

ASSESSMENT OF THE IMPACT OF ECONOMIC RELATIONS IN FOREIGN TRADE WITH MAIN PARTNER COUNTRIES ON ARMENIA'S GDP

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Introduction

The formation of foreign trade and economic relations in the Republic of Armenia exhibits distinctive characteristics shaped by its geographical location and three decades of ongoing conflict. Armenia became an official member of the Eurasian Economic Union (EEU) in 2015 and joined the World Trade Organization (WTO) in 2003. The Republic of Armenia maintains free trade agreements with Ukraine, Moldova, Tajikistan, Georgia, Turkmenistan, and Uzbekistan. Additionally, Armenia engages in cooperation with the European Union (EU) under the framework of the EEU and with third countries, utilizing the Generalized Scheme of Preferences for trade with the United States, Canada, Switzerland, Japan, and Norway.

In 2023, Armenia's exports totaled \$8,511.0 million, marking a 48.8% increase compared to the previous year, while imports rose by 44.5% to \$10,945.7 million. Exports to Eurasian Economic Union (EEU) member countries grew by 40.8% (\$1,045.2 million), predominantly to Russia (\$955.9 million). There was also an increase in exports to European Union (EU) countries, notably the Netherlands, by \$19.3 million. Significant increases in exports were observed in the 'Other countries' category, particularly to the United Arab Emirates (\$1,690.2 million) and China (\$55.8 million) compared to the previous year. In 2023, imports from Eurasian Economic Union (EEU) member countries increased by 44.6%, totaling \$1,235.1 million, primarily driven by a \$1,250.3 million rise in imports from Russia. Imports from European Union (EU) countries also saw an increase of \$449.4 million. Conversely, imports decreased from Georgia by \$21.5 million (14.9%) and from Ukraine by \$6.2 million (7.4%) [RA Statistical Committee, foreign trade statistics data].

Export growth was observed in several product categories: "Raw gold", "Refrigerator, freezer, parts", "Jewelry", "Smartphones", "Diamond stone", "Cigarettes and cigars", "Spirit liquor", and "Raw platinum". Meanwhile, the import structure showed increased volumes in categories such as "Precious and semi-precious stones, metals and their articles", "Ground, air and water vehicles", "Machines, equipment and mechanisms", "Jewelry articles", and "Devices and apparatus". Armenia predominantly exports mineral products, precious metals and stones, agricultural products, and finished goods to the

European Union (EU), while importing machinery, equipment, chemicals, textiles, and agricultural products from the EU. France exhibits a broad economic footprint in Armenia, spanning sectors such as hospitality, retail (supermarkets), insurance, alcoholic beverages, and electronics. In 2023, exports from France to Armenia amounted to €143 million, with imports totaling €17 million. Armenia ranks as Belgium's 121st largest import destination, with €86 million worth of Belgian goods exported to Armenia, and as the 94th supplier, exporting €136.2 million worth of Armenian goods to Belgium in 2022. Since 2020, bilateral trade between Belgium and Armenia has nearly tripled, with Armenia consistently maintaining a trade surplus. Key traded commodities include precious stones and metals, chemicals, and pharmaceuticals. From January to August 2023, Armenia's trade turnover with Belgium reached \$156.5 million, marking a 32% increase compared to the same period the previous year. Armenia primarily exports minerals such as copper and precious stones to Belgium, along with significant exports of agricultural products and textiles, including clothing and footwear. In return, Belgium exports a diverse array of goods to Armenia, including machinery, equipment, chemicals, pharmaceuticals, and food products.

Between 1995 and 2022, Armenia experienced notable growth in trade relations with Belarus, Georgia, the Russian Federation, Iran, and Kazakhstan. Specifically, from 2010 to 2022, Armenian exports to Belarus surged from \$4.6 million to \$76.96 million, while exports to Russia escalated from \$160.5 million to \$2.46 billion. Similarly, exports to Turkey increased from \$1.3 million to \$61.2 million during the same period. Conversely, from 2008 to 2022, Armenia observed a declining trend in imports from the United Kingdom, Switzerland, and Ukraine.

Methodology

The research was conducted using a panel data model. The following variables for the years 1995-2022 were considered on an annual basis:

- 1) GDP per capita of Armenia's main partner countries (Belgium, Belarus, France, Georgia, Iran, Kazakhstan, Netherlands, Russia, Switzerland, UAE, Turkey, Turkmenistan, Ukraine, United Kingdom, USA, Uzbekistan), USD (GDP_PC_BLG, GDP_PC_BRS ... GDP_PC_US),
- 2) RA GDP, thousand US dollars (GDP_HH),
- 3) export of goods and services from Armenia to main partner countries, thousand US dollars (EXP_BLG, EXP_BRS, ... EXP_US),
- 4) import of goods and services from main partner countries to Armenia, thousand US dollars (IMP_BLG, IMP_BRS, ... IMP_US).

The source of the data is the World Bank, RA Statistical Committee, RA Central Bank.

The time series included in the panel data model were assessed for stationarity using the ADF-Fisher test. For non-stationary series, the first difference operator was applied.

The panel data model utilized in this study encompassed 13 countries ($i=1,2,\dots,13$) and four variables ($k=1,\dots,4$) over a span of 27 years ($t=27$). The analysis included pooled regression, fixed effects, and random effects models [Hauser 20-39].

Pooled regression model is represented by the following equation:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (1)$$

where $\beta_1, \beta_2, \beta_3, \beta_4, \dots, \beta_k$ are unknown parameters. It is assumed that these parameters are constant in time and space. X_{kit} is the k -th explanatory variable of country i at time t .

The Fixed Effects or Dummy Variable Regression model assumes that β_1 varies by country:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (2)$$

Fixed effects for countries are given by a dummy variable:

$$D_{2i} = \begin{cases} 1, & \text{if the country is Belarus} \\ 0, & \text{in the case of other countries} \end{cases}$$

$$D_{3i} = \begin{cases} 1, & \text{if the country is France} \\ 0, & \text{in the case of other countries} \end{cases} \dots$$

With the use of dummy variables, the Fixed Effect model represented by formula (2) takes the following form:

$$Y_{it} = \alpha_1 + \alpha_2 D_{2i} + \dots + \alpha_{12} D_{12i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (3)$$

For Belgium, the constant component of the equation is α_1 , for Belarus: $\alpha_1 + \alpha_2$, for France: $\alpha_1 + \alpha_2 + \alpha_3$ etc.

In the Random Effects (REM) or Error Components (ECM) model, β_{1i} is fixed. It is assumed that β_{1i} is a random variable with mean β_1 . This model also allows for non-homogeneity and also does not depend on time, as in the case of Fixed Effect, but the individual effect does not depend on the independent variable:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \dots + \beta_k X_{kit} + \varepsilon_{it} \quad (4)$$

$$\beta_{1i} = \beta_1 + V_i, \quad (5)$$

where $i=1,\dots,n$ $\cup V_i \sim N(0, \sigma_V^2)$

Inserting (5) into (4), we get:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \dots + \beta_k X_{kit} + V_i + \varepsilon_{it} \quad (6)$$

Let's define the error of the model $V_i + \varepsilon_{it} = W_{it}$, among the components of which V_i represents the individual error, and ε_{it} represents the total error.

The assumptions of REM are:

$$\varepsilon_i \sim N(0, \sigma_\varepsilon^2), \quad V_i \sim N(0, \sigma_V^2), \quad E(\varepsilon_i V_i) = 0, \quad E(V_i V_j) = 0, \quad (i \neq j),$$

$$E(\varepsilon_{it} \varepsilon_{jt}) = 0, \quad (i \neq j) \quad (7)$$

To assess the statistical significance of the estimated coefficients and the overall model, t-statistics and F-statistics were employed. The quality of the model was eva-

luated using the adjusted R-squared, while hypotheses were tested using Chi-square tests and additional F-statistics. [Gujarati, D., & Porter, 2009, 34-107]:

Literature Review

A number of empirical studies have examined the impact of trade and economic ties on national economies. Tsai and colleagues [Jun et al., 2021, 249-267] applied a Panel Data model to assess the effects of the China (Shanghai) Free Trade Zone (FTZ) on local GDP. Their empirical findings indicated a positive impact of the FTZ on GDP growth rates, enhancing Shanghai's per capita GDP growth by 1.2-1.8 percent. The study suggests that the free trade zone policy could potentially benefit other provinces and cities across China.

F. Hsiao and Mei-Chu Hsiao [Hsiao & Hsiao, 2006, 1082-1106] conducted a causal analysis of foreign direct investment (FDI), exports, and GDP across eight countries in East and Southeast Asia using a Panel Data model. Their study, employing both Fixed Effect and Random Effect models, revealed that FDI exerts a direct influence on GDP and an indirect impact on exports. Furthermore, their analysis identified a reciprocal causal relationship between exports and GDP.

Mulali and Ting [Al-mulali et al., 2014, 484-498] conducted an econometric analysis across 189 countries, examining the two-way long-run relationships between trade-energy consumption, trade-CO2 emissions, export-energy consumption, export-CO2 emissions, import-energy consumption, and import-CO2 emissions across six regions. Their analysis revealed a consistent long-term positive relationship between trade and both energy consumption and CO2 emissions across all regions except Eastern Europe. Specifically, this relationship was predominant in relatively developed countries where trade's contribution to GDP is substantial. Conversely, in developing countries where trade's GDP share is smaller, the relationship tended to be negative or non-significant regarding energy consumption and CO2 emissions.

Blackwell [Blackwell, 2021, 1129-1145] conducted an econometric study examining the impact of signing a free trade agreement (FTA) with the United States on the GDP per capita of member states. The study found heterogeneous effects across countries. Specifically, the research revealed that while the FTA had a positive effect on GDP per capita in Chile and Jordan, it adversely affected Mexico's GDP per capita. For several other countries, including those with significant trade ties with the US, no significant economic impact was detected. The findings suggest that the benefits of entering into a Free Trade Area vary based on the extent of a country's trade dependence on the US.

The aim of this study is to analyze the trade and economic relations between Armenia and its primary partner countries, and to assess the impact of specific macroeconomic indicators on the GDP of the Republic of Armenia using econometric models.

Scientific novelty

As a result of the research:

- the impact of the export of goods and services from Armenia to the main trade partner countries on the GDP of Armenia was assessed,
- the impact of the import of goods and services from the main trading partner countries to Armenia on the GDP of Armenia was assessed,
- the effect of the increase of GDP per capita in the main trade partner countries of Armenia on the GDP of Armenia was assessed.
- hypotheses were proposed and tested.

Analysis

From 1994 to 2023, Armenia's average annual exports of goods and services to its primary partner countries totaled \$62.74 billion, while imports from these countries averaged \$145 billion annually. The peak export volume of \$2.46 billion was recorded in 2022, with a minimum of \$42.4 million in 1997. Throughout this period, the average annual GDP per capita of Armenia's partner countries stood at \$24.05 thousand, reaching a maximum of \$93.446 thousand (Table 1).

Table 1. Descriptive statistics of variables

| | GDP_PC_ | IMP_ | EXP_ | GDP_HH_ |
|--------------|----------|----------|----------|----------|
| Mean | 24053.90 | 1.45E+08 | 62740412 | 8.08E+09 |
| Median | 11634.00 | 79217562 | 18255800 | 9.26E+09 |
| Maximum | 93446.43 | 2.89E+09 | 2.46E+09 | 1.95E+10 |
| Minimum | 635.7579 | 84600.00 | 42400.00 | 1.60E+09 |
| Std. Dev. | 23177.24 | 2.69E+08 | 1.65E+08 | 4.86E+09 |
| Skewness | 0.872007 | 5.729969 | 9.801367 | 0.109540 |
| Kurtosis | 2.924507 | 45.68928 | 131.5914 | 2.153541 |
| Jarque-Bera | 44.56657 | 28572.94 | 247455.3 | 11.18065 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.003734 |
| Observations | 351 | 351 | 351 | 351 |

The variables analyzed in this study are time series, and their stationarity was assessed using the ADF-Fisher test (see Table 2). The test confirmed that all variables exhibit first-order integration processes, denoted as I(1).

Table 2. Results of Fisher's test

| Variable | ADF - Fisher Chi-square | Prob.** | Variable | ADF - Fisher Chi-square | Prob.** |
|----------|----------------------------|---------|------------|----------------------------|---------|
| EXP | 26.3296 | 0.445 | LIMP | 34.8220 | 0.1156 |
| D(EXP) | 97.7343 | 0.000 | D(LIMP) | 149.115 | 0.000 |
| LEXP | 38.397 | 0.0556 | GDP-PC | 10.0003 | 0.9980 |
| D(LEXP) | 148.074 | 0.000 | D(GDP_PC) | 114.984 | 0.000 |
| IMP | 16.9147 | 0.9116 | GDP-HH | 0.62205 | 1.000 |
| D(IMP) | 120.241 | 0.000 | D(GDP-HH) | 94.5596 | 0.000 |
| LGDP-HH | 7.83761 | 0.9998 | D(LGDP-HH) | 64.4025 | 0.000 |

The following hypotheses were proposed and tested using the Panel Data model:

- The increase in the total volume of trade with the main trade partner countries contributes to the increase of Armenia's GDP.
- The growth of GDP per capita in Armenia's main trade partner countries contributes to the growth of RA GDP.

Based on the findings from the *Pooled Regression Model* (see Table 3), GDP per capita of Armenia's main partner countries, exports of goods and services from Armenia to these partners, and imports of goods and services to Armenia all exhibit a statistically significant positive impact on Armenia's GDP.

Table 3. Pooled regression model

Dependent Variable: D(LGDP_HH)

Method: Panel Least Squares

Sample (adjusted): 1997 2022

Periods included: 26

Cross-sections included: 13

Total panel (balanced) observations: 338

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| C | 0.07116 | 0.00684 | 10.3975 | 0.0000 |
| D(GDP_PC_) | 2.4E-05 | 2.7E-06 | 8.68709 | 0.0000 |
| D(LIMP) | 0.06987 | 0.01353 | 5.16404 | 0.0000 |
| D(LEXP) | 0.01940 | 0.00877 | 2.21232 | 0.0276 |
| R-squared | 0.29539 | Mean dependent var | | 0.09621 |
| Adjusted R-squared | 0.28906 | S.D. dependent var | | 0.14183 |
| S.E. of regression | 0.11959 | Akaike info criterion | | -1.39775 |
| Sum squared resid | 4.77669 | Schwarz criterion | | -1.35251 |
| Log likelihood | 240.220 | Hannan-Quinn criter. | | -1.37972 |
| F-statistic | 46.6732 | Durbin-Watson stat | | 1.50814 |
| Prob(F-statistic) | 0.00000 | | | |

Similar results were observed using the **Fixed Effect Model** (see Table 4). The selection between the Pooled Regression and Fixed Effect models was guided by the Redundant Fixed Effects test. With a Cross-section Chi-square value of 4.113086 and a probability of Cross-section Chi-square ($0.9813 > 0.05$), we do not reject the null hypothesis of 'No fixed effect.' Therefore, the Pooled Regression model is preferred over the Fixed Effect model.

A *Random Effects Model* (see Table 5) was developed, followed by a Hausman test to determine the model that best fits the statistical data. The test results, with a Cross-section random Chi-Square Statistic of 3.942322 and a probability (Prob) of 0.2678 (>0.05), indicate that the Random Effects model provides a better fit.

Table 4. Fixed Effect model

Dependent Variable: D(LGDP_HH)
 Method: Panel Least Squares
 Sample (adjusted): 1997 2022
 Periods included: 26
 Cross-sections included: 13
 Total panel (balanced) observations: 338

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|------------|-------------|------------|-------------|--------|
| C | 0.070406 | 0.006938 | 10.14723 | 0.0000 |
| D(GDP_PC_) | 2.49E-05 | 2.85E-06 | 8.769385 | 0.0000 |
| D(LIMP) | 0.068110 | 0.013824 | 4.926824 | 0.0000 |
| D(LEXP) | 0.020391 | 0.008906 | 2.289487 | 0.0227 |

Effects Specification

| Cross-section fixed (dummy variables) | | | |
|---------------------------------------|----------|-----------------------|-----------|
| R-squared | 0.303910 | Mean dependent var | 0.096213 |
| Adjusted R-squared | 0.271484 | S.D. dependent var | 0.141832 |
| S.E. of regression | 0.121058 | Akaike info criterion | -1.338915 |
| Sum squared resid | 4.718915 | Schwarz criterion | -1.157943 |
| Log likelihood | 242.2767 | Hannan-Quinn criter. | -1.266790 |
| F-statistic | 9.372267 | Durbin-Watson stat | 1.535297 |
| Prob(F-statistic) | 0.000000 | | |

The residuals of the Random Effect model satisfy the necessary conditions. The model formula is:

$$D(\ln(GDP_HH))_t = 0.071 + 2.37e^{-05}d(GDP_PC_)_t + 0.07d(\ln(IMP))_t + 0.019d(\ln(EXP))_t + W_{it} \tag{8}$$

Table 5. Random effect model

Dependent Variable: D(LGDP_HH)
 Method: Panel EGLS (Cross-section random effects)
 Sample (adjusted): 1997 2022
 Periods included: 26
 Cross-sections included: 13
 Total panel (balanced) observations: 338
 Swamy and Arora estimator of component variances

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|------------|-------------|------------|-------------|--------|
| C | 0.071161 | 0.006928 | 10.27136 | 0.0000 |
| D(GDP_PC_) | 2.37E-05 | 2.76E-06 | 8.581663 | 0.0000 |
| D(LIMP) | 0.069874 | 0.013697 | 5.101373 | 0.0000 |
| D(LEXP) | 0.019404 | 0.008879 | 2.185468 | 0.0295 |

| Effects Specification | | S.D. | Rho |
|------------------------------|--|----------|--------|
| Cross-section random | | 0.000000 | 0.0000 |
| Idiosyncratic random | | 0.121058 | 1.0000 |

| Weighted Statistics | | | |
|----------------------------|----------|--------------------|----------|
| R-squared | 0.295388 | Mean dependent var | 0.096213 |
| Adjusted R-squared | 0.289059 | S.D. dependent var | 0.141832 |
| S.E. of regression | 0.119589 | Sum squared resid | 4.776690 |
| F-statistic | 46.67321 | Durbin-Watson stat | 1.508140 |
| Prob(F-statistic) | 0.000000 | | |

| Unweighted Statistics | | | |
|------------------------------|----------|--------------------|----------|
| R-squared | 0.295388 | Mean dependent var | 0.096213 |
| Sum squared resid | 4.776690 | Durbin-Watson stat | 1.508140 |

According to the results of the model, a 1% increase in exports contributes to a 0.02% increase in RA GDP, and a 1% increase in imports contributes to a 0.07% increase in RA GDP. The growth of the GDP per capita of the main trade partner countries contributes to the growth of the GDP of Armenia. A prediction was made based on the Random Effect model (Figure 1).

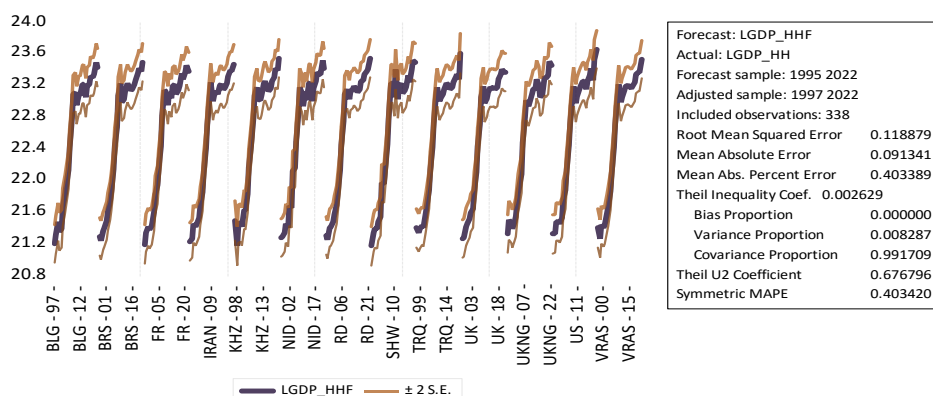


Figure 1. Forecasting RA GDP with the Random Effect model

Regarding forecast indicators, the Theil Inequality Coefficient of 0.002629 indicates high forecast accuracy in the model. The Bias Proportion, representing the gap between the means of the actual and predicted series of Armenia's GDP, is 0%, indicating unbiased forecasts. Additionally, the Variance Proportion, which measures the gap between dispersions, stands at 0.82%.

Conclusions

From 1995 to 2022, Armenia's trade and economic relations with Belarus, Georgia, Russia, Iran, and Kazakhstan exhibited varying developmental trends compared to other partner countries.

The results from panel data analysis indicate that both exports of goods and services to Armenia's main partner countries and imports from these countries have a significant and positive impact on Armenia's GDP growth rate. Given that exports are a component of GDP expenditure, their positive influence on the country's GDP is evident. Moreover, the positive coefficient for imports suggests that increased trade volume contributes to Armenia's GDP growth.

Armenia's GDP is further bolstered by the per capita GDP growth of its partner countries. Increased income levels in these countries stimulate demand for both domestic and foreign goods and services. Therefore, our hypotheses are validated.

The findings of this research are pertinent for policymakers involved in macroeconomic planning. They underscore the importance of fostering Armenia's trade and economic relations not only with the aforementioned 13 countries but also with other nations through strategic economic policies.

References

1. Al-mulali Usama, Low Sheau-Ting, "Econometric analysis of trade, exports, imports, energy consumption and CO2 emission in six regions", *Renewable and Sustainable Energy Reviews*, May 2014, Pages 484-498, <https://doi.org/10.1016/j.rser.2014.02.010>
2. Blackwell Wiley, "The effect of a free trade agreement with the United States on member countries' per capita GDP: A synthetic control analysis", *Regional Science Policy & Practice*, vol. 13(4), pp.1129-1145, Aug. 2021, <https://ideas.repec.org/a/bla/rgscpp/v13y2021i4p1129-1145.html>
3. Cai Jun, Kai Xin, Yahong Zhou, "A dynamic panel data approach and HCW's method: Assessing the effect of China (Shanghai) Free Trade Zone on local GDP", *Journal of Management Science and Engineering*, Sept. 2021, pp. 249-267. <https://doi.org/10.1016/j.jmse.2021.06.004>
4. Gujarati, D., & Porter, D. *Basic Econometrics* (5th ed.). 2009. McGraw Hill/Irwin.
5. Hauser Michael, *Financial Econometrics*. WS18/19. Panel Data Models. Chapter 5. https://statmath.wu.ac.at/~hauser/LVs/FinEtricsQF/FEtrics_Ch5.pdf
6. Hsiao Frank S.T., Mei-Chu W. Hsiao, "FDI, exports, and GDP in East and Southeast Asia—Panel data versus time-series causality analyses", *Journal of Asian Economics*, December 2006, pp. 1082-1106, <https://doi.org/10.1016/j.asieco.2006.09.011>
7. www.armstat.am
8. www.worldbank.org
9. <https://mineconomy.am/page/85>
10. <https://www.cba.am>

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Assessment of the impact of economic relations in foreign trade with main partner countries on Armenia's GDP

Key words: GDP per capita, export, import, Random Effect model, Fixed Effect model, Pooled regression model, GDP

The paper analyzed the foreign trade and economic relations of RA with 13 main partner countries. In the post-Soviet period, these ties developed with Belarus, Georgia, the Russian Federation, Iran and Kazakhstan, and the development of ties with other countries showed different trends. In order to assess the impact of the trade relations of the main partner countries on the GDP of Armenia, a panel data model was built based on the annual data of 1995-2022. The following hypotheses were proposed and verified: “Increasing trade volume with key partner countries contributes to the growth of Armenia's GDP” and “GDP growth of key partner countries contributes to the growth of Armenia's GDP”. Using the Hausman test, the Random Effect model was selected from the Fixed Effect model and Random Effect model alternatives. According to the results of the model, a one percent increase in the growth rate of exports contributes to an increase in the growth rate of the nominal GDP of RA by 0.02 percent, and a 1 percent increase in the growth rate of imports contributes to an increase in the growth rate of the RA GDP by 0.07 percent. An increase in per capita gross domestic product of foreign countries contributes to the growth of Armenia's nominal GDP. A prediction was made based on the model.