JTSR (2022) 29(2): 79-90
DOI 10.14665/1614-4007-29-2-005

PAPER

A Panel Data Analysis of Albania's Trade: The Gravity Model Approach

Flora Merko[*] • Llambi Prendi[**] • Fatmir Memaj[***]

Abstract International trade allows countries to expand markets for goods and services that otherwise may not have been available. These trade benefits have encouraged countries to strengthen trade ties and seek new trade opportunities, Adam Hayes (2022). This paper aims to investigate the role of distance and economic mass in gravity regressions. It also estimates a non-linear gravity model for 24 main European trade partners with Albania from 2008 to 2020. This paper uses a data set of 312 observations for each of the three variables (a total of 936), organized in panel data obtained from the World Bank during the mentioned period. Three research questions are designed to achieve the goal related to economic mass and distance's role in international trade, estimated elasticity coefficients, and the methods to evaluate the gravity model. The main findings explain that the Gravity Model successfully explains Albania's bilateral trade, and the estimated elasticity coefficients can explain the extent of the trade response to the change of the variable in percentage. This information may be helpful for policymakers to improve the trade balance and to orient the economy toward sustainable development.

Keywords: International Trade, Gravity Model, Distance, Economic Mass**,** Coefficient of Elasticity.

Jel Classification: F10, F14, A10, B27, C10

Introduction

Trade has brought enormous benefits to states and civilizations. In the economics literature, there is a consensus that international trade positively impacts economic growth. It has influenced the increase of productivity and the dissemination of

Flora Merko[*](✉), Llambi Prendi[**], Fatmir Memaj[***]
[*] Assoc. Prof., Aleksander Moisiu University, Faculty of Business, Department of Economics, Durrës, Albania
E-mail: floramerko@uamd.edu.al
[**] Ph.D., Aleksander Moisiu University, Faculty of Business, Department of Economics, Durrës, Albania
E-mail: llambiprendi@uamd.edu.al
[***] Prof., University of Tirana, Economic Faculty, Tirana, Albania
E-mail: fmema@yahoo.com

knowledge and technologies and has enriched the possibilities of consumer choices. These trade benefits have encouraged countries to strengthen trade ties and seek new trade opportunities (Adam Haye, 2022).

The neoliberal policies applied in the 1990s make Albania a country "dependent" on imports (Merko et al., 2019). The values of the trade deficit have different figures during the studied period. The table below shows that in the years 2008-2016, there are fluctuations, sometimes increasing and sometimes decreasing in the trade deficit. From 2017-2020, the values deteriorated, with the highest value in 2020 because of the difficulties created by the Covid-19 situation. What is noticeable for 2020 is that both exports and imports have decreased, but the decrease in exports (1.44 billion USD) is more significant than the decrease in imports (1.29 billion USD), and the weight of exports in GDP has decreased by 11.3% compared to the previous year. The same problem for the negative deficit is also analyzing products. According to Merko et al., 2019, referring to the Trade Map data, it can be easily evident that Albania's trade balance is negative in most of the products for 98 product groups, of which the authors have only selected the 11 most important ones.

Table 1. Some indicators of the trade performance of Albania

Years	EX. C. bln $	IM. C. bln $	GDP C. bln $	Trade Balance bln $	Trade Volume bln $	EX/IM	(IM+EX)/ GDP	EX/ GDP
2008	3.76	7.15	12.88	-3.39	10.91	53%	84.7%	29.2%
2009	3.44	6.60	12.04	-3.16	10.04	52%	83.4%	28.6%
2010	3.70	6.28	11.93	-2.58	9.98	59%	83.7%	31.0%
2011	4.08	7.01	12.89	-2.93	11.09	58%	86.0%	31.7%
2012	3.80	6.19	12.32	-2.39	9.99	61%	81.1%	30.8%
2013	4.07	6.16	12.78	-2.09	10.23	66%	80.0%	31.8%
2014	4.18	6.56	13.23	-2.38	10.74	64%	81.2%	31.6%
2015	3.52	5.35	11.39	-1.83	8.87	66%	77.9%	30.9%
2016	3.89	5.70	11.86	-1.81	9.59	68%	80.9%	32.8%
2017	4.61	6.55	13.02	-1.94	11.16	70%	85.7%	35.4%
2018	5.25	7.33	15.16	-2.08	12.58	72%	83.0%	34.6%
2019	5.29	7.60	14.40	-2.31	12.89	70%	89.5%	36.7%
2020	3.85	6.31	15.13	-2.46	10.16	61%	67.2%	25.4%

Source: World Bank &Traiding Economics 2020, and authors` calculations

To complement the computable general equilibrium model (CGE), one of the most common quantitative analyzes to study trade is the Gravity Model of International

Trade (Piermartini 2005). The gravity model of international trade states that the volume of trade between two countries is proportional to their economic mass and a measure of their relative trade frictions. Prendi & Velaj (2014), in their paper, show how to calculate the economic mass. This indicator is used in modeling international trade, such as gravity models, where the mass is of great importance in these models.

Helpman (2011), argued that trade theory involved three essential stages of development: The first phase of classical or neoclassical trade theory explained foreign trade from the nineteenth and twentieth centuries. The second phase began in the early 1980s and was dominated by the so-called new theory of trade. The third phase started in early 2000 and was focused on current research, dominated by the "new" theory of trade.

In addition to these theoretical developments, the gravity equation for trade has incorporated some new specifications for more sophisticated theoretical equations.

Linder (1961) and Linnemann (1966) are known as the founders of the creators of gravity models for commerce. Like the original theory of gravity, also the gravity models for trade express bilateral trade flows between two countries as a function of two main variables: Positively correlated (in direct/indirect proportion) with economic mass (size/size of the economy) of two countries trading between them and negatively related (in inverse proportion) to the distance between the capitals (economic capital) of these two countries. Recent studies added four more variables to the gravity model: language, common border, part of the same political-administrative territory, and the possibility of stimulating trade flows between a state that becomes part of a free trade area. (Cheng and Wall 2004).

As per above, this research aims to assess the Gravity Model, explain the country's trade flows, and conclude the quantitative effect that the selected independent variables have. Related to the purpose of the paper, we raised three scientific research questions, which will ask answers to the fact if economic mass and distance play a role in international trade; if yes, which are the estimated coefficients of elasticity; and finally, if some methods can be used to evaluate the gravity model.

The Gravity Model as an instrument used in estimating trade flows, is seen as the most appropriate model to answer these questions. In our paper, we will use this model to explain Albania's trade flows toward Europe's leading partners.

2. Literature Review

Before World War II, when economic theories were able to explain parts of international trade, using the 2x2x2 trade model based on the theory of comparative advantage, which is an improvement on the theory of absolute advantages, another theory was born (Bergstrand & Egger, 2010).

This theory was born to explain bilateral trade between countries statistically. Researchers note that bilateral trade relations between each country "i" and "j" can be explained by economic size and distance between countries. Specifically, this theory

raises two hypotheses: Is bilateral trade affected by economic measures? Is bilateral trade influenced by geographical factors, in our case, by distance?

According to these hypotheses, the shorter the distance between two countries, the greater the economic mass of each country (or both), the greater the "gravitational attraction" between the countries. Countries should choose by themselves the degree of optimal trade openness in order to take advantage of foreign trade without harming or exposing their economy more than it needs to turn to import-dependent (WIDER, 1991).

The origin of the Gravity Model dates back to the mid-1950s when Isard and Peck (1954) analyzed the correlation effects of distance, trade, and inequalities in bilateral trade.

The Tinbergen model of gravity was based on the Newtonian approximation of the interpretation of bilateral trade flows. However, there was the problem of a lack of theoretical basis for a long time.

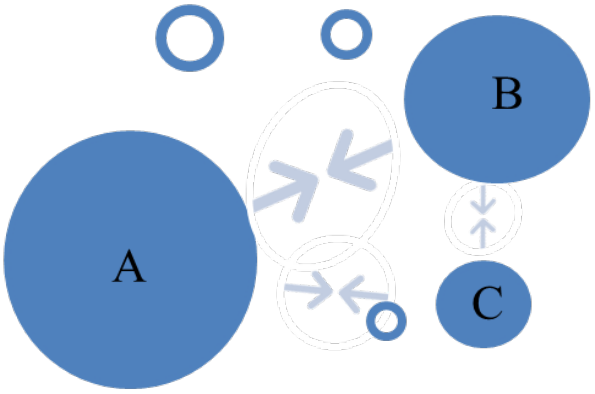

Figure 1. Illustration of the Gravity Model
Source: Authors

The first completed theoretical basis was realized by Anderson in 1979, who justified the equation of the Gravity Model with the theory of differentiated goods. Anderson provided the first serious micro-foundations of the gravity equation in his work, based on Armington's preferences. However, in his studies, he assumed that every country specializes in producing one good, which was not realistic.

Anderson and Van Wincoop (2001) argue that relative trade costs and the resistance of multilateral trade determine bilateral trade. Bergstrand (1985, 1989) continued to develop the theoretical derivation of gravity models based on the monopolistic competition model.

Helpman and Krugman (1985, 1990) derived the gravity equation based on economies of scale, and Deardorff (1998) proved its coherence with common trading theories and the help of approximation factor based on the Heckscher – Ohlin model.

The Heckscher-Ohlin (H-O) model relates bilateral trade flows between two countries to differentials in their factor endowments and continues to be one of the workhorse models of international trade.

Anderson (1979), developed a theory based on the gravity model. According to him, no matter the prices, a country will consume some of the goods and services of other countries, which means that we have bilateral trade with every country in the world. All goods would be traded, all countries trade, and in equilibrium, national income is calculated as the sum of aggregate domestic and foreign demand for each unique product that countries produce.

Therefore, this theory suggests that big countries import and export more than smaller ones. Anderson motivated Bergstrand (1985) to develop this theory, including price indices. Bergstrand found that price indices would affect bilateral trade; he assumed that domestic producers operated in the market structure of the monopolistic competition, and thus we would have product differentiation, not only between countries but also between firms.

A vital contribution to the development of this model was mentioned in a paper written by Anderson and Wincoop (2004), where they highlight the importance of relative trade costs. Interesting results come from their work, such as first the introduction of a new index like MRS (marginal rate of substitution), which helps explain imports and exports, and second, to measure the overall equilibrium better, it is required to calculate MRS for each country or region before and after it changes.

An important issue is that bilateral trade is not symmetrical (Anderson & Wincoop, 2004). In the recent work of Helpman (2008), we obtain biased evaluators in the empirical results by not considering countries that do not trade with others. A new theory has been developed to correct this problem, that predicts positive trade between countries. Trade will be zero between countries "*i*" and "*j*", only and only if the productivity of all firms in the country "*i*" is below the threshold that would make it profitable if it would export with country "*j*".

Chaney (2009) further explored the role of the coefficient of elasticity in the gravity model with heterogeneous firms. According to him, the coefficient of elasticity reduces the impact of foreign trade at the cost of a trade. This conclusion contradicts the model of given gravity by Anderson and Wincoop (2001).

Since 1962 the model of gravity has evolved. This means that along with the basic variables are used other factors such as transport costs, tariffs and non-tariff barriers, regional integration agreements, time delays at export/import and trade facilitations, common language, colonial relationship, common currency, island, landlocked institutions, infrastructure, migration flows, and so forth.

2. Material and Method

In order to achieve the goal, the material uses the Gravity Model approach, which

nowadays is one of the empirical models used in evaluating international trade. The model of gravity for trade is analogous to Newton's law of gravity in mechanics: the force of gravity between two physical objects is proportional to the weight of each of the objects divided by the square of the distance between the centers of gravity in meters.

This material uses a data set of 312 observations for each of three variables (a total of 936), for a period of 13 years organized in panel data, (from 2008 to 2020). Data are obtained from World Bank. We will use panel data because some relevant variables, such as GDP, vary over time, and some do not, such as Distance. Consequently, our estimation methods consider the variance, which would be impossible in the case of using cross-section data.

Referring to the theoretical model mentioned, the variables used in this study are shown in table 2.

Table 2. Variables used

Variable	Transformed variable	Compose
Total Trade	ln_{trade}	$ln(export+import)$
Economic Mass	$GDP_{distance}$	$ln((max(GDP^{partner}_{Albania}) - (min(GDP^{partner}_{Albania}))$
Distance	$Remote$	$ln(distance * GDP_{partner}/GDP_{world})$

Source: Authors` calculations

This material uses the Gravity Model of Frankel et al. (1997), which allows the inclusion of dynamics to explain trade flows.

$$Xij = G\frac{YiYj}{Dij^2}$$

Where, Xij represents the variable to be explained, the real bilateral trade flows between countries "i" and "j" in year "t" ($i, j = 1, N, i \neq j, t = 1, T$).

While the explanatory variables are as follows: "Yi" is the economic mass of country "I", "Yj" is the economic mass of country "j", and "Dij" represents the distance in kilometers between economic centers.

The methods used in this analysis are Panel EGLS (Cross-section random effects), Panel EGLS (Cross-section fixed effects), and Panel Least Squares.

As we have explained above, as well as based on the theory of Bergstrand and Egger, (2010), in the findings of this paper, we will answer the two raised hypotheses:

H1: Bilateral trade is affected by economic measures.

H2: Bilateral trade is influenced by geographical factors, in our case by distance.

3. Analysis and Findings

The main purpose of this chapter is to evaluate the Gravity Model for bilateral trade so that the market potential can then be assessed by giving suggestions for trade direction. We checked our variables for linearity in parameters, multicollinearity, heteroskedasticity, serial correlation, and stationarity to have reliable results.

Elasticity coefficients indicate the extent of the trade response to the change in the percentage variable. We have used three methods to look at the estimated elasticity coefficients as well as to evaluate the parameters of the Gravity Model with three different methods.

The tables below show that each method has its advantages and disadvantages, but what stands out is that these methods give almost the same results. The sign of elasticity determines the relationship between Trade, GDP, and Distance. If the elasticity is positive, the increase in the GDP and Distance leads to an increase in Trade and vice versa.

Let us look at the coefficients of elasticity for all three methods.

Panel EGLS (Cross-section random effects)

The Distance and Economic mass in this model are consistent with the theory of the gravity model. An increase in Distance by 1% would be accompanied by a decrease in trade by 1.082463%. While in terms of Economic mass, the correlation is positive but with a coefficient of elasticity of 1.786466.

Table 3. Gravity Model results with the first method.

Method	**Advantages**	**Disadvantages**
Panel EGLS (Cross-section random effects)	It deals with the zero trade flows problem	The variance-covariance matrix should be estimated first
Variable	**Coefficient**	**Prob.**
GDP_DISTANCE	1.786466	0
REMOTE	-1.082463	0
C	-41.26828	0
R-squared	0.283502	
F-statistic	61.13202	
Prob(F-statistic)	0	

Source: Authors` calculation

Panel EGLS (Cross-section fixed effects)

The Distance and Economic mass in this model are also consistent with the theory of the gravity model. An increase in distance by 1% would be accompanied by a decrease in trade by 0.663448%. While in terms of Economic mass the correlation is positive but with a coefficient of elasticity of 1.886314.

Table 4. Gravity Model results with the second method.

Method		Advantages	Disadvantages
Panel EGLS (Cross-section fixed effects)		It controls for unobserved heterogeneity	Loss of information
Variable		**Coefficient**	**Prob.**
GDP_DISTANCE		1.886314	0
REMOTE		-0.663448	0
C		-44.27372	0
R-squared	0.954097		
F-statistic	237.7824		
Prob(F-statistic)	0		

Source: Authors` calculation

Panel Least Squares

Distance and economic mass in this model are consistent with the gravity model's theory. An increase in distance by 1% would be accompanied by a decrease in trade by 1.248146%. While in terms of GDP the correlation is positive but with a coefficient of elasticity of 1.924984.

Table 5. Gravity Model results with the third method.

Method		Advantages	Disadvantages
Panel Least Squares		Simple	Loss of information
Variable		**Coefficient**	**Prob.**
GDP_DISTANCE		1.924984	0
REMOTE		-1.248146	0
C		-44.74522	0
R-squared	0.422609		
F-statistic	113.083		
Prob(F-statistic)	0		

Source: Authors`calculation

The three Gravity Model`results verify the two raised hypotheses, showing that bilateral trade is influenced by both economic mass and distance, having a direct relationship with economic mass, and an indirect relationship with distance.

The tables above also provide detailed information on the importance of variables in trade. Note that the P-values reported for the variables Distance and Economic mass coefficient imply that they are less than 0.05, which is statistically significant.

In this case, the estimates imply the following trade log-log functions:

Cross-section random effects :

$$Ln\ (trade) = -41 - Ln\ (Distance) + 1.8\ Ln\ (Economic\ mass)$$

Cross-section fixed effects:

$$Ln\ (trade) = -44 - 0.6\ Ln\ (Distance) + 1.9\ Ln\ (Economic\ mass)$$

Panel Least Squares:

$$Ln\ (trade) = -45 - 1.2\ Ln\ (Distance) + 1.9\ Ln\ (Economic\ mass)$$

Conclusions

Albania is a country dependent on imports of products and services. Albania's trade balance is negative in all years studied. So, the increase in trade opening after `90 is accompanied by the rapid growth of imports and the lighter growth of exports.

Empirical results show that the Gravity Model successfully explains Albania's bilateral trade. This is clear because the coefficients of the standard gravity variables are significant and consistent with the theory. Specifically, total trade has a negative relationship with distance, i.e., the distance variable (transport costs) negatively impacts trade flows. However, shortening the physical distance (construction of roads, highways, ports, railways, etc.) is not the only way to reduce transportation costs (although it is pretty important). Governments can also reduce transport costs through deeper integration and the creation of similar documentation requirements, the avoidance of dual/triple border controls, and the design of similar standards requirements in the regional and European markets.

At the same time, in addition to distance, as one of the traditional factors of the gravity model, economic measures (GDPij) also contribute to the stability of the basic model. From the modeling of trade flows, the results show that in conditions where other factors are kept unchanged, the mass of GDP growth of Albania and the partner countries leads to the growth of total trade.

The influence of traditional variables such as GDP and distance are fundamental for all three models applied in the paper (LS, FE, and RE). What distinguishes them from each other is the coefficient of elasticity.

It would be interesting to study trade flows between Albania and partner countries, considering specific sectors. The limitation of the model evaluated in this paper is that it considers all products and sectors equally contributors to trade so that other variables could be included.

References

Abbas, S. (2016). *Remittances Flow to Pakistan: A Gravity Approach.* Journal Transition Studies Review, 23(1), 97-106. https://doi.org/10.14665/1614-4007-23-1-007.

Anderson, J. E. and E. van Wincoop. (2003). *Gravity with Gravitas: A Solution to the Border Puzzle.* American Economic Review 93: pp.170–92.

Anderson, J. E. (1979). *A Theoretical Foundation for the Gravity Equation*. American Economic Review, March, pp.106-116.

Anderson, J. E. and E. van Wincoop. (2004). *Trade Costs.* Journal of Economic Literature 42(3): pp.691–751.

Baier, S. L. and J. H. Bergstrand. (2001). *The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity*. Journal of International Economics 53: pp.1–27.

Baier, S. L. and J. H. Bergstrand. (2009). *Bonus Vetus OLS: A Simple Method for Approximating International Trade-Costs Effects Using the Gravity Equation*. Journal of InternationalEconomics 77: pp.77–85.

Balassa, B. (1978). *Export incentives and export performance in developing countries: A comparative analysis.* Review of World Economics, 114(1), pp. 24-61.

Bergeijk, P. A. G. van. (1992). *Diplomatic Barriers to Trade.* De Economist 140 (1): pp.44–63.

Bergeijk, P. A. G. van. (2009). *Economic Diplomacy and the Geography of International Trade*. Cheltenham, UK: Edward Elgar.

Bergeijk, P. A. G. van. & S. Brakman. (1984). *The Gravity Model in international trade: advances and applications*. New York: Cambridge University Press.

Bergstrand, J. H. (1985). *The Gravity Equation in International Trade: some Microeconomic Foundations and Empirical Evidence*. Review of Economics and Statistics, 67, August, pp.474-481.

Bergstrand, J. H. 1989. *The Generalised Gravity Equation Monopolistic Competition, and the Factor-Proportions Theory in International Trade*. Review of Economics and Statistics (71), February, pp.143-153.

Bergstrand, J.H. & Egger, P. (2010) A general equilibrium theory for estimating gravity equations of bilateral FDI, final goods trade, and intermediate trade flows. In Van Bergeijk, P.A.G. & Brakman, S. (Eds.), *The Gravity Model in International Trade (*pp. 29–70). Cambridge University Press.

Bussiere et al., (2005). *Trade Integration of Central and Eastern European Countries: Lessons from a Gravity Model.* European Central Bank, pp. 18.

Candau, F., and Dienesh, E. (2011). *A Survey on the Micro-Foundations of the Trade Gravity Equation.* Available at SSRN: http://dx.doi.org/10.2139/ssrn.1859602.

Cheng, I-H. and H. J. Wall (2005). *Controlling for heterogeneity in gravity models of trade and integration.* Federal Reserve Bank of St. Louis Review, 87, 1, pp. 49-63.

Davis, D R., and Weinstein, D E (2001). *What role for empirics in international trade?* NBER Working Paper no. 8543.

Egger, P. (2000). *A Note on the Proper Econometric Specification of the Gravity Equation*. WIFO Working Papers:108.

Egger, P., and M. Pfaffermayr. (2003). *The proper panel econometric specification of the gravity*

equation: A three-way model with bilateral interaction effects. Empirical Economics, 28.

Feyrer, James. (2009). *Trade and Income – Exploiting Time Series in Geography*. NBER Working Paper 14910.

Fratianni, M. (2007). *The gravity equation in international trade*. Handbook of international trade, Oxford University Press, 2nd edition.

Frankel et al., (1997). *Regional Trading Blocs in the World Economy*. Institute of International Economics, Washington D.C.

Hayes, A. (2022). *Trade definition in Finance: Benefits and how it works.* Available at https://www.investopedia.com/terms/t/trade.asp

Helpman, E. (1984). *The factor content of foreign trade.* The Economic Journal, 94(373), pp. 84-94.

Helpman, E. (1999). *The structure of foreign trade.* The Journal of Economic Perspectives, Vol. 13, Issue 2, pp.121–44.

Helpman, E. (2011). *Understanding Global Trade*. Harvard University Press, Belknap Press, doi.org/10.2307/j.ctt24hhh9, pp: 232.

Im, K S, Pesaran, M H and Shin, Y. (1997). *Testing for unit roots in heterogeneous panels*. A revised version of University of Cambridge, DAE Working Paper No. 9526.

Krueger, A. O. (1997). *Trade policy and economic development: how we learn* (No. w5896). National Bureau of Economic Research.

Linnemann, H. (1966). *An Econometric Study of International Trade Flows*. Amsterdam: North-Holland

Linder, S. (1961). *An essay on trade and transformation*. Uppsala, Almqvist and Wiksells

Pedroni, P. (1999). *Critical values for cointegration tests in heterogeneous panels with multiple regressors.* Oxford Bulletin of Economics and Statistics: Special Issue, pp. 653–70.

Merko et al., (2019). *Albania's trade specialization and commercial relation with Turkey*. International Marmara Science and Social Sciences Congress. ISBN: 978-605-245-598-2, pp. 346-354.

Mitaj et al., (2014). *Albania's Trade Specialization and its Economic Growth Perspective in the Future*. European Journal of Sustainable Development, 3(3), 299-308.

Piermartini, R. (2005). *Demystifying Modelling Methods for Trade Policy,* Geneva: WTO Discussion Paper no.10.

Prendi, Ll., Velaj, E. (2014). *Measuring the economic mass, the Albanian case*. International Journal of Economics, Commerce and Management United Kingdom. Vol. 2, Issue 11, pp.1-6.

Prendi et al., (2015). *Evaluation of Albanian Exports to European Countries*. International Journal of Economics, Commerce and Management United Kingdom. Vol. 3, Issue 11, pp.157-168.

Sachs, J. D., and Warner, A. M. (1995). *Economic convergence and economic policies*, No. w5039. National Bureau of Economic Research.

Walter, Isard and Merton J. Peck, (1954). *Location Theory and International and Interregional Trade Theory.* The Quarterly Journal of Economics, Oxford University Press, vol. 68(1), pages 97-114.

Winters, L. A. (2004). *Trade liberalization and economic performance: an overview.* The Economic Journal, 114(493), pp. 4-21.