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Economics

Armenian-Georgian Commodity Export and Import: Analysis and Forecast

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(Presented by Academy Member Vladimer Papava)

Abstract. This study is devoted to the structural and factor-based analysis of commodity exports and imports between Armenia and Georgia, as well as the forecast of bilateral trade volumes. For this purpose, the Herfindahl-Hirschman Index (HHI) was used to assess the trade structure, and both gravity and regression models were applied. The HHI analysis revealed a low level of concentration and stable diversification in imports, while exports exhibited high concentration, with only a weak trend toward diversification by 2024. The gravity model was constructed by using variables such as GDP of Armenia and Georgia, population, geographic distance, shared border, free trade agreement (FTA), and EAEU membership. Exports and imports were modeled separately, allowing for differentiated assessments for the impact of each factor. The models were estimated with the use of the Ordinary Least Squares (OLS) method in a log-log format. Forecasts for 2025-2027 were based on World Bank GDP projections. The results indicate that GDP, border adjacency, and the FTA have statistically significant effects on trade flows (p-values < 0.05), while EAEU membership and population size showed limited or negligible influence. Regression models based on time-series data from 2009-2024 were used to forecast the trade trends up to 2030. Both gravity and regression models forecasted a stable growth in the trade flows, with high consistency between the results. The coefficients of determination were high ($R^2 > 0.91$ for gravity models and $R^2 > 0.65$ for regression models), indicating strong model accuracy and explanatory power. The results of this study provide a reliable scientific and empirical basis for the development of trade policy and strengthening economic cooperation between Armenia and Georgia. © *2025 Bull. Natl. Acad. Sci. Georg.*

Keywords: export, import, gravity model, regression model, forecast, Armenia, Georgia

Introduction

Armenia and Georgia are neighboring countries with historically established economic ties. For landlocked Armenia, which has closed borders with its two other neighbors, Georgia represents a key trade partner. It ensures not only mutually beneficial bilateral trade, but also provides transit and access for goods and energy resources to international markets. For Georgia, trade relations with Armenia are not only important

in terms of traditional international trade benefits, but also for deepening energy cooperation, joint implementation of transit and logistics projects such as the "North–South" corridor, and the associated opportunities for accessing new markets, earning transit revenues, and expanding in other mutually advantageous directions (Papava, 2021).

According to the First Deputy Prime Minister of Georgia, Armenia ranked 9th among Georgia's main trading partners in 2024 (Georgian Public Broadcaster, 2024). In the same year, Georgia ranked 8th among Armenia's trading partners, accounting for 1.1% of Armenia's total trade turnover (Statistical Committee of the Republic of Armenia, 2025).

Since November 1998, Armenia and Georgia have maintained a free trade agreement aimed at promoting economic and trade relations between the two countries (Government of Georgia, 1998). It is important to note that the econometric analyses conducted in this study confirm that the free trade agreement has a significantly positive impact on the growth of the trade volumes between Armenia and Georgia.

Over the past decade, the bilateral trade between Armenia and Georgia underwent significant changes in both quantitative volume and structural composition, influenced by regional and global factors. These include Armenia's accession to the Eurasian Economic Union (EAEU), the EU's trade and economic policy, the COVID-19 pandemic, and the impact of sanctions related to the Russian-Ukrainian conflict. In the current complex geo-economic environment, scientifically grounded empirical assessments and forecasts of bilateral commodity export and import are essential for both Armenia and Georgia in making informed and effective trade policy decisions. However, this topic remains notably underexplored in recent academic literature, particularly with regard to differentiated approaches to exports and imports. This study seeks to address the gap by offering a comprehensive analysis of Armenian-Georgian commodity trade, with specific attention to the distinct structural and dynamic features of each trade direction.

Methodology

The statistical foundation of this research is based on official bulletins and reports from Armenia, Georgia, the World Bank, and other reputable sources. However, it is important to note that the statistical methodologies of Armenia and Georgia differ. Therefore, in cases where discrepancies arise, the official statistics of Georgia are used as the primary reference to ensure data compatibility between the two countries.

To analyse and forecast Armenian-Georgian commodity exports and imports (excluding services), the study applies econometric models, including the Gravity model of international trade as well as other regression-based models (Leitão, 2024).

The analysis of the export and import product structure was conducted using the Herfindahl-Hirschman Index (HHI), which made it possible to determine the level of concentration and identify the trends in diversification. To assess the accuracy of the results obtained in the study, the coefficient of determination (R^2) was employed (Wooldridge, 2019).

There exists a rich body of literature on the application of the gravity model, encompassing both theoretical and empirical levels (Leitão, 2024). A review of these studies reveals that the application of the gravity model to trade between developing countries remains an underexplored area, which makes the present research actual.

There is a research on Armenia's and Georgia's foreign trade with individual countries with the use of gravity and other econometric models (Dilanchiev, 2012). However, in recent years, there has been a

notable absence of studies that apply the gravity model to the analysis and forecasting of bilateral export and import flows specifically between Armenia and Georgia.

Analysis and forecasting

Trade between the Armenian and Georgian peoples dates back millennia, shaped by geography, cultural ties, and regional exchange. While this legacy endures, bilateral trade between the two modern states has expanded significantly in recent decades. In 2023, trade turnover reached a record 1,123,689.28 thousand USD – almost nine times the 2009 level. However, in 2024, both exports and imports declined by about 24%, totalling 854,412.49 thousand USD (National Statistics Office of Georgia, 2009-2024).

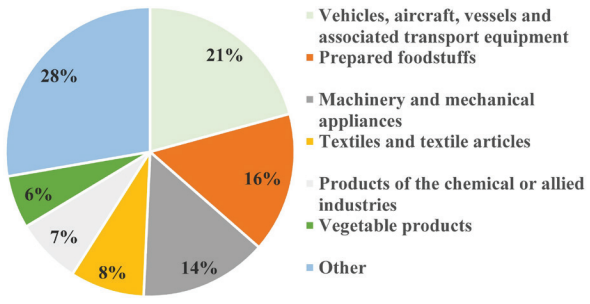
Structural Analysis of Commodity Imports and Exports (National Statistics Office of Georgia, 2009-2024). Over the past decade, the leading commodity group in the structure of goods imported from Georgia to Armenia has been Land transport vehicles, accounting for 16.7% to 62.9% of total imports (with the majority being re-exports from Georgia to Armenia). Within this category, automobiles represent more than 90% (Table 1, Fig. 1).

Other major product groups in bilateral trade include pharmaceuticals, prepared foodstuffs, electric machinery, and goods of vegetable origin.

Table 1. Import structure by product groups and degree of concentration (HHI)

Year	Land transport vehicles, %	Chemical / Food-related products, %	Electric equipment / Vegetable origin, %	Other, %	HHI
2015	27.0	17.7	14.5	40.8	0.13
2016	25.0	21.9	16.0	37.1	0.14
2019	62.9	6.6	5.5	25.0	0.40
2020	17.0	14.0	14.0	55.0	0.06
2021	16.7	13.9	12.9	56.5	0.06
2022	29.6	16.0	9.0	45.4	0.12
2023	45.0	13.0	9.0	33.0	0.23
2024	20.9	15.8	14.0	49.3	0.09

The Herfindahl-Hirschman Index (HHI) values for 2015–2024, which characterise the degree of concentration and trends in diversification of commodity groups, were high (HHI > 0.25) in the years when the share of the land transport vehicles in the overall import structure increased sharply, specifically in 2019, 2022, and 2023 (Table 1).



Source: https://ex-trade.geostat.ge/en

Fig. 1. Structure of imports from Georgia to Armenia by product groups in 2024.

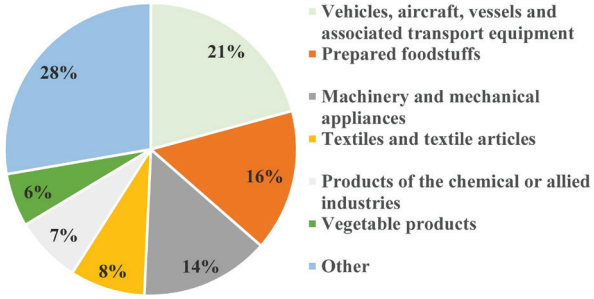
In other years, including 2024, the HHI remained at a low level of concentration (HHI < 0.15), indicating a stable and diversified import structure (Fig. 1).

In the structure of Armenia's exports to Georgia, the leading position has traditionally been held by Mineral products, with a very high share ranging from 36% to 87.8%. This has resulted in a high level of export concentration (HHI between 0.45 and 0.77) and a persistent lack of diversification in exports (Table 2).

Table 2. Export structure by product groups and degree of concentration (HHI)

Year	Mineral products, %	Prepared Foodstuffs, %	Base metals / other, %	Other, %	HHI
2015	73.0	6.8	3.7	16.5	0.54
2016	80.8	5.4	3.0	10.8	0.66
2019	81.5	5.0	3.0	10.5	0.67
2020	87.8	3.0	2.8	6.0	0.77
2021	83.0	4.0	3.0	10.0	0.69
2022	82.0	4.7	2.8	10.5	0.67
2023	66.0	12.0	5.0	17.0	0.45
2024	36.0	16.5	13.8	33.7	0.17

The trend shifted in 2024, when the share of this product group declined to 36%, leading to a corresponding decrease in the HHI to 0.17 (Table 2, Fig. 2). In the same years, the Base metals commodity group, which also consists of mineral raw materials, registered a sharp increase.



Source: https://www.geostat.ge

Fig. 2. Structure of Armenia's exports to Georgia by product groups in 2024.

Over the past decade, Armenia's export structure to Georgia has been undiversified and characterised by a high level of concentration. However, in 2024, a lower level of concentration was recorded, mainly due to the steady growth in the prepared foodstuffs category, the second-largest export group, and the sharp increase in the share of Base metals (Fig. 2).

Analysis and forecasting of Armenia–Georgia commodity exports and imports using the gravity model. This study analyses and forecasts the commodity export and import flows between Armenia and Georgia based on the gravity model of international trade. The model reveals the influence of several key factors on the bilateral trade, including the GDP of Armenia and Georgia, permanent population size, geographical characteristics (such as the direct distance between the capitals and the existence of a shared border), the presence of the free trade agreements between the two countries, and membership in economic unions, specifically the Eurasian Economic Union (EAEU).

The analysis is based on official data for the years 2015 to 2024 and includes forecasts for 2025 to 2027, derived from the GDP projections published by the World Bank. The model estimations were performed using Python-based econometric tools.

The gravity model was specified in a log-log functional form and estimated by using the ordinary least squares (OLS) method.

Based on the factors included in the study, the gravity model of Armenian-Georgian bilateral trade takes the following general form (1):

$$\ln(Trade\_\{i,j,t\}) = \beta_0 + \beta_1 \ln(GDP\_i) + \beta_2 \ln(GDP\_j) + \beta_3 \ln(Pop\_i) + \\ + \beta_4 \ln(Pop\_j) + \beta_5 \ln(DISTANCE) + \beta_6 Border + \beta_7 FTA + \beta_8 EAEU + \varepsilon\_t \quad (1),$$

Notations of the gravity model:

$Trade\_\{i, j, t\}$ - export or import volume, in thousand USD (National Statistics Office of Georgia, 2009–2024);

GDP_i, GDP_j - GDP of Armenia and Georgia, in thousand USD (World Bank, 2025a);

Pop_i, Pop_j - permanent population of Armenia and Georgia, in person (Worlddata.info, 2025);

DISTANCE - straight-line distance between Tbilisi and Yerevan, 173 km (UTC City, n.d.);

Border - presence of a common border between Armenia and Georgia, binary: 1;

FTA - free trade agreement between Armenia and Georgia, binary: 1;

EAEU - EAEU membership: Armenia = 1 (binary), Georgia = 0 (binary).

Armenian-Georgian imports and exports were modeled separately using gravity models (2) and (3), respectively, which allowed for precise and targeted estimations that reflect the differentiated impact of the explanatory variables.

The estimated gravity model for imports from Georgia to Armenia (import model) takes the following form:

$$\ln(IM) = -5.31 + 0.44\ln(GDP\_AM) + 0.91\ln(GDP\_GE) - 1.22\ln(173) + 0.79 + 0.66 + 0.21. \quad (2)$$

The estimated gravity model for exports from Armenia to Georgia (export model) takes the following form:

$$\ln(EX) = -4.85 + 1.03\ln(GDP\_AM) + 0.34\ln(GDP\_GE) - 1.15\ln(173) + 0.76 + 0.61 + 0.18. \quad (3)$$

The population variables are omitted from the final models (2) and (3), as they exhibit an almost negligible effect on the volumes of imports and exports, according to the statistical significance of their p-values. The results of the analysis of the estimated variables in the gravity models of imports (2) and exports (3), based on the β coefficients and the statistical significance of the estimated effects (P-values, with $P < 0.05$ as the accepted norm), allow for a substantiated interpretation of their economic impact on export and import flows.

According to the results of the import model (2):

- An increase in Armenia's GDP contributes to the volume of imports by 0.44% (β = 0.44, P = 0.031, strong effect);
- Georgia's GDP significantly stimulates imports by 0.91% (β = 0.91, P = 0.002, extremely strong effect);
- Armenia's population has no significant effect (β = 0.13, P = 0.26, very low impact, almost negligible);
- Georgia's population has no effect on imports (β = -0.05, P = 0.47, no effect);
- A 1% increase in distance leads to a 1.22% decrease in imports (β = -1.22, P = 0.003, very strong effect);
- Common border raises import volumes by 79% (β = 0.79, P = 0.017, strong effect);
- FTA increases imports by 66% (β = 0.66, P = 0.022, strong effect);
- The effect of EAEU membership is weak (β = 0.21, P = 0.12, marginally low impact).
- According to the results of the export model (3):
- A 1% growth in Armenia's GDP increases exports by 1.03% (β = 1.03, P = 0.002, very strong effect);
- A 1% growth in Georgia's GDP increases exports by 0.34% (β = 0.34, P = 0.048, strong effect);
- Armenia's population has no significant effect on exports (β = -0.11, P = 0.23, very low impact, almost negligible);
- Georgia's population has a weak and statistically insignificant effect (β = 0.22, P = 0.17, very low impact);

- A 1% increase in distance results in a 1.15% decrease in export volume (β = -1.15, P = 0.004, very strong effect);
- Common border raises export volumes by 76% (β = 0.76, P = 0.021, strong effect);
- FTA increases exports by 61% (β = 0.61, P = 0.03, strong effect);
- The effect of EAEU membership is weak (β = 0.18, P = 0.14, marginally low impact).

To assess the accuracy of the models, the coefficients of determination (R^2) are calculated: $R^2 = 0.94$ for the import model and $R^2 = 0.91$ for the export model. The very high R^2 values in both gravity models indicate a strong correspondence between the model-generated results and the actual data, thereby demonstrating their substantial practical relevance.

Based on the GDP of Armenia and Georgia (World Bank, 2025a) and the World Bank's GDP forecasts for the two countries for 2025–2027 (World Bank, 2025b), (World Bank, 2025c), the projected values of imports and exports for the same period have been calculated by using gravity models (2) and (3) (Table 3).

Table 3. GDP, import, and export forecasts for 2025-2027

Year	WB forecast, Armenia's GDP, million USD	WB Forecast, Georgia's GDP, million USD	Import forecast based on model (2), million USD	Export forecast based on model (3), million USD
2025	268320.0	355626.4	661.4	255.2
2026	278514.2	373407.7	698.8	266.8
2027	288095.7	392078.1	736.9	278.0

The projected growth in GDP will lead to stable upward trends in both exports and imports (Table 3), indicating that GDP growth, as a factor, generates proportionally increasing bilateral trade flows.

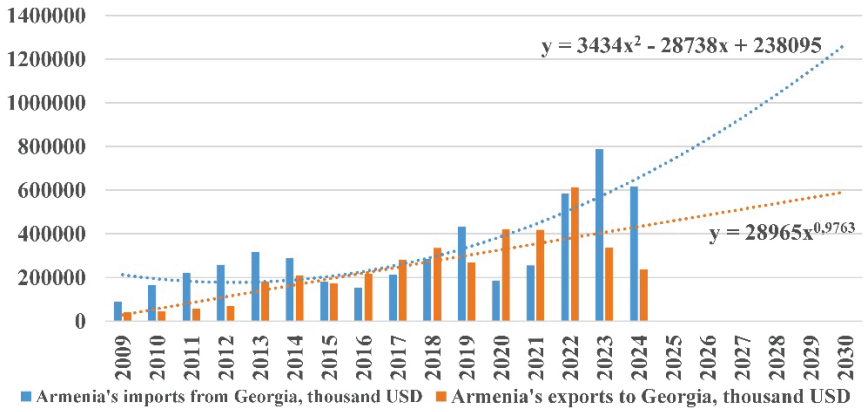
In order to reveal and project the export and import trends based solely on the time factor, a separate regression model was also constructed by using the time series data of imports and exports from 2009 to 2024 (National Statistics Office of Georgia, 2009-2024). For the purposes of import and export regression modeling, several functional forms were examined – exponential, linear, logarithmic, polynomial, and power regression models. Their respective coefficients of determination (R^2) were calculated, and the models with the highest R^2 values were selected. For imports, it is the polynomial model ($R^2 = 0.65$) represented by equation (4), and for exports, it is the Power model ($R^2 = 0.86$) represented by equation (5):

$$y = 3434x^2 - 28738x + 238095, \tag{4}$$

$$y = 28965x^{0.9763}. \tag{5}$$

The coefficients of determination for regression models (4) and (5), ranging from 0.65 to 0.86, are relatively high and provide sufficient accuracy for the trend analysis and forecasting. However, they are lower compared to those of the gravity models (2) and (3), which range from 0.91 to 0.94. This difference is explained by the fact that gravity models have stronger structural explanatory power, as they incorporate well-founded economic, geographical, and other relevant factors. In contrast, regression models are based solely on time series data and are more suitable for temporal forecasting.

Fig. 3 presents the graphical forecasts for Armenian-Georgian exports and imports for 2025-2030, based on the regression models (4) and (5) constructed by using the 2009–2024 time series data (National Statistics Office of Georgia, 2009-2024).



Source: https://ex-trade.geostat.ge/en

Fig. 3. Actual dynamics and forecast of Arenian-Georgian exports and imports for 2009-2030 using regression models.

According to the results of the regression modeling, Armenian-Georgian commodity imports and exports have exhibited a trend of growth over the past 16 years, with a stable upward trend forecasted for the period 2025-2030. This forecast corresponds to the trend patterns obtained from the gravity model forecasts.

Conclusions

The Armenia-Georgia trade relationship has experienced stable growth, underpinned by strong economic fundamentals in both countries and close bilateral ties. The gravity model results confirm that trade volumes respond positively to the size of the economies (GDP) and benefit from geographic proximity as well as the existing Armenia–Georgia free trade agreement. At the same time, the analysis reveals structural imbalances: Armenia's export basket remains highly concentrated in a few commodities (notably mineral products), whereas its imports are comparatively diversified. Notably, some anticipated factors (such as Armenia's Eurasian Economic Union membership and partner country population size) showed negligible influence on bilateral trade flows in this study.

Targeted policy measures. To address Armenia's persistent export concentration, policymakers should promote export diversification by supporting high value-added industries (for example, technology, manufacturing, or processed agricultural goods) that can broaden the export base beyond minerals. In parallel, both countries can leverage the FTA more effectively by deepening cooperation on trade facilitation – for instance, establishing joint logistics centers, improving transport connectivity, and harmonizing customs procedures. Such steps would reduce remaining trade barriers, lower transaction costs, and maximize the mutual benefits of the FTA.

Given the study's finding that Armenia's membership in the Eurasian Economic Union did not provide a significant boost to Armenia–Georgia trade, the conclusion calls for reforms to bridge this gap. Policymakers should seek to align EAEU policies with Armenia's bilateral trade objectives with Georgia to ensure regional commitments complement (rather than hinder) their trade. This could involve addressing non-tariff barriers within the EAEU framework or advocating for EAEU-wide measures that facilitate trade with key neighboring partners.

ეკონომიკა

სომხურ-ქართული სასაქონლო ექსპორტი და იმპორტი: ანალიზი და პროგნოზი

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[**] *საინჟინრო ეკონომიკისა და მენეჯმენტის დეპარტამენტი, სომხეთის ეროვნული პოლიტექნიკური უნივერსიტეტი, ერევანი, სომხეთის რესპუბლიკა*

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კვლევა ეხება საქართველოსა და სომხეთს შორის საქონლის ექსპორტისა და იმპორტის სტრუქტურული და ფაქტორული ანალიზისა და ორმხრივი ვაჭრობის პროგნოზირების საკითხს. აღნიშნული მიზნისთვის გამოყენებულია ჰერფინდალ-ჰირშმანის ინდექსი (HHI) სავაჭრო სტრუქტურის შეფასებისათვის, აგრეთვე გრავიტაციული და რეგრესიული მოდელები. HHI ანალიზმა აჩვენა იმპორტის დაბალი კონცენტრაციის დონე და სტაბილური დივერსიფიკაცია, მაშინ როცა ექსპორტი ხასიათდებოდა მაღალი კონცენტრაციით და მხოლოდ 2024 წელს აღინიშნება დივერსიფიკაციის სუსტი ტენდენცია. გრავიტაციული მოდელი აგებულია სომხეთისა და საქართველოს მთლიანი შიდა პროდუქტის (მშპ), მოსახლეობის რაოდენობის, გეოგრაფიული მანძილის, საერთო საზღვრის, თავისუფალი ვაჭრობის შეთანხმების (FTA) და ევრაზიის ეკონომიკური კავშირის (EAEU) წევრობის ფაქტორების საფუძველზე. ექსპორტი და იმპორტი მოდელირებულ იქნა ცალკე, რაც შესაძლებელს ხდიდა განსხვავებული გავლენების ზუსტ შეფასებას. მოდელები შეფასდა OLS მეთოდით, ლოგ-ლოგ ფორმატში. 2025-2027 წლების პროგნოზები ეფუძნება მსოფლიო ბანკის მშპ-ს პროგნოზებს. მიღებული შედეგები აჩვენებს, რომ მშპ, საზღვრის არსებობა და თავისუფალი ვაჭრობის შეთანხმება სტატისტიკურად მნიშვნელოვნად ახდენს გავლენას ვაჭრობაზე (p-შეფასება < 0.05), ხოლო EAEU-ს წევრობამ და მოსახლეობის ზომამ აჩვენა მხოლოდ მცირე ან უმნიშვნელო გავლენა. დროის სერიებზე დაფუძნებული რეგრესიული მოდელებით (2009–2024) შედგენილი პროგნოზები ვრცელდება 2030 წლამდე. ორივე მოდელის პროგნოზი აჩვენებს ექსპორტისა და იმპორტის სტაბილური ზრდის ტენდენციებს, რის შედეგადაც მოლოდინები თანხვედრილია. დეტერმინაციის კოეფიციენტები მაღალია ($R^2 > 0.91$ გრავიტაციულ მოდელებში და $R^2 > 0.65$ რეგრესიულ მოდელებში), რაც მეტყველებს შედეგების მაღალი სიზუსტისა და განმარტებითობის შესახებ. არსებული კვლევის შედეგები წარმოადგენს სანდო სამეცნიერო და ემპირიულ საფუძველს ვაჭრობის პოლიტიკის შემუშავებისა და სომხეთთან საქართველოს ეკონომიკური თანამშრომლობის გაძლიერებისთვის.

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