
ARTICLE

Connectivity and Corridors: Türkiye's Middle Corridor Vision through International Trade

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Abstract

This paper investigates the potential impact of Türkiye on international trade with Middle Corridor (MC) countries, taking into account its geopolitical and strategic role over the past two decades and evaluating how the corridor affects connectivity between partner countries. The study employs a gravity model (GM) to investigate the impact of trade flows on the Turkish economy. Our analysis utilizes a panel dataset spanning from 1990 to 2023. It incorporates a range of estimators, including the Poisson pseudo-maximum likelihood (PPML), the fixed effects (FE) estimator, and the random effects (RE) estimator. The findings obtained from all estimation models demonstrate that the gravity model accurately represents Türkiye's foreign trade with MC countries. In particular, the findings based on all the estimators suggest a positive correlation between the GDP per capita of importing countries and Türkiye's exports to the member states of the MC. More precisely, the results of the RE model indicate that a 1% increase in the average per capita gross domestic product of an importer country is associated with a 0.92% increase in exports from Türkiye to that country. The findings also indicated a positive correlation between the religious and linguistic homogeneity of the two countries and their membership in the MC. Overall, our results suggest that enhancing economic relations with the nations involved in the MC presents an advantageous scenario and promises significant policy benefits.

Keywords

Türkiye, Middle Corridor, gravity model, international trade, Asia

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Received on: 31.07.2024

Accepted on: 14.11.2024

Introduction

The global economic integration trend is gaining momentum, strengthening interconnections and promoting collaboration among neighboring states or regions. Regional economic and social progress presents novel prospects and obstacles, and economic corridors represent a novel approach for states to engage in collaborative efforts. They aim to foster regional economic collaboration by establishing connections between cities, regions, and nations spanning multiple continents. Government entities need to understand the current growing state of economic corridors clearly. Economic corridors have consistently played a crucial role in linking the economies of a given region. Venables asserts that economic corridors directly and indirectly influence well-being.¹ Kuroda et al. ascertain that in the era of globalization, economic corridors have emerged as crucial pillars of regional economic integration.²

With the Belt and Road Initiative (BRI) initiated by China in 2013, there has been increased interest in trade corridors in the literature. Huang argues that the BRI has the potential to reduce transport costs and time significantly, and increase the volume of trade between participating countries.³ On the other hand, Ascensão et al. highlight the potential harms of the BRI beyond its potential in terms of the need for sustainable development.⁴ Regarding the Trans-Caspian International Transport Route (TITR), more commonly known as the Middle Corridor (MC), another project linking Asia to Europe, Kenderdine and Bucskey argue that geopolitical advantages and coordination difficulties among participating countries raise doubts about the project's potential.⁵ A similar concern was recognized by Vinokurov et al., who acknowledge the need for greater coordination between participating countries as well as investment in transport infrastructure.⁶

In a comparative analysis of trade corridors, Baniya et al. highlight that the BRI attracts a greater volume of investment, though the Middle and South Corridors, which are still in their infancy stage, also possess considerable potential.⁷ As a result of their comparative analysis, Jakobowski et al. present geopolitical stability, infrastructure quality, and regulatory harmonization as success criteria for trade corridors.⁸ Şenol and Erbilin observe that Türkiye, situated at the confluence of the BRI and the Northern and Southern Routes, appears to have enhanced its significance within the Middle Corridor in response to conjunctural shifts such as the Russia-Ukraine conflict and decommissioning of the Nord Stream pipeline.⁹ Despite the existing literature on the potential impacts of trade corridors indicating that the impacts and expectations regarding Türkiye

have been examined, the analysis of the concrete impact of the MC on Türkiye was found to be incomplete. In contrast to previous narrative studies, this paper will illuminate the concrete impact through a methodological analysis.

Moreover, the intensifying emphasis by governments on international corridors in recent years highlights the pivotal role these corridors play in facilitating trade among their beneficiaries. This essay primarily examines the function of the MC initiative. A variety of factors influence trade, and a corridor can facilitate increased trade among those who stand to gain from it.

The gravity model (GM) is a commonly employed economic model for forecasting trade opportunities between nations.¹⁰ The model has been utilized in recent studies to analyze economic corridors and assess how much they enhance international trade.¹¹

This research employs data such as population, GDP per capita, exchange rates, distance from Türkiye, common language, common religion, coastline, colonial past, shared borders, trade flows, and bilateral trade agreements as inputs for the gravity model from 1990 to 2023 to examine the trade potential trends and patterns across member states of the MC.

This study is organized into six components. The introduction offers a concise summary of the importance of this research. The following section delineates the regional integration process and connectivity alternatives. The third section focuses on TRACECA (Transport Corridor Europe-Caucasus-Asia), as a transport corridor connecting Europe, Caucasus, and Asia. The fourth section deals with the MC initiative and how it serves as a bridge for Eurasian trade. The final part of this section comprehensively elucidates the gravity model, emphasizing its utilization in evaluating trade prospects. The model specification and data sources used in the study are presented in the fifth section. Section six contains the results of our research, discusses these findings, and provides a concise overview of the study's critical aspects.

Regional Integration and Connectivity

Regional integration is a complex process in which independent nation-states create shared political, legal, economic, and social institutions to govern collectively. Politically, regional integration entails establishing supranational institutions that possess administrative, legislative, and judicial authority. It also involves transferring policy responsibilities from domestic governance institutions to these supranational bodies. At the economic level, regional

integration progresses from a common market alongside national markets to a single market where barriers to the free movement of goods, services, capital, and labor are eliminated. This may be followed by adopting a common or single currency alongside or instead of national currencies. Ultimately, full economic union is achieved, involving the implementation of common macroeconomic and fiscal policies.¹²

According to the liberal intergovernmentalist theory, regional integration is positioned between liberalism and realism. Liberal intergovernmentalism (LI) posits that state preferences are shaped by domestic competition among competing economic interests within society, as opposed to the ideology of liberalism. According to LI, realism suggests that after states develop their preferences, they bargain to safeguard and advance their interests. States also collaborate to create institutions that minimize the costs of transactions, overcome collective action issues, and establish trustworthy commitments. This can be achieved, for instance, by delegating agenda-setting and enforcement powers to supranational agents.¹³ The LI literature is situated closer to realism, with a particular focus on the role of national governments in the decision-making process. The argument is made that states negotiate in accordance with their self-interest and that the connectivity of states also affects national preferences and bargaining processes.¹⁴

In this understanding, regional integration is advantageous for states since it enables them to make logical decisions based on their interests while facilitating vertical and horizontal exchanges among themselves. Regional integration creates a sense of connectivity that facilitates the retention of mutual peace, the development of mutual capabilities, and carving out a new self-image and role identity. Connectivity encompasses the physical, institutional, and interpersonal connections that form the fundamental support and enabling mechanisms for achieving economic, political, security, and sociocultural goals, and creating connected communities. Improving regional connectivity is a complex undertaking that will necessitate executing ambitious policy measures at both the national and regional levels.¹⁵

The concept of connectivity represents a shift from traditional state-centered models to a more complex approach to understanding international politics. Connectivity emphasizes the reach beyond

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the physical borders of nation-states, challenging the traditional international agenda. It has become a phenomenon for addressing transnational issues such as climate change, cybersecurity, and global health crises. In particular, the advent of new technologies has enabled the emergence of digital diplomacy and network-based approaches, which are transforming traditional methods.¹⁶ This transformation is a consequence of the multifaceted nature of connectivity. The tangible aspect of connectivity is physical connectivity, which encompasses transport networks and major infrastructure projects such as the BRI, TRACECA, and the MC. The intangible aspect reflects the interaction between international organizations, states, and non-state actors.¹⁷

TRACECA and the BTK Railway Project

The conclusion of the Cold War resulted in the reconciliation of certain Eastern Bloc nations with their former adversaries, specifically the Western Bloc nations. TRACECA (Transport Corridor Europe-Caucasus-Asia) is an example of a transport corridor connecting Europe, Caucasus, and Asia. In May 1993, eight countries (Azerbaijan, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) convened in Brussels with the backing of the EU to establish a transit corridor connecting Europe to the Central Asian countries by utilizing the Black Sea, the Caucasus, and the Caspian Sea. In 1996-1998, Ukraine, Mongolia, and Moldova became participants in the scheme. Bulgaria, Romania, and Türkiye joined in 2002, and Iran joined in 2009.¹⁸

Considering the route from China to Europe, the TRACECA corridor is a significant advantage for Türkiye's regionalization efforts. For this reason, Türkiye also supports many new initiatives that will complement TRACECA to enhance existing regionalization efforts, including the Baku-Tbilisi-Kars (BTK) Railway Project.

Since the early 1900s, geopoliticians have emphasized the construction of many transport corridors across the continent to seize Eurasian geography's dominance; TRACECA is one of these regional cooperation projects. TRACECA, the result of an effort toward strategic superiority, aims to reduce Russia's geographical dominance in the region. The inclusion of critical actors, such as the post-Soviet Union of Socialist Republics (SSR) and the Commonwealth of Independent States, in particular, has been effective in achieving this aim.

Considering the route from China to Europe, the TRACECA corridor is a significant advantage for Türkiye's regionalization efforts. For this reason, Türkiye also supports many new initiatives that will complement TRACECA to enhance existing regionalization efforts, including the Baku-Tbilisi-Kars (BTK) Railway Project. The BTK Railway Project is an essential step in TRACECA, also known as the "Iron Silk Road," as when the project is completed, a significant portion of trade between Europe and Asia will be carried out via this railway.

The BTK project's foundation was laid on November 21, 2007, with the participation of the presidents of Türkiye, Azerbaijan, and Georgia. The BTK Railway Project is carried out at the heart of TRACECA to fill the shortcomings under the program's objective. The main difficulties facing the planned transport infrastructure to be developed for the corridor are congestion in international traffic and border crossing.

All in all, the BTK Railway Project is strategically significant. It connects Baku, Turkmenistan, and China via the Caspian Passage and Türkiye, Bulgaria, Serbia, Hungary, Austria, Switzerland, Germany, France, and the UK through Kars. From a geographical perspective, the railway line runs from China to the UK, making the reference to the "Iron Silk Road" easy to understand. In addition to developing economic relations with the West, from Türkiye's perspective, developing economic ties with countries in the East is a strategic step, and the BTK plays an essential role in this. According to a report prepared during BTK Railway feasibility studies, in the first year after its completion, one million passengers and 6.5 million tons of cargo will be transported, while the target for the next 20 years is three million passengers and 17 million tons of cargo capacity.

Türkiye, a highly engaged member of TRACECA, has not limited itself to the BTK Railway: it has successfully executed several transport projects, with others nearing completion or in the planning phase. Among these projects is the Kars-Nakhchivan railway project, which aims to extend to Tabriz-Tehran-Zahedan and Islamabad after Nakhchivan.

Transportation corridors are of significant geostrategic importance for Türkiye and Russia, which are in regional competition. TRACECA's geopolitical impact as a transportation corridor that connects Asia with the European continent is to reduce the role of the Russian Federation in global competition. In particular, shortening and facilitating transportation from China to Europe has reduced Russia's influence in Asia. In addition, the effect of the recent war with

Ukraine has made the TRACECA corridor advantageous in terms of security. TRACECA alone cannot be held accountable for the negative turn in Turkish-Russian relations while talking about TRACECA's positive contribution to the rising momentum in Turkish-Russian relations until 2015.¹⁹ However, Russia's lack of security in terms of the policies implemented by the EU and the U.S. is starting to result in it pursuing an aggressive policy in today's conjuncture. The annexation of Crimea following the 2008 Russia-Georgia War, its involvement in Syria, and finally freezing relations with Türkiye are manifestations of this foreign policy perception.²⁰

Projects like TRACECA serve as socio-economic development tools for Eurasia. The increase in cooperative initiatives resulting from the forces of globalization and regionalization is crucial for promoting regional cooperation and development, facilitating Eurasia's integration into the international community, and serving as a model for others. These projects are thought to enhance socio-economic growth in Eurasia and are a significant benchmark for bolstering societal connections and promoting the region's wealth, peace, and stability.

As a pivotal stakeholder in the implementation of these initiatives, the EU offers financial assistance for the establishment and enhancement of transportation infrastructure, including roads, railways, ports and telecommunication networks, along the TRACECA route, which it views as a crucial gateway to Asia. In 2006, the European Commission allocated €6 million to infrastructure projects in member states. The European Central Bank committed approximately €51 million to 39 technical investment projects. Additionally, the IMF and the World Bank invested €1.7 billion in the construction of ports, roads, and railways in member states. Türkiye, a significant partner country, has also made notable contributions, with €63.9 million invested in 19 projects.²¹

The Middle Corridor: A Bridge for Eurasian Trade

A substantial transformation has occurred in the global trading environment. Countries increasingly seek alternative transport routes due to geopolitical concerns and a greater focus on diversification. Asia and Europe are connected by three primary inland trade routes: the Northern Corridor, which passes through Russia; the Southern Corridor, which passes through Iran; and the Trans-Caspian International Transport Route (TITR), or MC, which passes via

Central Asia and the South Caucasus. The ongoing military conflict in Ukraine has resulted in unavoidable spillover effects that have raised concerns about the safety of freight traffic along the Northern Corridor. Additionally, cargo transportation along the Southern Corridor is facing difficulties due to sanctions against Iran in the crisis-prone Middle East. As a result, the MC, which passes through Central Asia, the Caspian Sea, the Caucasus, and into Europe, has gained increased significance.²² Within this framework, the MC is a prospective catalyst for enhancing connectivity across Eurasia.

The MC, which gained significant attention after Russia invaded Ukraine, is a transportation route connecting China to Europe via multiple modes of transport. The transportation network includes railways, roadways, and sea lines, providing an alternative land route that avoids the conventional Northern Corridor via Russia and the Suez Canal. This strategic positioning has numerous benefits. The MC links China and Kazakhstan by rail through Dostyk or Khorgos/Altyntkol, crosses Kazakhstan by rail to Aktau Port, crosses the Caspian Sea to the Port of Baku/Alyat, and Azerbaijan and Georgia by rail to, then either continue by rail to Europe through Türkiye or cross the Black Sea.²³

The MC offers a more reliable option than routes susceptible to geopolitical disturbances. Furthermore, it guarantees expedited transit times compared to the clogged Suez Canal and the protracted voyages through Russia.

The MC is an international transport infrastructure project that commenced in November 2013 with the signing of an agreement between the CEOs of rail firms from Kazakhstan, Azerbaijan, and Georgia. The agreement established that the Coordination Committee was responsible for the development of the MC. Over the subsequent years, several additional national enterprises became part of the MC, ultimately culminating in forming the international association “Trans-Caspian International Transport Route” (TITR) in December 2016. The MC is a component of China’s Belt and Road Initiative (BRI), which is anticipated to shape the future of transport connectivity in the region. So far, the BRI has significantly contributed to the growth and improvement of established and emergent transportation networks throughout Eurasia.

The MC offers a more reliable option than routes susceptible to geopolitical disturbances. Furthermore, it guarantees expedited transit times compared to the clogged Suez Canal and the protracted voyages through Russia. The estimated travel duration of 14-18 days across the MC is notably shorter than the 19-day voyage through Russia and sea routes that last between 22 and 37 days.

The emergence of the MC offers substantial economic prospects for the participating nations. Enhanced trade flows will spur infrastructure growth, generate employment opportunities, and promote the integration of different regions. Moreover, the corridor has the potential to stimulate economic diversification in Central Asian countries, which have traditionally depended on exporting resources.

Although the MC has substantial promise, it also encounters various problems. Investing significant money is necessary to upgrade infrastructure and establish smooth communication between countries. Efficiently simplifying customs procedures and standardizing laws are essential for seamless operation. Furthermore, the corridor must position itself as a viable alternative to well-established routes.

The effectiveness of the MC relies on solid international collaboration. Collaboration between governments, private investors, and international organizations is necessary to tackle infrastructure bottlenecks and establish a robust institutional framework. This collective endeavor has the capacity to reach the corridor's potential and fundamentally transform the dynamics of trade in the Eurasian region.

To summarize, the MC is a significant initiative that has the capacity to revolutionize the connectivity in the Eurasian region. Through international cooperation, this land bridge can provide a secure, efficient, and economically prosperous path for global trade by successfully addressing current obstacles. Its success hinges on the joint dedication of the participating nations to establish a corridor that not only promotes trade but also encourages regional integration and a more integrated future.

Data and Methodology

Data

To analyze how Türkiye's international trade with MC countries has changed over the last three decades, we constructed a panel dataset covering 11 countries (Azerbaijan, Georgia, Kazakhstan, China, Austria, Bulgaria, Czech Republic,

Hungary, Poland, Romania, and Slovakia) from 1990 to 2023. The countries selected for inclusion in the study were chosen according to their commercial importance to Türkiye in the context of the MC initiative.²⁴

To estimate international trade between Türkiye and MC countries, the dependent variable of the econometric models is the amount of exports from Türkiye to these countries (EXPORT). The data on Türkiye's exports were obtained from the United Nations Commodity Trade Statistics Database.²⁵ The data on the independent variables, including importer countries' GDP per capita (GDPPC), population (POP), and exchange rates (EXCR), were obtained from the World Bank Development Indicators.²⁶ The data on the distance from Türkiye to the countries under study were compiled using Google Maps.²⁷ The distance variable (DIST) was constructed based on the geographic coordinates of the capital cities of the countries under study. The data on bilateral trade agreements (BTA) were sourced from the Republic of Türkiye Ministry of Trade databases.²⁸ Similarly, crises and conflicts (CC) data were obtained from the International Crisis Group database.²⁹

In addition to the aforementioned independent variables, the model incorporates a series of dummy variables based on the previous studies in the relevant literature. These variables are employed to ascertain whether two countries are border neighbors (BOR), whether they share a common language (LANG) with Türkiye, whether they adhere to a common religion (REL) with Türkiye, whether they possess a coastline (SEA), whether they are an MC country (MC), and whether they have a colonial past (COL). All variables used in the econometric analyses were transformed into natural logarithms, with the exception of dummy variables. The panel data set utilized in the study encompasses 374 observations, spanning 11 countries and 34 years. Table 1 presents the descriptive statistics of the variables used in the analyses.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std.	Min.	Max.
lnEXPORT	360	20.028	1.400	16.153	22.663
lnGDPPC	362	8.606	1.222	4.1026	10.890
lnDIST	374	7.395	.5888	6.619	8.829
lnPOP	363	16.605	1.510	15.126	21.068
lnEXCR	336	8.459	2.320	-2.302	16.866
BOR	374	.2723	.445	0	1
LANG	374	.272	.445	0	1
REL	374	.181	.386	0	1
SEA	374	.633	.482	0	1
COL	374	.727	.445	0	1
MC	374	.264	.441	0	1
BTA	374	.433	.496	0	1
CC	374	.328	.470	0	1

Model Specification and Method

The gravity model (GM) for international trade is a popular and intuitive framework used to predict and explain trade flows between countries. It extensively discusses diverse international financial matters, such as trade flows, economic integration agreements, foreign direct investment, overseas affiliate sales, and multinational firms.³⁰ In addition, the GM considers not just the distance between locations but also other factors, such as the existence of different languages, as a means of international communication.³¹

This study aims to develop and estimate a gravity model for international trade among the study countries. The GM, an econometric model employed to analyze trade flows between countries and regions, has been employed extensively across a range of scientific disciplines to investigate the interactions and flows between entities that are separated by distance. The GM borrows its concept from Newton's law of gravity, which states that the gravitational attraction between two objects is directly proportional to their masses and inversely proportional to the square of the distance between them. Similarly, in the context of international trade, the gravity model posits that the trade volume between two countries is positively related to their economic sizes and negatively related to the distance between them. The GM is applied in a diverse

range of fields, such as international trade, traffic, foreign direct investment (FDI), and tourism.

The basic form of the Newtonian gravity model can be expressed mathematically as:

$$F_{ij} = \frac{M_i M_j}{D_{ij}^2} \alpha G \quad (1)$$

where F_{ij} is the interaction force between entities i and j ; G is a gravitational constant of proportionality; M_i and M_j are the sizes of country i and j , respectively; and D_{ij} is the distance between entity i and j . Although the original formulation has been demonstrated to possess utility, subsequent studies have proposed a number of modifications with a view to enhancing the explanatory power of the formula. Following the initial application of the gravity formula to trade,³² a significant contribution was made through the introduction of novel modifications in conjunction with the previously established parameters of mass and distance.

The following equation (2) expresses a basic form of the gravity model for international trade:³³

$$T_{ij} = \frac{GDP_i^{\beta_1} GDP_j^{\beta_2}}{D_{ij}^{\beta_3}} \alpha C \quad (2)$$

where T_{ij} represents the value of trade between country i and country j ; C is a normalizing constant of proportionality; GDP_i is the GDP of country i and GDP_j of country j ; and D_{ij} is the distance between country i and j .³⁴

The estimated basic gravity model is obtained by taking the natural logarithm of Eq. (2).³⁵

$$\ln T_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j - \beta_3 \ln D_{ij} + \varepsilon_{ij} \quad (3)$$

In light of the preceding literature, it can be posited that there is a positive correlation between bilateral trade and the economic size of countries. Conversely, geographical distance between countries has been identified as a factor that negatively affects their bilateral trade. Recent contributions to the

relevant literature indicate that the characteristics of expenditure systems may be utilized to develop a variety of international trade models, including gravity models, Ricardian models, Heckscher-Ohlin frameworks, and monopolistic competition models.³⁶ The argument is put forth that the gravity model, which is utilized to examine the determinants of demand and costs in bilateral trade flows, should be employed in conjunction with a standard fixed effects estimator.³⁷ However, this approach is thought to be biased due to the correlation that exists between trade costs and multilateral resistance conditions.³⁸

The GM indicates a positive correlation between international trade flows and market size. It is therefore recommended that the analysis be based on the economic size of countries.

The GM indicates a positive correlation between international trade flows and market size. It is therefore recommended that the analysis be based on the economic size of countries. In the case of an analysis where GDP is the primary variable, it is also necessary to consider geographical and spatial factors. The most authoritative examples of geographical distance have their origins in comparisons

between neighboring countries. For example, a comparative analysis of neighboring countries Canada and the U.S. demonstrated that national borders exert a significant impact on trade effects.³⁹ Moreover, the incorporation of multilateral resistance terms into gravity equations is purported to facilitate the identification of trade barriers and promote more consistent analysis.⁴⁰

A variety of estimation methods have been developed in the literature with the objective of increasing the number of variables and ensuring more consistent analyses. In lieu of the conventional log-linear OLS estimator, which is ill-equipped to address nonlinearity and zero trade flow problems, the Poisson pseudo-maximum likelihood (PPML) estimator is to be employed as a replacement, as it is expected to yield more accurate results.⁴¹ A gravity model that permits the existence of firm heterogeneity and zero trade flows has been developed over an extended period.⁴² The two-stage estimation procedure permits the estimation of both the extensive margin (trade decision) and the intensive margin (trade volume) on an independent basis, thereby facilitating the analysis of trade decisions and trade volumes.

The GM, which seeks to examine the influence of geography on economic activity, also endeavors to elucidate the role of trade corridors, which encompass the intertwined factors of geography, politics, and economics. It is notable that

the majority of studies in the literature focus on the BRI, which represents one of the most significant developments of the recent period. The findings of these studies indicate that China's FDI flows were more significantly impacted by the inception of the BRI than by China's accession to the World Trade Organization (WTO). This is because China's diplomatic engagement with the BRI economies enabled it to identify more accurately the sources of investment by considering factors such as cross-border distance and per capita income.⁴³ The application of diverse regression techniques, including pooled ordinary least squares (POLS), fixed effects (FE), and Heckman two-stage estimation, indicates that China possesses the capacity to export a greater volume of goods to BRI countries. Concurrently, China stands to benefit from the vast market opportunities presented by BRI countries.⁴⁴ The implementation of the stochastic frontier analysis (SFA) method within GM has demonstrated that China's agricultural exports are adversely impacted by several factors,¹ including the country's income level relative to that of its trade partners.⁴⁵ The Poisson pseudo-maximum likelihood (PPML) estimation method, which analyzed the impact of the BRI on Türkiye's economy, found that distance, bilateral trade agreement (BTA), and border variables had a positive effect, while GDP, distance, and capital endowment had a negative effect.⁴⁶

Given the lack of empirical research on the trade corridors that encompass Türkiye, this study will investigate the economic and political implications of the MC on Türkiye. To address the existing literature on the MC and to demonstrate the practical outcomes of Türkiye's policies in this regard, we have transformed Eq. (3) into a general model by including additional control variables which may have a significant effect on bilateral trade.

The following Eq. (4) represents a more general gravity model for the international trade between Türkiye and the study countries.

$$\ln T_{ijt} = \beta_0 + \beta_1 \ln \text{GDPPC}_{jt} + \beta_2 \ln \text{DIST}_{ij} + \beta_3 \ln \text{POP}_{jt} + \beta_4 \text{MC}_j + \beta_5 \text{SEA}_j + \beta_6 \text{BORD}_j + \beta_7 \text{LANG}_j + \beta_8 \text{REL}_j + \beta_9 \text{COL}_j + \beta_{10} \text{BTA}_{jt} + \beta_{11} \text{CC}_{ijt} + \varepsilon_{ij} \quad (4)$$

where subscript t denotes time, i symbolizes Türkiye, and j is for importer countries, as explained in the previous section. T_{ijt} is the dependent variable of the model and represents the amount of export of country i to importer country

1 Including the per capita income of its trading partners, currency fluctuations, and geographical isolation due to landlockedness.

j at time t ; $GDPPC_{jt}$ is the per capita income of importer country j in year t ; $DIST_{ij}$ is the distance between the capital cities of country i and importer country j ; POP_{jt} is the population of country j at time t . The dummy variables are as follows: MC_j assumes the value of 1 if country j is a member of the MC and the value of 0 otherwise; SEA_j denotes the maritime accessibility of country j ; $BORD_j$ takes the value of 1 if importer country j shares a border with Türkiye and 0 otherwise; $LANG_j$ indicates whether country j shares a common language with Türkiye; REL_j indicates whether importer country j shares a common religion with Türkiye; COL_j indicates whether country j has experienced a colonial history at any point in its historical development; BTA_j represents if country j has a free trade agreement with Türkiye; and, finally, CC_{ijt} represents the national and international crises/conflicts faced by countries i and j in year t . In Eq. (4), all β coefficients except for the dummy variables can be interpreted as the elasticities of the observed trade flows relative to the specified explanatory variables, given that the variables have undergone a natural logarithmic transformation. Finally, ε_{ij} stands for the error term of Eq. (4), which is assumed to be independent and identically distributed with zero mean.

Empirical Results

The gravity model of Türkiye's international trade with MC countries, as depicted in Eq. (4), is estimated using three different estimators: the Poisson pseudo-maximum likelihood (PPML) estimator, the fixed effects (FE) estimator, and the random effects (RE) estimator. These models employ a comparable set of independent variables to explain the dependent variable, which is represented as the natural logarithm of Türkiye's exports to the study countries. The PPML model is especially beneficial for the examination of international trade, as it is capable of addressing the prevalent challenges of zero trade flows and fluctuating variance in the data.⁴⁷ In contrast, the RE regression model allows for the investigation of individual heterogeneity across panel units, which can be a valuable approach when analyzing trade data that may exhibit country-specific effects.⁴⁸ One reason for using an FE regression estimator in analyzing international trade between countries is to control for unobserved heterogeneity. The FE estimator accounts for country-specific characteristics that do not change over time, such as geographical factors, institutional quality, or cultural aspects, which could otherwise bias the results. By controlling for these time-invariant factors, the FE estimator provides more accurate and reliable estimates of the impact of the explanatory variables on trade flows.

Table 2 reports the regression results based on the three estimators.

Table 2: Regression Results

Variables/Models	PPML	Random Effects	Fixed Effects
lnGDPPC	0.046*** (0.003)	0.917*** (0.040)	1.047*** (0.048)
lnDIST	-0.060*** (0.006)	-1.208*** (0.128)	- -
lnPOP	0.030*** (0.003)	0.601*** (0.056)	-0.299 (0.572)
lnEXCR	-0.001 (0.002)	-0.020 (0.024)	-0.021 (0.023)
BORD	0.055*** (0.004)	1.101*** (0.092)	- -
LANG	0.037*** (0.011)	0.711*** (0.175)	- -
REL	0.018 (0.012)	0.376 (0.230)	- -
SEA	0.063*** (0.006)	1.236*** (0.128)	- -
COL	-0.034*** (0.007)	-0.665*** (0.123)	- -
MC	0.014*** (0.003)	0.306*** (0.070)	0.245*** (0.068)
BTA	0.041*** (0.005)	0.803*** (0.081)	0.666*** (0.096)
CC	0.001 (0.003)	0.017 (0.056)	0.020 (0.053)
Constant	2.483*** (0.040)	9.936*** (0.688)	15.760* (9.368)
Observations	327	327	327
Number of id	11	11	11

Note: The dependent variable is the log of Türkiye's exports to the study countries. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

According to the results presented in Table 2, all three models demonstrate general compatibility with one another and produce outcomes that align with expectations. As the FE model presented in the final column of the table does not account for variables that remain constant over time, these variables were omitted from the model. Consequently, the estimation results for these variables are not included in the table.

The results based on the PPML estimator indicate a positive relationship between GDP per capita and the dependent variable, namely Türkiye's exports to the countries included in the study. To be more precise, an increase of 1% in a given country's average per capita GDP leads to a notable increase (0.046%) in Türkiye's exports to that country. Conversely, the augmented distance between the two countries has a statistically significant and negative impact on the bilateral foreign trade between these two countries, in accordance with the predictions derived from the gravity theory. In particular, a 1% increase in the

In alignment with gravity theory, the findings of the analysis indicate that an increase in the population of importing countries is associated with a statistically significant expansion in their foreign trade with Türkiye.

distance between the countries included in the study and Türkiye results in a 0.06% average reduction in Türkiye's exports to that country. In alignment with gravity theory, the findings of the analysis indicate that an increase in the population of importing countries is associated with a statistically significant expansion in their foreign trade with Türkiye. In particular, a 1% increase in the population of importing countries is associated with a 0.03% increase in

Türkiye's exports to these countries. This indicates that countries with larger populations tend to import more, potentially due to increased domestic demand and market size. Furthermore, no statistically significant correlation was identified between exchange rates and foreign trade between countries in any of the estimation models.

The empirical findings obtained by the RE estimator are similar to those obtained by the PPML estimator. However, the RE model exhibits considerably higher elasticity coefficients than the PPML. The RE results indicate that a 1% increase in the per capita income of the importing countries is associated with a 0.92% increase in Türkiye's exports to these countries, a relationship that is statistically significant. Additionally, the findings indicate that a 1% increase in

the distance between Türkiye and the importing country will result in a 1.2% reduction in trade between the two countries. Similarly, the results demonstrate a statistically significant and positive correlation between the growth of the population of the importing country and Türkiye's exports to that country.

The results of the PPML and the RE estimation models validate the hypothesis proposed by the GM, namely that the volume of bilateral foreign trade between countries is directly proportional to their respective sizes and inversely proportional to the distance between them. This relationship is particularly evident in the case of countries situated along the MC.

Upon examination of the results obtained from the PPML and RE estimation models for dummy variables, it becomes evident that both models yield comparable outcomes with regard to the sign of the coefficients. However, the RE estimator exhibits higher elasticity coefficients than the PPML estimator. The findings indicate that the existence of a border neighbor with Türkiye in the importing country is a statistically significant predictor of increased trade between the two countries. In particular, the PPML results indicate that an importing country that is a border neighbor of Türkiye engages in approximately 5.5% more trade with Türkiye than countries which do not have a common border with it. Additionally, the results indicate that the existence of shared religious and linguistic traditions between the importing country and Türkiye is associated with a statistically significant increase in trade between the two countries. This serves to reinforce the significance of cultural and linguistic ties in fostering trade. Similarly, the results indicate that the presence of a coastline in the importing countries is associated with an increase in foreign trade with Türkiye, highlighting the significance of maritime transportation in the context of international trade. However, the results also indicate a negative correlation between the importing country's colonial history and its trade with Türkiye.

Overall, the results indicate a positive correlation between an MC country and its foreign trade with Türkiye. In particular, the RE estimator indicates that countries classified as "MC countries" engage in approximately 80% more foreign trade with Türkiye than countries that are not included in this group. This positive and significant coefficient indicates that the MC initiative has a beneficial effect on trade between member countries. Ultimately, the findings indicate that the establishment of bilateral trade agreements between the importing countries included in the study and Türkiye leads to an increase in their foreign trade. The results demonstrate that the economic crises did not exert a statistically significant influence on the foreign trade between the

analyzed countries and Türkiye during the specified time period.

The final column of Table 2 presents the FE estimation results for comparison with the random effects and PPML estimation results. As previously stated, the FE estimators exclude time-invariant variables from the analysis, and thus, time-constant dummy variables are not included in the resulting estimation results. For this reason, the FE estimators are not the preferred method for analysis in studies that include time-invariant variables, such as the GM. The FE estimation results for the remaining variables indicate that the per capita income variable is the sole factor with a significant and positive impact on Türkiye's foreign trade with the countries under examination. Among the dummy variables, only the MC and BORD variables demonstrate a significant and positive relationship with the dependent variable.

Conclusion

The MC initiative represents a significant opportunity for the advancement of Eurasian connectivity through trade. The initiative is centered on Türkiye, a country with a historical mission of building a bridge between Europe and Asia. This study examined the potential impact of Türkiye, which has assumed

The RE estimator indicated that the MC member countries engage in approximately 80% more trade with Türkiye than non-member countries.

an important geopolitical and strategic role in the last two decades, on the MC and concluded that the MC has had a positive impact on trade flows between member countries, as indicated by results obtained using PPML, RE and FE regression estimators. The RE estimator indicated that the MC member countries engage in approximately 80% more trade with

Türkiye than non-member countries. In particular, the PPML and RE estimation results corroborate the hypothesis that, in the case of MC countries, the volume of bilateral trade is directly proportional to the size of countries and inversely proportional to the distance between them. This notable pattern confirms the hypothesis of the gravity model.

The results of all three regression estimators demonstrate that, as a founding member of the initiative, Türkiye has witnessed an expansion in the volume of trade with partner countries and that the MC has helped to increase Türkiye's impact on connectivity in this region. The estimators indicate a strong negative

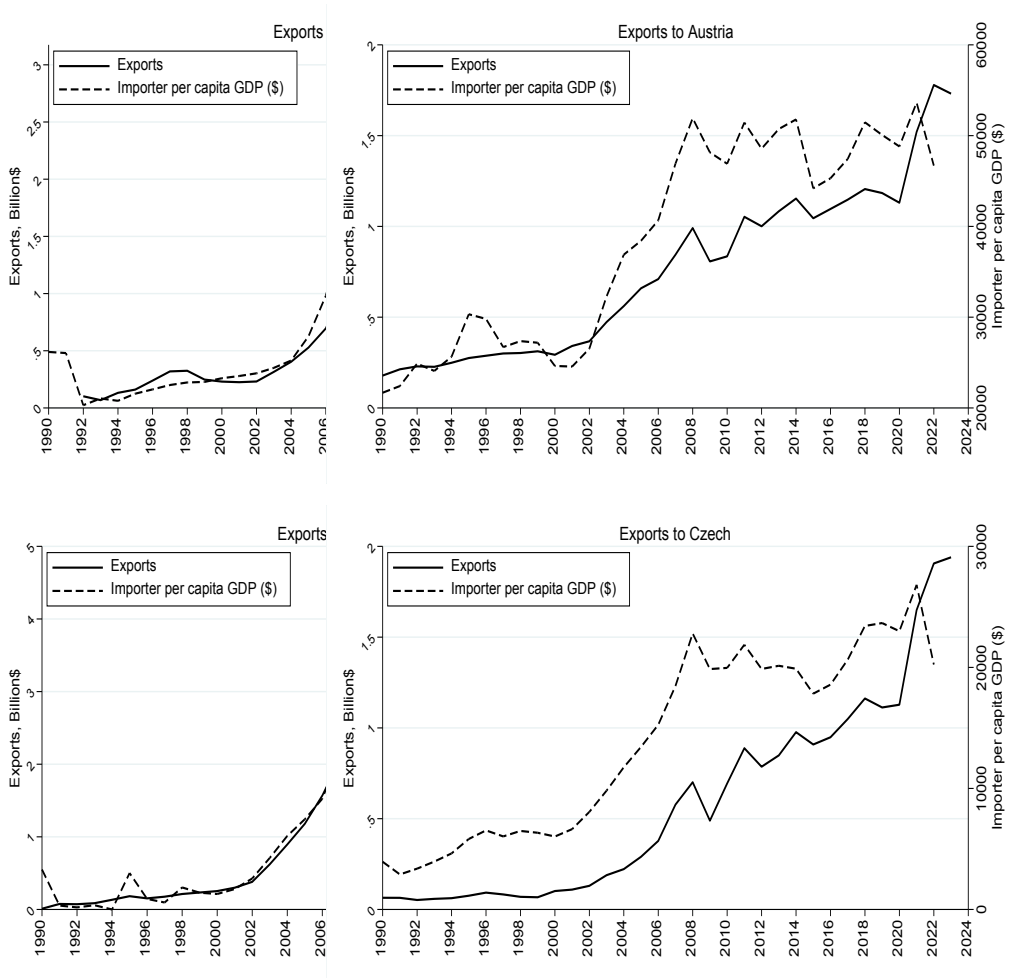
correlation between distance and trade flows, which can be attributed to the fundamental principles of the gravity model. Türkiye's central position within the MC initiative serves to reduce the effect of the average distance within the region. Türkiye's extensive coastline and land connectivity with MC members such as Georgia results in other partner countries leveraging Türkiye's influence to access the European market. The regression estimators also indicate that the presence of coastline in importing countries is associated with an increase in foreign trade with Türkiye. This result serves to underscore the significance of maritime transportation as a pivotal factor in securing economic connectivity. As is the case with many other trade corridors that facilitate connectivity, maritime transport plays a significant role in the MC. In particular, the ports of Aktau and Kuryk in Kazakhstan, Baku in Azerbaijan, and Batumi and Poti in Georgia play a pivotal role in the movement of goods from mainland China to Europe. Türkiye's geographical proximity to critical ports for MC positions makes it a crucial transit point between China and Europe, thereby reducing the time and costs associated with regional trade. As a key player in this context, Türkiye has the potential to exert a considerable influence in the future, particularly given its capacity to offer a viable alternative to the established Southern and Northern Corridors.

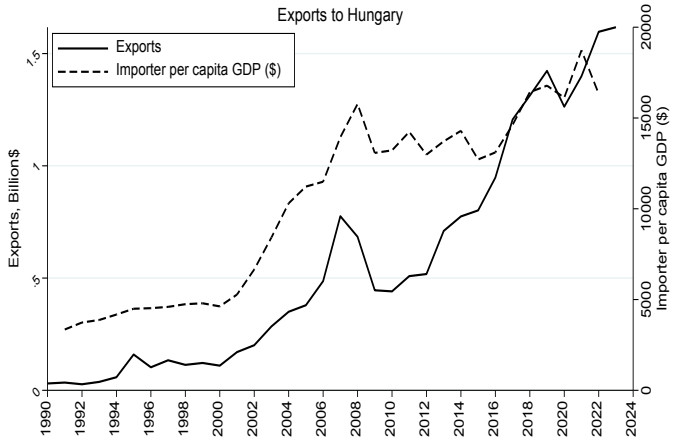
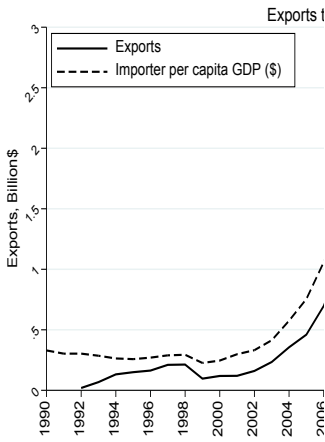
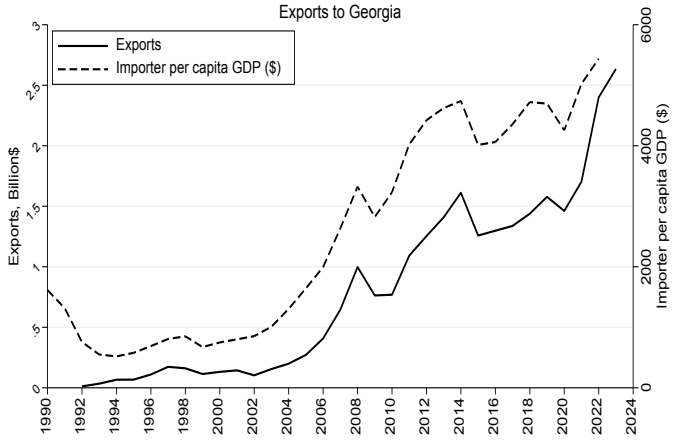
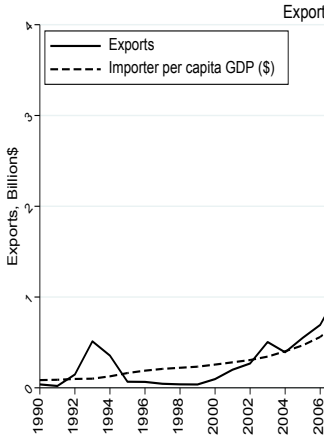
In light of Türkiye's growing involvement in the MC initiative, it is imperative to highlight its recent investments in transportation infrastructure. In particular, the BTK Railway, which connects the Caucasus to Europe, represents the cornerstone of MC's land route. The enhancement of the BTK Railway and the injection of capital into the expansion of high-speed railway lines within the internal railway networks have led to an increase in trade within the region. The Marmaray, the Yavuz Sultan Selim Bridge, the Eurasia Tunnels, the Çanakkale Strait Bridge, the Edirne-Kars High-Speed Railway project, the Gebze-Orhangazi-Izmir Motorway, the Northern Marmara Motorway, and the Filyos, Çandarlı, and Mersin port expansion projects are not only results of national vision but also reflect an international vision in terms of their impact on the MC. Furthermore, Türkiye's cultural and historical ties with the MC countries represent an additional crucial factor that enhances the likelihood of success for the initiative. The cultural and historical ties that exist between Türkiye and Azerbaijan, as well as other Turkish-speaking Central Asian countries, have resulted in the strengthening of commercial relations between these countries. While there are potential sources of conflict in the MC route, Türkiye, with its extensive connections, has the capacity to prevent instability in the region and maintain the security of trade.

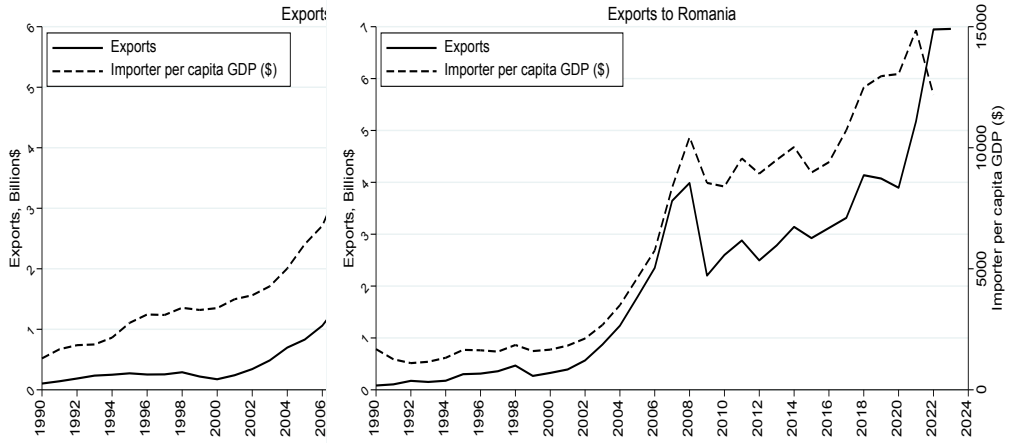
In the post-Cold War period, the advent of globalization has led to a greater focus on commercial relations and political alliances to increase connectivity. As a consequence of this transformation, connectivity, as one of the most recent phenomena, is exemplified by trade corridors that connect disparate geographical regions. This study, which analyzes the case of MC, has demonstrated that Türkiye's geopolitical advantages can be transformed into economic advantages. The results obtained from different regression estimators indicate that Türkiye has achieved a statistically significant increase in foreign trade due to its cultural and linguistic ties with the region. However, it can be concluded that infrastructure investments and developments in transport are equally important when considering connectivity. This result challenges the traditional understanding of the role of culture, language, common history, and political consolidation in trade. Instead, a more flexible alternative understanding, shaped by infrastructure investments and trade agreements, seems to have emerged. As the MC countries develop as examples of this flexible organization, Türkiye's role in increasing connectivity will become increasingly important. In light of the potential risks and opportunity costs, it is evident that the manner in which Türkiye manages crises in the context of the initiative may serve to reinforce its status as a pivotal facilitator of Eurasian trade. In consideration of its developmental process, the MC persists as an alternative to both the Southern and Northern trade corridors. The findings of this study indicate that Türkiye's strategic vision and recent investments have served to reinforce the objectives of the MC by facilitating enhanced connectivity.

Appendix

Türkiye's Exports to Countries Examined in the Dataset and Their Per Capita GDP (1990-2023)







Endnotes

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