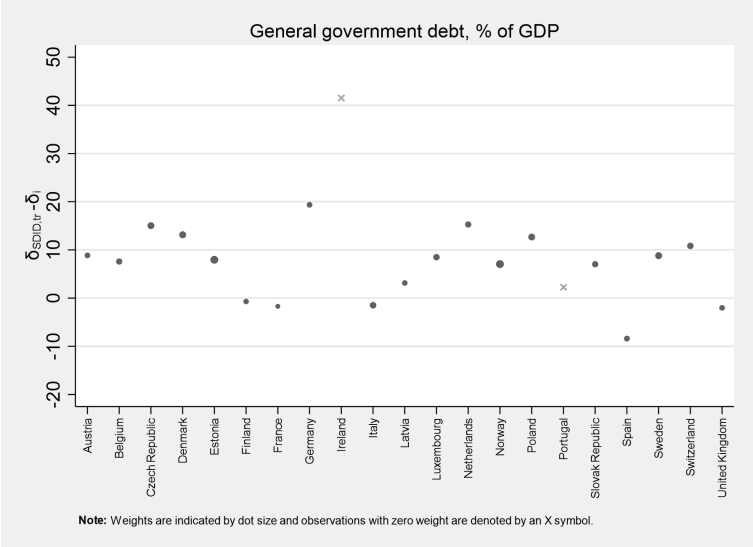
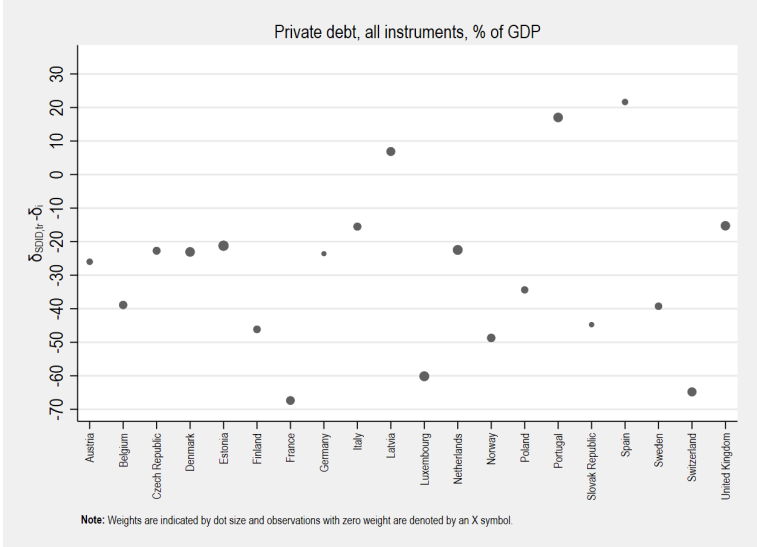


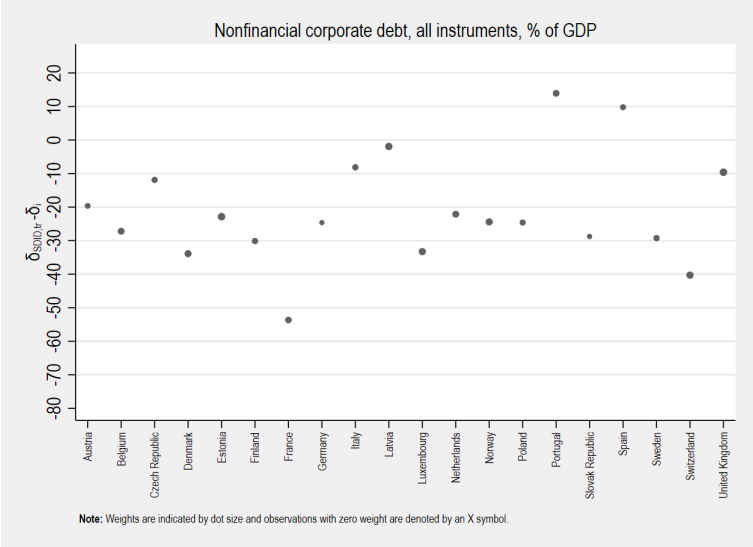
Figure A9: **State by State Adjusted Outcome Differences**
This figure presents state by state adjusted outcome differences for the synthetic difference-in-differences (SDID) findings presented in Table 2.



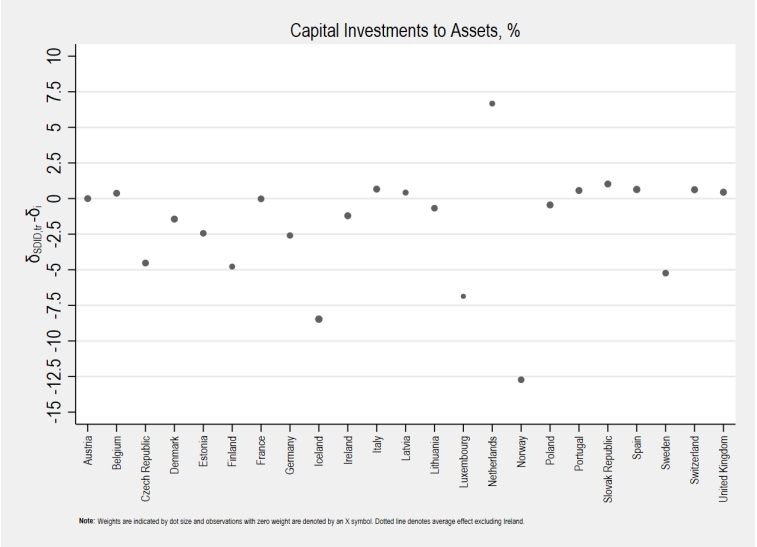
(a) Government debt to GDP



(b) Private debt to GDP



(c) Corporate debt to GDP



(d) Capex to Assets