

Economic Diplomacy and Bilateral Trade Flows in Times of Crisis: Evidence from Croatia

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Abstract

Background: Economic diplomacy is widely regarded as an instrument of trade promotion, particularly for small open economies seeking to strengthen their position in international markets. **Objectives:** This paper investigates the determinants of Croatian bilateral trade flows from 1992 to 2022 using an augmented gravity model. In addition to standard gravity variables, such as gross domestic product and geographical distance, the analysis focuses on the role of embassy presence as a proxy for economic diplomacy. **Methods/Approach:** The study distinguishes between two forms of diplomatic presence: Croatian embassies abroad and foreign embassies in Croatia. Given the prevalence of zero trade flows in the bilateral trade dataset, the Poisson Pseudo-Maximum Likelihood estimator is applied. **Results:** Embassy presence is positively associated with bilateral trade. Croatian embassies abroad are particularly relevant for facilitating exports, while foreign embassies in Croatia are more strongly associated with import flows. **Conclusions:** The results suggest that economic diplomacy contributes to trade development, but its effects differ across trade directions. Crisis periods also affected trade unevenly: the 2008 global financial crisis had a stronger disruptive effect on Croatian trade flows, whereas the COVID-19 pandemic appears to have had a less pronounced negative impact.

Keywords: augmented gravity model; embassy; bilateral trade; Croatia; panel data; PPML.

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Introduction

By lowering transaction costs, reducing political risk, and easing access to foreign markets, economic diplomacy represents an important instrument for supporting international trade flows. It uses government resources and diplomatic networks to promote a country's economic interests abroad. In the context of trade promotion, embassies and other diplomatic representations are particularly relevant because they may reduce information asymmetries, facilitate business contacts, and support firms in entering or expanding in foreign markets.

Seminal contributions in this field include Rose (2007), who found a positive and significant effect of a country's foreign service on export promotion, and Nitsch (2007), who showed that state visits have a positive impact on international trade flows. Moons and van Bergeijk (2017) provided an influential meta-analysis of the impact of economic diplomacy on trade and investment, confirming that economic diplomacy, reflected in the presence of embassies and consulates, is a statistically significant driver of trade.

More recent research has distinguished between two types of embassy presence: domestic embassies abroad and foreign embassies at home. Fernandes and Forte (2022) and Msafiri and Leyaro (2024) argue that a country may increase its exports through its own diplomatic offices abroad, while imports may be supported by the presence of foreign diplomatic offices at home. Accordingly, the main research question of this paper is whether both types of embassy presence contribute to trade, and whether their effects differ depending on the direction of trade flows. The paper builds on Mlinarić et al. (2022), who investigated the impact of economic diplomacy on Croatian bilateral trade, by extending the analysis to the period marked by the COVID-19 pandemic and by explicitly considering crisis-related disruptions, including the 2008 global financial crisis.

This study investigates the impact of economic diplomacy on Croatia's bilateral trade using an augmented gravity model. The analysis is policy-relevant because it provides empirical evidence on how different forms of diplomatic presence are associated with exports and imports. Rather than examining only the general relationship between diplomacy and trade, the paper distinguishes between the role of Croatian embassies abroad and foreign embassies in Croatia. In this way, the findings may support more informed decisions on allocating diplomatic resources and designing trade-promotion strategies.

Methodologically, the research applies a gravity model of trade to panel data on Croatian bilateral trade with partner countries for the period 1992–2022. The gravity model, originally introduced by Tinbergen (1962), is a standard framework for analysing international trade flows. In addition to standard gravity variables, such as gross domestic product and geographical distance, the augmented gravity model, following Anderson and van Wincoop (2003), incorporates additional controls, including common border, common language, and free trade agreements, as proxies for trade costs and trade facilitators.

The initial sample covers 237 countries and dependent territories worldwide, although the final number of observations is reduced due to missing data, particularly for gross domestic product. Following Santos Silva and Tenreyro (2011), the model is estimated using the Poisson Pseudo-Maximum Likelihood estimator, which is suitable for gravity models with zero trade flows and heteroskedasticity. The specification also accounts for the influence of major global crises on Croatian bilateral trade flows.

The paper is structured as follows. After the introduction, the literature review provides a chronological overview of studies on the influence of economic diplomacy on international trade. The following section presents the historical background of

economic diplomacy in Croatia. The methodology section describes the data, variables, and empirical strategy. The subsequent section presents the empirical findings and discusses their implications for the allocation of diplomatic resources. The final section concludes and outlines directions for future research.

Literature review

A chronological overview of studies on the influence of economic diplomacy representatives on international trade is presented in Table A1 in the Appendix. The table summarises key contributions in terms of authors, time period, trade flows, types of economic diplomacy representatives, country samples, estimation methods, and main findings.

Early empirical contributions generally identify a positive association between diplomatic presence and trade flows. After adjusting for reverse causation using a cross-sectional dataset of 22 large exporters, Rose (2007) discovered that each extra consulate overseas boosts bilateral exports by roughly 6% to 10%. The establishment of a new embassy had a greater effect than the opening of a consulate; the influence was also not linear. These findings demonstrate that, despite declining communication costs, diplomatic representation remains a methodical and effective strategy for export promotion. Nitsch (2007) found that state or official visits are linked to an 8% to 10% boost in exports for France, Germany, and the United States. His research was based on a gravity model and differences-in-differences analysis of state visits from 1948 to 2003. Repeated visits to the same country were the main cause of this strong but short-lived effect.

Gil-Pareja et al. (2007) found that embassies and consulates boost tourism by 15% to 30%, using fixed-effects models on G-7 tourism trade flows. This benefit was more noticeable for travel to poorer countries. All G-7 countries saw a favourable, substantial effect on visitor inflows. Using the Helpman-Melitz-Rubinstein estimation approach, Segura-Cayuela and Vilarrubia (2008) discovered that a foreign service office boosts the likelihood of establishing new trade connections with a trade partner country by 11% to 18%. Nevertheless, there was no discernible impact on trade volumes with current partners.

Through country-pair fixed effects and bilateral trade data, Head and Ries (2010) showed that Canada trades more with countries to which it dispatches trade missions. However, that fact had a negligible impact on overall trade and was not caused by the missions themselves. This implies that pre-existing ties have a greater impact on trade volumes than the missions themselves do. Van Veestra et al. (2010) used a gravity model of trade for 36 countries in the year 2006. The research focused on the efficiency of foreign missions and export promotion organisations. The findings suggest that economic diplomacy is associated with improved bilateral trade, particularly in less developed country contexts.

Volpe Martincus et al. (2010) evaluated how export promotion organisations influence the extensive margin of exports from Latin American and Caribbean countries during the period 1995-2004. The authors conclude that the presence of export promotion organisations increases the quantity of exported differentiated products. Contrary to that result, exports of more homogeneous products appear to be correlated with the number of diplomatic missions in the importing countries.

According to Afman and Maurel (2010), increased exports and economic diplomacy are significantly correlated, as demonstrated by the number of permanent missions overseas. It was discovered that the opening of an embassy would lower tariffs by 2% to 8%. These findings refute the notion that trade patterns are determined solely by macroeconomic variables and confirm the important role of economic

diplomacy in boosting trade flows. On a sample of 63 countries, Yakop and van Bergeijk (2011) showed that improved trade between developed OECD countries was not significantly influenced by diplomatic representation. Nonetheless, it is a vital factor in bilateral trade between emerging countries. This result emphasises the role of economic diplomacy in building trade ties between the South countries.

Using a gravity model of trade, Moons and de Boer (2014) show that economic diplomacy has a significant influence on trade flows between countries with varying degrees of development. Furthermore, it is successful at promoting trade in more complex, differentiated items. Key findings show that economic diplomacy is a useful policy tool for both industrialised countries seeking to assist businesses entering emerging markets and developing countries seeking to penetrate developed markets with complex goods.

Hayakawa et al. (2014) argue that export promotion agencies (EPAs) increase exports, using Japan and Korea as case studies to address endogeneity issues. The paper's main finding suggests that opening an EPA office in a country has a similar effect to signing a free trade agreement (FTA) with that country. Afesorgbor (2018) examined 45 African countries between 1980 and 2005 and found that bilateral diplomatic ties had a stronger influence on exports than regional integration. Additionally, there was a subtle trade-off suggesting that countries within the same geographical bloc benefited less from diplomacy.

Bagir (2017) finds that opening of an embassy in Turkey increases exports by 27%. This advantage is solely due to trade in differentiated goods. The presence of an embassy also increases imports by 70%, and this rise is solely due to trade in homogeneous goods. These results show that, depending on the kind of product, economic diplomacy has a highly unequal effect on trade. Using panel data from 1985 to 2005, Visser (2018) demonstrated that diplomatic representation has a positive and substantial impact on exports of differentiated goods by helping businesses form new trade relationships rather than boosting current trade volumes. This fact highlights the role of economic diplomacy as a valuable tool of economic policy.

Fernandes and Forte (2022) use a quasi-gravity model to analyse the impact of diplomatic representatives on Portuguese merchandise exports over the period 2008-2018. It was found that Portuguese exports are significantly higher to countries with a Portuguese economic diplomatic office. The network of overseas offices proved an effective tool for removing export restrictions and fostering bilateral trade.

Using an improved Pseudo-Poisson Maximum Likelihood (PPML) estimator on bilateral trade data from 1997 to 2019, Msafiri and Leyaro (2024) found that Tanzania imports more from countries that have an embassy in Tanzania. Likewise, it exports more to countries that host its embassies. Methodological improvements over previous research address zero trade flows and potential reverse causality. These findings suggest that economic diplomacy contributes to lowering trade barriers. Bugarčić et al. (2025), using a novel sScore indicator, show that the quality of bilateral diplomatic relations significantly contributes to Serbian export performance.

Overall, previous studies suggest that economic diplomacy is positively associated with international trade, although its effects vary depending on the type of diplomatic representative, trade flow, product characteristics and country context. The literature also shows a gradual methodological shift from standard OLS and fixed-effects models towards approaches that better address zero trade flows, endogeneity and asymmetries between exports and imports. This provides a relevant foundation for examining the role of Croatian embassies abroad and foreign embassies in Croatia within an augmented gravity model framework.

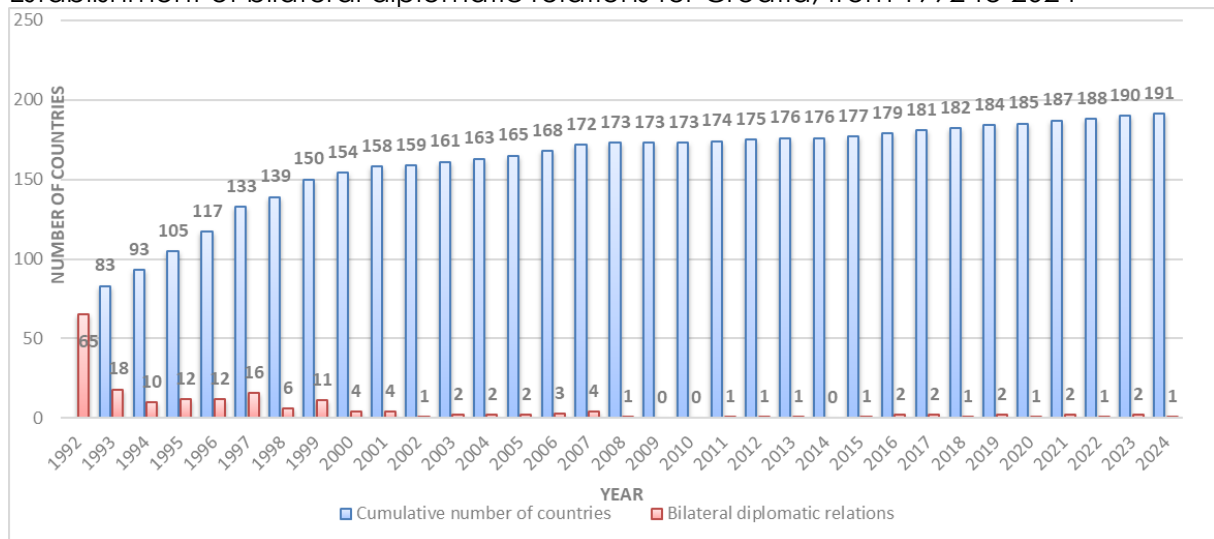
Economic diplomacy in Croatia

Croatia's transition from a former Yugoslav republic to an independent, EU member state has had a profound impact on its economic diplomacy. The Republic of Croatia has consistently made membership in international organisations, including the EU, WTO, and CEFTA, a top priority since achieving independence. Compared to more developed European countries, Croatia's economic diplomacy remains relatively less developed compared to long-established European systems as a relatively young country, and it has not yet had the chance to establish long-standing relations like its regional counterparts, Bilandžić and Barun (2013). Nonetheless, Croatia's diplomacy has demonstrated the capacity to adapt and integrate into the global economy in overcoming challenges, demonstrating Croatia's preparedness to fully integrate into the global economy (Grgurević et al., 2017). In addition to non-state organisations such as the Croatian Chamber of Economy, state organisations, including the Government led by the Ministry of Foreign Affairs and the Office of the President, are the main forces behind Croatia's economic diplomacy (Plevnik, 2016). Other important organisations that significantly influence Croatian economic diplomacy include the State Office for Trade Policy, the Croatian Bank for Reconstruction and Development, the Ministry of Tourism, and the Ministry of Entrepreneurship and Crafts. Together, these institutions contribute to the coordination of Croatia's economic diplomacy framework.

Increasing exports per capita and their share of global trade is often considered a key macroeconomic priority of Croatia's macroeconomic policy. Such an export-push approach is a crucial policy choice for a small, open transition economy like Croatia (Radošević, 2002). According to Mlinarić (2020), the main objective of economic diplomacy should be to increase a country's international trade flows and attract foreign direct investment by leveraging diplomatic tools and international partnerships. The growth of Croatia's bilateral diplomatic network from 1992 to 2024 is depicted in Figure 1, which also shows the cumulative number of countries with which Croatia established diplomatic ties.

Figure 1

Establishment of bilateral diplomatic relations for Croatia, from 1992 to 2024



Source: Authors, based on data from MFEA (2025a)

In 1992, Croatia established bilateral diplomatic ties with 64 countries immediately upon its independence. By 2001, Croatia had 158 diplomatic partners, and by 2024,

it had established diplomatic ties with 191 countries, demonstrating its rapid worldwide expansion. Croatia has no official diplomatic ties with Taiwan, Tonga, Niger and Bhutan. This indicates that the contemporary Croatian state is almost universally acknowledged worldwide, indicating near-universal international recognition.

In this section, the impact of economic diplomacy on Croatia's economy will be presented and elaborated. The main conclusions of the study by Škare and Radolović (2020) are that economic diplomacy has a long-term, favourable effect on Croatia's macroeconomic performance. Due to this fractionally integrated relationship, diplomatic efforts have long-lasting positive effects on the economy. Since economic diplomacy needs the backing of strong public institutions to be completely effective, it is a necessary but insufficient prerequisite for growth. Similarly, another study on this subject by these same authors, Škare et al. (2020), emphasises the long-term positive impact of economic diplomacy on Croatia's macroeconomic performance, particularly promoting development in industrial production and exports. Another important finding of this study is that economic diplomacy had no statistically significant causal effect on other macroeconomic variables that are more influenced by external social factors, such as labour costs, consumer prices and unemployment.

Peternel and Grešš (2021) use a gravity model to examine the factors influencing Croatia's international trade. Their preliminary results indicate a positive relationship between exports and the number of staff employed in diplomatic missions. However, when other standard variables (GDP and distance) were observed, the diplomatic staff variable lost its statistical significance. These findings suggest that, in the long run, Croatia's exports may be more strongly influenced by its long-standing economic issues and historical trading partners than by its current diplomatic initiatives.

Mlinarić et al. (2022) empirically show that the Croatian diplomatic network significantly improves the country's bilateral trade flows. Furthermore, the authors demonstrate that embassies and consulates are useful economic policy tools for promoting both imports and exports. As Peternel and Grešš (2021) highlight, the positive role of diplomatic staff in bilateral trade is emphasised. This paper further examines into the dual role of diplomatic representation by comparing the impact of Croatian embassies abroad on exports and foreign embassies in Croatia on imports. The study will also investigate how large external shocks, such as the 2008 financial crisis and the COVID-19 epidemic, affected these trade dynamics.

Methodology

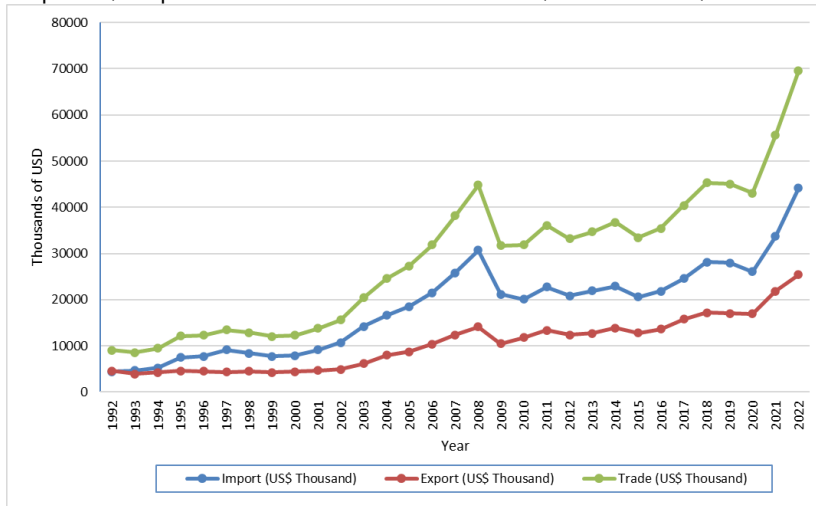
This section presents the data and methodology used in the analysis. The analysis investigates the impact of economic diplomacy representatives on Croatia's international trade during the period from 1992 to 2022. Figure 2 visualises the trends in Croatia's international trade from 1992 to 2022. Croatia has consistently maintained a trade deficit over the last three decades, as the value of its imports have consistently exceeded exports. There was a significant downturn during the 2008 global financial crisis, when Croatia's imports, exports, and total trade volume stagnated for several years. The COVID-19 pandemic led to a contraction in trade flows in 2020. Despite these major external shocks, the Croatian economy demonstrated resilience by recovering to reach new record heights by 2022.

The vast majority of Croatia's total exports are destined from its top 20 partner countries, nearly all of which are European. Precisely, it exports more to neighbouring countries and large EU economies. Italy (12.24%) and Germany (11.39%) are the top export destinations. Neighbouring countries, Bosnia and Herzegovina (10.39%) and Slovenia (11.55%) are the most important regional trade partners. This export structure emphasises the importance of deep economic integration and intra-regional trade

within Europe, particularly in the Balkans. Other important export destinations in Europe include Serbia (6.23%), Austria (5.30%) and Poland (2.11%). In 2022, Croatia's imports from its top 20 trade partners were similar to its exports. These imports come mainly from European countries. Italy (13.84%) and Germany (12.46%) are the largest sources of imports, together accounting for over a quarter of total imports. Other important suppliers are the United States (7.56%), Austria (5.18%), Serbia (3.48%) and the Netherlands (3.34%).

Figure 2

Imports, exports and trade for Croatia, 1992-2022, in thousands of USD

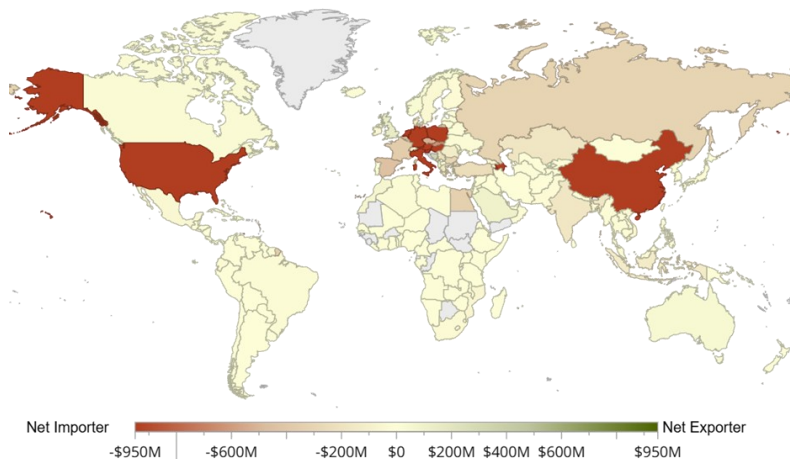


Source: Authors, based on World Bank (2025) data.

Figure 3 presents Croatia's overall trade balance for the year 2022. This figure visually represents whether Croatia had a trade surplus (when exports exceed imports) or a trade deficit (when imports exceed exports) in 2022. The Observatory of Economic Complexity (OEC) data show that Croatia had trade deficits with most countries worldwide in 2022. The red colour in a trade balance chart represents the largest trade deficits. The largest imbalances are occurring among major economies, including China, Germany, Italy, and the United States. This pattern highlights Croatia's role as a net importer of goods, particularly from the world's leading industrialised countries.

Figure 3

Croatia's trade balance (2022)



Source: Observatory of Economic Complexity (2025)

Table 1 outlines the variables used to analyse the determinants of Croatia's trade flows (imports, exports and trade), including core gravity model variables, GDP and distance, as well as policy and shock variables in the form of dummy variables such as free trade agreements, common border, the financial crisis and diplomatic presence. In the context of this trade analysis table, dummy variables are a simple statistical tool for representing qualitative, "yes or no" characteristics by assigning values of 0 or 1.

Their purpose is to allow the model to measure the distinct impact of specific conditions (such as a shared border, a trade agreement, or a global crisis) on Croatia's trade flows, isolating their effects from continuous economic variables, such as GDP and/or distance. Each variable is clearly defined with its corresponding code, unit of measurement and data source. The data are sourced from the World Bank, the World Bank's software tool WITS, the Ministry of Foreign and European Affairs of Croatia (MFEA), and a distance calculator website.

Table 1
The list of observed variables

Variable code	Variable	Measure	Source
Dependent variables			
Imports	Imports of goods and services	In 000 of US\$	1)
Exports	Exports of goods and services	In 000 of US\$	1)
Trade	Trade of goods and services	In 000 of US\$	1)
Independent variables			
GDP_i	Gross domestic product country i (Croatia)	In US\$	2)
GDP_j	Gross domestic product country j (trade partner country)	In US\$	2)
Distance	Distance between capital cities	In kilometres	3)
Contiguity	Common border, dummy variable	0, 1	4)
FTA	Free trade area (EU and/or CEFTA), dummy variable	0, 1	4)
Fincrisis	2008 financial crisis, dummy variable	0, 1	4)
COVID-19	COVID-19, dummy variable	0, 1	4)
EMBDW	Croatian embassies in the World, dummy variable	0, 1	5)
EMBFC	Foreign embassies in Croatia, dummy variable	0, 1	5)

Note: World Integrated Trade Solution, WITS (2025), 2) World Bank (2025), 3) DistanceFromTo webpage, DistanceFromTo (2025), 4) Authors, 5) Ministry of Foreign and European Affairs, MFEA (2025)

Source: Authors'

Precisely, imports, exports, and trade are expressed in thousands of US\$ and are extracted from WITS. Gross domestic products of trade partner countries (GDP_i and GDP_j) are given as current US dollars and available from the World Bank database, World Bank (2025). Distance between countries is measured in kilometres, denoting the aerial distance between the trade partner capital cities (Zagreb, capital city of Croatia, country i , and trade partner capital j) Data are retrieved from the DistanceFromTo webpage (DistanceFromTo, 2025). Data on Croatian embassies worldwide are extracted from the Ministry of Foreign and European Affairs, MFEA (2025a) as well as the number of foreign embassies in Croatia, MFEA (2025b).

The standard workhorse model for analysing bilateral trade is the gravity model of trade (Tinbergen, 1962). The gravity model of trade is named after Isaac Newton's Law of Universal Gravitation, which states that the gravitational force between two objects is proportional to their masses and inversely proportional to the square of the distance between them. The trade version applies this logic to the economic interaction between two countries: trade flows are proportional to the size of their economies and inversely proportional to the distance between them. The model is commonly expressed in a multiplicative form (Equation 1):

$$T_{ij} = A \frac{Y_i^\alpha Y_j^\beta}{D_{ij}^\gamma} \quad (1)$$

where T_{ij} are trade flows (imports, exports or total trade from country i to country j), A is a constant of proportionality, Y_i and Y_j are national incomes of trading countries i and j (typically measured by their GDPs), α , β and γ are regression coefficients while D_{ij} is the distance between country i and country j . This is often the geographic (aerial) distance between their capitals. The standard gravity model is often expressed in natural logarithms (Equation 2):

$$\ln(\text{Trade}_{ijt}) = \beta_0 + \beta_1 \ln(\text{GDP}_{it}) + \beta_2 \ln(\text{GDP}_{jt}) + \beta_3 \ln(\text{Dist}_{ij}) + \varepsilon_{ij} \quad (2)$$

where \ln is the natural logarithm, β_0 is the constant term, β_1 is the elasticity of trade with respect to the exporter's GDP, β_2 is the elasticity of trade with respect to the importer's GDP, β_3 is the elasticity of trade with respect to distance and ε_{ij} is the error term, capturing all other factors influencing trade not included in the model.

The augmented gravity model takes into account other variables, mostly dummy variables (common border, common language, free trade area (FTA), landlockness, remoteness, etc.), that act as trade resistances or trade facilitators, Anderson and van Wincoop (2003). The modern augmented gravity model looks like this:

$$\ln(\text{Trade}_{ijt}) = \beta_0 + \beta_1 \ln(\text{GDP}_{it}) + \beta_2 \ln(\text{GDP}_{jt}) + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4(X_{ij}) + \varepsilon_{ij} \quad (3)$$

where X_{ij} is a vector of other dyadic (pair-specific) variables. The augmented gravity model estimated in this paper is as follows:

$$E_{ijt} = \beta_0 + \beta_1 \text{GDP}_{it} + \beta_2 \text{GDP}_{jt} + \beta_3 \text{Dist}_{ij} + \beta_4 \text{Contiguity}_{ijt} + \beta_5 \text{FTA}_{ijt} + \beta_6 \text{Fincrisis}_t + \beta_7 \text{COVID} - 19_t + \beta_8 \text{EMBDW}_{ijt} + \beta_9 \text{EMBFC}_{ijt} + \varepsilon_{ijt} \quad (4)$$

Dependent variable in the model, E_{ijt} , represents bilateral trade flows (imports, exports and/or total trade). Explanatory variables in the model are: gross domestic product of domestic country i , Croatia, GDP_i , gross domestic product of Croatia's trade partner country j , GDP_j , distance between countries DIST_{ij} , common border between Croatia and neighbouring countries dummy variable, Contiguity_{ij} , free trade area dummy variable FTA_{ij} , 2008 financial crisis dummy variable, Fincrisis_t , COVID-19 dummy variable, $\text{COVID} - 19_t$ Croatian embassies in the World dummy variable, EMBDW_{ijt} , and Foreign embassies in Croatia dummy variable, EMBFC_{ijt} .

There are 237 countries and dependent territories in the full sample. Data for gross domestic product of Croatia, GDP_i , were available for the whole observed time period. Data for gross domestic product of trade partner countries, GDP_j , were available for 175 countries due to missing data for some small and island countries and

dependent territories. Croatia borders with Bosnia and Herzegovina, Slovenia, Hungary, Montenegro and Serbia. In the gravity model equation these five countries were coded as "1" for sharing a land border. Free trade area dummy variable, $FTA_{ij,t}$, gets the value 1 if Croatia and trade partner country j were both members of Central European Free Trade Area (CEFTA) and/or European Union (EU) in the same year t . Croatia was a member of the Central European Free Trade Agreement (CEFTA) from 2006 until its accession to the European Union in 2013.

The Fincrisis dummy variable is coded 1 for the observation years 2008 and 2009 and 0 for all other years to capture the effects of the global financial crisis. In the panel regression models, the time lag for this variable was set to 1 year to account for the delayed economic impact of the financial crisis on trade flows. The COVID-19 dummy variable takes the value 1 for the period from 2020 to 2022 to control for the global economic disruption caused by the pandemic. EMBDW dummy variable equals 1 if country i (Croatia) has an embassy in country j during year t . Similarly, EMBFC dummy variable gets the value 1 if country j (the trade partner country of Croatia) has an embassy in Croatia during year t .

The hypothesis of the paper can be stated as follows:

- o H1... Embassy presence significantly positively influences Croatian bilateral trade, while the global shocks have affected trade asymmetrically

Table 2 outlines the hypothesised relationships (expected signs) between the explanatory variables and Croatia's trade flows, providing the economic rationale for each. The expectations are grounded in the established gravity model of trade, which posits that trade is positively influenced by the economic mass (GDP) of partner countries and negatively influenced by the distance between them.

Table 2
Expected signs of the regression coefficients

Variable	Expected sign	Rationale
GDP_i	Positive (+)	A larger economy in the origin country i (Croatia) increases its production capacity and ability to supply goods for export.
GDP_j	Positive (+)	A larger economy of the bilateral trade partner country j increases its purchasing power and demand for goods from abroad.
Distance	Negative(-)	A greater distance proxies for higher transportation costs, longer delivery times, and increased information frictions, all of which discourage trade.
Contiguity	Positive (+)	Sharing a border reduces transaction costs and facilitates land transportation.
FTA	Positive (+)	A free trade agreement eliminates tariff and non-tariff barriers, making trade between member countries cheaper and more attractive.
Fincrisis	Negative (-)	A global financial crisis led to reduced consumer demand and a general contraction in economic activity, suppressing trade volumes.
COVID-19	Negative (-)	Pandemic lockdowns, factory closures, and disruptions of global supply chains severely hampered the production and movement of goods.
EMBDW Dummy	Positive (+)	The presence of Croatia's embassy in a foreign country reduces information costs and facilitates trade with that country.
EMBFC Dummy	Positive (+)	The presence of a foreign country's embassy in Croatia reduces information costs and facilitates trade from that country to Croatia.

Source: Authors'

Panel regression modelling of Croatian bilateral trade is conducted using the pooled OLS (POLS), Fixed Effects (FE), and Random Effects (RE) estimators. The Fixed Effects (FE) estimator is employed to control for unobserved, time-invariant characteristics of units that can be correlated with the explanatory variables, while the Random Effects (RE) estimator is employed when these characteristics are

uncorrelated with the explanatory variables. To determine whether the FE or RE model is more appropriate for the data, the Hausman test will be conducted.

The estimation strategy presented in the paper addresses the issue of zero trade flows, present for both exports and imports. The log-log model could not be estimated when trade data contained zeros, because the logarithm of zero is undefined. Simply dropping these observations would create a selected sample and could lead to biased estimates. Using an OLS estimator in a model that includes zero flows is unsuitable and leads to significant bias. Therefore, we use the Poisson Pseudo-Maximum Likelihood (PPML) estimator, which is more robust to the inclusion of zero trade flows and provides consistent parameter estimates. In the PPML model, the expected value of trade flow E_{ijt} between country i and country j at time t is specified as follows:

$$E[E_{ijt} | X_{ijt}] = \exp(\beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \beta_3 \ln(Dist_{ijt}) + \beta_4 Contiguity_{ijt} + \beta_5 FTA_{ijt} + \beta_6 Fincrisis_t + \beta_7 COVID - 19_t + \beta_8 EMBDW_{ijt} + \beta_9 EMBFC_{ijt}) \tag{5}$$

The PPML estimator was first advocated for gravity model estimation by Santos Silva and Tenreyro (2006). This technique models trade flows using an exponential function, yielding an unbiased estimate (Afesorgbor, 2018). While Martin and Pham (2020) critique the PPML estimator for potential bias estimates when zero flows are prevalent, Santos Silva and Tenreyro (2011) present counter-evidence of its robustness in such a context.

Results

Table 3 presents descriptive statistics for the main variables used in the analysis. Trade flows vary substantially across observations, indicating considerable heterogeneity in the data. The high standard deviations further reflect large differences in trade volumes across country pairs and years. The GDP and distance variables also show a wide range of values, highlighting the economic and geographic diversity of partner countries in the sample. The number of observations is 7,347, except for the GDP_j variable, due to missing data.

Table 3
Descriptive statistics of observed variables

Variable	Mean	Median	Min.	Max.	Std. Dev.	Skewness	Kurtosis	Obs.
Imports	76,666.14	85.81	0.0	6,106,911	354,600.70	8.23	86.29	7,347
Exports	44,041.41	107.73	0.0	3,107,917	209,615.40	8.19	81.96	7,347
Trade	120,707.6	426.56	0.0	9,214,828	548,055.30	8.25	86.46	7,347
GDP_i	4.72E+10	5.01E+10	2.99E+10	6.41E+10	8.85E+09	-0.35	2.15	7,347
GDP_j	3.07E+11	1.99E+10	22,963,355	2.14E+13	1.37E+12	9.94	117.61	6,102
Distance	6,739.85	6,768.0	118.0	18,304.0	4,507.78	0.57	2.63	7,347

Note: Descriptive statistics of dummy variables have been excluded from the presentation.
Source: Authors' calculations

The correlation matrix in Table 4 indicates low pairwise correlations among the explanatory variables, suggesting that multicollinearity is unlikely to pose a concern in the panel regression models.

Due to the moderately high correlation between EMBDW and EMBFC (0.652), potential multicollinearity is addressed by estimating separate models. The baseline model first estimates total trade without economic diplomacy variables, while the subsequent models include EMBDW for exports and EMBFC for imports.

Table 4
Correlation matrix of explanatory variables

Variable	GDP _i	GDP _j	DIST	CONT	FTA	FINC	COVID-19	EMBDW	EMBFC
GDP _i	1								
GDP _j	0.050	1							
DIST	0.007	0.005	1						
CONT	0.009	0.006	-0.241	1					
FTA	0.190	0.041	-0.285	0.017	1				
FINC	0.179	0.001	0.0003	0.001	-0.017	1			
COVID-19	0.434	0.029	0.002	0.002	0.125	-0.061	1		
EMBDW	0.302	0.113	-0.250	0.069	0.124	0.029	0.095	1	
EMBFC	0.122	0.174	-0.395	0.122	0.191	0.015	0.026	0.652	1

Source: Authors' calculations

The results in Table 5 are broadly consistent with the gravity model: Croatia's trade is positively associated with its own and partner countries' GDP, while distance significantly reduces trade. Diagnostic tests support the Fixed Effects (FE) model, as indicated by the significant Hausman test and the highest explanatory power (adjusted R-squared = 0.78).

Table 5
Augmented gravity model, Croatian bilateral trade (in 000), panel regression models, 1992-2022

Dependent var.	Trade			
Independent var./ Model	POLS	FE	RE	PPML
CONSTANT	-3,782.56*** (862.87)	-8,673.23*** (559.94)	-4,443.54*** (568.42)	-56.56*** (0.21)
LOG(GDP _i)	126.44*** (35.34)	426.86*** (32.06)	205.02*** (24.66)	2.18*** (0.008)
LOG(GDP _j)	53.03*** (2.66)	-70.20*** (16.53)	12.69 (9.50)	0.60*** (6.2E-03)
LOG(DISTANCE)	-62.31*** (7.70)		-98.61*** (32.16)	-1.07*** (0.001)
CONTIGUITY	1,517.69*** (40.61)		1,414.70*** (181.50)	0.75*** (0.002)
FTA	569.82*** (29.93)		519.07*** (18.97)	0.16*** (0.002)
FINCRISIS(-1)	10.86 (33.76)	-19.70 (20.72)	6.03 (19.51)	0.003 (0.005)
COVID-19	43.57** (21.98)	72.88*** (13.51)	45.26*** (12.72)	0.06*** (0.003)
Diagnostics				
Adjusted R-squared	0.41	0.78	0.32	
S.E. of regress.	464.87	285.06	268.99	
Prob. (F-stat.)	0.0	0.0	0.0	
Mean dep. var.	148.15	148.15	148.15	148.15
Restr. quasi-logl				350,2733
Prob(Quasi-LR stat)				0.0
Observations	5,913	5,913	5,913	5,913
Hausman test	Chi-Square Stat. 33.56, Prob. 0.0			
Redundant fixed effects (LR test)	Cross-section F Stat. 90.25, Prob. 0.0 Cross-section Chi-square Stat. 8,501.81, Prob. 0.0			

Note: Standard errors in parentheses, * denotes significance under 10%, ** significance under 5% and *** significance under 1%, Swamy and Arora estimator of component variances, GML (Newton-Raphson/Marquardt steps), Poisson Quasi likelihood, Link log, dispersion fixed at 1, convergence achieved after 5 iterations, coeff. covar. computed using observed Hessian.
Source: Authors' calculations

Contiguity and free trade agreements are also positive and statistically significant drivers of bilateral trade. The COVID-19 period has a positive, significant coefficient, whereas the financial crisis variable is not statistically significant. The negative effect of the 2008 financial crisis appears to have materialised with a one-year delay, reducing trade flows in 2009. However, since this effect is significant only in the FE specification, it should be interpreted cautiously. Similarly, the positive COVID-19 coefficient likely reflects the strong recovery in 2021–2022, visible in Figure 2, which outweighed the initial contraction in 2020.

Table 6
Augmented gravity model with EMBDWDummy explanatory economic diplomacy variable, Croatian bilateral exports (in 000), panel regression models, 1992–2022

Dependent var.	Exports			
	Independent var./ Model	POLS	FE	RE
CONSTANT	-1,824.40*** (320.43)	-3,856.23*** (234.98)	-2,002.83*** (23.52)	-53.66*** (0.35)
LOG(GDP _i)	69.52*** (13.11)	185.46*** (12.87)	91.64*** (9.96)	2.18*** (0.01)
LOG(GDP _j)	16.43*** (1.03)	-25.50*** (6.27)	4.34 (3.41)	0.48*** (0.001)
LOG(DISTANCE)	-26.84*** (2.80)		-36.53*** (11.16)	-1.11*** (0.002)
CONTIGUITY	714.67*** (14.54)		679.87*** (62.80)	1.009*** (0.004)
FTA	197.79*** (10.73)		191.44*** (7.27)	0.177*** (0.004)
FINCRISIS(-1)	-0.98 (12.07)	-11.66 (7.86)	-1.93 (7.43)	-0.07*** (0.01)
COVID-19	22.22*** (7.86)	31.75*** (5.13)	22.30*** (4.85)	0.15*** (0.005)
EMBDWDummy	62.54*** (5.10)	8.90** (4.71)	10.79** (4.65)	3.13*** (0.01)
Diagnostics				
Adjusted R-squared	0.48	0.78	0.47	
S.E. of regress.	166.28	108.16	102.46	
Prob. (F-stat.)	0.0	0.0	0.0	
Mean dep. var.	53.67	53.67	53.67	53.67
Restr. quasi-logl				946,809.6
Prob(Quasi-LR stat)				0.0
Observations	5,913	5,913	5,913	5,913
Hausman test	Chi Square Stat. 29.61, Prob. 0.0			
Redundant fixed effects (LR test)	Cross-section F Stat. 96.22, Prob. 0.0			
	Cross-section Chi-square Stat. 8,793.87, Prob. 0.0			

Note: Standard errors in parentheses, * denotes significance under 10%, ** significance under 5% and *** significance under 1%, Swamy and Arora estimator of component variances, GML (Newton-Raphson/Marquardt steps), Poisson Quasi likelihood, Link log, dispersion fixed at 1, convergence achieved after 6 iterations, coeff. covar. computed using observed Hessian.
Source: Authors' calculations

With the core variables of gravity model displaying the expected signs and statistical significance, the estimation results presented in Table 6 support the validity of the augmented gravity model for Croatian exports. The establishment of Croatian embassies abroad has a positive and statistically significant impact on exports across

all gravity model specifications. The lagged financial crisis variable negatively affected exports, indicating a decline in trade during the global economic downturn.

The results in Table 7 show that foreign embassies located in Croatia (EMFCDummy) have a positive and significant effect on Croatian imports. This indicates that the presence of foreign diplomatic missions in Croatia facilitates the inflow of goods, likely by reducing information barriers and trade costs for exporters in their home countries. Together with the previous findings on exports, these results confirm that the overall diplomatic presence within Croatia is a significant institution that promotes bilateral trade flows in both directions.

Table 7
Augmented gravity model with EMFCDummy explanatory economic diplomacy variable, Croatian bilateral imports (in 000), panel regression models, 1992-2022

Dependent var.	Imports			
Independent var./ Model	POLS	FE	RE	PPML
CONSTANT	-3,175.92*** (584.18)	-6,351.11*** (394.17)	-3,316.77*** (393.41)	-59.66*** (0.27)
LOG(GDP _i)	101.97*** (23.89)	305.01*** (22.07)	147,55*** (17.04)	2.17*** (0.01)
LOG(GDP _j)	54.25*** (2.21)	-41.82*** (11.11)	17.25*** (6.51)	0.68*** (0.008)
LOG(DISTANCE)	-58.78*** (5.46)		-75.24*** (21.73)	-1.04*** (0.001)
CONTIGUITY	780.40*** (27.41)		721.79*** (121.81)	0.59*** (0.003)
FTA	358.94*** (20.18)		319.77*** (12.90)	0.17*** (0.003)
FINCRISIS(-1)	11.21 (22.74)	-8.76 (13.92)	7.62 (13.24)	0.05*** (0.007)
COVID-19	14.30 (14.82)	35.65*** (9.09)	19.09** (8.65)	0.012*** (0.004)
EMFCDummy	148.91*** (8.09)	14.10 (11.91)	25.99** (11.44)	0.74*** (0.01)
Diagnostics				
Adjusted R-squared	0.36	0.77	0.33	
S.E. of regress.	313.20	191.52	182.76	
Prob. (F-stat.)	0.0	0.0	0.0	
Mean dep. var.	94.47	94.47	94.47	53.67
Restr. quasi-logl				1982338.6
Prob(Quasi-LR stat)				0.0
Observations	5,913	5,913	5,913	5,913
Hausman test	Chi Square Stat. 42.74, Prob. 0.0			
Redundant fixed effects (LR test)	Cross-section F Stat. 80.15, Prob. 0.0 Cross-section Chi-square Stat. 7,975.30, Prob. 0.0			

Note: Standard errors in parentheses, * denotes significance under 10%, ** significance under 5% and *** significance under 1%. Swamy and Arora estimator of component variances, GML (Newton-Raphson/Marquardt steps), Poisson Quasi likelihood, Link log, dispersion fixed at 1, convergence achieved after 7 iterations, coeff. covar. computed using observed Hessian.

Source: Authors' calculations

Table 8 compares the theoretically expected signs of the model variables with their actual, statistically significant signs obtained from the estimated exports and imports regressions.

Table 8
Comparison of theoretical and empirical results

Variable	Expected sign	Gravity model with EMBDWDummy, Exports				Gravity model with EMBFCDummy, Imports			
		POLS	FE	RE	PPML	POLS	FE	RE	PPML
<i>GDP_i</i>	+	+	+	+	+	+	+	+	+
<i>GDP_j</i>	+	+	-	+	+	+	-	+	+
DIST	-	-		-	-	-		-	-
CONT	+	+		+	+	+		+	+
FTA	+	+		+	+	+		+	+
FINC	-	-	-	-	-	+	-	+	+
COVID	-	+	+	+	+	+	+	+	+
EMBDW	+	+	+	+	+				
EMBFC	+					+	+	+	+

Note: Highlighted signs indicate significance at the 5%
Source: Authors'

The empirical results are largely consistent with the core propositions of the gravity model, with domestic and partner GDP, distance, contiguity, and free trade agreements showing the expected signs and statistical significance across most specifications. The key finding is that both economic diplomacy variables have a positive effect, indicating that embassy presence increases bilateral trade between diplomatic partners. Regarding economic shocks, the results suggest asymmetric effects. Croatia's bilateral trade declined in the first year of the COVID-19 pandemic, but the overall pandemic-period effect was not negative, reflecting the subsequent recovery. By contrast, the 2008 global financial crisis was associated with a decline in trade volumes.

Discussion

The main findings of the analysis provide evidence that Croatia's trade patterns are significantly influenced by economic diplomacy, thereby supporting the gravity model framework. Croatia's GDP and the GDPs of its trade partners are confirmed as important drivers of bilateral trade. Furthermore, regional integration, through shared borders and free trade agreements, is positively associated with trade, while geographical distance significantly reduces trade flows.

The results are consistent with previous research, including Rose (2007), Moons and de Boer (2014), and Afesorgbor (2018). In line with studies on Tanzania and Portugal (Fernandes & Forte, 2022; Msafiri & Leyaro, 2024), this study supports the dual, asymmetric role of embassies, whereby a country's own embassies are associated with higher exports, while foreign embassies are associated with higher imports. The explicit inclusion of global crises as control variables in the gravity model further extends this literature, indicating that the impact of diplomatic networks remains relevant even during periods of economic disruption.

The differing impacts of the COVID-19 pandemic and the 2008 global financial crisis highlight how distinct types of shocks affect trade. The financial crisis, as a severe demand-side shock, led to a substantial decline in trade flows. In contrast, although trade declined in 2020, the overall effect of the COVID-19 period (2020–2022) was not negative, reflecting a relatively rapid recovery and the resilience of trade networks. The relevance of broader country-level conditions for internationalisation is also supported by Pejić Bach et al. (2018), who show that economic and institutional risk factors, including the economic costs of violence, are associated with differences in

countries' internationalisation environments. This further supports the view that economic diplomacy may be particularly important in markets characterised by higher uncertainty and transaction costs.

From a policy perspective, a diplomatic strategy oriented towards export promotion requires a well-developed international network. Economic diplomacy can support exports by reducing market frictions, lowering informal barriers, and facilitating information flows to domestic firms (Fernandes & Forte, 2022). Diplomatic missions may also contribute by facilitating market access, mitigating risks, and providing support through engagement with local authorities.

To enhance the effectiveness of diplomatic representation in promoting international trade, governments may consider strengthening the capacity and specialisation of diplomatic staff, improving coordination among institutions, and complementing diplomatic efforts with targeted instruments, such as export promotion agencies (Msafiri & Leyaro, 2024).

Foreign embassies in Croatia also play a role in shaping trade patterns by supporting exporters from their home countries, thereby influencing import structures, supply chains, and market conditions. Conversely, Croatian embassies abroad function not only as political institutions but also as nodes of economic diplomacy, supporting domestic firms in accessing foreign markets. This broader policy relevance is consistent with Memeti, Abazi Alili, and Memeti Karemani (2025), who examine FDI inflows in Western Balkan economies and highlight the importance of aligning investment attraction strategies with employment and economic stability objectives in small transition economies. Although their focus is on FDI rather than trade, their findings support the broader argument that external economic relations should be analysed alongside domestic development priorities.

By reducing transaction costs, facilitating information exchange, and supporting partner identification, diplomatic missions contribute to firms' internationalisation strategies. In this context, the strategic placement of embassies—particularly in emerging markets—may help reduce exporters' risks and support more stable, diversified trade relationships.

Conclusion

The main finding of this paper is that the gravity model of trade provides a strong explanation for the direction and volume of Croatia's trade flows. The results provide empirical evidence that Croatian embassies abroad are associated with higher exports, while foreign embassies located in Croatia are associated with higher imports. These findings confirm the paper's main research question and point to the asymmetric role of diplomatic representation in bilateral trade. The analysis also shows a differentiated impact of economic crises: the 2008 financial crisis significantly reduced trade flows, whereas the COVID-19 pandemic had a negative effect mainly in 2020, followed by a recovery in the subsequent period.

These findings highlight the relevance of economic diplomacy as a policy instrument for facilitating trade, including during periods of economic disruption. By building on previous Croatian studies, particularly Peternel and Grešš (2021) and Mlinarić et al. (2022), this paper distinguishes between the effects of Croatian embassies abroad and those of foreign embassies in Croatia. While previous research confirmed the general importance of diplomacy for trade, this study shows that different forms of diplomatic presence are not interchangeable but play distinct roles in shaping exports and imports.

A limitation of the analysis is related to missing and incomplete data for the GDP variable. Another limitation is the reliance on dummy variables to represent economic

diplomacy representatives. Furthermore, the macro-level perspective does not capture important firm-level factors, such as managerial expertise, financial strength, technological capability, and internationalisation strategy. This limitation is also relevant, as Martinčević (2023) shows that the absorptive capacity of Croatian export companies is significantly related to their financial performance, particularly in foreign markets. This suggests that diplomatic support should be interpreted alongside firm-level capabilities rather than as an isolated determinant of export success.

Future research should develop a quantitative index to measure the intensity of diplomatic efforts and the quality of a country's economic diplomacy network. Potential metrics could include the expertise of embassy staff, the resources allocated to trade promotion, and the number of successfully facilitated business partnerships or trade disputes resolved. Such an index would enable more detailed research at the firm level, including the relationship between economic diplomacy, export performance, market diversification, and supply chain resilience.

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Appendix

Table A1

The overview of studies on the influence of economic diplomacy representatives on international trade

Author(s)	Period	Trade flow(s)	Economic diplomacy representative(s)	Country	Estimation method	Results
Gil-Pareja et al. (2007)	2001-2003	Exports of services	Embassies and consulates	G-7	OLS	Embassies and consulates have a positive, significant effect on tourism, ranging from 15% to 30%.
Nitsch (2007)	1948-2003	Exports	State and official visits	France, Germany and the United States	OLS, FE, RE	State and official visits are positively correlated with exports, with a 8% to 10% increase.
Rose (2007)	2002-2003	Exports	Foreign missions	22 exporters, 200 destination countries.	OLS	Bilateral exports rise by approximately 6% to 10% for each additional consulate abroad.
Segura-Cayuela and Vilarubia (2008)	1999	Total trade	Embassies and consulates	21 exporters and 163 importing countries	OLS, Probit	The presence of a foreign service office in a given country increases trade by 11% to 18%.
Afman and Maurel (2010)	1995, 2000, 2005	Exports	Foreign missions	Transition countries, EU-15 and OECD	OLS, FE, RE	Opening an embassy is equivalent to an ad valorem tariff reduction varying from 2% to 8%.
Head and Ries (2010)	1990-2003	Imports and exports	Trade missions	Canada	OLS, FE	Trade missions do not exert a statistically significant effect on trade.
Martincus et al. (2010)	1995-2004	Exports	Trade promotion offices, embassies and consulates	26 Latin American and Caribbean countries	OLS	Export promotion agencies favour expanding the extensive margin of exports of more differentiated goods.
van Veestra et al. (2010)	2006	Exports	Export-promoting agencies, embassies and consulates	36 countries	OLS	The overall effect of EPAs is insignificant, whereas that of embassies and consulates is positive.
Yakop and van Bergeijk (2011)	2006	Imports and exports	Embassies and consulates	63 importing and exporting countries	OLS	The impact of embassies and consulates is positive and significant, ranging from 6% to 16%.
Hayakawa et al. (2014)	1962-2009	Exports	Export-promoting agencies	Japan and Korea	OLS	Establishing an EPA office in a country is equivalent to signing an FTA with that country.
Moons and de Boer (2014)	2006	Exports and total trade	Foreign missions, embassies and consulates	63 exporting countries	OLS	Embassies and consulates are shown to be very effective in stimulating trade between countries of different income levels.
Afesorgbor (2016)	1980-2005	Exports	Diplomatic exchange	45 African countries	OLS, FE, PPML	Diplomatic exchange is a more important factor in exports among African states than regional integration.
Bagir (2017)	2006-2014	Imports and exports	Embassies	Turkey	FE, RE, PGMM	The presence of an embassy increases exports by 27% and imports by 70%.
Visser (2019)	1985-2005	Exports of homogeneous and differentiated goods	Diplomatic representation	100 countries	OLS, PPML	The effect of diplomatic representation on exports of differentiated goods is positive and significant.
Fernandes and Forte (2022)	2008-2018	Merchandise exports	Embassies, consulates, and foreign offices	Portugal	FE, PPML	The number of offices in a foreign country positively affects exports to that country.
Msafiri and Leyaro (2024)	1997-2019	Imports and exports	Domestic and foreign embassies	Tanzania	OLS, PPML	Tanzania exports more to countries hosting Tanzanian embassies, and imports more from countries having embassies there
Bugarčić et al. (2025)	2007-2018	Exports	Similarity between foreign policy positions	Serbia	OLS	The quality of diplomatic relations contributes to the promotion of Serbian exports.

Source: Mlinarić et al. (2022) and authors' collection