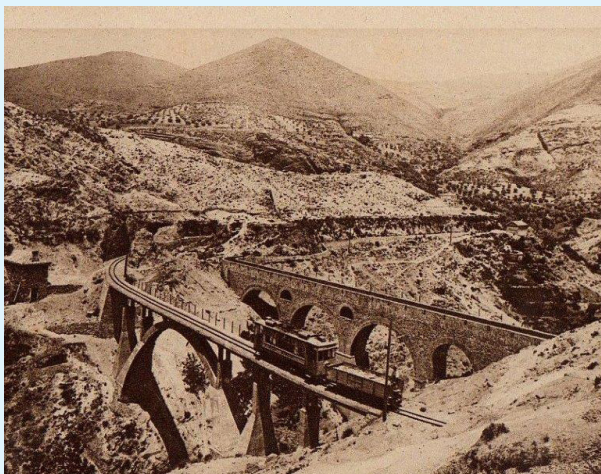


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132

SUMARIO

Tetiana Kondratiuk, Iryna Novoselska, Oksana Paleulko, Olena Shevchenko y Oksana Tsiupa. Economic and legal aspects of social protection during the COVID-19 pandemic: Challenges and strategies

Rosa Iris Balbuena-Hernández, Ricardo Herrera-Navarrete y Ana I. Casarrubias-Jaimez. Índice rápido para evaluar la percepción del servicio de agua y saneamiento en una comunidad rural de Guerrero, México

María Jesús Guillén Palomino, Triana Arias Abelaira, Lázaro Rodríguez Ariza y Miriam Guillén Palomino. Inteligencia artificial y transparencia corporativa: un análisis bibliométrico de la divulgación financiera y de sostenibilidad

Diego Sande Veiga, Edmir Luciano Santos Ferreira y Eddy A. Castillo Montesdeoca. Determinants of trade flows between Spain and CPLP countries: A gravity model approach

José Damián Toboso-Gómez, Fernando Almeida-García, Pere Mercadé-Melé y Abolfazl Siyamiyan-Gorji. The impact of short-term rental on housing rents: Evidence from Andalusian provincial capitals

Determinants of trade flows between Spain and CPLP countries: A gravity model approach

Factores determinantes de los flujos comerciales entre España y los países de la CPLP: un enfoque basado en el modelo de gravedad

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ABSTRACT

In a global context marked by the reconfiguration of international value chains and the growing relevance of nearshoring and friendshoring strategies, strengthening trade relations between Spain and the Community of Portuguese-Speaking Countries (CPLP) emerges as a strategic opportunity. Spain's recent admission as an associate observer in the CPLP provides an institutional framework to intensify economic linkages, especially as market diversification becomes increasingly important for economic resilience. This study investigates the determinants of trade flow between Spain and CPLP member states, employing a gravity model complemented by robust econometric estimation. It is the first article on this subject after Spain's

admission in the CPLP and dealing with this topic in a pioneering way following this internationally significant event.

Methodology and Model Specification

The analysis is grounded in the gravity model of international trade, widely recognized as one of the most effective empirical tools for modelling bilateral trade flows. Since the foundational work of Tinbergen (1962) and Anderson (1979), gravity models have consistently demonstrated strong econometric performance, explaining trade flows based on variables such as GDP, geographical distance, and population size. Following the theoretical structure proposed by Anderson and van Wincoop (2003), the model includes multilateral resistance terms to reflect trade frictions beyond simple bilateral barriers.

The baseline log-linear model is specified as follows:

$$\ln x_{ij,t} = a + b_1 \ln y_{i,t} + b_2 \ln y_{j,t} + b_3 \ln d_{ij,t} + b_4 \ln b_{ij} + b_5 \ln P_{i,t} + b_6 \ln P_{j,t} + \varepsilon_{ij,t}$$

where a is a constant, denotes export of good and services from country i to country j in period t ; $y_{i,t}$ is the GDP of a country i in a period t ; $y_{j,t}$ is GDP of a country j in a period t ; d_{ij} is a dummy which is one if country i and country j are contiguous and zero otherwise; d_{ij} is the bilateral distance between country i and j ; $P_{i,t}$ and $P_{j,t}$ are the price level in country i and j in period t .

Evolution of Trade Between Spain and the CPLP (2000–2022)

To contextualize the empirical findings, the study presents a descriptive analysis of trade dynamics between Spain and CPLP countries from 2000 to 2022. Trade patterns reveal marked asymmetries. Portugal, due to both geographic and cultural proximity, accounts for the vast majority of Spain's trade with the CPLP, representing nearly 10% of all Spanish exports, equivalent to approximately €35 billion. Brazil, in contrast -despite its economic weight- receives only €3.7 billion in Spanish exports, indicating a significant untapped potential.

Distance appears to be a major determinant. Except for Portugal, which shares a land border with Spain, all other CPLP countries are separated by considerable geographic distances. African CPLP members lie between 3,500 and 5,500 km from Spain, while Brazil (7,744 km), Mozambique

(8,288 km), and Timor Leste (13,911 km) present logistical challenges to trade.

In terms of GDP evolution, CPLP countries show general growth, with noticeable contractions during the 2009 financial crisis and the 2020–2021 COVID-19 pandemic. Spain's exports are concentrated in a few African CPLP countries: Equatorial Guinea (€167 million), Cape Verde (€120 million), and Angola (€114 million). Other destinations, such as Mozambique, Guinea-Bissau, São Tomé and Príncipe, and Timor Leste, show much smaller trade volumes. Notably, the pandemic had a visible impact, reducing trade figures and interrupting previously stable trends.

Imports from CPLP countries are generally lower than exports, creating a favorable trade balance for Spain. This surplus is largely due to the high volume of trade with Portugal. With other CPLP countries -especially Brazil, Angola, and Mozambique-Spain tends to run trade deficits, though small economies like Cape Verde and Guinea-Bissau show marginal trade surpluses.

Empirical Results

Initial OLS estimations show a strong model fit ($R^2 = 0.92$), with results largely consistent with theoretical expectations. The GDP of CPLP countries is positively and significantly associated with Spanish exports, indicating that larger economies attract more exports. Surprisingly, Spain's own GDP shows a negative and significant coefficient, an unexpected result that may be linked to multicollinearity or the low variability of this variable over time.

Distance has the expected negative effect on trade and is statistically significant. Its estimated coefficient is considerably larger in magnitude than the typical benchmark of -1 (Disdier and Head, 2008), suggesting that geographic distance is a substantial barrier to trade, particularly in the absence of proximity-related advantages. Only Portugal shares a border with Spain, which is reflected in the notably higher trade flows between them. Due to this imbalance, the contiguity variable was excluded from the final regression.

Robustness checks using multilateral resistance terms and importer fixed effects support the consistency of results. The Random Effect estimation also confirms the significance of key variables, particularly the negative effect of distance and the positive relationship with importer GDP.

Conclusions and Policy Implications

The empirical evidence reveals that Spain's trade relations with CPLP countries are highly asymmetrical, with a dominant focus on Portugal and relatively weak links with the rest of the Lusophone world. This imbalance reflects both structural and institutional barriers, most notably geographic distance and limited bilateral engagement.

To address these challenges and harness the latent potential of these markets, the study proposes a series of policy recommendations aimed at enhancing Spain's trade integration with the CPLP:

Consolidate existing markets: Reinforce trade ties with countries like Portugal and Brazil by expanding export product portfolios and strengthening existing supply chains.

Diversify trade partners and products: Promote entry into underexplored CPLP markets through tailored export strategies in sectors with high added value, including energy, biotechnology, shipbuilding, aerospace, and environmental technologies.

Improve connectivity and logistics: Invest in transport infrastructure to reduce trade costs, especially maritime and air connections with Africa and Latin America. Enhanced connectivity would mitigate the friction caused by long distances.

Strengthen trade diplomacy: Create permanent commercial delegations, negotiate bilateral trade agreements, and align regulatory frameworks to facilitate market entry and reduce non-tariff barriers.

Promote SME internationalization and digitalization: Provide financial and institutional support to small and medium-sized enterprises to encourage export capacity, particularly through digital platforms.

Develop financial instruments and risk mitigation tools: Introduce specific credit lines, fiscal incentives, and insurance schemes to reduce investment risk in emerging CPLP markets.

Foster academic and institutional cooperation: Utilize cultural and linguistic affinities to promote bilateral networks for knowledge transfer, training, and innovation, particularly in sectors where Spain enjoys a comparative advantage.

These strategies are aligned with recent research by Sande-Veiga and Ferreira (2025), Sande-Veiga (2019; 2025a; 2025b), and Pérez & Jiménez (2023), which highlight the importance of targeted market strategies, public-private partnerships, and sector-specific initiatives.

Final Remarks

Strengthening Spain's position in CPLP markets goes beyond economic interests, and it contributes to building a strategic partnership grounded in cultural affinity and shared geopolitical interests. Addressing current trade barriers through integrated policy measures will allow Spain to diversify its export destinations, reduce its dependency on traditional partners, and promote sustainable and inclusive economic growth within the Lusophone community.

By leveraging its institutional ties, geographic positioning, and sectoral strengths, Spain has the potential to become a central economic actor within the CPLP. The findings of this study underscore the urgency of translating this potential into concrete action, particularly through coordinated public policies and strategic investments.

RESUMEN

En el contexto de la creciente relevancia de las estrategias de nearshoring y friendshoring, la reciente adhesión de España como observador asociado a la Comunidad de Países de Lengua Portuguesa (CPLP) constituye una oportunidad estratégica para profundizar sus relaciones comerciales. Este artículo examina cuáles son los factores determinantes del comercio de España con los Estados miembros de la CPLP, aplicando un marco de modelo de gravedad. Los resultados empíricos revelan asimetrías significativas y un potencial comercial infrautilizado. En concreto, las relaciones económicas entre España y los países de la CPLP revelan un patrón diferenciado entre Portugal y el resto de la comunidad lusófona, atribuible en gran medida a la distancia comercial efectiva. A partir de estos resultados, el estudio ofrece recomendaciones de política destinadas a reducir las fricciones comerciales y fomentar vínculos económicos bilaterales más sólidos y diversificados.

1. INTRODUCTION

Spain's admission as an Associate Observer of the Community of Portuguese Language Countries (CPLP) in 2021 represents a strategic opportunity to deepen trade and economic ties with member states. This development builds on Spain's historical and cultural links with Lusophone countries, offering scope for new diplomatic and commercial initiatives.

Spain already plays a notable economic role in the Lusophone world, particularly with countries like Portugal (Silva, Afonso & Africano, 2013; Lorenzo, González-Portela & Cabanelas, 2009) and Cabo Verde (Irwin & Wilson, 2011; Loureiro, Martins & Ribeiro, 2010). Moreover, regional policies -such as Galicia's Paz Andrade Law (Xunta de Galicia, 2014) and Galician External Action Law (Xunta de Galicia, 2021)- reflect institutional interest in strengthening ties with CPLP countries (Sande-Veiga, 2019; 2025a; 2025b).

Despite these ties, current trade flows do not appear to reflect the full economic potential of these relations. This paper assesses the impact of factors such as production in exporter country, expenditure of importer, geographical, social and political distance on trade flow between Spain and CPLP members. The hypothesis is that trade levels remain below potential and could be expanded through targeted economic policies.

A mixed-methods approach has been used in the current study, combining descriptive statistics with a gravity model and macroeconomic data from official sources, to analyse trade determinants and identify structural patterns. Thus, the article has made an innovative contribution to the enrichment of the scientific literature related to Spain and the CPLP countries following Spain's entry as an associate observer of that Community. It is the first article on this subject and deals with this topic in a pioneering way following this internationally significant event. The study is particularly timely given current global trends such as protectionism (Robinson & Thierfelder, 2024) and friendshoring (Vivoda & Matthews, 2024), which reshape trade priorities. The findings provide valuable insights for policymakers, business stakeholders, and

scholars focused on Spain's economic engagement with Lusophone countries.

The paper is structured as follows: Section 2 reviews the literature on trade partner selection and economic mass. Section 3 outlines the CPLP trade context. Section 4 describes the methodology. Section 5 presents results. Section 6 concludes with policy implications and future research directions.

2. THEORETICAL FRAMEWORK

This paper investigates trade flow between Spain's and CPLP member states and its determinants. To achieve this aim, the authors have employed a gravity model framework. Key variables such as GDP, bilateral exports, and geographical distance are used to assess trade flows and identify underlying patterns.

The selection of trade partners increasingly depends on intangible factors such as trust, institutional alignment, and perceived credibility, alongside economic fundamentals (Helpman, Melitz & Rubinstein, 2008; Ter Huurne et al., 2017). This is particularly pertinent in the case of Spain and CPLP countries, where shared language and cultural heritage may act as informal trade facilitators. Nevertheless, these relations continues underexplored (Pires, 2024; Cardoso, 2023).

Within the Iberian Peninsula, Portugal has historically maintained close ties with African CPLP members. However, Brazil's growing global influence has altered Lusophone trade dynamics (Carvalho, 2018). And joint Spanish-Portuguese strategies have thus been proposed to expand trade across CPLP regions, particularly in Africa and Latin America (Ip & Shen, 2022; Rodrigues et al., 2022; Sande-Veiga, 2019; 2025a; 2025b).

From a methodological point of view, the study of international trade has evolved from classical theories to empirically grounded models with strong predictive capabilities. Among these, the gravity model stands out as one of the most robust and widely applied tools for explaining bilateral trade flows. As Sande-Veiga and Ferreira (2025) explain, based in Tinbergen (1962) and Anderson (1979), the gravity model - which

was inspired by Newton's law of gravity - exposes that trade between two countries is directly proportional to their economic size -typically measured by Gross Domestic Product (GDP)- and inversely proportional to geographical distance and other trade frictions.

From a theoretical standpoint, Deardorff (1995) demonstrated the model's compatibility with neoclassical trade theories, including those featuring heterogeneous factor endowments and homothetic preferences. This theoretical validation enabled the gravity model's application to real-world trade scenarios and policy analysis.

The gravity model has proven particularly useful for analysing regional and sectoral trade. Martínez-Zarzoso (2003) used the model to assess EU-MERCOSUR trade, identifying the positive influence of economic integration. In a similar way, Gallego (2015) integrated insights from New Economic Geography to highlight how spatial factors and borders influence trade patterns within the EU.

More recent refinements have introduced variables such as trade agreements, institutional quality, cultural proximity, and infrastructure, significantly improving explanatory power (Baier, Kerr & Yotov, 2018). Methodologically, the adoption of Poisson pseudo-maximum likelihood (PPML) estimators has addressed issues related to zero trade flows and heteroskedasticity (Dadakas, Ghazvini & Fargher, 2020). Moreover, the model integrates elements from foundational trade theories: Ricardian comparative advantage, which focuses on productivity differentials (Siddiqui, 2018); the Heckscher-Ohlin framework, centred on factor endowments and price equalization (Krugman & Obstfeld, 2001); and theories of economic integration, which assess both static and dynamic effects of regional cooperation (Balassa, 2013; Hosny, 2013). These components converge in the structural formulation of Anderson and van Wincoop (2003), which introduces multilateral resistance terms to account for the broader trade environment beyond bilateral frictions. In sum, the gravity model -enriched by both classical and contemporary trade theory- offers a powerful framework to assess the current and potential structure of Spain's trade relations with CPLP countries. Its integration of quantitative and qualitative variables makes it especially

well suited to identifying structural gaps and guiding strategic trade policy in a rapidly evolving global context.

At the same time, and according to the academic literature, the concept of economic mass -defined by the relative size and systemic importance of an economy- becomes crucial. Kejriwal and Luo (2022) suggest that large economies function as anchors within global value chains. Assessing whether trade flows are proportional to economic mass offers a benchmark for identifying untapped trade potential (Zhang & Wang, 2015).

Thus, studies have emerged using the Gravity Model at sectoral or territorial level or including additional dimensions. Firstly, Da Costa Cunha (2022) applied the gravity framework to Portugal's textile industry, emphasizing the relevance of GDP, EU membership, and distance. Blázquez and Díaz-Mora (2023) combined gravity modelling with network analysis to explore trade in digital services, providing insights into global value chains and partner selection. Secondly, and regarding regional approaches, in the African context -home to several CPLP members- the gravity model has been used to expose the disconnect between formal regional integration and actual trade flows. Sandambi and João (2024) identify persistent structural barriers within SADC and COMESA, reinforcing the need for complementary policies beyond trade agreements. And thirdly, recent extensions of the model incorporate socio-economic dimensions. Douw et al. (2024), for example, argue that diaspora communities reduce transaction costs by fostering trust and institutional familiarity -factors especially relevant to Spain's relations with CPLP countries, which are shaped by shared history and language-.

So, in the current international context, Spain's 2021 entry into the CPLP as an Associate Observer offers a unique and strategic opportunity to strengthen trade with Portuguese-speaking countries. Despite cultural and historical proximity, economic ties -especially in trade- remain limited. Scholars such as Olivé and Gracia (2022) argue that Spain could serve as an additional bridge between Europe and the CPLP, leveraging institutional and linguistic linkages. Others point to complemen-

tarities in infrastructure and innovation ecosystems (González-Pernía & Peña, 2020; Zaninović, 2020).

3. METHODOLOGY

3.1. *Data*

Aligned with previous studies (Sande-Veiga & Ferreira, 2025, Sande-Veiga, 2019; 2025a; 2025b; 2025c), several measures should be implemented to strengthen commercial ties and increase the volume of Spanish exports to CPLP countries. Specifically, the authors identified key aspects: a) consolidating existing markets; b) promoting the introduction of new products and technological services, particularly in high-potential sectors such as energy, aeronautics, shipbuilding, environment, and biotechnology; c) diversifying markets; and d) establishing market-specific initiatives, such as setting up commercial offices, participating in international trade fairs, and engaging chambers of commerce (Pérez & Jiménez, 2023).

To shed light on key aspects and the importance of CPLP countries' dimension on their trade relation with Spain, we use data for the period 2000 to 2021 on the trade relation between 9 countries that belong to the Portuguese-speaking community. Data on per capita GDP (in current US\$), official and real exchange rates, and consumer price index are from the World Bank – World Development Indicators; the distance between Spain and the CPLP countries, border (contiguous) and colonial linkages are from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database; the terms of trade variable was obtained from the United Nations Conference on Trade and Development (UNCTAD) database; and export and import refer to the value of export from Spain to each one of the CPLP countries and import from each one of them, respectively in euros. We also got data from export and import for different levels of intensity of technology which has been used for another study specially focused on innovation policies. These data were obtained from the Spanish Ministry of Indus-

try, Commerce and Tourism and treated with Stata software. For the Gravity Model in Stata, there is generally no single package, but rather fundamental commands.

3.2. Model specification

Although we have present the three main theoretical views of the reasons why countries trade between themselves, it is worth to present the basis for the empirical strategy followed by other authors in recent studies, similar in aims with our, which can help us finding the proper methodologies and variables to be used in this article and to serve as comparison with our results.

Traditionally, the empirics of international trade used the frameworks of Comparative advantage and Heckscher-Ohlin (HO) models, with data incapable of been explained by existing theoretical frameworks. Since the classic theoretical work of Anderson (1979), one of the most used frameworks for studying trade relations between countries has been the gravity equation, which was introduced first by the classical work of Tinbergen (1962) and have been called the “workhorse in international trade” (Yotov et al., 2016). As the name indicates, this methodology is based on Newton's Law of Gravity that elaborate on the relationship between the dimension of the economy, trade values, and distance between trade partners, following previous studies (Bairer, Kerr & Yotov, 2018; Acharya, 2013; Wang, Wei & Liu, 2010). The gravity equation is the analytical expression of a model that explains trade between countries, zones or economic regions. The relevance of this methodology is evident if we consider that it has been widely used in studies in the field of international economics thanks to its good econometric performance. As Lacace (2023) argues, the gravitational equation -similar to what happens in the field of physics with the Law of Universal Gravitation- postulates that trade between two countries is proportional to the distance between them and the size of their respective markets. Thus, trade between two countries results from the conjunction of a group of attraction and repulsion factors. The models estimated more recently in the literature are based in the theoretical foundation presented by Anderson (1979) and extended by Berstrand

(1989, 1990) and Deardorff (1998). The gravity equation can be represented, following Anderson and van Wincoop (2003) specification, by:

$$(1) X_{ij} = \frac{Y_i E_j}{P_i P_j \Pi_{ij} \Phi_{ij}}$$

where Y_i is gross output of exporter i , E_j is the total expenditure on goods in j and P_i and P_j are Multilateral Trade Resistance terms (MTR), capturing equilibrium price levels for the exporting and importing country respectively. Our model specification will follow the theoretical foundation of Gravity equations (Anderson and van Wincoop, 2001) and most of the formulations that have been proposed since, as follows:

$$(2) \ln x_{ij,t} = a + b_1 \ln y_{i,t} + b_2 \ln y_{j,t} + b_3 \ln d_{ij,t} + b_4 \ln b_{ij} + b_5 \ln P_{i,t} + b_6 \ln P_{j,t} + \varepsilon_{ij,t}$$

where a is a constant, denotes export of good and services from country i to country j in period t ; $y_{i,t}$ is the GDP of a country i in a period t ; $y_{j,t}$ is GDP of a country j in a period t ; b_{ij} is a dummy which is one if country i and country j are contiguous and zero otherwise; $P_{i,t}$ is the bilateral distance between country i and j ; $P_{i,t}$ and $P_{j,t}$ are the price level in country i and j in period t .

Although there is no much divergence as to the specification of the gravity model, estimation methodologies vary. Magerman et al. (2016) present us with a comparison between several methodologies which have been used to estimate gravity equation. According to them, these methodologies vary between Ordinary Least Square (OLS) and Least Square Dummy Variable (LSDV) (Colley, 2015; Anderson & van Wincoop, 2003), random effects, and Pseudo Maximum Likelihood Estimators (PMLE) (Santos Silva & Tenreyro, 2006). This last methodology is proposed to solve the zero-trade values. Nijkamp and Ratajczak (2021) uses a vector gradient approach to estimates a gravity model. We will follow the traditional works (Egger & Stau, 2016; Westerlund, & Wilhelmsson, 2011; Keum, 2010) and use panel data methodologies, fixed and random effects to estimates our panel data gravity model of trade, because gravity

models in this sense tend to predict large bilateral trade flows with much smaller error than small trade flows (Egger & Nigai, 2014).

4. ANALYSIS

In this section we have established two sections. The first analyses and characterises the evolution of Spain's foreign trade data with the CPLP countries. In the second, the authors present the statistical information obtained in the analysis carried out.

4.1. Evolution of the trade relationship between Spain and the CPLP Countries

A consistent study that aims to assess the situation and potential of foreign trade between Spain and the CPLP countries requires a prior effort to contextualise and review the evolution of Spanish exports and imports to the CPLP countries within the selected time frame, for the case 2000-2022. For this reason, in this section we will present data on three key variables: the distance in kilometres from Spain, the evolution of the GDP of the CPLP countries, and the evolution of Spanish exports to CPLP destinations together with imports from these countries.

Firstly, the only CPLP country bordering Spain is Portugal. Most African countries would be located in the following distance range (approximately 3,500-5,500 kms), while Brazil (+7,700), Mozambique (+8,200) and Timor Leste (almost 14,000) would present greater difficulties in establishing economic relations according to this variable (Table 1).

In relation to the evolution of the GDP of the CPLP countries, a positive evolution of GDP can be observed in general, with some moments in which the values fall back: in 2009 and 2015-2016, mainly as a consequence of the financial crisis, and during 2020-2021, as a result of the global economic stagnation that occurred during the Covid-19 pandemic (Figures 1 and 2).

TABLE 1
**DISTANCE BETWEEN CAPITALS OF SPAIN AND CPLP
COUNTRIES (KILOMETRES)**

ORIGIN	DESTINY	DISTANCE
Spain	Angola	5.752
	Brazil	7.744
	Cabo Verde	3.425
	Guinea-Bissau	3.386
	Equatorial Guinea	4.270
	Mozambique	8.288
	Portugal	501
	São Tome and Príncipe	4.599
	Timor Leste	13.911

Source: Own elaboration based on data from CEPII

The latest available data show that Portugal ranks first among the CPLP countries in terms of export destination, with nearly 10% of total Spanish exports, with almost 35 billion euros. Brazil follows at a significant distance with nearly 3.7 billion euros, more than ten times less than the previous country, despite the size of its market. This fact, together with the size of the Brazilian market, would allow us to show the potential of this market for Spain, although geographical distance, and not so much cultural distance, seems to be an obstacle at present, despite the proliferation of electronic commerce. Apart from Portugal and Brazil, exports to other CPLP countries are also noteworthy, with three of the most important in Africa according to the volume of exports in 2027: Equatorial Guinea (€167 million), Cape Verde (with almost €120 million) and Angola (which falls to €114 million). The third group includes the countries with which Spain maintains the most commercial relations, and which are experiencing greater economic difficulties and/or are physically further away. This is the case of Mozambique (around €50 million), Guinea-Bissau (about €11 million), São Tomé and Príncipe (€2.10 million) and East Timor (approximately €0.13 million). The effects

of the pandemic are visible as a drop in the figures, especially in the years 2020 and 2021, breaking the continuity of the series in some cases.

FIGURE 1
**EVOLUTION OF NOMINAL GDP IN CPLP COUNTRIES (USD),
2000-2022 (INDEX 2000=100, LOG10(X))**

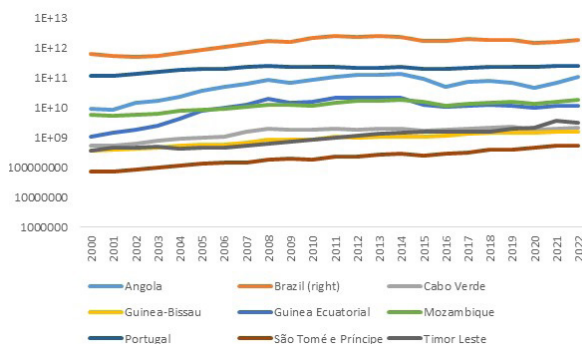
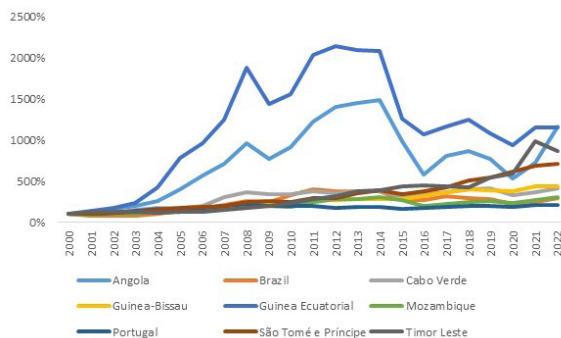


FIGURE 2
**EVOLUTION OF NOMINAL GDP IN CPLP COUNTRIES (USD),
2000-2022 (INDEX 2000=100)**

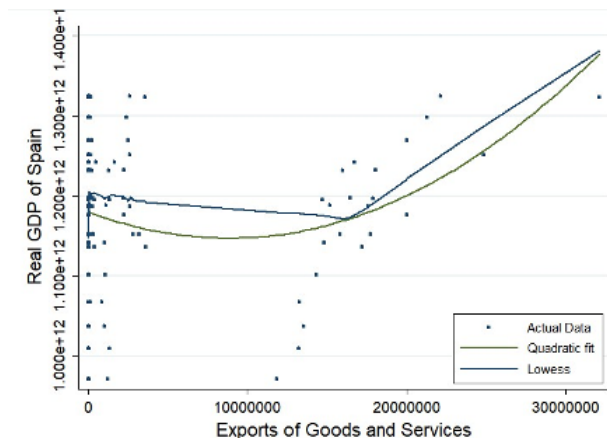


Source: Own elaboration based on World Bank data

The import figures from the CPLP countries to Spain as a whole are lower than those of exports. The positive trade balance is mainly explained by the difference between exports to and imports from Portugal, where the latter are close to €17 billion, according to data from the Spanish Chambers of Commerce. For the rest of the main destinations (Brazil, Angola, Equatorial Guinea and Mozambique among them) the balance is negative, except for Cape Verde, São Tomé e Príncipe and Guinea-Bissau, although the results reach minimum values in the last two cases (Appendix- Figures A-1 to A-9).

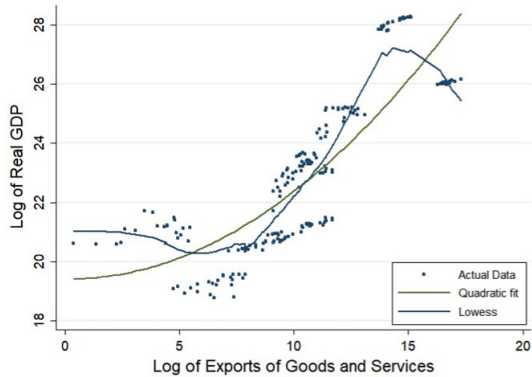
Before estimating, we used scatter diagrams between the logarithm of Spain's exports to the CPLP countries and the logarithm of these countries' GDP, and between the logarithm of exports and Spain's distance from the CPLP countries. We then present these two scatter diagrams, showing a positive correlation between the log of exports and the log of the GDP of the CPLP countries and a negative correlation between the same log of exports and the distance between Spain and the CPLP countries (Figures 3 to 5).

FIGURE 3
**SCATTER OF REAL GDP OF SPAIN AND EXPORTS
OF GOODS AND SERVICES**



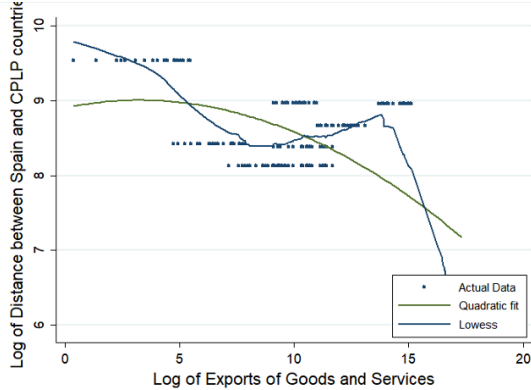
Source: Own elaboration using Stata software

FIGURE 4
**SCATTER OF PLOT OF THE LOGARITHM OF REAL GDP AND
THE LOGARITHM OF EXPORTS OF GOODS AND SERVICES OF
SPAIN**



Source: Own elaboration using Stata software

FIGURE 5
**SCATTER PLOT OF THE LOGARITHM OF DISTANCE BETWEEN
SPAIN AND THE CPLP COUNTRIES AND THE LOGARITHM OF
EXPORTS OF GOODS AND SERVICES**



Source: Own elaboration using Stata software

4.2. Statistical Analysis

We start our analysis by employing Pooled Ordinary Least Squares (OLS) estimation of the panel gravity specification presented earlier to explore the determinants of trade flow to Spain from CPLP countries. We do not show this result, as we estimate our model using Random Effect (RE) estimator and by applying the Breusch and Pagan test we see that random effect is present. We also use the Hausman test to compare between Fixed Effects (FE) and RE models, which is in favour of FE model. The only issue here is that the FE model drop variables which does not varies across time or individuals, leading us to not be able to interpret variables such as distance and colonial ties. Because of this we use the RE model, although the problem of inconsistency.

As presented in column 1 of Table 2, the estimation results of our models are overall as expected and statistically significant, except for GDP of the exporter country, Spain, which has a contrary sign. The R^2 of 0.92, give us a very good fit of our specification. The estimate of expenditure of the importer countries, GDP of CPLP countries, is positive and statistically significant and close to one. By the other hand, the covariate of exporter GDP is negative and statistically significant. This result goes against the results predicted in the structural gravity model. The estimate of log of distance is negative, as expected, and statistically significant, but far from the conventional benchmark value of -1 (Disdier and Head, 2008), which show that the main factor against trade between Spain and the CPLP countries is the distance between them. In our sample, only Portugal shares a frontier with Spain, and as we showed before, trade between Portugal and Spain is much higher than trade between Spain and the other lusophone countries, we did not include the variable contiguous and instead include the variable colony ties. We follow the recommendation of Anderson and van Wincoop (2003) and we add a term of multilateral resistance only for the importers. Robustness test with change in explanatory variable GDP per capita and correlation among variables have also been checked, confirming results (Appendix, Tables A-1 and A-2).

TABLE 2
**RESULTS OF THE GRAVITY MODEL FOR SPAIN
 AND CPLP COUNTRIES, 2000-2022**

VARIABLES	(1) Random Effects (RE)	(2) Fixed Effects	(3) RE 2000-2008	(4) RE Africa
Log of Nominal GDP, partners	0.680*** (0.233)	0.534** (0.229)	0.487 (0.333)	0.807*** (0.286)
Log of Nominal GDP, Spain	-1.190*** (0.385)	-1.313*** (0.392)	-1.483*** (0.463)	-2.056*** (0.491)
Log of Distance from Spain, weighted	-2.691*** (0.328)		-2.321*** (0.408)	-1.800*** (0.411)
Country ex colony	0.886* (0.518)		0.709 (0.521)	-0.931*** (0.219)
Log of Total Population	0.561*** (0.167)	0.203 (0.470)	0.481*** (0.184)	-0.226** (0.0948)
Log of Total Population, Spain	6.749** (3.004)	9.831*** (3.719)	10.69** (4.993)	11.06*** (3.848)
Log of Remotness of the Importer Countries	0.104 (0.224)	0.0748 (0.215)	-0.161 (0.325)	-0.475* (0.285)
Constant	-78.49* (42.34)	-142.7*** (48.78)	-133.6* (71.18)	-120.3** (54.16)
Observations	204	204	177	137
R-squared		0.463		
Number of id	9	9	9	6

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Own elaboration with Stata software

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

Once the main aspects of Spanish relations are analyzed with CPLP countries, and considering the formulated goals and the results obtained, the findings are presented in two sections. The first includes the results and implications of this research. The second section contains the policy recommendations derived from this research.

5.1. Implications

The analysis of economic relations between Spain and CPLP countries reveals a distinct pattern between Portugal and the rest of the Lusophone community. While geographical and cultural proximity fosters strong ties with Portugal, trade relations with key economies such as Brazil, Angola, and Mozambique remain underdeveloped. This disparity underscores the necessity for targeted strategies to strengthen economic links between Spain and CPLP countries, particularly in strategic sectors and high-potential markets.

To address these challenges, we propose economic policy recommendations. These measures, if designed and implemented in an integrated manner, can help overcome barriers currently limiting economic relations between Spain and CPLP countries. Enhancing connectivity, diversifying markets, and promoting strategic sectors and innovation could position Spain as a key partner within this community, fostering sustainable and mutually beneficial economic growth.

5.2. Policy Recommendations

Beyond strategies recommended in the previous literature (section 3.1), additional initiatives should be considered to strengthen Spain's role in CPLP markets. Investments in infrastructure, such as improving maritime and air connectivity with key CPLP countries, would reduce logistical costs and enhance trade efficiency. Trade diplomacy should be reinforced through permanent trade delegations and bilateral agreements that minimize non-tariff barriers and harmonize regulatory frameworks. Academic and cultural networks can facilitate knowledge

transfer and business collaboration, particularly in sectors where Spain has a comparative advantage, such as renewable energy, agribusiness, and digital services. Encouraging the digitalization of small and medium-sized enterprises (SMEs) will enhance their capacity to compete in CPLP markets, while the development of financial instruments, such as dedicated credit lines and fiscal incentives, can mitigate investment risks for Spanish companies expanding into these markets.

By implementing these integrated measures, Spain can effectively overcome trade barriers, diversify export destinations, and solidify its position as a strategic economic partner within the CPLP. In doing so, it will foster long-term, sustainable, and mutually beneficial economic growth for both Spain and Lusophone countries.

Abbreviations

CEPII- Centre d'Etudes Prospectives et d'Informations Internationales

CPLP- Community of Portuguese Speaking Countries

EU- European Union

FE- Fixed Effects

GDP- Gross Domestic Product

HO- Heckscher-Ohlin

LSDV- Least Square Dummy Variable

MTR- Multilateral Trade Resistance

OLS- Ordinary Least Square

PALOP- African Countries with Portuguese as an Official Language

PMLE- Pseudo Maximum Likelihood Estimators

PPML- Poisson Pseudo Maximum Likelihood

RE- Random Effects

UNCTAD- United Nations Conference on Trade and Development

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APPENDIX

FIGURE A-1: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO ANGOLA, 2000-2022 (THOUSAND €)

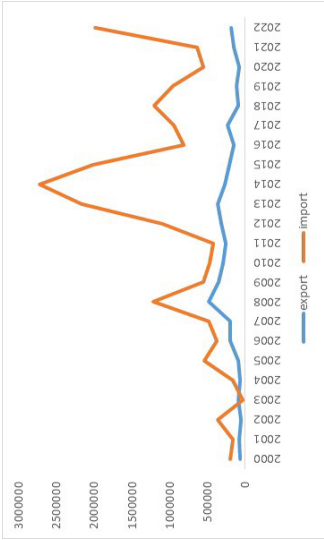


FIGURE A-2: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO BRAZIL, 2000-2022 (THOUSAND €)

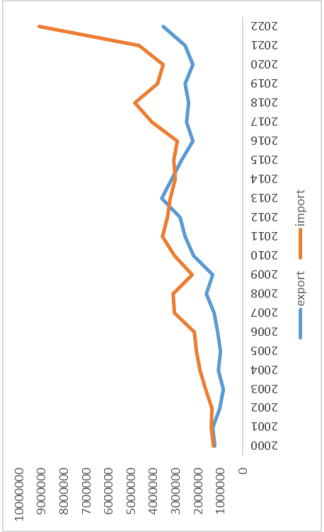


FIGURE A-3: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO CABO VERDE, 2000-2022 (THOUSAND €)

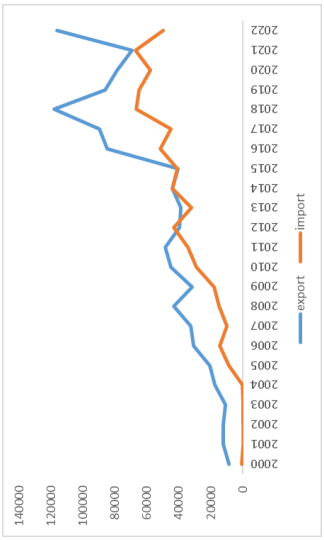


FIGURE A-4: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO GUINEA ECUATORIAL, 2000-2022 (THOUSAND €)

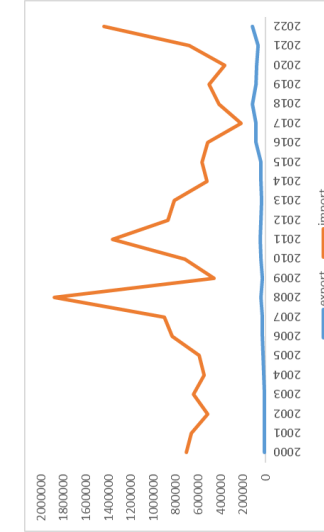


FIGURE A-5: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO GUINEA-BISSAU, 2000-2022 (THOUSAND €)

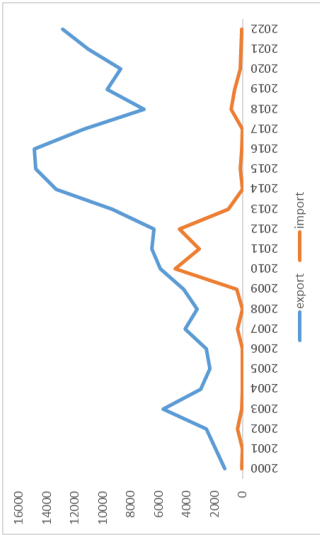


FIGURE A-6: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO MOZAMBIQUE, 2000-2022 (THOUSAND €)

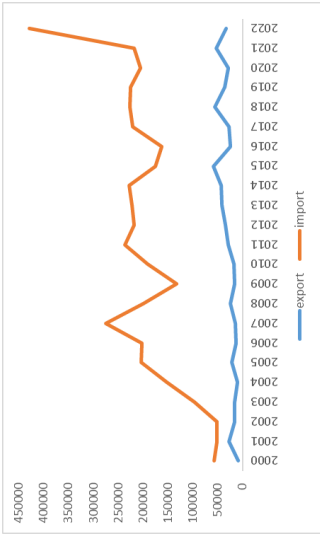


FIGURE A-7: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO PORTUGAL, 2000-2022 (THOUSAND €)

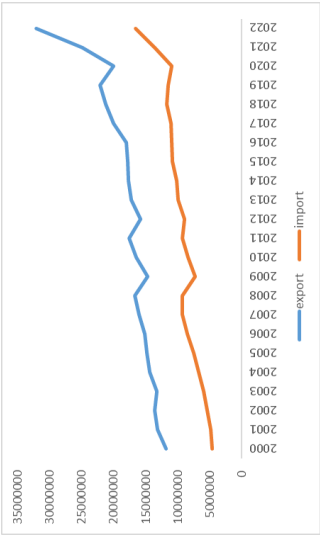


FIGURE A-8: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO SAO TOMÉ, 2000-2022 (THOUSAND €)

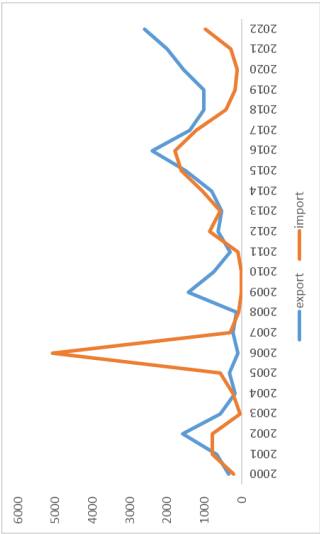
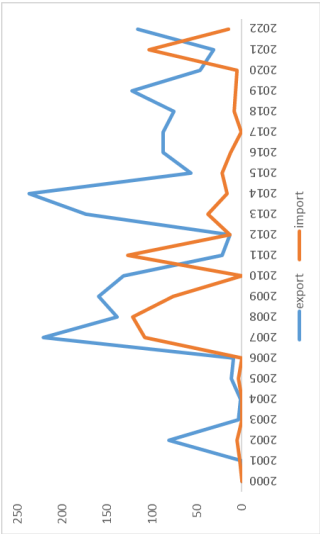


FIGURE A-9: EVOLUTION OF SPANISH EXPORTS-IMPORTS TO TIMOR LESTE, 2000-2022 (THOUSAND €)



Source: Own elaboration based on data from the Spanish Ministry of Industry, Commerce and Tourism

TABLE A-1: ROBUSTNESS TEST WITH CHANGE IN EXPLANATORY VARIABLE GDP PER CAPITA

	(1)	(2)	(3)	(4)	(5)	(6)
	Robust	Random Effects	Fixed Effects	Cluster	2000-2008	Africa
	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services
VARIABLES	total Euros	total Euros	total Euros	total Euros	total Euros	total Euros
Log of Gross Domestic Product, constant US\$	0.551* (0.325)	0.551*** (0.176)	0.398 (0.439)	0.551* (0.325)	0.761*** (0.232)	1.129*** (0.0806)
Log of Gross Domestic Product, constant US\$(Spain)	-0.0307 (1.010)	-0.0307 (1.101)	-0.0430 (0.971)	-0.0307 (1.010)	0.331 (1.097)	0.901 (1.639)
Log of Distance from Spain, weighted	-2.662*** (0.622)	-2.662*** (0.266)		-2.662*** (0.622)	-3.961*** (0.674)	-2.527*** (0.371)
Country ex colony	0.968 (0.980)	0.968 (0.638)		0.968 (0.980)		
Log of Total Population	0.610 (0.494)	0.610*** (0.230)	0.822 (1.113)	0.610 (0.494)	0.485 (0.297)	-0.0281 (0.0946)
Log of Total Population, Spain	5.161*** (0.760)	5.161*** (1.812)	5.433** (2.011)	5.161*** (0.760)	8.932*** (2.482)	5.928 (3.687)
Log of Distance from Spain, weighted = 0,			-			

	(1)	(2)	(3)	(4)	(5)	(6)
	Robust	Random Effects	Fixed Effects	Cluster	2000-2008	Africa
	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services	Log of Exports of Good and Services
VARIABLES	total Euros	total Euros	total Euros	total Euros	total Euros	total Euros
Country ex colony = 0,			-			
Dummy set to 1 if the countries are contiguous					-4.483*** (1.707)	
Log of Terms of Trade, base year 2015					0.384 (0.320)	-0.916** (0.381)
Log of Real Exchange Rate, Spain					-1.625 (1.734)	-1.483 (2.788)
Constant	-79.41*** (25.16)	-79.41*** (17.10)	-105.8** (35.50)	-79.41*** (25.16)	-141.8*** (48.47)	-111.9 (71.14)
Observations	204	204	204	204	135	108
Number of id	9	9	9	9	9	6
R-squared			0.412			

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Source: Own elaboration with Stata software

TABLE A-2: CORRELATION AMONG VARIABLES ANALYSED

Correlation table						
	Log of Exports of Good and Services, total Euros	Log of Nominal GDP, partners	Log of Nominal GDP, Spain	Log of Distance from Spain, weighted	Country ex colony	Log of Total Population Spain
Log of Exports of Good and Services, total Euros	1.00					
Log of Nominal GDP, partners	0.84	1.00				
Log of Nominal GDP, Spain	0.05	0.15	1.00			
Log of Distance from Spain, weighted	-0.60	-0.20	-0.00	1.00		
Country ex colony	0.01	-0.00	-0.00	-0.01	1.00	
Log of Total Population	0.65	0.89	0.05	0.08	-0.21	1.00
Log of Total Population, Spain	0.09	0.17	0.91	-0.00	-0.00	1.00

Source: Own elaboration with Stata software

EDITORIAL INFORMATION

Author Contributions

An authorship contributions statement following the CRediT taxonomy can be included here. More information: <https://credit.niso.org>

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Data Availability Statement

The datasets generated and/or analyzed during the present study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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