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# Causes of Defaults in Argentina and Likelihood of Another

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## ABSTRACT

*For more than 100 years, Argentina has attracted the attention of the global community for the specific evolution of its internal economic and political processes and the international context of its economic development. The prosperity of the Argentine economy depends on internal and external factors. The chronic government budget deficit and the low domestic savings rate led to indebtedness in the international financial markets. The government budget deficit and indebtedness in international markets result in inflation and devaluation of the Argentine peso. Externally, economic growth and economic stability are influenced by the demand in world agricultural markets for Argentine products and the willingness of foreign investors to buy Argentine bonds. When export earnings fall, Argentina's ability to repay its foreign liabilities decreases, which generally leads to further defaults. Paper analyzes the factors that will potentially lead the Argentine economy into another default. Paper models the probability of default in the Argentine economy using the multivariate analysis. The 9 factors selected to model the probability of default show the impact and extent of the event. Based on the results obtained, it can be concluded that the model built based on statistical selection of factors shows similar results in terms of predicting non-default cases, and worse in terms of predicting default cases, compared to the model built based on the phased inclusion of variables. The ability to better identify non-defaults than to identify cases of defaults, in general, is a characteristic of this class of models, in part this fact can be explained by the fact that the models were built based on a sample in which the number of non-default cases is greater than the number of default variants.*

## INTRODUCTION

Argentina represents a special phenomenon in the world economy. The country benefits from advantages based on rich natural resources, a well-developed export-oriented agriculture, a skilled workforce and diversified industrial production.

From the late 19th century onwards, the country's rapid economic growth began, thanks to the favorable internal economic conditions and external factors, two technical inventions that modernized and accelerated maritime transport, and an increase in the demand for agricultural products in world markets. As the 'breadbasket of the world', Argentina became one of the world's largest exporters of agricultural products and has remained so ever since. At the turn of the 19th and 20th centuries, Argentina was the twelfth richest country in the world, with a GDP per capita of USD 2 756 (Nationmaster, 2021). After the world economic crisis of the 1930s, it began to decline and ceded its place in world trade to competitors. Today its GDP per capita is USD 20 820 in purchasing power parity and USD 14 508 in nominal terms, ranking it 66th in the world (Worldometer, 2021). Throughout the 20th century, Argentina suffered recurrent economic crises, chronic government deficits, high inflation and an inability to pay its foreign financial obligations (*The Economist*, 2020). During the two hundred years of independence, Argentina has declared nine defaults. Argentina's economic and social policies remain unbalanced and may lead to further defaults. In this paper, we analyze the factors that will potentially lead the Argentine economy into another default.

## 1 LITERATURE REVIEW

As a special phenomenon in the world economy, Argentina's economic development has attracted the attention of theorists who have sought to define the problems in the country's economic development and, at the same time, to propose measures to change the often critical economic situation. In the scientific economic literature, we encounter many fundamental articles on the subject. Let us mention at least some of the works published in the world's renowned scientific journals. Our attention was drawn to an analytical article by Lewis published under the title "Explaining decline: a review of recent debates in the economic and social history literature on Argentina" (Lewis, 1998). The author focused on an assessment of published quantitative and qualitative data on the development of the Argentine economy, the analysis of which was intended to explain the failure to complete the relatively smooth transition from rapid economic growth and institutional change in the late 19th century to a developed economy and economic policy in the second half of the 20th century. The article analyzes three distinct phases in Argentine growth over the last hundred years: strong, sustained growth from about the 1870s to the end of the 19th century; a period of rapid cyclical change but a negative overall trend from 1910 to 1940; and another strong upswing from the 1940s to the 1970s. For almost fifty years, Argentina experienced no notable long-term positive results in economic growth. In terms of an assessment of political economy, the author considers institutional failure as the inability to resolve distributional conflicts between accumulation and consumption and between different sectors of the economy.

Another interesting paper by R. Spruk (2019) "The rise and fall of Argentina" examines again the institutional failures in ensuring the long-term positive development of Argentina's economy. He draws attention to the uniqueness of the situation in the world economy, where a rich country - Argentina - is gradually slipping into the group of economically middle-developed countries. The author draws on an extensive Argentine historical bibliography to identify institutional failures and traces them over the period 1850-2012. The paper concludes that with effective economic management and the necessary structural changes, Argentina would have largely avoided decline and could have been among the rich countries with a per capita income like that of New Zealand. R. Scharff (20039 in his article "Argentina: from hyperinflation to deflation and foreign economic insolvency" also reflects on the achievements of the historical development of Argentina's economy up to the issue of its insolvency. He examines Argentina's economic growth and compares it historically with the situation in the USA, Australia, Canada, and OECD member states during the 20th century. He analyzes the impact of interest rates and their effect on economic growth, explains the role of the currency board in stabilizing the Argentine economy and its subsequent default. In his paper, he searches for the cause of the long-term decline of the Argentine economy.

Our attention was drawn to the article by I. Brambilla et al. (2018) "Argentine trade policies in the XX century: 60 years of solitude". Like other authors, they pay attention to the peculiarities of Argentina's economic development. At the turn of the 19th and 20th centuries, the Argentine economy was on the road to prosperity, which, however, was never achieved in the absence of a change in the economic structure. International trade and trade policy are identified in the article as the culprit of the economic problems. The authors point to the fact that in the past Argentine governments have favored industrial development over agriculture, in which Argentina has a major comparative advantage. The economic policies of successive governments have not led to the expected economic growth and restructuring of the economy.

In his article "Currency Board in Argentina", L. Křupka (2021) analyses the effectiveness of the introduction of the currency board in the 1990s in the Argentine economy. In the 1990s, President C. Menem deployed the currency board policy to reduce inflation. Inflation declined in absolute terms, but Křupka points out that the currency board policy lacked other components of a stabilizing macroeconomic policy and lacked institutional factors therefore the system was not fully and long term functional. A deep crisis followed, which ended with the declaration of bankruptcy in the early 2000s.

According to J. Jonas (2002), in fact, the path of least resistance has been external borrowing rather than constraining, politically difficult, compromises. American economist P. Samuelson said in 2005: "*If I had been asked in 1945 which part of the world had the greatest prospects, I would have said Latin America - Argentina and Chile. They have a mild climate and a population of European origin. I was absolutely wrong*" (Glaeser et al., 2018).

M. Mussa (2002), in his work "Argentina and the Fund: From Triumph to Tragedy (Policy Analyses in International Economics)" examines the evolution of Argentina's economy at the turn of the century. He reviews Argentina's initially successful, decade-long experiment with monetary and market-oriented economic reform, which led to the stabilization of the Argentine economy. However, Moussa reflects on the catastrophic crisis of late 2001 and early 2002. He points out that the IMF consistently supported Argentina's stabilization and reform efforts in the 1990s. The author points to many of Argentina's economic policies that could be implemented in other developing economies. However, he questions where there was a flaw in Argentina's choice of economic policy instruments that did not lead to Argentina's long-term success.

## 2. METHODOLOGY

The purpose of the practical part of the work is:

- collect the necessary statistical information and form a representative sample to build a model based on data on the economy of Argentina,
- to highlight the most risk-dominant indicators (financial, macroeconomic, and institutional indicators), allowing the best way to divide the country's economy in terms of the default / non-default attribute,
- based on the selected indicators, build a set of multifactor models for assessing the probability of default,
- to analyze the quality of the obtained models and provide an economic interpretation.

In practice, there are many approaches to assessing the probability of default. In following two figures we provide an overview and develop a classification of the main models of this type, considering the prerequisites and assumptions underlying each model, the strengths, and weaknesses of each subclass of models.

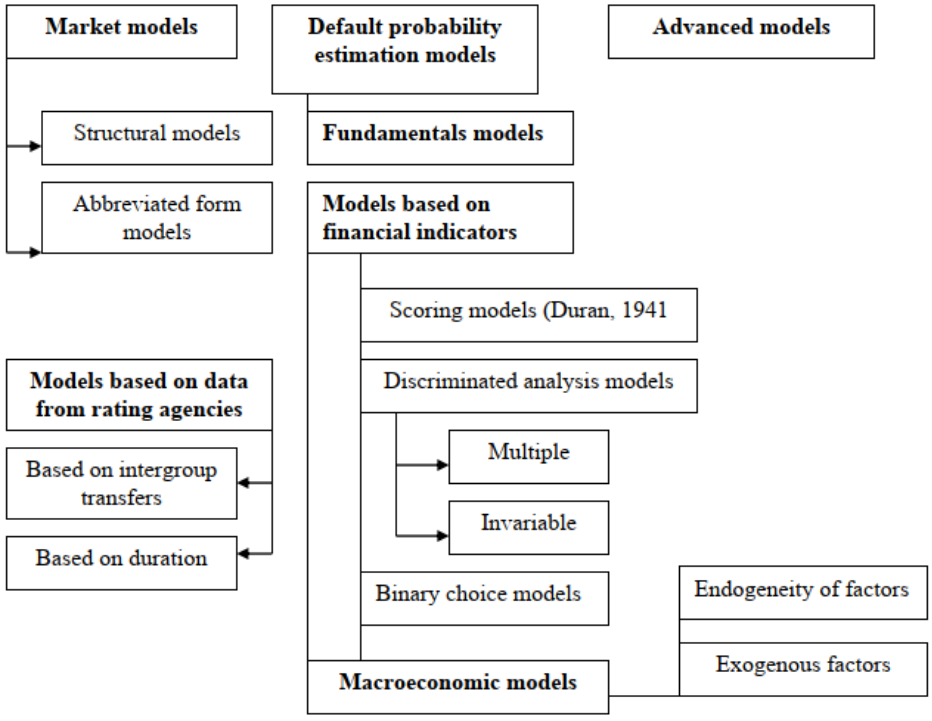


**Figure 1.** Classification of default probability models
Source: authors

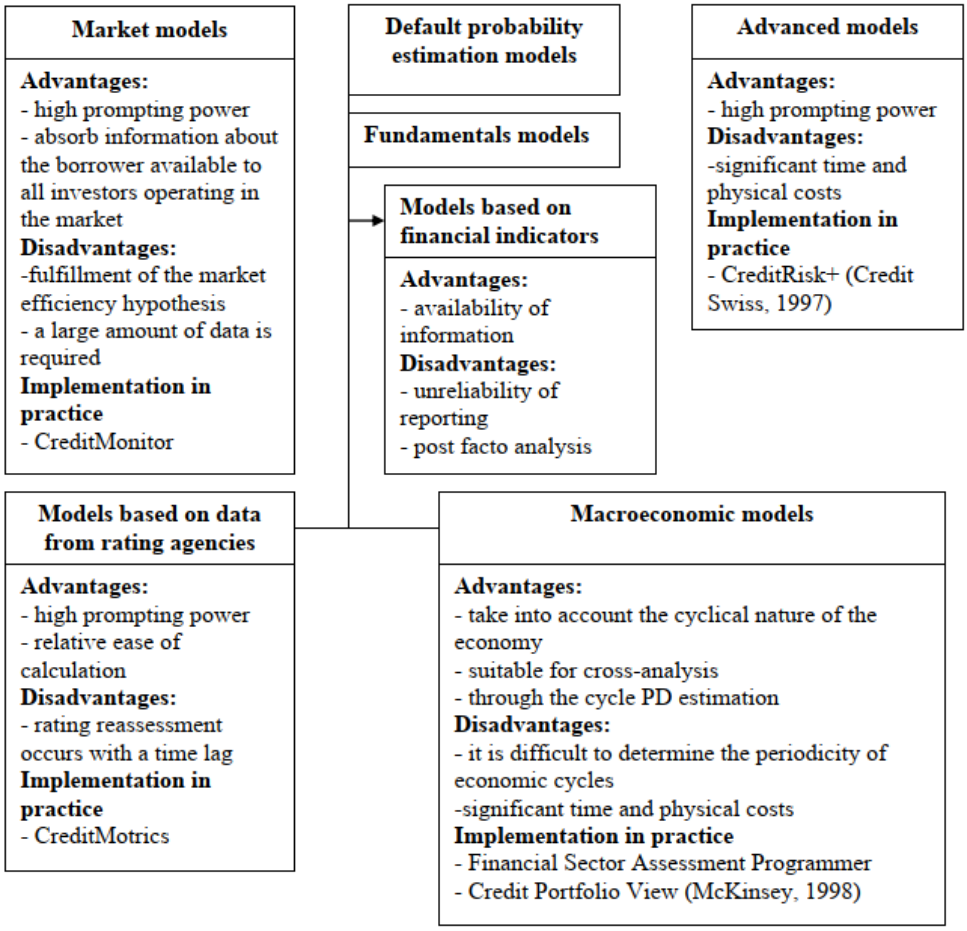


**Figure 2.** Analysis of default probability models
Source: authors

## 2.1 Modeling the probability of default in the Argentine economy: multivariate analysis

Within the framework of multivariate modeling of the probability of default, it is proposed to carry out the following main stages:

- Analysis of emissions and data rationing.
- Analysis of the multicollinearity of dependence and pair wise correlations.
- Selection of the most risk-dominant financial indicators using the following methods:
  - Method 1: Conducting statistical tests to isolate the most descriptive variables.
  - Method 2: selection of the optimal combination of factors in terms of model quality based on the phased inclusion of indicators from each class.
  - Method 3: selection of factors based on one-way factors AR (Accuracy Ratio) and ROC-curves.
- Testing the hypothesis about the importance of macroeconomic factors.
- Testing the hypothesis about the importance of institutional factors.
- Checking the functional form of the dependence of the explanatory factors of the model.
- Checking the quality of the final models and a comparative analysis of the results.

In this paper, a multivariate model for assessing the probability of default is built based on binary choice models.

The functional dependence of the binary model is set by the logit-model, which looks like:

$$P(Y_i = 1) = \frac{1}{1 + e^{-(b_0 + b_1 X_{i1} + b_2 X_{i2} + \cdots + b_n X_{in}}}$$

where:

$Y_i = \{^{1, default}_{0, undefault}$,
$X_{ij}$ = the value of the j-th explanatory variable for the i-borrower,
$b_j$ = regression coefficient of the j-th variable.

Observations of financial, macroeconomic, and institutional indicators were used as a vector of explanatory variables. Calculations were performed using the EViews, MedCalc and Excel programs.

## 2.2 Emission Analysis and Data Normalization

Several indicators may be characterized by too high / low values for sub-samples relative to the aggregate average of the indicator for the sample, which may be due to a significant number of outliers in the sample. To reduce the effect of outliers for each of the sub-samples, it is proposed to apply Chebyshev's inequality, and assume that an outlier is the value of an indicator that satisfies the following condition:

$(x_i - M_{X_i})\rangle^3 \times \sigma_{x_i}$ , for the upper border
$(x_i - M_{X_i})\rangle^{-3} \times \sigma_{x_i}$ , for the lower bound of the indicator value
where:

$M_{X_i}$ – the mathematical mean of the i-th explanatory variable
$\sigma_{x_i}$ – the standard deviation of the i-th explanatory variable.

In this case, the identified outliers are replaced by the upper / lower value of the interval, respectively. For the purposes of standardization and sample smoothing, the entire population of observations was normalized relative to the standard deviation as follows:

$$x_{ij}^{norm} = \frac{x_{ij} - M_{x_j}}{\sigma_{x_j}}$$

where:

$x_{ij}^{norm}$ – normalized value of the j-th explanatory variable of the i-th observation
$x_{ij}$ – value of the j-th explanatory variable of the i-th observation
$M_{x_j}$ – mathematical mean of the j-th explanatory variable
$\sigma_{x_j}$ – standard deviation of the j-th explanatory variable.

# 3. RESULTS

## 3.1 Analysis of multicollinear dependence and pairwise correlations

One of the important stages of multivariate analysis is multicollinearity analysis. It is possible to identify the multicollinearity of variables using the analysis of pair wise correlations, which will help to exclude the possibility of including indicators with strong interdependence in the model. In the framework of this work, the analysis of correlations was carried out using the analysis of Spearman`s correlation coefficients, which were calculated as:

$$\rho = 1 - \frac{6}{n(n-1)(n+1)} \sum_{i=1}^{n} (R_i - S_i)^2$$

Where:

$R_i, S_i$ – the ranks of the corresponding n observations.

Spearman's coefficient takes values from -1 to 1. The coefficient, which takes a value equal to one, indicates that there is a strict direct linear relationship between the indicators, and vice versa, a coefficient equal to -1 indicates the presence of a strict inverse relationship.
In table 1 the initial data of main economic indicators of Argentina in 2001-2020 for modelling the probability of default are systematized by the authors.

**Table 1.** Initial data of main economic indicators of Argentina in 2001-2020 for modelling the probability of default

| *Year* | *Agricultural products export, mln USD* | *Import of goods, mln USD* | *Export of goods, mln USD* | *Capital Inflow / Outflow, mln USD* | *Total debt mln USD* | *GDP deflator, inflation, %* | *Investments in fixed assets, mln USD* | *TOTAL outstanding bonds, mln USD* |
|---|---|---|---|---|---|---|---|---|
| 2001 | 12653,21 | 20321,13 | 26610,06 | 2166,14 | 144453 | -1,10 | 38098,83 | 419,28 |
| 2002 | 12758,75 | 8989,55 | 25709,37 | 2148,91 | 137320 | 30,56 | 11688,42 | 5340,44 |
| 2003 | 15644,77 | 13850,77 | 29938,75 | 1652,01 | 178821 | 10,50 | 19313,49 | 6461,27 |
| 2004 | 18034,4 | 22445,25 | 34575,71 | 4124,71 | 191296 | 18,36 | 26170,38 | 4245,83 |
| 2005 | 20001,83 | 28688,64 | 40106,39 | 5265,25 | 128630 | 10,32 | 34483,17 | 2925,39 |
| 2006 | 22779,6 | 34153,54 | 46546,22 | 5537,35 | 136725 | 13,74 | 42630,51 | 782,01 |
| 2007 | 30286,57 | 44707,04 | 55779,58 | 6473,16 | 144729 | 14,94 | 56114,68 | 1640,58 |
| 2008 | 38818,05 | 57461,77 | 70018,85 | 9725,55 | 145975 | 23,17 | 68732,76 | 2231,43 |
| 2009 | 29509,08 | 38786,16 | 55672,12 | 4017,16 | 147119 | 15,38 | 51883,57 | 828,14 |
| 2010 | 36546 | 56792,38 | 68174,45 | 11332,72 | 164331 | 20,92 | 70497,81 | 704,76 |
| 2011 | 46276,93 | 73960,66 | 82981,09 | 10839,93 | 178963 | 23,70 | 91444,07 | 1517,27 |
| 2012 | 44649,99 | 67973,97 | 79982,38 | 15323,93 | 197464 | 22,31 | 86579,29 | 11883,35 |
| 2013 | 43446,9 | 74441,75 | 75962,98 | 9821,66 | 223439 | 23,95 | 89922,20 | 3441,81 |
| 2014 | 39218,99 | 65735,99 | 68404,35 | 5065,34 | 239325 | 40,28 | 84105,64 | 0,00 |
| 2015 | 35380,33 | 60202,84 | 56783,95 | 11758,99 | 240665 | 26,58 | 92571,21 | 6344,13 |
| 2016 | 38038,33 | 55910,81 | 57879,35 | 3260,16 | 275446 | 41,12 | 79572,90 | 2394,70 |
| 2017 | 36354,11 | 66899,3 | 58384,19 | 11516,86 | 320935 | 26,01 | 97588,26 | 11223,79 |
| 2018 | 34380,78 | 65440,97 | 61558,36 | 11872,86 | 332192 | 40,01 | 75883,50 | 5199,43 |
| 2019 | 39037,36 | 49125,03 | 65114,13 | 6663,06 | 323065 | 50,62 | 60331,49 | 22018,27 |
| 2020 | 36130,15 | 42355,51 | 54883,82 | N/A | 335582 | 39,84 | 51246,10 | 2701,73 |

Source: authors

The results of the analysis of Spearman's correlations for the macroeconomic indicators are presented in table 2. It is necessary to analyze the level of correlation dependence for the selected macro indicators. This analysis must be carried out to test the hypothesis of high interdependence of macro indicators and to exclude multicollinear data.

According to the results obtained, the closest relationship is characteristic of the indicators of Export of goods and Agricultural products export, Nominal GDP and Investments in fixed assets, Bonds and Import of goods, Investments in fixed assets and Bonds, Capital Inflow / Outflow and Import: the correlation of indicators is 97.3%, 97.3%, 97.1%, 88.4%, 80.2% accordingly. The following is a frequent impact of factors such as Agricultural products export and Bonds.

Moreover, these indicators are highly correlated with each other: Agricultural products export and bonds 89.4%. These results indicate the high importance of the indicator of the cost of agricultural products in terms of influencing the value of other macro parameters and general trends in the Argentina economy. Inflation indicators also show a high correlation: total debt have a correlation with GDP (77.7%). The Total Debt and GDP deflator also have a high correlation (77.7%), Capital inflow/outflow and Agricultural products export (74.5%), Capital inflow/outflow and Total Export of goods (76.7%).

Analysis of Spearman`s correlations for Capital/Inflow and GDP deflator (inflation) did not reveal a high correlation dependence for them since the value of the correlation coefficient is less than 30% (22.9%). As a result, to exclude the effect of multicollinearity and high correlation between the indicators under consideration, it is proposed not to use combinations of indicators with a correlation coefficient of more than 70% in the framework of multivariate regression analysis at the next stages of modeling.

Selected factors for the integration of the defaults modeling showed the impact on the resultant position.

**Table 2.** Spearman correlation matrix for macroeconomic indicators

| *Indicator* | *1. Agricultural products export* | *2. Import of goods,* | *3. Export of goods* | *4. Capital Inflow / Outflow* | *5. Total debt* | *6. GDP deflator, inflation* | *7. Bonds* | *8. Investments in fixed assets* | *9. Nominal GDP* |
|---|---|---|---|---|---|---|---|---|---|
| 1. Agricultural products export | 1,000 | x | x | x | x | x | x | x | x |
| 2. Import of goods | 0.945 | 1,000 | x | x | x | x | x | x | x |
| 3. Export of goods | **0.973** | 0,935 | 1,000 | x | x | x | x | x | x |
| 4. Capital Inflow / Outflow | 0.745 | **0,802** | 0,767 | 1,000 | x | x | x | x | x |
| 5. Total debt | 0.475 | 0,458 | 0,312 | 0,349 | 1,000 | x | x | x | x |
| 6. GDP deflator, inflation | 0.551 | 0,442 | 0,428 | 0,229 | 0,777 | 1,000 | x | x | x |
| 7. Bonds | 0.894 | **0,971** | 0,859 | 0,769 | 0,45 | 0,435 | 1.000 | x | x |
| 8. Investments in fixed assets | 0.864 | 0,928 | 0,791 | 0,712 | 0,625 | 0,401 | **0,884** | 1,000 | x |
| 9. Nominal GDP | 0,709 | 0,935 | 0,8 | 0,703 | 0,612 | 0,402 | **0,112** | 0,973 | 1.000 |

Source: authors.

## 3.2 Testing the hypothesis about the significance of macroeconomic indicators

For choosing the final model, considering macro factors, for each possible combination of financial indicators selected at the previous stage (based on testing for descriptive strength, stepwise selection and ROC analysis), one of the selected macro factors was alternately included, and the influence of this macro-factor on the value of the coefficient of determination of the model. This analysis also considered the results of the multicollinearity analysis of financial and macroeconomic indicators carried out earlier. Mathematical apparatus and purpose of binary logistic regression – a popular tool for solving regression and classification problems. ROC analysis is closely related to binary logistic regression and is used to assess the quality of models: it allows an analyst to select a model with the best predictive power, analyze the sensitivity and specificity of models, and select a cut-off threshold. Logistic regression is a useful classical tool for solving the problem of regression and classification. ROC analysis is an apparatus for analyzing the quality of models. When constructing multivariate models, it was also assumed that no more than 8-10 different indicators were simultaneously included at the same time, guided by the principle that to build a model for each explanatory indicator, there must be at least 30 default observations.

Model options based on a multivariate binary choice model considering macro factors within the first, second approaches to the selection of indicators are presented in table 3. Table shows the values of the regression coefficients and the coefficients of determination of the corresponding models. As a result, for all approaches to the selection of risk-dominant macroeconomic indicators, the best results (the highest coefficient of determination and the significance of the selected indicators at the 5-8% level) were observed when the macroeconomic indicator of the Agricultural products export was included in the model. The analysis of ROC curves and AR coefficients for the macroeconomic indicators under consideration also confirmed the high-risk significance of this indicator for the considered sample; in comparison with other macroeconomic indicators, this indicator has the highest AR value.

**Table 3.** Results of multivariate analysis, considering macroeconomic factors in the framework of the statistical selection approach for the indicator

| *No. model* | *Selected macroeconomic indicators* | | | | | | | | | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1. Agricultural products export* | *2. Import of goods* | *3. Export of goods* | *4. Capital Inflow / utflow* | *5. Total debt* | *6. GDP deflator, inflation* | *7. Bonds* | *8. Investments in fixed assets* | *9. Nominal GDP* | |
| 1. Agricultural products export | 0.928 | x | x | x | x | x | x | x | x | 0.862 |
| 2. Import of goods | x | 0.911 | x | x | x | x | x | x | x | 0.830 |
| 3. Export of goods | x | x | 0.902 | x | x | x | x | x | x | 0.814 |
| 4. Capital Inflow / outflow | x | x | x | 0.733 | x | x | x | x | x | 0.538 |
| 5. Total debt | x | x | x | x | 0.963 | x | x | x | x | 0.928 |
| 6. GDP deflator, inflation | x | x | x | x | x | 0.820 | x | x | x | 0.673 |
| 7. Bonds | x | x | x | x | x | | 0.494 | x | x | 0.244 |
| 7. Investments in fixed assets | x | x | x | x | x | x | X | 0.878 | x | 0.771 |
| 8. Nominal GDP | x | x | x | x | x | x | x | x | 0.966 | 0.934 |

Source: authors.

## 3.3 Comparative analysis and quality assessment of the final models

Thus, when choosing indicators based on a statistical selection of variables, the following model shows the best results ($R^2$ = 93%) – Total Debt and Nominal GDP.

$$P(Y_i = 1) = \frac{1}{1 + e^{-(b_0 + b_1 X_{i1} + b_2 X_{i2} + \cdots + b_n X_{in}}}$$

where:

$Y_i = \{^{1, default}_{0, undefault}$

**Table 4.** Main indicators and its value of the regression coefficient

| *Indicator* | *Value of regression coefficient* |
|---|---|
| 1. Agricultural products export | 0.8284-0.8622 |
| 2. Import of goods | 0.7016-0.8299 |
| 3. Export of goods | 0.7192-0.814 |
| 4. Capital inflow / outflow | 0.4184-0.5383 |
| 5. Total debt | 0.7912-0.9277 |
| 6. GDP deflator, inflation | 0.5178-0.6727 |
| 7. BONDS | 0.1586-0.2439 |
| 8. Investment in fixed assets | 0.6037-0.7714 |
| 9. Nominal GDP | 0.8151-0.9337 |

Source: authors.

Next, we move on to checking the quality of the models using a classification table (following two tables), in which the observed indicators of belonging to one or another of the two considered samples (default and non-default) are compared with the predicted outcomes based on the resulting model.

**Table 5.** Classification table: selection of indicators based on statistical selection of variables

| *Classification table* | | *Based on model* | |
|---|---|---|---|
| | | *Not default* | *Default* |
| Really | Not default | 84% (TN) | 54% (FP) |
| | Default | 16% (FN) | 46% (TP) |

Source: authors.

**Table 6.** Classification table: selection of indicators based on the phased inclusion of factors

| Classification table | | Based on model | |
|---|---|---|---|
| | | Not default | Default |
| Really | Not default | 84% (TN) | 53% (FP) |
| | Default | 16% (FN) | 47% (TP) |

Source: authors.

*Note:*

The first:

TN – true negative (correctly classified case of default),
TP – true positive (correctly classified case of non-default),
FP - false positive (falsely classified case of not default),
FN - false negative (falsely classified default case).

The second:

All indicators are significant at the 5-8% significance level. See Table 3. All indicators normalized according to $x_{ij}^{norm} = (x_{ij} - M(x_j))/\sigma(x_j)$.

Based on the results obtained, it can be concluded that the model built based on statistical selection of factors shows similar results in terms of predicting non-default cases, and worse in terms of predicting default cases, compared to the model built based on the phased inclusion of variables.

The ability to better identify non-defaults than to identify cases of defaults, in general, is a characteristic of this class of models, in part this fact can be explained by the fact that the models were built based on a sample in which the number of non-default cases is greater than the number of default variants (based on the ratio of 3 to 1).

## 3.4 Predictive validity of main macroeconomic indicators of Argentina in 2001-2020

Following tables presents the dynamics analysis of macroeconomic indicators of Argentina in 2001-2020.

**Table 7.** Dynamics of main economic indicators of Argentina in 2001-2020

| *Year* | *Export mln USD* | *Changes of export* | | *Default, mld USD* | *Agri export total, mln USD* | *Debt, mlnl USD* | *External debt, mln USD* |
|---|---|---|---|---|---|---|---|
| | | *In absolute terms, mln USD* | *In relative terms, rate of increase/decrease, %* | | | | |
| 2001 | 26610,06 | -900,68 | ... | x | 12653,21 | 144453 | 84564 |
| 2002 | 25709,37 | 4229,38 | -3,38 | 90 | 12758,75 | 137320 | 87604 |
| 2003 | 29938,75 | 4636,95 | 16,45 | x | 15644,77 | 178821 | 102008 |
| 2004 | 34575,71 | 5530,68 | 15,49 | x | 18034,40 | 191296 | 111628 |
| 2005 | 40106,39 | 6439,84 | 16,00 | x | 20001,83 | 128630 | 60926 |
| 2006 | 46546,22 | 9233,36 | 16,06 | x | 22779,60 | 136725 | 56247 |
| 2007 | 55779,58 | 14239,27 | 19,84 | x | 30286,57 | 144729 | 62132 |
| 2008 | 70018,85 | -14346,73 | 25,53 | x | 38818,05 | 145975 | 55733 |
| 2009 | 55672,12 | 12502,33 | -20,49 | x | 29509,08 | 147119 | 55007 |
| 2010 | 68174,45 | 14806,64 | 22,46 | x | 36546,00 | 164331 | 61145 |
| 2011 | 82981,09 | -2998,71 | 21,72 | x | 46276,93 | 178963 | 60585 |
| 2012 | 79982,38 | -4019,40 | -3,61 | x | 44649,99 | 197464 | 60171 |
| 2013 | 75962,98 | -7558,63 | -5,03 | x | 43446,90 | 223439 | 60758 |
| 2014 | 68404,35 | -11620,39 | -9,95 | 1,3 | 39218,99 | 239325 | 67303 |
| 2015 | 56783,95 | 1095,39 | -16,99 | x | 35380,33 | 240665 | 74085 |
| 2016 | 57879,35 | 504,85 | 1,93 | x | 38038,33 | 275446 | 91815 |
| 2017 | 58384,19 | 3174,16 | 0,87 | x | 36354,11 | 320935 | 129848 |
| 2018 | 61558,36 | 3555,77 | 5,44 | x | 34380,78 | 332192 | 161461 |
| 2019 | 65114,13 | -10230,31 | 5,78 | 323 | 39037,36 | 323065 | ... |
| 2020 | 54883,82 | -54883,82 | -15,71 | x | 36130,15 | 335582 | ... |

Source: authors

**Table 8.** Dynamics of main economic indicators Agri Export and GDP of Argentina in 2001-2020

| *Year* | *Agri export total, mln USD* | *Changes of agri export* | | *GDP, mln USD* | *Changes of GDP* | |
|---|---|---|---|---|---|---|
| | | *in absolute terms, mln USD* | *in relative terms, rate of increase (decrease), %* | | *in absolute terms, mln USD* | *in relative terms, rate of increase (decrease), %* |
| 2001 | 12653,21 | … | … | 289860,61 | … | … |
| 2002 | 12758,75 | 105,54 | 0,83 | 258281,79 | -31578,82 | -10,89 |
| 2003 | 15644,77 | 2886,02 | 22,62 | 281106,26 | 22824,47 | 8,84 |
| 2004 | 18034,4 | 2389,63 | 15,27 | 306488,95 | 25382,69 | 9,03 |
| 2005 | 20001,83 | 1967,43 | 10,91 | 333618,31 | 27129,36 | 8,85 |
| 2006 | 22779,6 | 2777,77 | 13,89 | 360465,08 | 26846,77 | 8,05 |
| 2007 | 30286,57 | 7506,97 | 32,95 | 392934,52 | 32469,44 | 9,01 |
| 2008 | 38818,05 | 8531,48 | 28,17 | 408876,79 | 15942,27 | 4,06 |
| 2009 | 29509,08 | -9308,97 | -23,98 | 384677,31 | -24199,48 | -5,92 |
| 2010 | 36546 | 7036,92 | 23,85 | 423627,42 | 38950,11 | 10,13 |
| 2011 | 46276,93 | 9730,93 | 26,63 | 449061,81 | 25434,39 | 6,00 |
| 2012 | 44649,99 | -1626,94 | -3,52 | 444452,55 | -4609,26 | -1,03 |
| 2013 | 43446,9 | -1203,09 | -2,69 | 455143,07 | 10690,52 | 2,41 |
| 2014 | 39218,99 | -4227,91 | -9,73 | 443707,07 | -11436,00 | -2,51 |
| 2015 | 35380,33 | -3838,66 | -9,79 | 455825,42 | 12118,35 | 2,73 |
| 2016 | 38038,33 | 2658,00 | 7,51 | 446342,76 | -9482,66 | -2,08 |
| 2017 | 36354,11 | -1684,22 | -4,43 | 458922,94 | 12580,18 | 2,82 |
| 2018 | 34380,78 | -1973,33 | -5,43 | 447149,96 | -11772,98 | -2,57 |
| 2019 | 39037,36 | 4656,58 | 13,54 | 437813,40 | -9336,56 | -2,09 |
| 2020 | 36130,15 | -2907,21 | -7,45 | 394446,95 | -43366,45 | -9,91 |

Source: authors

Stochastic relationships are investigated using correlation-regression analysis. In socio-economic forecasting, this method is used to construct contingent forecasts and forecasts based on the assessment of stable cause and effect relationships. The correlation-regression model of the relationship is a regression equation. Linear regression is a function that binds the mean values of X (independent variable) and Y (dependent variable). The coefficient of determination ($R^2$) shows how many percent of the variation Y is due to variation X (Karpenko and Filyppova, 2016). Following figures present probabilistic forecasts of the main macroeconomic indicators until 2026, provided that the trend of the previous period continues.

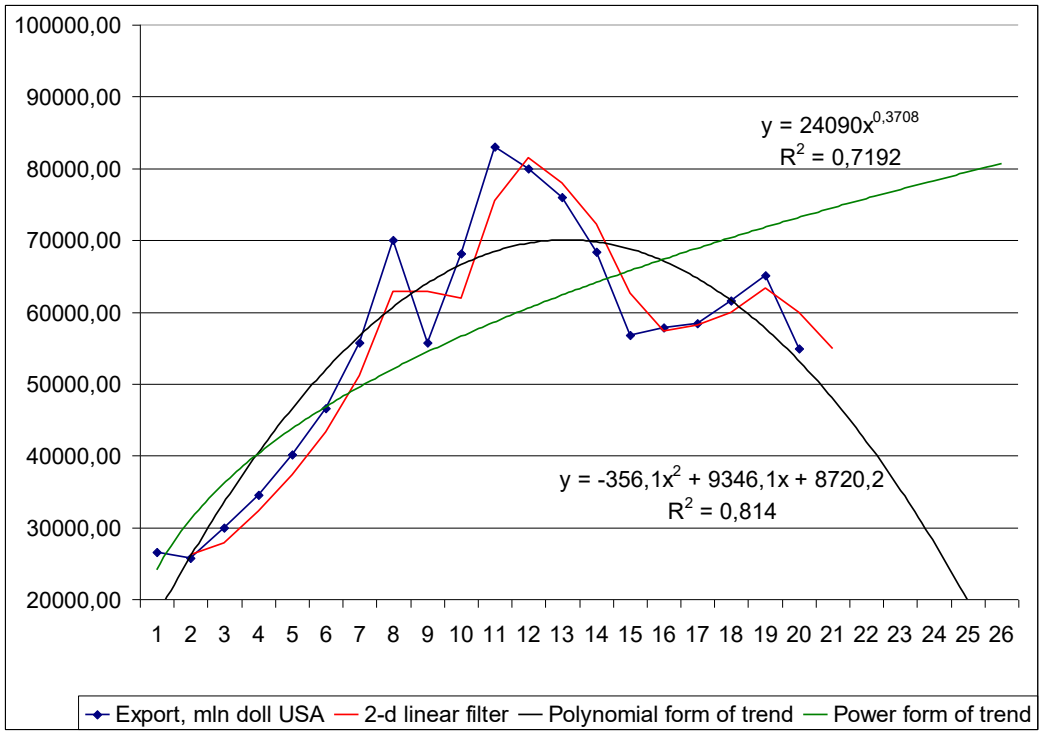


**Figure 3.** Forecasted estimation of Export Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors.

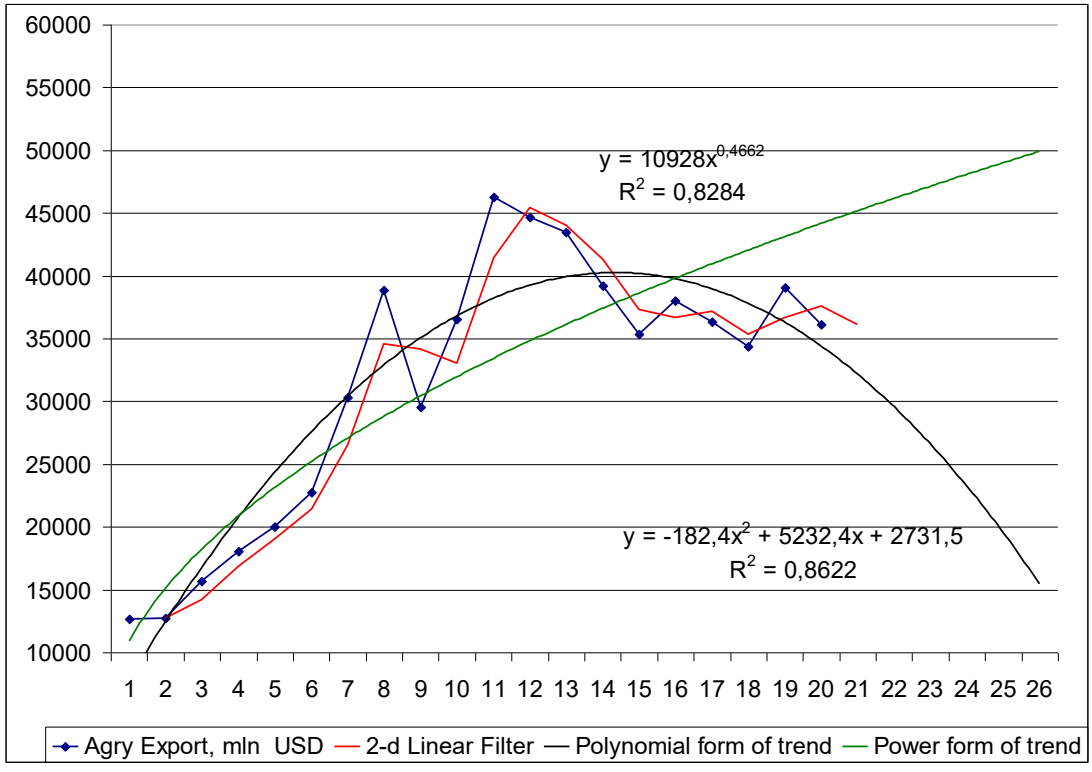


**Figure 4.** Forecasted estimation of Agry Export Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

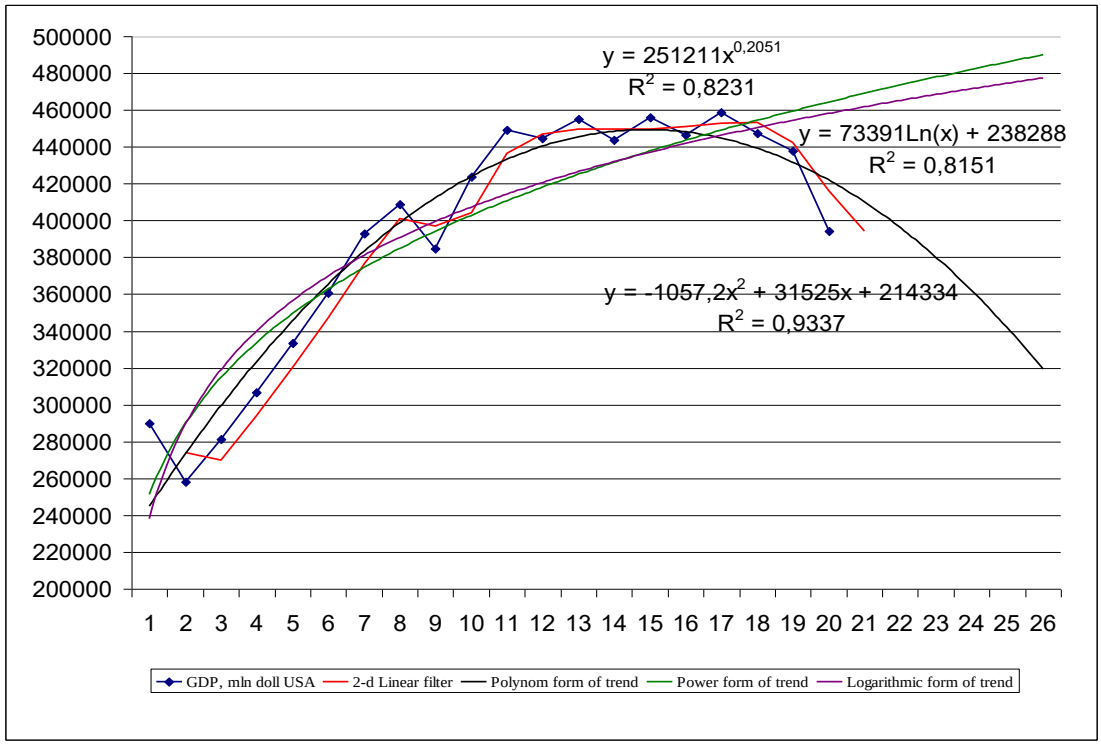


**Figure 5.** Forecasted estimation of Nominal GDP Argentina by the trend extrapolation method for 2021-2026: predic tive validity

Source: authors

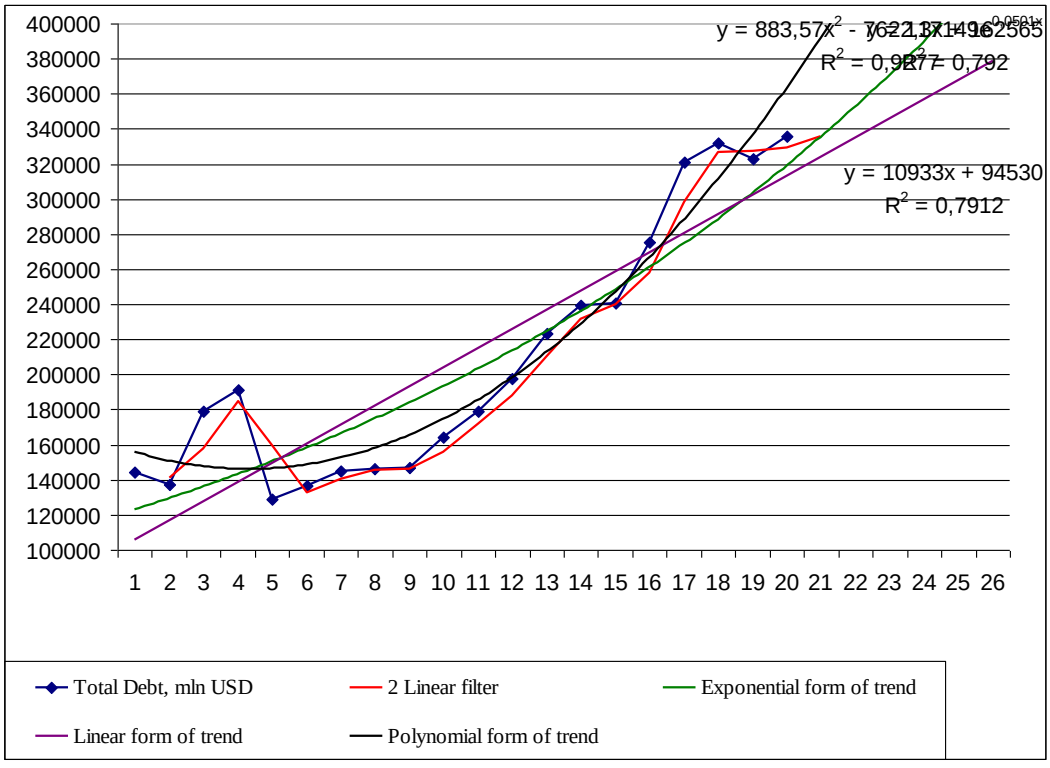


**Figure 6.** Forecasted estimation of Total Debt Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

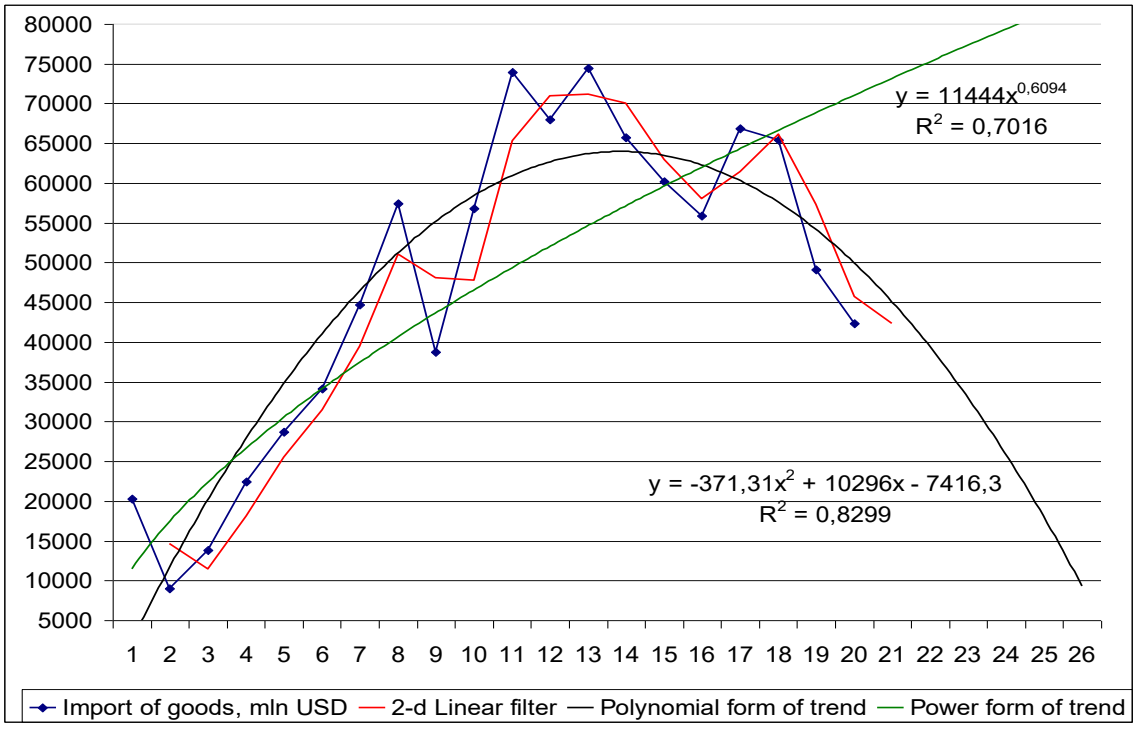


**Figure 7.** Forecasted estimation of Import Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

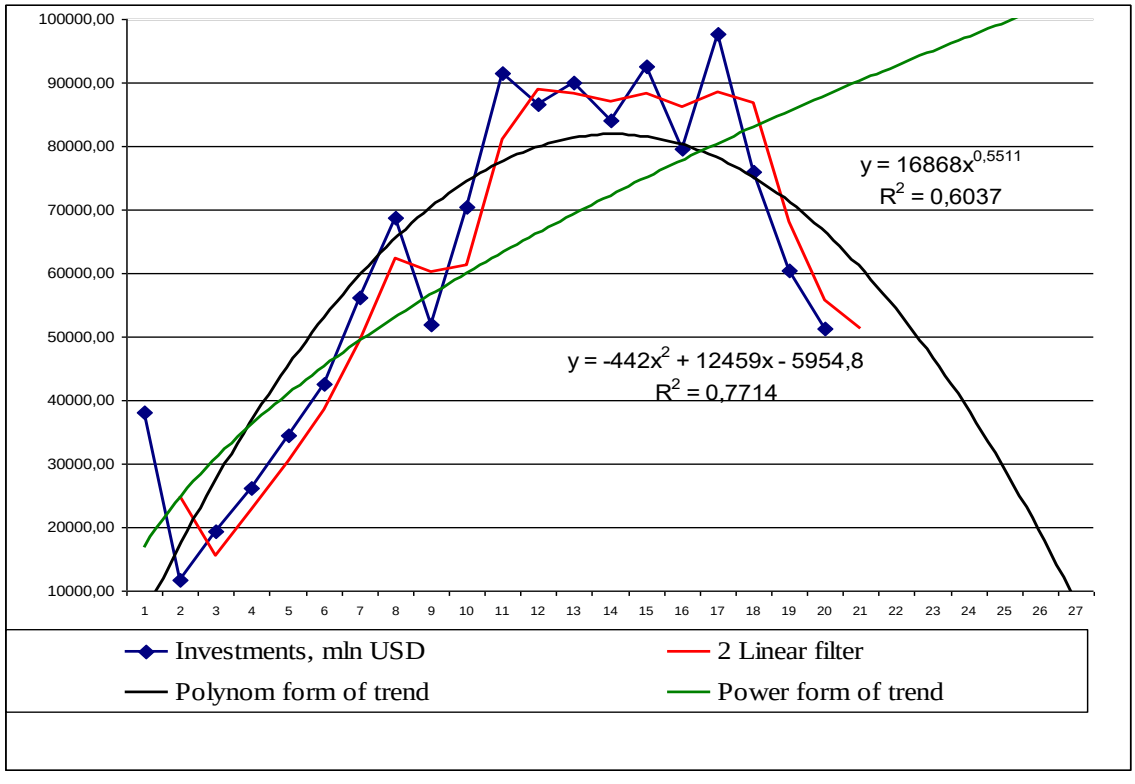


**Figure 8.** Forecasted estimation of Investments Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

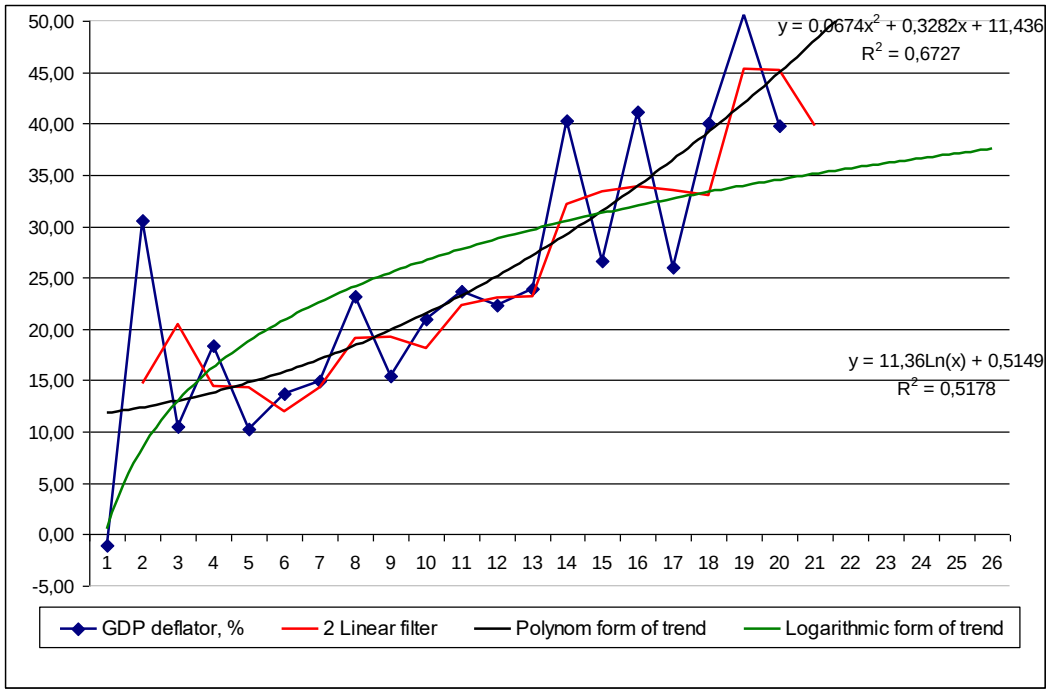


**Figure 9.** Forecasted estimation of GDP deflator Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

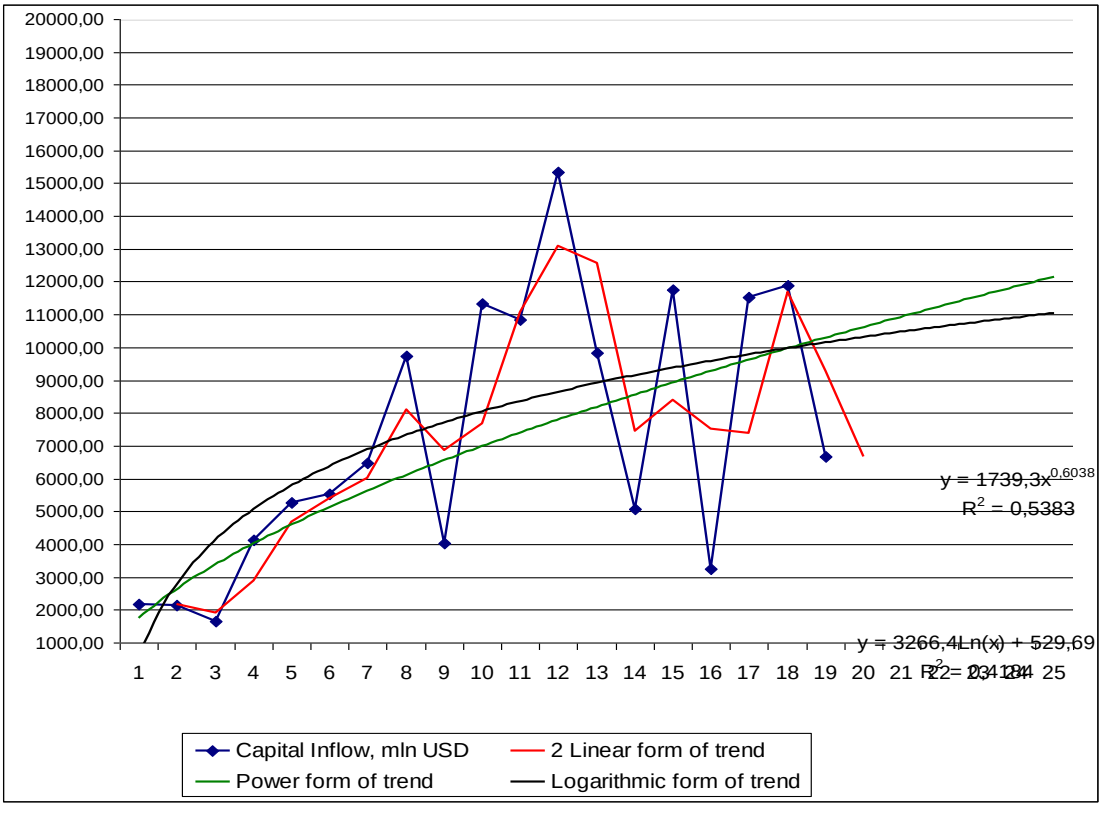


**Figure 10.** Forecasted estimation of Capital Inflow Argentina by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

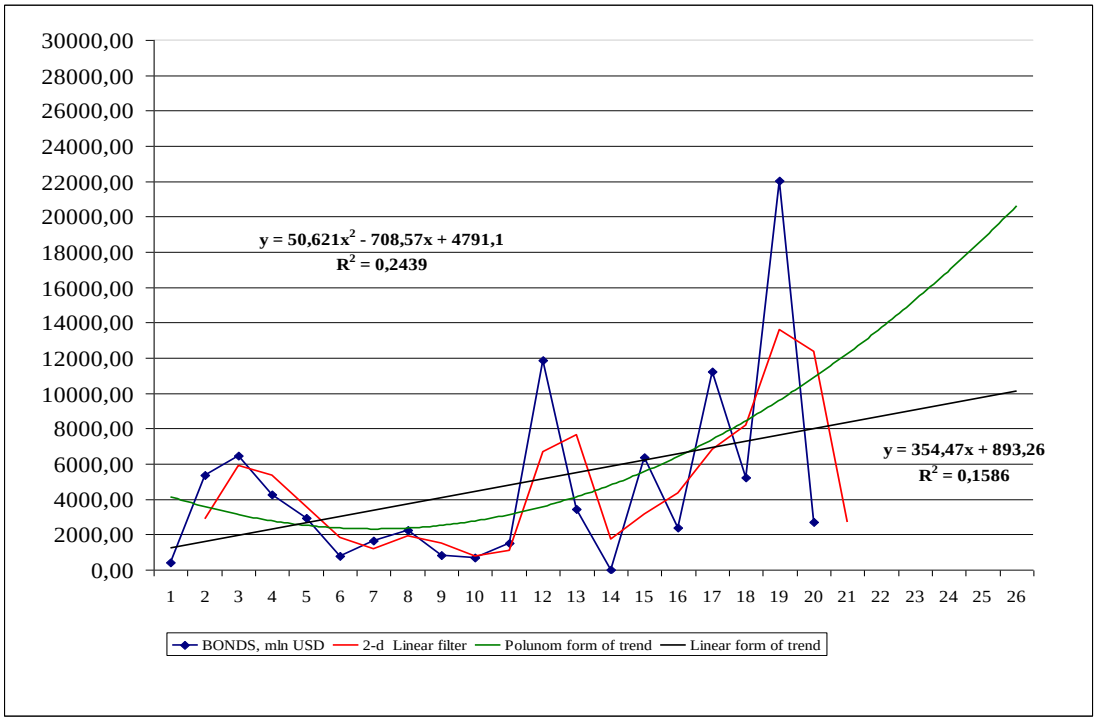


**Figure 11.** Forecasted estimation of BONDS by the trend extrapolation method for 2021-2026: predictive validity

Source: authors

## CONCLUSION

Argentina's historical development since the second third of the 20th century is an example of a long-standing failed economic policy that has led to uneven growth, inflation, exchange rate devaluations and frequent defaults. As recently as the second half of the 20th century, Argentina was still one of the rich countries; this position has been steadily deteriorating. Argentina's economic development since the Great Depression has been described as a lost century. At the turn of the 19th and 20th centuries, Argentina had sufficient resources to modernize and restructure its economy. At the root of Argentina's economic problems are macroeconomic and structural imbalances. In the past, attempts have been made to address the imbalances by implementing stabilization programs. Their successes had only a short-term positive effect. There are several causes that ultimately led the country to default. The economy has been very slow to restructure and has lagged behind the world's economic vanguard. The economies that are modernizing and restructuring are relegating Argentina to the bottom ranks of the world economy. The reluctance of the population to undergo structural changes in the economy is worsening the country's position in world competition, but also the economic and social situation of the entire population.

The 9 factors selected to model the probability of default show the impact and extent of the event. Based on the results obtained, it can be concluded that the model built based on statistical selection of factors shows similar results in terms of predicting non-default cases, and worse in terms of predicting default cases, compared to the model built based on the phased inclusion of variables. The ability to better identify non-defaults than to identify cases of defaults, in general, is a characteristic of this class of models, in part this fact can be explained by the fact that the models were built based on a sample in which the number of non-default cases is greater than the number of default variants.

The final part of the paper was the forecasting of several dynamics by the method of trend extrapolation by the main macroeconomic indicators that were used in modeling the probability of default, in particular: total exports, agricultural exports, nominal Gross Domestic Product, Total Debt, import, investment, GDP deflator, Capital inflow, Bonds. Since the prehistory period is 20 years, it seems possible to give a

forecast estimate for 1/3 of the initial series of dynamics, that is, for 6 years ahead (from 2021 to 2026), provided that the previous trend continues. The predictive validity of the studied indicators is justified. Despite Argentina's frequent economic crises and recessions, the country remains one of the most developed and highly educated among Latin American countries.

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