Policy Research Working Paper 8694

Trade Effects of the New Silk Road

A Gravity Analysis

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WORLD BANK GROUP
Macroeconomics, Trade and Investment Global Practice
January 2019

Policy Research Working Paper 8694

Abstract

This paper takes a first look at the trade effects of China's Belt and Road Initiative, also referred to as the New Silk Road, on the 71 countries potentially involved. The initiative consists of several infrastructure investment projects to improve the land and maritime transportation in the Belt and Road Initiative region. The analysis first uses geo-referenced data and geographical information system analysis to compute the bilateral time to trade before and after the Belt and Road Initiative. Then, it estimates the effect of improvement in bilateral time to trade on bilateral export values and trade patterns, using a gravity model and a comparative advantage model. Finally, the analysis combines the estimates from the regression analysis with the results of the geographical information system analysis to quantify the potential trade effects of the Belt and Road Initiative. The paper finds that (i) the Belt and Road Initiative increases trade flows among participating countries by up to 4.1 percent; (ii) these effects would be three times as large on average if trade reforms complemented the upgrading in transport infrastructure; and (iii) products that use time sensitive inputs and countries that are highly exposed to the new infrastructure and integrated in global value chains have larger trade gains.

This paper is a product of the Macroeconomics, Trade and Investment Global Practice. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/research. The authors may be contacted at mruta@worldbank.org.

Trade Effects of the New Silk Road: A Gravity Analysis

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Keywords: Belt and Road Initiative, Transport Infrastructure, GIS Analysis, Trade Flows, Time Sensitivity, Input-output Linkages

JEL Codes: F14, F15, R41

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1. Introduction

A stated goal of China's Belt and Road initiative is to strengthen economic integration and policy coordination in the broad Eurasia region. The initiative includes a series of transportation infrastructure projects, which are proposed along two pillars: the Silk Road Economic Belt and the 21st Century Maritime Silk Road. Specifically, the "Belt" links China to Central and South Asia and onward to Europe, while the "Road" links China to the nations of Southeast Asia, the Gulf countries, East and North Africa, and on to Europe. Six economic corridors have been identified: (1) the China-Mongolia-Russia Economic Corridor; (2) the New Eurasian Land Bridge; (3) the China–Central Asia–West Asia Economic Corridor; (4) the China–Indochina Peninsula Economic Corridor; (5) the China-Pakistan Economic Corridor, and (6) the Bangladesh-China-India-Myanmar Economic Corridor.

This paper offers a first assessment of the impact of the new and improved BRI transport infrastructure on trade flows of BRI countries.[2] Specifically, we examine the potential trade effects of the BRI using a combination of geographic and econometric analysis. First, we assess the impact of the BRI on trading times using a new database on transport projects linked to the BRI (de Soyres et al., 2018; Reed and Trubetskoy, 2018). Georeferenced data and geographical information systems (GIS) analysis are used to compute the bilateral trade time between capitals, ports and major cities (>100K) in the Belt and Road countries before and after the proposed interventions.[3] Second, we use a gravity model (Head and Mayer, 2014) to estimate the total effect of bilateral trade time on bilateral exports and a comparative advantage model à la Nunn (2007) to estimate the impact of bilateral time to trade on the export pattern in time sensitive products and in products that rely on time sensitive inputs.

To assess the trade impact of the BRI, the GIS analysis and econometric estimates are combined. These results are also used to investigate whether there is complementarity between infrastructure improvements and policy reforms that promote trade facilitation, market access

[2] There is no official list of "BRI countries". In this paper, we focus on a list of 71 economies, including China, that are geographically located along the "Belt" and the "Road" (see Table A. 1).
[3] The list of proposed interventions can be found in de Soyres et al. (2018).

and further regional integration between BRI countries. Specifically, the paper provides a series of simulations on how the potential impact of BRI could be boosted once BRI countries work towards reducing time delays at the border, decrease tariffs or sign “deep” trade agreements, i.e. agreements that go beyond tariff reductions. To test the complementarity between transport infrastructure improvements and trade reforms, we augment the gravity model to introduce an interaction term between our main variable of interest, bilateral trading times, and the average applied tariffs between two countries at the sectoral level or the “depth” of bilateral trade agreements signed between BRI countries.

An important issue in the estimation of the trade effects of transportation infrastructure is endogeneity. The plan to invest in these infrastructure projects could be driven by China’s rising trade prospects with BRI countries (Constantinescu and Ruta, 2018). We address the potential endogeneity between infrastructure and trade in different ways. First, we eliminate nodal countries and the extractive sector from the analysis. Intuitively, if the goal of the BRI is for China to access larger markets or to secure energy supplies, an analysis focused on transit countries and non-energy sectors should mitigate endogeneity problems. Second, we use an Instrumental Variable (IV) approach. Specifically, we employ the physical geography features of transit countries along any trade route as instruments for the bilateral transport time between the trading partners. Third, in the comparative advantage model, we estimate a difference-in-difference estimation that allows us to introduce a richer set of fixed effects, including country-pair and country-sector, to control for other sources of omitted variable biases.

The results from the econometric analysis confirm that there is a negative relationship between trading times and trade: a one-day reduction in trading times increases exports between BRI economies by 5.2 percent on average. In addition, trading times are particularly important for time sensitive products that are used as inputs in production processes, suggesting that reductions in shipping times are key in the presence of global value chains. Last, we find that reducing border delays, having better market access to countries and signing deeper trade agreements would magnify the trade impact of a reduction of time to trade due to new and improved transport infrastructure.

We combine the estimates from the regressions with the results of the GIS analysis to quantify the potential trade effects of the BRI. An upper-bound estimate is that total BRI trade increases by 4.1 percent. This assumes that trade in all products can switch transportation modes relatively easily to take advantage of the improved transport links. A lower-bound estimate, which assumes that products cannot switch transportation mode, is that trade increases by 2.5 percent. The trade effects of the BRI present a large variation across individual countries and across sectors. Largest improvements in trade are predicted for countries in Sub-Saharan Africa, Central and Western Asia and for products that use time sensitive inputs such as chemicals. Complementing BRI infrastructure improvements with trade reforms such as deepening trade agreements or better market access would boost trade by respectively, 7.9 and 12.9 percent.

While there is much debate surrounding the Belt and Road Initiative, little rigorous economic analysis on its effects has been done so far. Exceptions include Villafuerte, Coron and Zhuang (2016) and Zhai (2018), who use a Computable General Equilibrium (CGE) model to assess the impact of the BRI on trade and economic growth.[4] Differently from the CGE approach, our paper builds on a number of recent econometric studies. First, there is a recent literature that aims at assessing the impact that reduction in time to trade, due to trade facilitation reforms or infrastructure improvements, has on trade flows (e.g. Djankov, Freund and Pham, 2010; Hummels and Schaur, 2013; and Baniya, 2017). Second, several studies analyze the trade effects of infrastructure projects (Donaldson, 2013; Duranton, Morrow and Turner, 2012; Alder, 2015). Finally, a subset of this literature also relies on georeferenced data and GIS analysis to assess the trade and spatial effects of transport infrastructure (e.g. Roberts, Deichmann, Fingleton and Shi, 2010; Roberts, Deichmann, Fingleton and Shi, 2010).

The rest of the paper is organized as follows. Section 2 presents the GIS analysis. The econometric strategy and results are discussed in Section 3. Section 4 outlines the trade impact of the BRI. Concluding remarks follow.

[4] Related work by de Soyres et al., Mulabdic and Ruta (2018) and Maliszewska and van der Mensbrugghe (2018) uses the data on trade costs from de Soyres et al. (2018) in a structural and CGE trade model respectively.

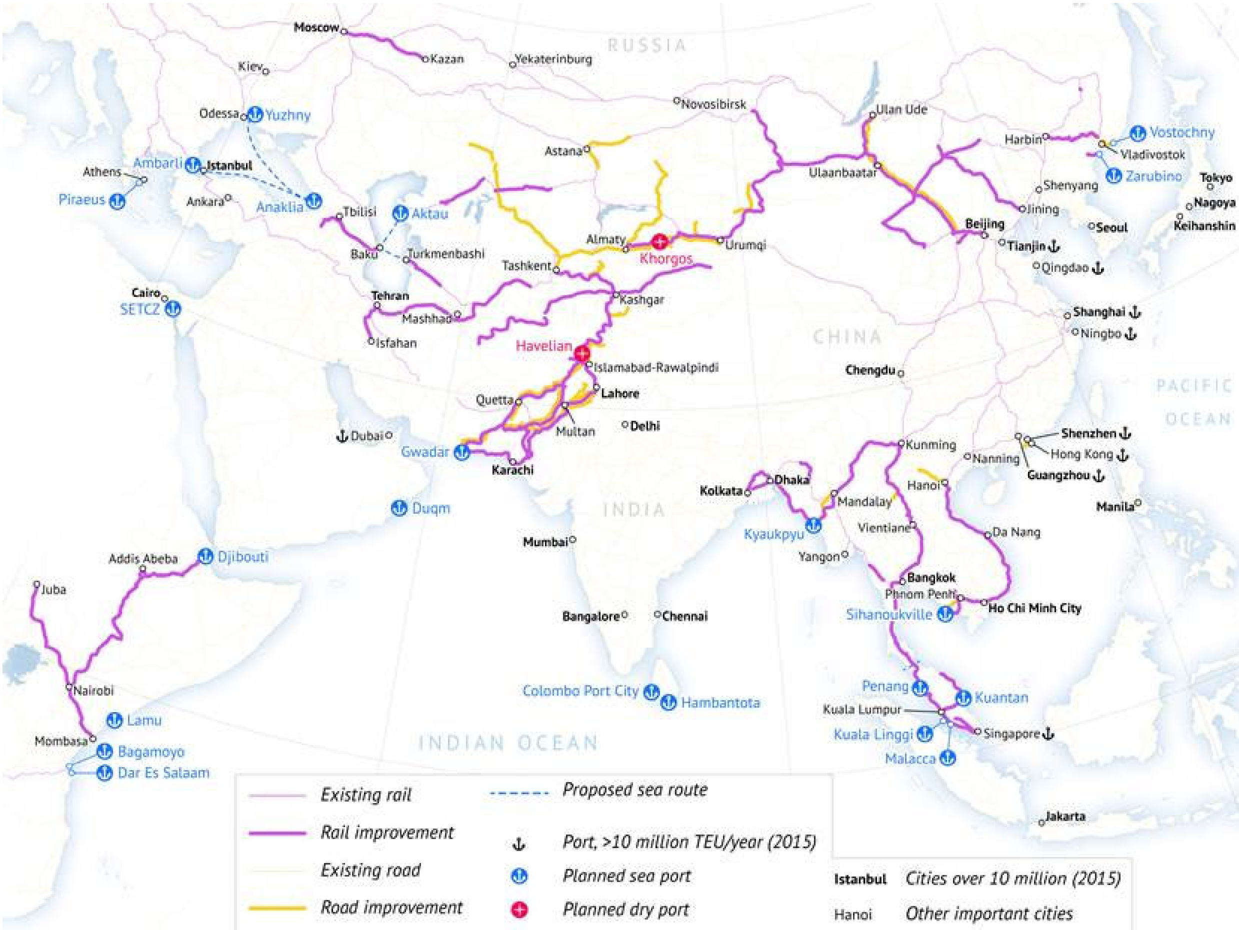
2. Estimating trading times using network analysis

To estimate the shipping times between two BRI locations, we use georeferenced data combined with GIS analysis on a country's transport network.[5] The main objective of the network analysis is to quantify the connectivity between capitals, ports and major cities (>100K) of BRI countries before and after various planned interventions (see Figure 1).[6] Trading times are assessed with the transport network in 2013 (i.e. before the official launch of BRI) for a set of 1,818 cities across 71 BRI economies listed in Appendix Table A. 1. This section reviews the main steps that are performed to assess the time it takes to trade across countries before the Belt and Road interventions (the assessment of the updated transport network on trade times is discussed in Section 4). It also highlights the main statistics deriving from this exercise.

A network analysis provides a more accurate measure of the real time it takes to ship goods across countries, as it takes into account factors such as the quality and quantity of infrastructure, physical obstacles (rough terrain) or other barriers (border and other delays). It also provides a more realistic description of the travel routes of goods that are shipped between cities compared to other measures such as the distance between capitals or main cities that are commonly used in the trade literature.

[5] The details of the methodology and data are discussed in de Soyres et al. (2018).
[6] The list of interventions under the BRI has been identified in Reed and Trubetskoy (2018).

Figure 1: BRI transport projects



Source: Reed and Trubetskoy (2018)

A network solution involves finding the shortest path between two locations, where the length of a path is the sum of a cumulative variable such as travel time (hours). Routing is determined by minimum time cost path, where travel time is a function of physical distance, geographical characteristics, speed and mode of transportation. In the baseline scenario, existing rail speed (50 kph) and sea routes (25 kph) are assumed along the network. Other variables such as the number of borders crossed along the route or how long it takes to load or unload the merchandise at the port can also affect trading times and therefore can change the shortest path connecting two locations. To account for this, information on border and port delays is included in the GIS analysis. The total time spent at the border that is assigned to each pair of countries is based on the importing and exporting trading times information from the Doing Business data set. Estimates on the time it takes to load and unload the goods at the ports is taken from Slack e al. (2018).

Before transportation infrastructure projects are implemented, bilateral trading times between BRI economies are on average 383.1 hours, equivalent to 16 days, and they range between a minimum of 0.9 hours to a maximum of 40.6 days (see Table 1). To perform the econometric analysis on the impact of trading times on bilateral trade flows, the minimum time it takes to connect cities is aggregated at the country pair level. To control for the fact that the economic activity varies across cities, we compute a population weighted average of the shipping times between each pair of cities that are in a pair of countries.

Table 1: Summary statistics of bilateral shipping times pre-BRI

	Obs.	Mean	Std. Dev.	Min	Max
Travel Time (hours)	4,891	383.112	192.625	0.89	974.781

At the regional level, before BRI transport projects, the East Asia & Pacific region has the highest trading times vis-a-vis all the other regions, particularly with countries in Central & Eastern Europe and Central & Western Asia (see Table 2). For example, it takes on average more than 30 days to ship goods between China and countries in Central & Eastern Europe such as Estonia, Poland and Croatia. Shipping times between China and Central Asian countries such as Georgia and Armenia are also high, amounting to 32.3 and 32.1 days on average. [7]

Table 2: Average pre-BRI trading times between regions

Avg. Travel time (days)	CEE	CWA	EAS	MEA	SAS	SSF
Central and Eastern Europe	3.6					
Central and Western Asia	13.1	10.8				
East Asia & Pacific	25.9	23.4	8.1			
Middle East & North Africa	13.1	14.2	20.7	8.9		
South Asia	22.3	19.6	16.2	14.9	11.8	
Sub-Saharan Africa	19.6	22.3	21.4	14.3	17.6	4.0
Regional	13.9	16.1	19.7	14.1	17.8	18.5

Note: Averaged over all country-pairs in each region-pair

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Table A. 8 presents simple average trading times for all countries.

3. The impact of trading times on trade

i. Methodology

In this section, we build on the literature on trade times and trade discussed in the Introduction and investigate how time to trade affects trade values between BRI economies. Intuitively, longer time delays act as a tax on exports, especially in the context of global value chains, where goods need to be shipped on time in order to ensure that production processes are not disrupted.

We begin by estimating the following augmented gravity equation:

$$X_{ijg} = \exp\{\beta_0 + \beta_1 GisTime_{ij} + \beta_2 Tariff_{ijk} + \beta_3 PTA\ depth_{ij} + Gravity_{ij} + \lambda_{ig} + \gamma_{jg}\} + \varepsilon_{ijg}, \qquad (1)$$

where the *i,j and g* subscripts correspond to the exporter, the importer and the hs6 product, respectively; the dependent variable X_{ijg} represents bilateral exports of product *g* from country *i* to country *j*; $GisTime_{ij}$ represents our variable of interest and is calculated as the minimum time it takes to transport a good from country *i* to country *j* in the baseline scenario presented in Section 2. $Gravity_{ij}$ includes a set of gravity-type variables associated with the exporter and the importer such as sharing the same official language or border or past colonial relationship and the strength of market penetration; $PTA\ depth_{ij}$ captures the level of depth of preferential trade agreements between the exporter and importer and is measured as the number of legally enforceable[8] disciplines that are included in a PTA. $Tariff_{ijk}$ refers to the logarithm of the average tariff applied by country *j* to country *i* for hs4-level product *k* plus one. Finally, we include exporter-product (λ_{ig}) and importer-product (γ_{jg}) fixed effects to control for factors such as comparative advantage, foreign industrial demand for intermediate inputs that can increase the exports, availability of intermediate inputs in the local economy that can raise the industrial

[8] The legal enforceability of the PTA disciplines is established according to the language used in the text of the agreements. In other words, it is assumed that commitments expressed with a clear, specific and imperative legal language can more successfully be invoked by a complainant in a dispute settlement proceeding and therefore are more likely to be legally enforceable. In contrast, unclear legal language might be related to policy areas that are covered but that might not be legally enforceable. See Hofmann, Osnago and Ruta (2017).

expenditure on inputs and thereby raise the production and exports, market potential, trade intensity, and agglomeration forces or co-location effects (see Hummels and Hillberry, 2002).

The data for the main variable of interest ($GisTime_{ij}$) were described in detail in the previous section. Other variables that are used in the econometric analysis come from usual sources. Export flows are collected from Comtrade at the hs6 level for the year 2013. Information on the gravity variables (common language or border or past colonial relationship and the strength of market penetration) comes from BACI data set produced at Center for Prospective Studies and International Information. Product-level information on preferential and Most Favored Nation tariffs imposed by countries comes from the new ITC-World Bank data set on preferential tariffs (Espitia et al, 2018). Data on the depth of preferential trade agreements come from the new World Bank database on the content of preferential trade agreements (Hofmann, Osnago and Ruta, 2017). Table A. 2 in the appendix presents the correlation between all the variables that are used in the estimations.

ii. Results

Table 3 presents the results of the estimation of equation 1 for a set of 71 countries and 5,039 HS-6 products in 2013. Regressions are estimated both using a linear model (OLS) and a Poisson pseudo maximum likelihood model (PPML) to control for the presence of zero trade flows. The results confirm a negative relationship between trading time and exports. The coefficient of the $GisTime_{ij}$ variable represents the percentage change in exports to a one hour increase in trading times. Results from the PPML model suggest that a one-day increase in trading times decreases exports by 5.2 (0.00217*100*24hrs) percent on average. Our results are in line with what has been found in the literature on the impact of trading times on exports. Papers such as Djankov, Freund and Pham (2010) find that, on average, each additional day that a product is delayed prior to being shipped reduces trade by at least 1 percent. They also find that the impact of delays is significantly higher for developing countries. Other papers focusing on the Sub-Saharan Africa region find that a one-day reduction in inland travel times leads to a 7 percent increase in exports (Freund and Rocha, 2011).

Table 3: Effects of Time to Trade on Trade Values

	OLS	**PPML**
	(1)	(2)
GIS Time	-0.00233***	-0.00217***
	(0.000187)	(0.000153)
Ln(tariff+1)	-1.315***	-1.871***
	(0.376)	(0.285)
PTA Depth	0.0208***	0.0195***
	(0.00290)	(0.00211)
Observations	1,205,865	8,287,250
R-squared	0.619	0.499

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

The coefficient of our control variable, *PTA depth,* suggests that BRI countries with deeper agreements trade more on average. Specifically, having one extra provision included in the agreement increases trade by 1.9 percent on average. This result is in line with the literature on the trade effects of deep trade agreements.[9] In terms of tariffs, a 1 percent increase in tariff rates will reduce exports by 1.8 percent on average. Other standard gravity variables (not reported) have the usual signs found in the literature.

Different products are likely to respond differently to changes in trade time because time sensitivity varies by product. To take a first look into the potential heterogeneity that the variable trading times can have on exports at the product level, we run equation (1) for each hs4 product[10] --we come back to this issue in Section 3.iv using a different specification based on Nunn (2007). Specifically, we estimate the following equation:

$$X_{ij} = \exp\{\beta_0 + \beta_1 GisTime_{ij} + \beta_2 Tariff_{ij} + \beta_3 PTA\ depth_{ij} + Gravity_{ij} + \lambda_i + \gamma_j\} + \varepsilon_{ij}$$

[9] Papers such as Orefice and Rocha (2014) find that deeper agreements increase trade across countries by 2 percent on average. More recent research by Mattoo, Mulabdic and Ruta (2017) finds that trade between country pairs that sign an agreement with the highest depth increases by around 12.5 percent.

[10] Regressions cannot be run at the hs6 level as some of the products have very few observations and the PPML does not always converge.

Notice that now the fixed effects that are included in the regression are at the country level instead of country-product level.

Results for the product-level estimations aggregated at the sectoral level are presented in Table 4. The negative impact of time delays on exports ranges between -0.002 and -0.06. For sectors such as wood/wood products (e.g. chemical wood pulp and wood wool) and vegetable products (e.g. ground nut oil and its fractions, mate, and cucumbers and gherkins), the GIS time coefficient is the highest, suggesting that these sectors are more sensitive to time variations. Specifically, a one-day increase in export delays decreases exports in these industries by more than 25 percent on average. For other sectors such as footwear/headwear, miscellaneous products (works of art and clocks/watches) and transportation equipment, the impact of a one-day increase on exports is much lower and equal to 3.9 percent on average.

Table 4: Average effect of GIS Time to trade – At the 4-digit level aggregated by sector

Sector	Coefficient
Wood & Wood Products	-0.058
Vegetable Products	-0.051
Stone / Glass	-0.011
Mineral Products	-0.010
Raw Hides, Skins, Leather, & Furs	-0.007
Animal & Animal Products	-0.005
Foodstuffs	-0.003
Plastics / Rubbers	-0.003
Chemicals & Allied Industries	-0.003
Metals	-0.003
Textiles	-0.003
Machinery / Electrical	-0.003
Transportation equipment	-0.003
Miscellaneous (Hs 90-97)	-0.002
Footwear / Headgear	-0.002

iii. Robustness checks

The previous results might be subject to endogeneity deriving from omitted variables bias and reverse causality. Omitted variables bias arises when there are unobserved country-pair specific policy variables (peaceful relationship, common legal origin, etc.) that affect both exports and trading times. The rich set of fixed effects that are included in the regressions together with the policy controls that vary at the country-pair level control for a significant degree of the omitted variables. Moreover, in a second exercise that is presented in sub-section (iv), we estimate the impact of trading times on exports of time sensitive products using a difference in difference approach. In this case, the higher number of fixed effects that are included in the regression allows us to fully control for omitted variables (see section-below).

Reverse causality may arise when the time to export variables are likely to be correlated with country exports. An improvement of rail or ports infrastructure and administrative time costs has positive effects on exports. However, trade partners that have better trade prospects or that wish to improve their current trade volume will also invest more on such trade facilitating infrastructure. Such incentives of infrastructure reform are clearly important in the case of the Belt and Road Initiative. In particular, the rising trade prospects of China and its increasing need for energy supplies are some of the major incentives to improve infrastructure in the context of the BRI. To control for reverse causality, we use three types of robustness checks. First, we estimate the regressions excluding the nodal countries in the BRI, mainly Europe and China, which are those that are trading more between them. Second, we re-estimate the regressions excluding the extractive industries. Third, we follow an instrumental variable approach to estimate equation (1).

For the instrumental variables estimation, we follow the literature and instrument travel times between trading partners using the mean physical geography features of transit countries along any trade route.[11] The set of geographical variables that are used to compute the instruments are taken from Nunn and Puga (2009) and include the percentage of moderately to highly rugged

[11] Geographical characteristics of a country have been used in the past by papers such as Limao and Venables (2001) to instrument for transport infrastructure.

land area and the proximity to the coast (percentage of land area within 100km of the nearest ice-free coastline). These geographical features are clearly exogenous to trade as countries are naturally endowed with them. In addition, they have a direct impact on the ability of bilateral trade partners to transport goods on time. Trade routes that are highly rugged (presence of rough and uneven land surfaces) tend to have lower quality of land transportation infrastructure, while trade routes that are closer to the coast tend to have well established maritime ports and transport infrastructure.

Results from the first stage regression (see appendix

Table A. 3 and Table A. 4) confirm that the proposed instruments are a good predictor of transport infrastructure. Trading routes that are less rugged and near to the coast have lower bilateral time to trade. The F-statistics reported in

Table A. 3 and Table A. 4 also confirm that the instruments are not weak. In addition, the low correlations between export values and geographical features (see Table A. 5) support the fact that they meet the exclusion restriction criteria.

To control for the potential reverse causality of other explanatory variables such as the depth of preferential trade agreements, we instrument PTA depth between country *i* and country *j* with the trade weighted average depth of all the agreements signed by *i* and *j* with third countries. This type of instrumental variable approach has already been used in the literature (see, for instance, Orefice and Rocha, 2014 and Laget et al., 2018). We aggregate tariffs at the HS4 level, so the degree of endogeneity between trade and tariffs at the product level decreases.[12]

Table 5 presents the results of the impact of trading times on export values once we control for endogeneity. Estimations excluding nodal countries and products from the extractive industries are very similar to those in the baseline regression and suggest that a one-day decrease in trading times increases trade by 5.2-6.6 percent on average (columns 1, 2, 4 and 5). The second-stage results of the instrumental variable regressions are presented in column (3). The magnitude of the coefficients on trading times is larger compared to those in the baseline results and show that a one-day decrease in trading times increases exports by 12 percent on average. One potential reason for this is that the variable, GIS time, might be subject to measurement error as it might not fully reflect the role of geography in explaining the connectivity between countries.

Table 5: Sorting out endogeneity

	OLS			**PPML**	
	Eliminate CHN-EU	**Eliminate Extraction**	**IV**	**Eliminate CHN-EU**	**Eliminate Extraction**
	(1)	(2)	(3)	(4)	(5)
GIS Time	-0.00264***	-0.00233***	-0.00499***	-0.00273***	-0.00215***
	(0.000198)	(0.000188)	(0.000995)	(0.000166)	(0.000153)
Ln(PRF+1)	-1.166***	-1.314***	1.401	-1.686***	-1.889***
	(0.367)	(0.377)	(0.974)	(0.276)	(0.285)
PTA Depth	0.0228***	0.0208***	0.00803	0.0226***	0.0194***

[12] As an extra check, regressions are conducted aggregating tariffs at the hs2 level. Results presented in appendix Table A. 6 are very similar to those in the baseline regression.

	(0.00293)	(0.00291)	(0.0137)	(0.00199)	(0.00211)
Observations	1,140,459	1,192,038	1,224,775	8,093,490	8,135,016
R-squared	0.622	0.617	0.603	0.511	0.500

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

Two additional robustness tests are performed. First, to control for year-specific effects in our analysis, regressions are estimated using export values in periods t-1 and t+1, where t equals 2013. Results presented in appendix Table A. 7 are in line with the baseline results and confirm the negative impact of trading times on export values. Second, we also conduct regressions excluding the trade flows of the exporting country from the computation of the importer market sizes to avoid endogeneity. Results are once again in line with those in our baseline specification (see columns 3 and 6 of Table A. 7 in the appendix).

iv. Time sensitivity and export delays

As discussed in Section 3.i, time delays should have a greater effect on export patterns of time sensitive goods. In this section, we go one step further and examine how the ability of bilateral trade partners to transport goods on time determines their comparative advantage in products that are time sensitive (direct time sensitivity) and that value timely delivery of their inputs (indirect time sensitivity).

Following Nunn (2007), we adopt an empirical specification that explains export values by the interactions of exporter-importer specific characteristics with product specific characteristics. In particular, we estimate the following specification:

$$\mathrm{lnX_{ijg}} = \beta_0 + \beta_1 \mathrm{lnGisTime_{ij}} * \mathrm{t_g} + \beta_2 \mathrm{lnGisTime_{ij}} * \tilde{\mathrm{t}}_\mathrm{g} + \mathrm{Controls_{ijg}} + \mu_\mathrm{i} + \pi_\mathrm{j} + \eta_\mathrm{g} + \rho_\mathrm{ij} + \lambda_\mathrm{ig} + \gamma_\mathrm{jg} + \varepsilon_\mathrm{ijg} \quad (2)$$

where $\beta_1 * t_g$ represents the direct effect of transportation infrastructure projects, while $\beta_2 * \tilde{t}_g$ represents the indirect effect of transportation infrastructure projects arising through the input-output linkages. Specifically, the direct effect comes from the improvement in the ability to transport the final products to the consumers or end users on time, whereas, the indirect effect comes from the improvement in the ability to access the intermediate inputs on time. Hence, a one-day decrease in bilateral time to trade leads to an increase in the bilateral export pattern by: $(\beta_1 * t_g + \beta_2 * \tilde{t}_g)$%.

The results presented in Table 6 show that the impact of trading times is relatively higher for products that are time sensitive to their consumers or end users and that use time sensitive inputs in production. In addition, the indirect effect (impact of trading times on products that highly use time sensitive inputs in production) is higher than the direct effect (impact of trading times on products that are time sensitive to their consumers), suggesting that improving trading times is particularly important in a world of global value chains, where time sensitive inputs are imported for production.

To gauge the magnitude of the estimates on the interaction between time reductions and direct time sensitiveness, we evaluate the coefficients for two sets of industries: textiles, leather and apparel, and motor, parts and transport equipment. These industries fall respectively in the 25th and 75th percentile of the *direct* time sensitivity distribution. The increase in average trade from a one-day reduction in trading time is 0.17 percentage points higher for products within the motor, parts and equipment sector compared to products in the textile, leather and apparel industries. Conversely, the impact of reduction in timeliness on exports of products that use time sensitive inputs is 0.23 percentage points higher for products in the paper and metals industries, which fall in the 75th percentile of the *indirect* time sensitivity distribution, compared to products in the textiles, leather and apparel industries, which are in the 25th percentile of the distribution.

Table 6: Time sensitive products and products using time sensitive inputs

	OLS	**PPML**
	(1)	(2)
GIS Time * t0 (Direct Effect)	-0.00925***	-0.00886***
	(0.00105)	(0.000701)
GIS Time * t1 (Indirect Effect)	-0.0261***	-0.0388***
	(0.00333)	(0.00181)
Ln(PRF+1)	-0.509***	-0.220**
	(0.151)	(0.0910)

Observations	1,235,877	8,308,722
R-squared	0.669	0.627

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

v. Complementarity between infrastructure improvements and trade reforms

In this sub-section, we assess the complementarity of trade policy reforms (deepening trade agreements and improving market access) on the one hand and infrastructure improvements in the BRI region on the other hand. To do this, we introduce an interaction term between the GIS variable of shipment times across countries and the policy variable ($Policy_{ij}$), capturing respectively, the level of depth of agreements signed between a pair of countries *ij* or the average preferential tariffs that the importer *j* is imposing to *i* in sector *k*:

$$X_{ijg} = \exp\{\beta_0 + \beta_1 GisTime_{ij} + \beta_2 Tariff_{ijk} + \beta_3 PTAdepth_{ij} + \beta_4 Policy_{ij} * GisTime_{ij} + Gravity_{ij} + \lambda_{ig} + \gamma_{jg}\} + \varepsilon_{ijg} \quad (3)$$

The results presented in Table 7 highlight the complementarity between infrastructure improvements and trade reforms.[13] The positive impact of a reduction in trading times is magnified for country-pairs that are involved in deeper trade agreements (e.g. countries that have better institutions and that share a common regulatory framework in trade related disciplines such as investment, intellectual property rights, competition policy and technical barriers to trade among others) as opposed to country pairs that have shallow agreements (see columns 1 and 2). Specifically, the positive impact of a one-day reduction in trading times is 1.1 percent higher (6.3 percent) for country-pairs that are part of the European Union, the deepest agreement in the BRI sample of countries, compared to countries that are part of very shallow agreements (agreements including only one provision).

In terms of market access, the positive impact of reducing trading times is dampened for country-pair-products with lower levels of tariff liberalization (see columns 3 and 4). Whereas a one-day reduction in trading times without reductions in tariff rates will increase average exports of

[13] The IV regressions are excluded from this exercise given the complexity to instrument and interpret the interaction between endogenous variables.

country-pair-products by 6.3 percent on average, exports of products subject to 1 and 10 percent reductions in tariff rates will increase by 6.6 and 8.9 percent on average respectively as a result of a one-day reduction in trading times. A one-day reduction in trading times with a half-reduction or full reduction of tariff rates (tariff rate=0) will boost exports by respectively 19.5 and 32.7 percent on average.

Table 7: Complementarity between infrastructure improvements and trade reforms

	Deepening trade agreements		***Improving market access***	
	OLS	**PPML**	**OLS**	**PPML**
	(1)	(2)	(3)	(4)
GIS Time	-0.00228***	-0.00214***	-0.00271***	-0.00262***
	(0.000185)	(0.000149)	(0.000190)	(0.000159)
PTA Depth	0.0287***	0.0277***	0.0190***	0.0168***
	(0.00329)	(0.00253)	(0.00291)	(0.00213)
PTA Depth * GIS Time	-0.000105***	-0.000111***		
	(2.30e-05)	(2.18e-05)		
Ln(PRF+1)	-1.728***	-2.284***	-3.849***	-5.254***
	(0.360)	(0.278)	(0.644)	(0.547)
Ln(PRF+1) * GIS Time			0.00713***	0.00883***
			(0.00134)	(0.00108)
Observations	1,205,865	8,287,250	1,205,865	8,287,250
R-squared	0.620	0.501	0.619	0.502

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

4. Assessing the potential impact of BRI on trade

In this section we assess the potential impact of BRI improvement on export flows. First, we study the time improvements that derive from BRI transportation projects using GIS analysis and then we focus on trade effects. The following cases are presented: improvements in infrastructure only, improvements in both infrastructure and border delays and improvements in infrastructure along economic corridors. We also assess the overall effect of BRI transportation projects in the presence of deeper agreements and when better market access is granted to countries.

i. Effects of BRI transportation projects on trade times

To assess improvements in trading times after BRI projects are implemented, a higher speed is assumed for the parts of the new or improved existing network. The baseline scenario discussed in Section 2 uses existing rail speed (50 kph) and sea routes (25 kph), while the post-BRI scenario includes proposed new rail links and main rail along the route segments that have been improved at the increased speed (75 kph). To capture the upgrading of existing ports, it is assumed that the time it takes to handle the merchandise in the port decreases to the minimum time estimates in the region that are provided in Slack et al. (2018).

The choice of a shipping route between two locations can depend on factors other than time (and distance), such as the monetary cost determined by the mode of transportation (railway or maritime). To take into account the trade-off between shorter trade/travel times of railway connectivity and cheaper monetary costs associated with maritime travel, two extreme scenarios are created post-BRI. In the first scenario (referred to as the lower bound scenario), a high preference for using maritime links whenever available is assumed. Here the improvements in shipping times will derive either from improvements in existing ports or from alternative maritime routes where new land connectivity with certain cities exists. In the second scenario, the upper bound scenario, the preference for maritime transport is removed, implicitly allowing for modal substitution between maritime and railway transport whenever the time/distance is lower transporting goods by land.

Table 8 shows that the Belt and Road Initiative would both create new land and maritime connections among BRI economies and reduce trade times by 2.8 percent on average, equivalent to 11.7 hours (0.5 days), assuming that there is a preference for maritime transport after BRI interventions (lower-bound scenario). For the upper-bound scenario, where change in mode of transportation from sea to rail is allowed, the average reduction in trading times is 4.4 percent, equivalent to 17.6 hours (0.7 days). Changes in trade time vary widely, with reductions that range between zero and 9.6 days.

Table 8: Trade time improvements post-BRI

Lower-bound	Obs.	Mean	Std. Dev.	Min	Max

Change in travel time (hours)	4,891	-11.6911	19.4378	-220.8858	0
Change in travel time (%)	4,891	2.8393	5.2048	0	86.9523
Upper-bound					
Change in travel time (hours)	4,891	-17.6081	25.1575	-231.5271	0
Change in travel time (%)	4,891	4.3604	6.1668	0	86.9523

Average trade time reductions across pairs of regions range between 0.4 and 19.4 percent in the lower bound scenario and between 0.8 and 20.8 percent in the upper bound scenario (Table 9). Largest reductions in time to trade are predicted for country-pairs within Central & Western Asia (19.4 in the lower bound and 20.8 in the upper bound). Across regions, the highest time decreases take place between Sub-Saharan Africa and East Asia & Pacific in the lower bound (7.8 percent); and between Central & Western Asia and East Asia & Pacific in the upper bound (9.1 percent). [14]

Table 9: Average change in time to trade (%) between regions

a. Lower-bound

Avg. Change in time to trade (%)	CEE	CWA	EAS	MEA	SAS	SSF
Central and Eastern Europe	0.7					
Central and Western Asia	2.9	19.4				
East Asia & Pacific	2.9	5.6	5.2			
Middle East & North Africa	0.4	2.3	4.0	0.6		
South Asia	1.4	1.9	6.0	1.5	2.9	
Sub-Saharan Africa	3.5	4.0	7.8	4.0	4.9	5.8
Regional Average	1.9	6.0	5.3	2.1	3.1	5.0

b. Upper-bound

Avg. Change in time to trade (%)	CEE	CWA	EAS	MEA	SAS	SSF
Central and Eastern Europe	1.1					
Central and Western Asia	3.8	20.8				
East Asia & Pacific	3.7	9.1	8.6			
Middle East & North Africa	3.1	4.2	5.1	0.8		
South Asia	3.5	2.9	7.0	2.9	3.6	
Sub-Saharan Africa	5.8	8.9	8.6	4.4	5.4	6.3
Regional Average	3.5	8.3	7.0	3.4	4.2	6.6

Note: Averaged over all country-pairs in each region-pair

ii. Effects of BRI transportation projects on trade

To estimate the impact of BRI on trade, we multiply the trade elasticities of time obtained from the gravity estimation and the time reductions derived from GIS analysis: $\Delta lnX_{ijg} = 100 * \widehat{\beta_1} *$

[14] Time reductions for the lower and upper bound scenarios at the country level are presented in Appendix

Table A. 8.

$\Delta GisTime_{ijg}$ at the product level. We then calculate the total pre-BRI and post-BRI trade for each country-pair. An upper-bound estimate of the overall effect of the BRI suggests that total trade within BRI countries increases by 4.1 percent. This assumes that trade in all products can switch transportation modes relatively easily to take advantage of the improved transport links. A lower-bound estimate, which assumes that products cannot switch transportation mode, is that total trade within BRI countries increases by 2.5 percent.

The discussion below highlights the heterogeneity of the trade effects of the BRI across regions, countries and sectors. Table 10 shows the results on the impact of BRI improvements on trade between BRI regions for the lower and upper bound scenarios respectively. Trade gains range between 1.5 and 5.5 percent in the lower bound scenario and between 2.3 and 8.6 percent in the upper bound scenario with East Asia & Pacific and Sub-Saharan Africa experiencing the largest increments in exports (5.5 and 5.1 percent, respectively in the lower bound scenario and 8.5 and 8.6 percent in the upper bound scenario). Across pairs of regions, some interesting patterns appear. In the lower-bound scenario, the highest changes in trade occur between East Asia & Pacific and Sub-Saharan Africa. In the upper bound scenario, exports from Sub-Saharan Africa to Central & Western Asia increase the most. This is consistent with the fact that the upper bound scenario allows for a greater flexibility in changing transport mode from maritime to rail.

Table 10: Change in total trade (%) between regions

a. Lower-bound

Origin \ Destination	CEE	CWA	EAS	MEA	SAS	SSF	Total
Central and Eastern Europe	0.4	1.6	4.0	0.7	0.8	4.1	1.93
Central and Western Asia	2.2	8.3	4.3	1.2	0.3	3.7	3.34
East Asia & Pacific	5.1	6.4	1.5	5.2	4.6	10.2	5.48
Middle East & North Africa	0.7	0.7	5.0	0.0	0.1	3.1	1.60
South Asia	0.8	0.3	4.2	0.1	0.4	3.0	1.46
Sub-Saharan Africa	3.5	6.0	11.1	3.1	3.3	3.5	5.11

b. Upper-bound

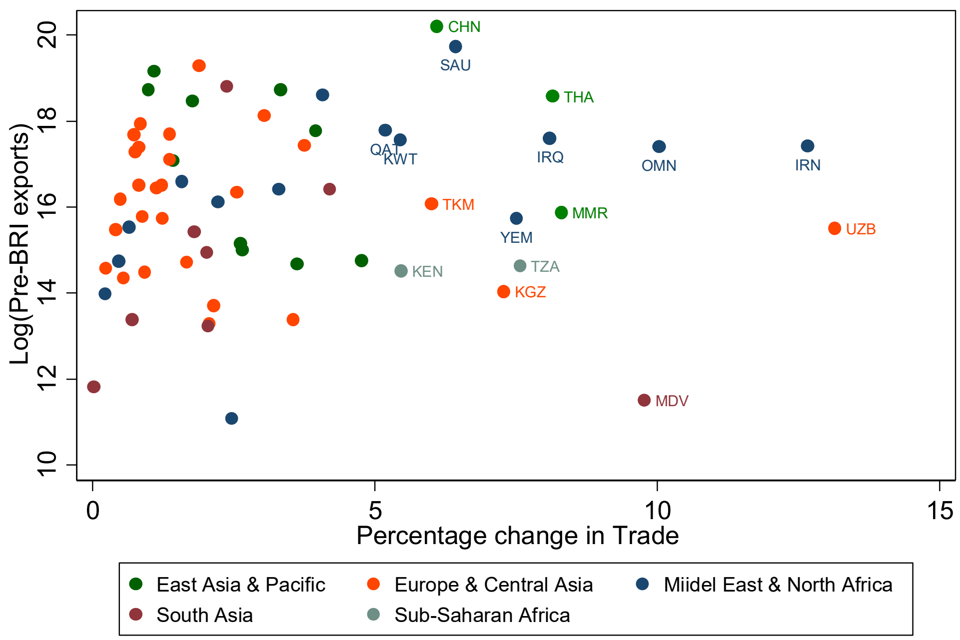
Origin \ Destination	CEE	CWA	EAS	MEA	SAS	SSF	Total
Central and Eastern Europe	0.7	2.5	4.5	2.0	3.7	6.0	3.21
Central and Western Asia	3.4	10.2	10.6	3.7	0.8	6.9	5.93
East Asia & Pacific	5.5	12.6	2.2	12.0	5.7	12.8	8.45
Middle East & North Africa	1.7	1.8	8.7	0.1	1.1	3.3	2.78
South Asia	2.7	0.9	5.0	0.9	0.6	3.8	2.33
Sub-Saharan Africa	5.6	20.9	13.7	3.4	4.1	3.9	8.60

Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each country -pair in each region-pair

At the country level, expected trade gains from BRI reflect both the extent of improved connectivity and the export structure of the country. Figure 2 plots the expected change in exports for the BRI countries against their levels of trade pre-BRI. Countries such as Uzbekistan, the Islamic Republic of Iran, Oman, Maldives and Myanmar benefit the most after improvements in trading times, with an increase in their exports above 7 percent. Other countries, such as China ,and Saudi Arabia, will benefit the most in terms of value of their exports given their already high trade within the BRI. While in some cases trade gains are sizeable, an important constraint to trade expansion is the persistence of significant policy barriers for many BRI countries. We expand on this in the next sections.

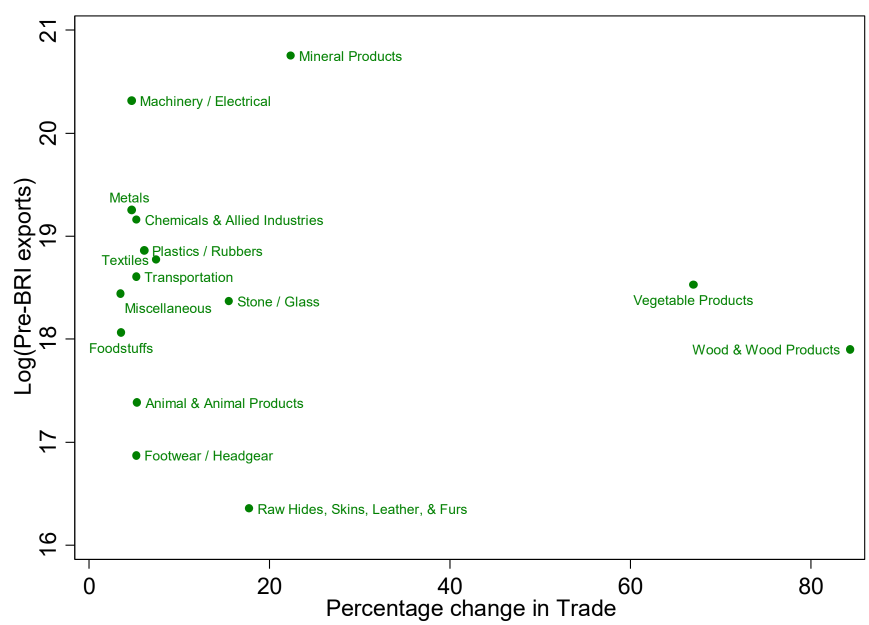
At the sectoral level, the positive impact of the BRI ranges between 3.5 and 84 percent. Industries gaining the most from the BRI include wood/wood products (e.g. chemical wood pulp and wood wool) and vegetable products (e.g. ground nut oil and its fractions, mate, and cucumbers and gherkins). Their exports will increase by more than 60 percent. In contrast, exports of industries such as miscellaneous products (works of art and clocks/watches), metals and machinery will increase by 5 percent or less after the BRI (see Figure 3). The effects of BRI transportation projects on the exports of different sectors depend on their time sensitivity -direct and indirect. Figure 4 shows that reduction in trade times will increase specialization in sectors such as livestock, vegetable, fruits, nuts and crops, which will benefit the most from the improvement in the ability to transport the final products on time to the consumers or end users (direct effect). Specialization in exports from meat products, chemicals, ferrous metals, rubber and plastics will also increase given the improvement in the ability to access the intermediate inputs on time (indirect effect).

Figure 2: Change in total exports by country



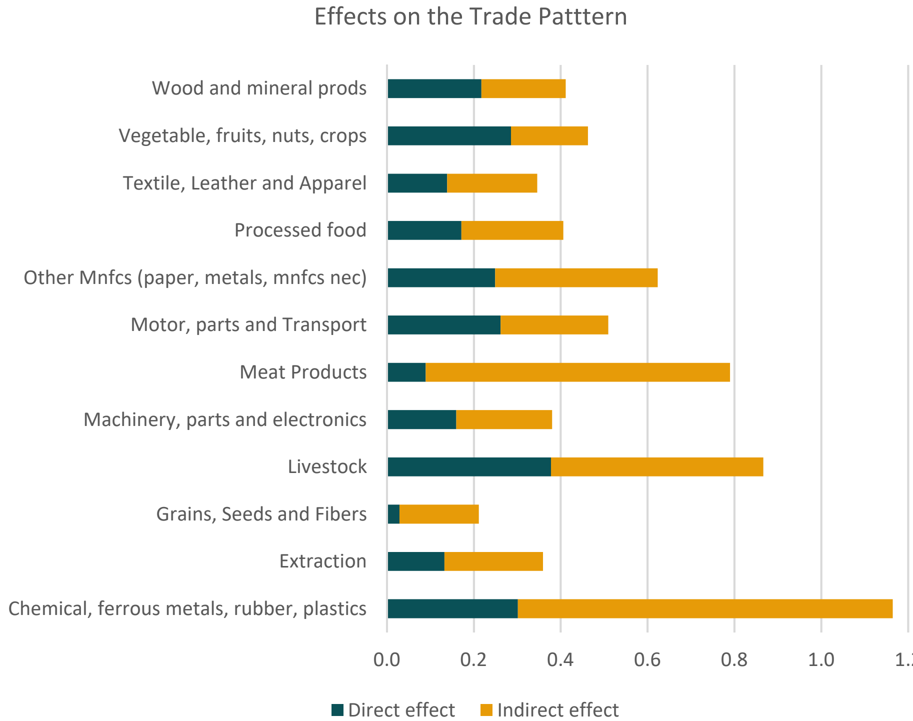
Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each country

Figure 3: Change in total exports by sector



Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each sector

Figure 4: Effects of BRI on the trade pattern (% Change)



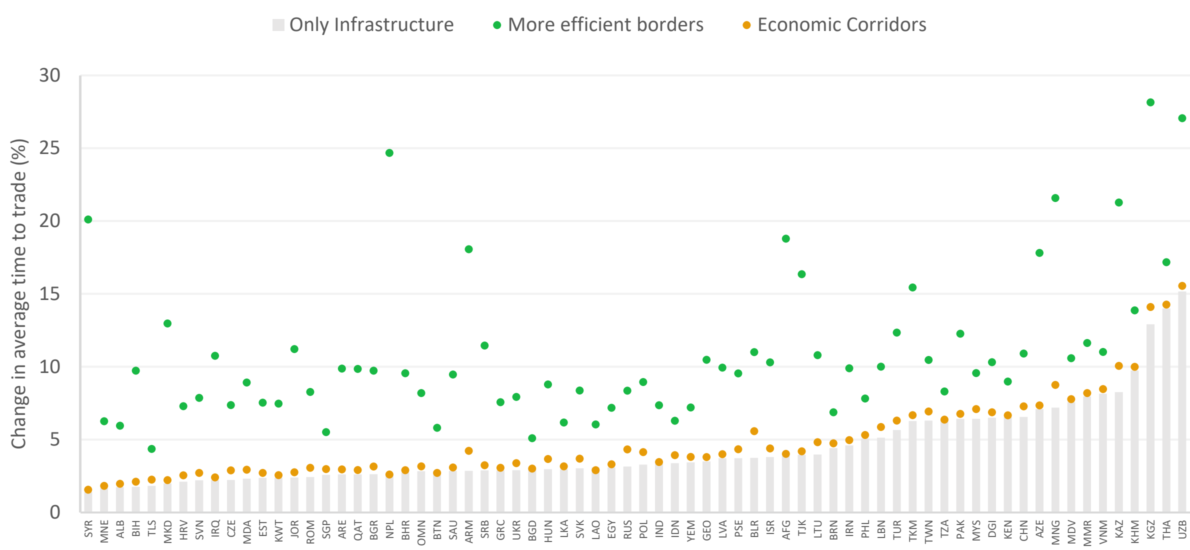
Note: (i) The impact is estimated using the sector specific average time sensitivity characteristics irrespective of the regional production and trade structure. (ii) Impact is calculated using $\Delta lnX_{ijg} = 100 * (\widehat{\beta_1} t_g + \widehat{\beta_2}\, \tilde{t}_g) * \Delta GisTime_{ij}$ with the average change in time to trade from the upper-bound scenario (17.61 hours)

iii. Complementarity between improved infrastructure, corridor management and trade facilitation reform

In this section, we study two alternative cases for reductions in trading times after BRI are presented: (i) improvements in infrastructure combined with reductions in border delays, and (ii) improvements in infrastructure along economic corridors. In the first case, time improvements after BRI are computed in the GIS analysis assuming that border delays are reduced 50 percent across countries. In the second case, we assume that improvements in corridor management and decreases in congestion take place after BRI interventions along the corridors. To take this into account, we assume that improvements in the rail links after the BRI intervention apply along the economic corridors (for the whole rail instead of the segment that is new or improved).

Reductions in total trading times for the upper bound scenario are on average 10.9 percent when border delays are reduced and 4.8 percent in the presence of improved economic corridors (Figure 5). Countries in regions such as Central & Western Asia, South Asia and Middle East & North Africa would reduce their average trading times by more than 10 percent if border delays are improved. Improvements in corridor management would significantly reduce trading times in other regions such as East Asia & Pacific and Sub-Saharan Africa.

Figure 5: Change in average time to trade (%) – Upper bound scenario

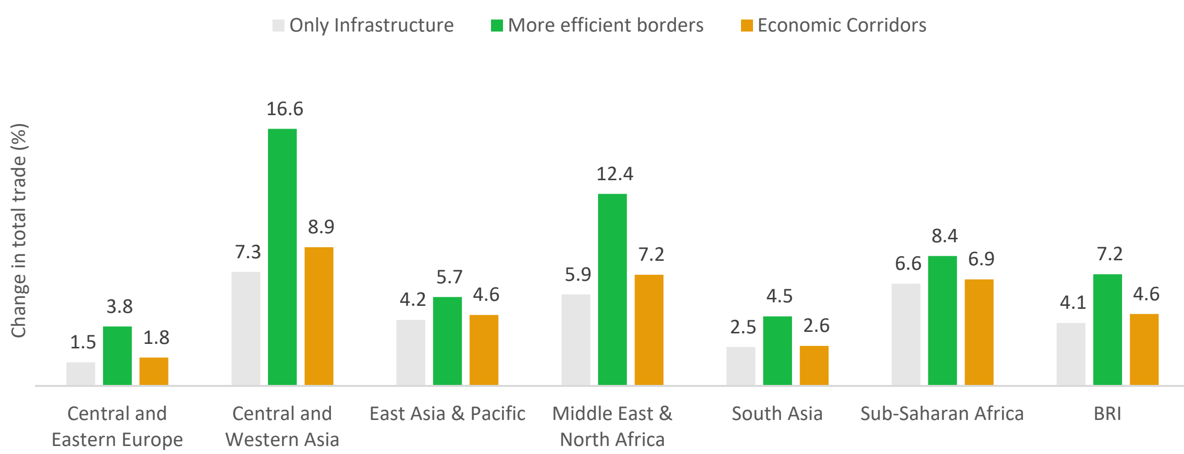


Note: Averaged over all country-pairs for each country.

In terms of trade flows, the overall impact of the BRI on total exports ranges between 3.1 and 7.2 percent when border delays are reduced and between 2.6 and 4.6 percent in the presence of improved economic corridors. Results at the regional level are illustrated for the upper bound scenario in Figure 6. Improvements in infrastructure combined with reductions in border delays will increase trade by more than 10 percent for regions such as Central & Western Asia and Middle East & North Africa. In the same way, once the BRI intervention along the entire economic corridors are implemented, countries from Sub-Saharan Africa, Middle East & North Africa and

Central & Western Asia will benefit the most.[15] These results point to a strong complementarity between infrastructure improvements and policy reforms aimed at reducing border delays and those that allow a better management of corridors that span multiple countries.

Figure 6: Change in total trade (%), upper bound scenario



Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each region

iv. Complementarity between improved infrastructure and trade policy reform

The results presented in Figure 7 and Figure 8 highlight the complementarity between infrastructure improvements and trade reforms (deepening trade agreements or improving market access). To estimate the impact of deepening trade agreements after BRI interventions, we assume that the depth of PTAs currently signed between countries in the BRI region increases up to the regional average (13.7 disciplines) for those country pairs with an original level of depth below that value.[16] Total BRI trade will increase between 9.5 and 11.2 for the lower and upper bound, respectively. At the country level, improvements in trade range between 0.4 and 40.4 percent in the lower bound scenario and 0.8 and 42.6 percent in the upper bound scenario. With countries in East Asia & Pacific such as Myanmar, Thailand, Lao PDR and Brunei Darussalam,

[15] See Appendix

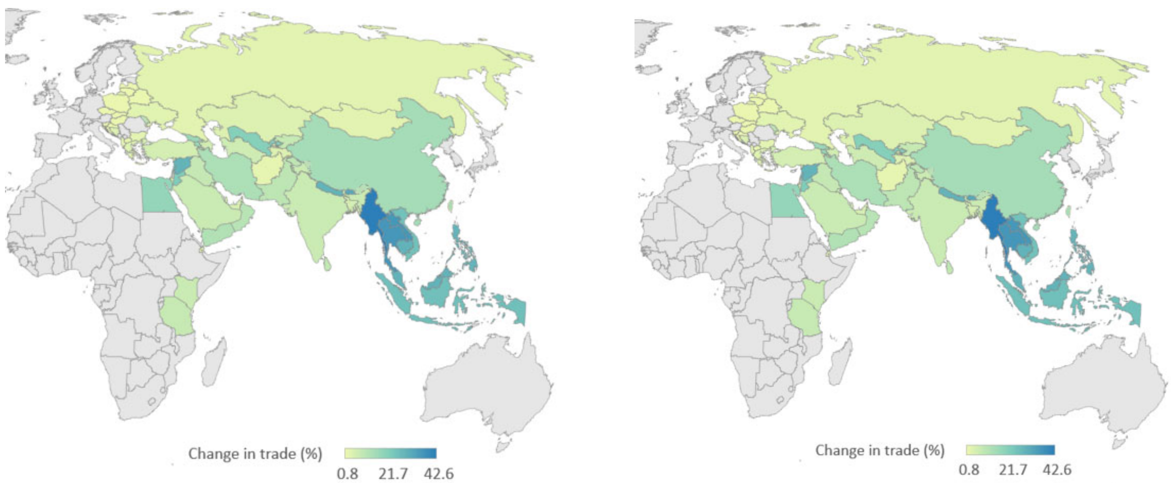
Table A. 9 for detailed trade improvements for all the cases.

[16] Specifically, we assume that the new level of depth of an agreement signed by two countries is $NewDepth_{ij} = \max(PTADepth_{ij}, BRIDepth)$.

increasing their exports by more than 30 percent. Intuitively, deepening trade agreements would allow BRI economies to reduce trade costs and discrimination associated to border and behind the border policies, such as trade remedies (e.g. antidumping duties), competition and investment policy.

Figure 7: Change in trade – Deepening trade agreements

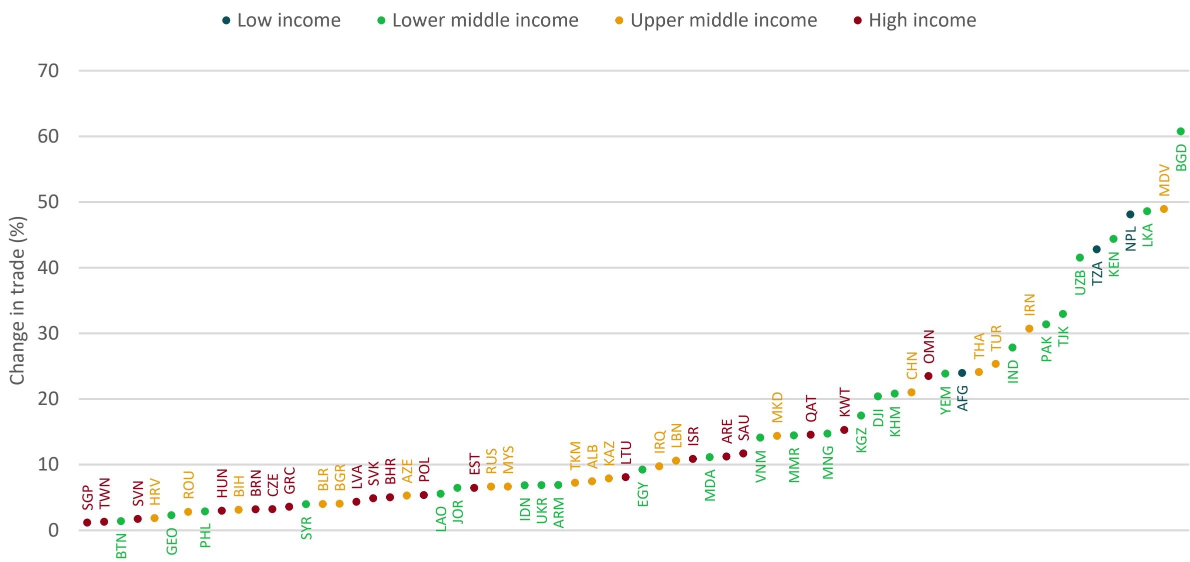
a. Lower-bound *b. Upper-bound*



Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each country

In terms of market access, we assume that as an incentive to promote trade along the route, tariff rates among BRI countries are reduced by half. Specifically, tariff rates will decrease from 5.9 to 2.9 percent on average. The combination of lower tariffs and lower BRI trading times leads to increases in trade among BRI economies between 10.9 and 12.9 percent for the lower and upper bound scenarios, respectively. Results highlighting the average increase in trade by country for the upper bound scenario are presented in figure 8. The positive impact of the BRI will be boosted significantly for low and lower middle-income countries, which currently face high levels of protection. Specifically, their exports will increase by 38 and 19 percent on average, respectively in the upper bound scenario.

Figure 8: Change in total trade – Improving market access (upper bound scenario)



Note: Change in trade is calculated as the difference between pre-BRI and post-BRI trade for each country.

5. Conclusion

This paper is a first attempt to examine the effects of the Belt and Road Initiative of China on bilateral times to trade, and the resulting trade impacts for the Belt and Road countries using a combination of geographic and economic analysis. We particularly focus our analysis on the land and maritime transportation infrastructure reform that improve the connectivity of the 70 countries (plus China) that will potentially participate to the initiative. An important caveat is that significant uncertainty attaches to our estimates: the BRI is a fluid project and the details of the infrastructure investments are not known. Specifics on how the initiative will shape up will obviously affect how it will impact shipment times, and ultimately, trade flows.

Keeping this caveat in mind, our results suggest that BRI transport projects would both create new land and maritime connections in the broad Eurasia region and would reduce trade times along the existing transport links between 2.8 percent (assuming that exporters do not switch mode of transportation -lower bound) and 4.4 percent (assuming that exporters can switch transport modes relatively easily -upper bound). When improvements in infrastructure are combined with decreases in border delays, reductions in trading times are equal to 7.4 and 10.9

percent for the lower and upper bound scenarios respectively. These results suggest that the positive impact of the BRI on trading times will be magnified if countries also implement trade facilitation reforms.

We find that BRI infrastructure improvements could increase total trade among BRI economies between 2.5 percent to 4.1 percent. Policy reforms aimed at reducing border delays and those that allow a better management of corridors would complement BRI transportation projects. Indeed, results show that BRI transportation projects increase total exports among BRI economies by 4.6 percent in the presence of improved economic corridors and by 7.2 percent when border delays are reduced. Finally, we find that deeper trade agreements and improved market access would magnify the trade impact of BRI infrastructure projects, increasing total exports by 11.2 and 12.9 percent, indicating that trade gains would be larger if trade cooperation complemented infrastructure cooperation.

Differences in the BRI impact across countries reflect both the extent of improved connectivity, and the export structure of the country—time-sensitive products and products that require time-sensitive inputs are highly impacted. The biggest trade gains stem from improvements in trade times for inputs whose timely delivery is highly valued by producers. Put differently, countries that are more integrated in regional and global value chains tend to benefit more from reductions in trade times.

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Appendix

Table A. 1: Countries geographically located along the Belt and Road

Region	Belt and Road Countries (besides China)	Number of Countries
Central and Western Asia	Armenia, Azerbaijan, Georgia, Iran, Islamic Rep., Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, Turkmenistan, Uzbekistan	10
East Asia & Pacific	Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Mongoloia, Myanmar, Philippines, Singapore, Taiwan, China, Thailand, Timor-Leste, Vietnam	14
South Asia	Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka	8
Central and East Europe	Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania Macedonia, FYR, Moldova, Montenegro, Poland, Russian Federation, Serbia, Slovak Republic, Slovenia, Ukraine	20
Middle East & North Africa	Bahrain, Djibouti, Egypt, Arab Rep., Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, West Bank and Gaza, Yemen, Rep.	16
Sub-Saharan Africa	Kenya, Tanzania	2

Source: de Soyres et al, 2018

Table A. 2: Correlation between all the variables that are used in the estimations

	ln(exp)	GIS Time	Ln(tariff+1)	PTA Depth	Contiguity	Common Language	Colony	Common currency
ln(exp)	1							
GIS Time	-0.15	1						
Ln(tariff+1)	-0.04	0.19	1					
PTA Depth	0.15	-0.51	-0.21	1				
Contiguity	0.25	-0.29	-0.07	0.19	1			
Common Language	0.08	-0.14	-0.08	0.02	0.15	1		
Colony	0.12	-0.13	-0.03	0.05	0.26	0.01	1	
Common currency	0.06	-0.06	-0.03	0.01	0.17	0.14	-0.01	1

Table A. 3: Effects of Time to Trade on Trade Values – First stage results (Time to trade)

	Time to trade
% of Rugged Area	25.26***
	(3.712)
Proximity to Coast	-17.13***
	(2.224)
Observations	1,165,613
R-squared	0.729
F-stat	76.12***

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

Table A. 4: Effects of Time to Trade on Trade Values – First stage results (PTA Depth)

	PTA Depth
Weighted average partners depth	3.936***
	(0.0977)
Observations	1,165,613
R-squared	0.915
F-stat	573.28***

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

Table A. 5: Correlations between Trade, Timeliness, Geography and PTAs with Third Countries

	Export Value	% of Rugged Area	Proximity to Coast	Third party agreements
Export Value	1			
% of Rugged Area	-0.0003	1		
Proximity to Coast	-0.0001	0.0972	1	
Third party agreements	-0.0011	0.0089	-0.0390	1

	Trading Time	% of Rugged Area	Proximity to Coast	Third party agreements
Trading Time	1			
% of Rugged Area	0.1085	1		
Proximity to Coast	0.0272	0.0972	1	
Third party agreements	-0.0641	0.0089	-0.0390	1

Table A. 6: Effects of Time to Trade on Trade Values – Tariff at HS2

	OLS	PPML
	(1)	(2)
GIS Time	-0.00153***	-0.00219***
	(0.000110)	(0.000148)
Ln(tariff+1)	-0.846***	-2.002***
	(0.257)	(0.374)
PTA Depth	0.0136***	0.0187***
	(0.00173)	(0.00207)
Observations	1,277,904	8,178,000
R-squared	0.242	0.500

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

Table A. 7: Robustness Checks

	OLS			PPML		
	T-1 2012	**T+1 2014**	**Market Size**	**T-1 2012**	**T+1 2014**	**Market Size**
	(1)	(2)	(3)	(4)	(5)	(6)
GIS Time	-0.00223***	-0.00236***	-0.00200***	-0.00216***	-0.00216***	-0.00221***
	(0.000208)	(0.000199)	(0.000147)	(0.000160)	(0.000150)	(0.000146)
Ln(PRF+1)	-1.126**	-0.951**	-0.824***	-1.844***	-1.631***	-1.694***
	(0.455)	(0.381)	(0.281)	(0.342)	(0.284)	(0.283)
PTA Depth	0.0199***	0.0183***	0.0178***	0.0165***	0.0175***	0.0191***
	(0.00324)	(0.00317)	(0.00242)	(0.00225)	(0.00218)	(0.00208)
Market size			6.93e-08***			4.33e-08*
			(7.44e-09)			(2.55e-08)
Observations	1,024,135	1,244,135	1,254,992	6,960,805	7,674,330	8,287,250
R-squared	0.610	0.592	0.478	0.477	0.492	0.500

Note: Standard errors in parentheses are clustered by exporter-importer pair. *** p<0.01, ** p<0.05, * p<0.1

Table A. 8 Trade effects of time to trade reductions due to Belt and Road Initiative

Simple average	Time to Trade		Change in Time to Trade (%)		Change in Exports (%)	
	Avg. days within BRI	Days to China	Lower-bound	Upper-bound	Lower-bound	Upper-bound
Nepal	23.30	24.84	1.24	2.65	0.47	0.70
China	23.21	-	4.45	6.55	3.72	6.10
Bhutan	22.61	23.78	1.38	2.83	0.01	0.02
Timor-Leste	21.61	11.26	0.88	1.80	0.85	1.73
Philippines	21.56	6.93	3.90	5.06	0.91	1.43
Taiwan, China	21.49	4.34	4.47	6.30	0.74	1.09
Afghanistan	20.96	27.19	3.18	3.88	1.54	2.04
Kyrgyz Republic	20.69	15.22	8.45	12.91	6.67	7.29
Mongolia	20.55	7.51	4.89	7.18	2.40	2.62
Brunei Darussalam	20.42	8.00	3.25	4.41	1.87	2.65
Vietnam	20.12	7.23	6.95	8.14	7.18	8.23
Cambodia	19.81	8.98	8.83	9.73	4.43	4.77
Tanzania	18.79	25.93	4.55	6.30	5.94	7.57
Tajikistan	18.70	31.66	3.00	3.94	3.04	3.55
Syrian Arab Republic	18.64	34.28	1.08	1.38	0.11	0.23
Myanmar	18.23	13.64	4.34	7.95	6.93	8.31
Kenya	18.19	25.67	4.94	6.52	4.09	5.47
Singapore	18.03	9.52	1.39	2.57	0.44	0.99
Thailand	17.99	9.95	11.58	13.99	6.05	8.15
Bangladesh	17.98	15.21	2.28	2.93	1.44	1.80
Indonesia	17.87	10.78	1.18	3.37	0.65	1.77
Malaysia	17.60	9.67	5.21	6.42	2.82	3.33
Lao PDR	17.48	10.62	0.65	3.07	0.88	3.63
Uzbekistan	17.31	26.99	13.58	15.16	8.68	13.16
Estonia	16.60	35.96	1.06	2.36	0.43	1.24
Latvia	16.54	35.83	1.05	3.71	0.36	0.88
Iraq	15.68	23.60	1.33	2.21	2.11	8.10
Armenia	15.47	32.10	2.18	2.84	1.67	2.14
Kazakhstan	15.35	11.98	4.44	8.25	2.52	3.75
Russian Federation	15.08	24.86	1.59	3.14	1.26	1.88

Iran, Islamic Rep.	15.07	23.32	2.51	4.59	3.75	12.67
Kuwait	15.00	22.78	1.43	2.37	1.68	5.45
Maldives	14.94	16.94	6.49	7.56	8.90	9.78
Sri Lanka	14.82	16.26	1.90	2.95	1.09	2.02
Jordan	14.73	28.46	1.42	2.38	0.42	0.64
Lithuania	14.57	33.56	1.16	3.97	0.27	0.82
Georgia	14.56	32.60	2.60	3.49	1.49	1.67
Bahrain	14.56	22.16	1.27	2.72	1.12	2.22
Qatar	14.45	22.00	1.31	2.60	2.44	5.18
Saudi Arabia	14.27	23.13	1.34	2.83	4.24	6.43
Belarus	14.24	33.19	1.28	3.73	0.46	1.37
Pakistan	14.16	20.84	3.28	6.41	2.90	4.20
United Arab Emirates	14.11	21.64	1.33	2.60	2.16	4.08
Turkmenistan	14.08	26.49	5.20	6.26	5.88	6.01
Ukraine	14.03	31.78	1.39	2.88	0.83	1.37
India	13.88	16.43	1.71	3.32	1.53	2.38
Montenegro	13.83	30.56	1.40	1.64	1.42	1.67
Azerbaijan	13.81	22.54	6.10	7.09	2.03	2.55
Poland	13.79	32.54	1.36	3.27	0.54	0.85
Albania	13.78	30.55	1.34	1.72	1.90	2.06
Bosnia and Herzegovina	13.62	31.49	1.33	1.74	0.19	0.24
Czech Republic	13.62	32.29	1.32	2.21	0.55	0.73
Slovenia	13.60	31.70	1.32	2.20	0.39	0.49
Serbia	13.55	31.99	1.30	2.87	1.34	2.78
Croatia	13.54	31.51	1.34	2.10	0.30	0.40
Slovak Republic	13.50	32.18	1.33	3.02	0.63	0.76
Hungary	13.34	31.89	1.33	2.95	0.58	0.82
Oman	13.31	20.64	1.38	2.82	3.62	10.03
Moldova	13.18	31.26	1.34	2.30	0.36	0.92
Macedonia, FYR	13.18	30.82	1.29	1.98	0.49	0.55
Greece	13.17	29.62	2.03	2.87	1.00	1.23
Israel	13.04	27.70	1.64	3.78	2.32	3.29
Turkey	13.04	29.15	4.66	5.64	2.17	3.04
Djibouti	13.01	22.63	4.65	6.49	2.16	2.47

Yemen, Rep.	12.90	22.84	1.74	3.43	1.41	2.74
Romania	12.90	31.03	1.36	2.42	0.55	0.83
Bulgaria	12.81	30.65	1.38	2.61	0.84	1.13
West Bank and Gaza	12.71	27.42	1.67	3.72	1.52	2.60
Lebanon	12.66	27.50	1.70	5.12	0.23	0.47
Egypt, Arab Rep.	12.41	26.87	1.57	3.07	0.96	1.58

Table A. 9: Additional scenarios assessing the potential impact of BRI on trade (%)

	Reductions in trading times after BRI				**Trade Policy**			
	More efficient borders		***Economic Corridors***		***Deepening trade agreements***		***Improving market access***	
	Lower bound	*Upper bound*	*Lower bound*	*Upper bound*	*Lower bound*	*Upper bound*	*Lower bound*	*Upper bound*
Afghanistan	17.77	18.82	1.49	2.10	2.85	3.40	23.26	23.99
Albania	2.23	2.94	2.01	2.15	12.38	12.58	7.26	7.47
Armenia	9.48	10.02	2.18	2.70	2.61	3.10	6.35	6.93
Azerbaijan	5.07	6.53	2.03	2.69	4.05	4.62	4.66	5.30
Bahrain	1.18	3.41	1.13	2.41	2.80	4.06	3.62	5.05
Bangladesh	1.66	2.95	1.58	1.93	2.60	2.99	60.19	60.77
Belarus	1.34	1.69	0.78	1.75	4.67	5.67	2.90	4.01
Bhutan	0.36	0.39	0.01	0.02	0.01	0.02	1.40	1.41
Bosnia and Herzegovina	0.92	1.32	0.22	0.27	2.04	2.11	3.07	3.13
Brunei Darussalam	1.87	2.66	1.87	2.66	1.97	2.79	2.26	3.21
Bulgaria	1.39	2.87	0.89	1.35	7.22	7.59	3.68	4.06
Cambodia	4.72	6.61	4.49	4.86	5.20	5.56	20.40	20.82
China	4.29	8.95	4.00	6.69	4.98	7.53	17.74	21.02
Croatia	0.68	1.34	0.35	0.48	3.96	4.09	1.74	1.87
Czech Republic	0.74	1.53	0.63	0.88	6.57	6.82	3.02	3.25
Djibouti	2.22	2.65	2.15	2.52	7.10	7.45	19.91	20.41
Egypt, Arab Rep.	1.66	2.80	1.01	1.65	2.87	3.55	8.45	9.26
Estonia	1.18	3.66	0.65	1.55	11.88	13.00	5.44	6.47
Georgia	5.49	5.97	1.58	1.76	2.32	2.50	2.09	2.30
Greece	1.34	2.20	1.05	1.30	6.08	6.37	3.30	3.59
Hungary	0.73	1.73	0.64	0.97	6.75	7.06	2.69	2.98
India	2.32	4.08	1.57	2.45	2.46	3.37	26.65	27.86
Indonesia	0.73	2.02	0.72	1.90	1.02	2.22	5.47	6.88
Iran, Islamic Rep.	3.77	21.05	3.97	14.44	6.28	15.99	19.17	30.72
Iraq	2.81	15.52	2.18	9.16	7.43	14.24	2.55	9.78
Israel	3.28	4.47	2.43	3.59	6.29	7.36	9.60	10.88
Jordan	3.29	7.11	0.43	0.67	2.03	2.27	6.19	6.47
Kazakhstan	12.92	15.97	4.75	6.35	4.40	5.72	6.40	7.91
Kenya	5.50	7.27	4.21	5.85	5.05	6.52	42.18	44.39
Kuwait	1.72	8.21	1.72	6.08	5.93	10.22	10.44	15.31
Kyrgyz Republic	20.71	21.90	8.63	9.36	7.91	8.57	16.71	17.49
Lao PDR	6.37	9.11	0.89	3.65	0.94	3.83	2.24	5.57
Latvia	1.26	2.48	0.49	1.04	7.95	8.66	3.72	4.36
Lebanon	3.76	6.42	0.24	0.52	0.92	1.18	10.31	10.61
Lithuania	1.25	2.08	0.47	1.04	10.46	11.19	7.44	8.12
Macedonia, FYR	2.60	2.79	0.52	0.58	3.56	3.62	14.32	14.39
Malaysia	2.88	3.59	2.90	3.44	3.25	3.79	6.04	6.67
Maldives	8.91	9.83	8.91	9.81	10.54	11.49	47.64	48.96
Moldova	1.07	2.97	0.52	1.22	12.24	12.88	10.46	11.15
Mongolia	13.19	13.49	2.86	3.09	4.82	5.06	14.46	14.74
Myanmar	6.95	10.95	7.02	8.37	7.31	8.76	12.73	14.46
Nepal	24.13	24.64	0.49	0.73	0.66	0.91	47.77	48.13
Oman	3.64	15.58	3.71	11.40	8.06	15.35	15.14	23.52
Pakistan	5.43	7.75	2.93	4.35	3.84	5.23	29.47	31.38
Philippines	0.95	1.53	1.03	1.54	1.09	1.63	2.26	2.89
Poland	0.79	1.68	0.67	1.04	8.54	8.96	4.98	5.38
Qatar	2.46	8.90	2.47	5.99	6.49	9.61	10.99	14.57
Romania	0.95	2.29	0.61	0.99	7.12	7.47	2.48	2.83
Russian Federation	2.71	4.34	1.69	2.40	15.14	15.95	5.89	6.66
Saudi Arabia	4.29	15.83	4.27	8.32	9.47	11.95	8.92	11.72
Singapore	0.49	1.09	0.49	1.05	0.67	1.25	0.53	1.20
Slovak Republic	0.74	1.16	0.70	0.85	5.85	6.01	4.73	4.89
Slovenia	0.66	1.17	0.47	0.62	5.97	6.10	1.62	1.74
Sri Lanka	1.74	4.79	1.16	2.22	2.07	3.06	47.08	48.62
Syrian Arab Republic	13.00	13.37	0.13	0.25	0.40	0.51	3.86	4.00
Taiwan, China	0.77	1.30	0.87	1.26	2.36	2.74	0.89	1.31
Tajikistan	6.97	7.89	3.06	3.78	5.03	5.56	32.34	32.96
Tanzania	5.98	9.34	5.99	7.76	7.26	9.00	40.48	42.82
Thailand	6.35	9.30	6.11	8.23	6.74	8.96	21.51	24.14

Turkey	3.60	10.85	2.31	3.26	6.04	7.03	24.17	25.35
Turkmenistan	13.93	14.17	5.93	6.10	8.53	8.66	7.10	7.25
Ukraine	1.66	3.27	0.97	1.63	11.68	12.36	6.22	6.89
United Arab Emirates	2.28	5.78	2.19	4.36	5.78	7.96	8.77	11.25
Uzbekistan	17.97	23.29	8.40	13.59	10.98	15.83	35.42	41.54
Vietnam	3.65	4.52	3.54	4.03	4.22	4.73	13.51	14.13
Yemen, Rep.	4.68	11.67	4.69	8.46	9.63	12.92	20.01	23.87