CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

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Diploma Thesis Title:

THE WAYS OF IMPROVING THE EFFICIENCY OF THE IMPORT SUBSTITUTION IN THE AGRIFOOD SECTOR

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ANOTACE

Tématem této disertační práce je “Způsoby zvyšování efektivity politiky náhrady dovozu v zemědělsko-potravinářském sektoru”. Tato práce analyzuje celkový ekonomický problém a zkoumá většinu aspektů problému na různých úrovních

Tato disertační práce je rozdělena do tří kapitol. První kapitola zahrnuje teoretické aspekty substituce importu, výzkumné metody a metodiku. Tato kapitola také zkoumá cíle a způsoby, jak zvyšit efektivitu dovozu.

Druhá kapitola je založena na makroekonomické a mikroekonomické analýze substituce dovozu v zemědělsko-potravinářském odvětví. Na mikroekonomické úrovni byla pro analýzu vybrána akciová společnost “Sad-Gigant”. V závěrečné části kapitoly je problém řešen na příkladu sektoru jablek.

Výsledky provedené analýzy jsou základem pro vytvoření ekonometrického modelu ukazujícího přítomnost vzájemných závislostí mezi studovanými ukazateli. Třetí část také analyzuje,dovoz ze kterých zemí má největší vliv na produkci jablek v Rusku, a také uvadí prognózu vývoje situace pro příštích 5 let.

Situace, která je popsaná v práci je považována za klíčový faktor vedoucí ke stabilitě a prosperitě státu. Zvyšení efektivity substituce dovozu umožňuje státu dosáhnout mnoha významných cílů, jako stabilní ekonomický růst, snížení nezaměstnanosti, snížení závislostu na dovozu atd.

CONTENTS

INTRODUCTION

The given report discusses a common economic problem of import substitution and analyzes all aspects of the issue – on macro- and microeconomic levels. The situation described in the work is considered as a key factor leading to the prosperity of a state. Improvement of the import substitution efficiency allows a state to achieve many substantial goals, such as stable economic growth, lower unemployment rates, decrease the dependency from import, etc.

The given work analyzes many factors influencing the observed problem and offers tool for its solution. It describes the successful experience of some other countries which allows to choose the most appropriate way leading to the solution.

Relevance of the topic is that nowadays it is incredibly important to discuss, research, and analyze the results of the part experience regarding the problems of import substitution.

The purpose of the research is to analyze the effectiveness of the import substitution in the agrifood sector, identify some problems connected with it, and offer possible solutions to the problem.

The objectives of the research correspond with the following tasks that define the logic and structure of the work:

– to analyze the theoretical basis and methodological foundation of the import substitution effectiveness improvement;

– to evaluate the import substitution problem in the agrifood sector on the macroeconomic level;

– to research the problem on the microlevel;

– to conduct the comparative analysis of the import substitution problem on the relevant example – apples industry;

– econometric evaluation of the dependency of production from import on the example of apple industry; identification of the major importers having the most significant influence on the apples production;

– to identify the main trends existing in the import substitution and forecast the further development of the problem.

The scientific importance of this study is that it analyzes the problem from many sides, offers the most current solutions of the import substitution problem, gives reasonable comparative analysis of the main indicators within the agrifood industry, as well as in the one part of the industry – apples import and production. Also, the work presents quantitative data and uses econometric modelling tool to show the methodology for the problem solution.

The object of the research is the agrifood production in Russia and many other countries, the tools, which might help to improve the production, and apples production in Russia as a most relevant example showing the problem from the narrower side.

We have chosen the agrifood sector as a relevant and necessary for discussion. Currently it receives a lot of attention from the government and it is incredibly important to achieve self-sufficiency of basic foods and products implementing different tools of improving the effectiveness of the import substitution.

Subject of the research is the agrifood production in Russia and other factors influencing it, such as import from different countries.

The type of the research is quantitative as it presents a lot of statistical data and offers quantitative solution of the problem.

The major methods chosen are:

– statistical research and economic comparison methods (to gather the necessary data on the import substitution problem and compare it);

– regression analysis and modelling (to show a methodology for the problem solution).

Empirical base of the work consists of the databases of Food and Agriculture Organization of the United Nations, Federal State Statistic Service and Federal Customs Service, OSCD data and World bank data.

The Master's Thesis consists of an introduction, sixteen parts combined into three chapters, conclusion, references and appendix.

1. Theoretical basis of import substitution

1.1 Import substitution as a strategy of economic development

Import substitution can be a strong tool leading towards economic growth of a country and its stable position on the international level. Import substitution strategy is intended for the long term and should ensure the achievement of the objectives of the capacity and structure of domestic production while reducing the consumption of imported goods [1, P. 38]. The major focus of the import substitution strategy is to reduce the currently existing import to provide domestic producers with support and arrange this process in such a way that it keeps high domestic production numbers. The given strategy should be implemented accurately and rationally, while its unreasonable application might create shortage or scarcity of essential goods, which sometimes cannot be produced domestically due to geographical or technological reasons, or even foster counter measures from the other countries, which might lead to zero profit from international trade and, as a result, low or negative trade balance. Consequently, it means that the necessary import amount is substantial for an economy, but it should not prevent domestic producers from increasing their production volumes and all the strategy should be directed at motivating domestic producers to do so.

In general, when a country pursues the implementation of the import substitution strategy, it implies economic and social objectives. The given objectives foster the economic growth and stability and increase the population sustainability and well-being level. Let us describe the given objectives in detail.

1) Economic objectives:

– increasing the production effectiveness;
– limitation of the dependency from import;
– increasing the speed of GDP growth;
– increasing the tax volumes and assuring their stability [2, P. 124].

Economic objectives of pursuing the import substitution strategy are directed, first of all, at the general growth of a country. Increasing the production effectiveness leads to increased production volumes and, as a result, to bigger GDP. Another important objective of a state is to limit its dependency from import. In general, the attention of a government should be directed at the general well-being of a country, and the dependency from import makes the position of a state vulnerable and unstable.

Besides, the speed of GDP growth is incredibly important for a country, especially at the current situation with so many countries able to increase their volumes quite fast. One more economic objective is to increase the tax volumes. Taxes form the core of a country. With the help of improving the production effectiveness and by motivating domestic producers to grow and improve their organizations, governments are able to get stable taxes and make nation's well-being more enhanced and directed at the long-term certainty. The economic objectives are inseparably connected with the social ones, and usually one turns into another. The social objectives are presented below:

2) Social objectives:

– domestic employment rate growth;

– saturation of the domestic consumption market;

– ensuring the well-balanced social and economic growth [2, P. 124].

The presented social objectives let us understand that the necessity to improve the import substitution effectiveness is a high priority nowadays which results in the peoples' general well-being increases the population's level of life.

The growth of employment rate is directly connected with the increase of production effectiveness. If producers decide to improve their production volumes and to expand their businesses, it immediately results in bigger number of vacant places for the new employees.

Moreover, saturation of the domestic consumption market allows to increase country's stability and independence from foreign import. The problem of saturation will be explained in this work on the example of apples import and production. For

a long time, Russia has been the biggest apples importer in the world in spite of being one of the top countries which have the biggest numbers of agricultural land. Russia does not produce enough apples to saturate its own demand. Currently after embargo imposed on the import from EU and a break of import from China, still it is impossible to immediately increase the domestic supply of apples due to the fact that apple gardens need at least 2 years before they start to give first fruit. This fact shows that effective import substitution should be the result of long-term work and can be called a strategy [3, P. 107].

Finally, the effective import substitution strategy pursued by a government should result in well-balanced social and economic growth. If a country has got all the necessary resources for production and has an opportunity to increase its domestic production and saturate consumption, it lets a country decrease the amount of import and gives an opportunity to grow economically and improve its general wealth.

To support domestic producers, governments can use different tools and methods, which might lead to reasonable implementation of the import substitution strategy [2, P. 125]. Among them we can underline the following tools:

1) Customs tariffs, which should be reasonably applied to create the necessary effect. They depend on the current economic situation within a country. For example, the United States customs and tariff regulation depends on the current economic conditions: during the recession periods, the US government introduces high import duties (1828, 1861–1865, 1890), and reduces import tariffs during the periods of growth. Related goods are also subject to seasonal changes in imports duties. Given the power of lobbying in the United States, where it is enshrined in law, the government naturally pays great attention to the needs of business and trade unions [4, P. 167].

Another example is that the European Union does not have any internal import or export tariffs within its territory, though it introduced unified ones for external countries. The unified customs tariff of the European Union has a double column structure. The first column contains the autonomous (maximum) tariff rates, the

second indicates the conventional rates for goods from countries-members of the WTO, or for countries with which the EU has signed the necessary agreements. The given structure encourages trade cooperation with the European Union [5, P. 306].

2) Tax stimulation has a widespread positive foreign experience. This tool can be used within the areas where businesses widely use innovations, while some innovations-based businesses are highly risky for investments as quite often such enterprises result in zero profit. For example, in Sweden, 10% of the firm's research costs are exempted from taxation, and a rate of up to 20% on the amount of growth in research costs in the current year compared to last year is set. In France and Germany, current research and development expenses may be even written off.

According to several researchers and companies, the most promising form of tax incentive might be the reduction in the tax rate on material benefits from the sale of shares (the formation or increase of capital due to the issue of shares). US experience demonstrates the importance of this tool in stimulating venture capital and small venture research companies.

3) Government procurement can also stimulate the growth of import substitution. While developing a procurement policy, it must be borne in mind that one of the most important forms of economic progress is the competition between producers (domestic and foreign). This leads to continuous improvement of the products, technologies and services offered by businesses, regardless of the legal form, and makes it possible for consumers to receive goods (technologies or services) of appropriate quality for a reasonable market price. There are many countries in the world where government procurement takes a big market share. The ability of local companies to receive government orders on priority terms provides domestic producers with long-term contracts that allow them to expand production, apply modern world technologies, increase the number of job positions, etc.

For example, in accordance with the US law, the state restricts the supply of goods and services of foreign products for the state needs. At the same time, a foreign company can win a competition only if its product has obvious advantages for the

same price (moreover, it has to pay import customs duties) or if the similar goods and services do not exist at the domestic market.

4) Standardization and certification. Standardization as one of the elements of technical regulation in a market economy can provide a significant contribution to economic growth. For example, in the United States, there are requirements for the content of local components in the final product. Though the aim is not import substitution (as in developing countries), it motivates domestic producers operate within the country and lets the government deter national producers from moving production to countries with cheaper labor. But even if the main objective is different, the principle influences the producers and, as a matter of fact, motivates domestic producers increase their production volumes on the territory of the US.

5) Offset agreements. In world practice, offset transactions are most often carried out in the sphere of defense by concluding series of compensation agreements at the request of foreign governments or foreign firms as a condition for the purchase of defense products. Application of the offset tool can compensate the negative effect from large funds leaving a country and help to stimulate economic development with the help of increasing competitiveness in the world [2, P. 126].

It should also be mentioned that import can be a source of economic development. Eliminating import is a harmful strategy, while import helps to give way to many factors stimulating economy. Unfortunately, for various reasons (political and economic), the role of import is usually misinterpreted or underestimated. Even in the classical theory of trade, it was shown that the import of goods is the main reason for the economic profit from trade integration. Producers in an open economy refuse to produce any product if they cannot produce this product cheaper than an external producer, even taking into account all trade and transportation costs. By abandoning the production of a product, economy receives the product at a lower relative price than the expenses for its inner production. This is precisely the key mechanism of gaining profit from international trade. Export is also important, but it is a consequence of the refusal to produce imported goods. Moreover, if a country abandons the idea to substitute all imports with domestic

production, it is able to concentrate on the export sector of the economy, increase its productivity, become even more competitive and increase revenues from the sale of exported goods, and, finally, to buy cheaper imported goods [6, P. 144].

If we supplement the arguments mentioned above with the fact that the main international flows of manufacturing goods are not final goods, but goods used as factors of production or components (in Russia the share of such imports is more than a half), then it is necessary to consider import as partial costs of domestic firms, which are related to the production chain. As a matter of fact, it becomes obvious that the competitiveness of domestic production is also determined by the availability of cheap imports.

1.2 Methods of solving the problem with improving the efficiency of import substitution

When solving the problem connected with import substitution, there can be used various methods. Method is a way we study the subject of research. A method can be scientific if it reflects the objective laws of reality, is based on practice, continuous study and generalization of experience [7, P. 15]. In the given part we would like to present the main scientific methods, which might be helpful while performing research.

One of the major methods of doing research in economics is the statistical and research method. This research method is a set of techniques used to comprehensively characterize the development of economic phenomena and processes using massive digital data.

Stages of the statistical and economic method [7, P. 17]:

Stage 1 – collection of initial information (statistical observation);

Stage 2 – processing of the initial information;

Stage 3 – analysis of the data;

Stage 4 – development of specific activities based on data obtained.

The statistical and economic research method is used to study social phenomena and processes occurring in economics and society. The given method can be useful when researching various databases connected with the sphere of trade or domestic production.

Within the statistical and economic research method there are several tools for analysis. Data on a researched phenomenon, accumulated in the process of statistical observation, should be subjected to statistical and economic analysis. When performing the analysis, it is necessary to reveal the characteristic features of the studied phenomenon and its inherent patterns of development. There are some tools for analysis, which might be helpful to process the research within the sphere of import substitution [7, P. 18]:

1) The method of economic grouping provides the division of data studied into groups according to essential features in order to study the types, structure, structural changes, and patterns of development.

2) Economic comparison is one of the most important and most common methods for studying the interconnections in the development of researched phenomena. It might be essential for the analysis of some operations in organizations and their units.

3) Correlation analysis is a method for studying the relationship of the interdependence between factors which are random variables. Its role is to identify the dependence of one factor from another one. It is used to establish the form and direction, as well as the degree/measure and tightness of the relationship between variables. Using the correlation method, it is possible to measure the relationship between two features (pair correlation) or even three or more features (multiple correlation).

4) Regression analysis is performed when studying the dependence of a random variable on several other independent variables. Regression analysis is a major method used in the work when performing the analysis of the problem with apples import substitution. Linear regression analysis is the most widely used

analysis within this method of research. This tool will be explained with more details in part 1.3.

5) Dispersion analysis. Dispersion is the mean square deviation of values from the arithmetic mean. It is the main measure used to show variation. Dispersion analysis is a special technique for establishing a quantitative relationship. It can also be used in cases where it is not possible to collect sufficiently uniform and mass material on the subject researched.

Another method of research which can be used is the method of logical abstraction. The given method of research is used to study the essence of a phenomenon and processes through abstractive reasoning. Abstraction in its main sense is a conceptual process where general rules and concepts are derived from the usage and classification of specific examples. The method of logical abstraction is widely used to study the essence of the phenomenon in the case when it is impossible to base the study on an experiment [7, P. 19].

Before starting to study a social phenomenon, on the basis of previously accumulated facts, we need to work out a hypothesis (one or more). A hypothesis is a scientific assumption about a natural causal reason of certain facts or phenomena. The results of the entire study depend on the advancement of the working hypothesis, its correctness. The correctness of the working hypothesis is verified by deriving a number of consequences and comparing them with reality. If the consequences are confirmed by the presence of preliminary facts, then such a hypothesis can be accepted as a working one.

As a result of testing, a hypothesis becomes a scientific theory, or it can be rejected if it is not confirmed by reality. The criterion of the truth of each hypothesis is practice. The hypothesis can also be proved by statistical observation and by studying the actual processes occurring in the economy, specially conducted economic experiments, as well as a combination of logical techniques and machine simulation.

In some cases, to study the problems existing in economics it is possible to use experiments. Method of experimental research is the formulation and conduct of

scientific experiments when studying the influence of separate factors on the development of economic processes. This method also involves observing the results of an experiment and measuring them.

An economic experiment contributes to the disclosure of the essence of the studied phenomena and processes [7, P. 21]. Unlike other sciences in economics, individual economic processes cannot be studied in isolation. An experiment has such cognitive properties that are indispensable even to the most thorough observations of phenomena and processes. Only an experiment can provide a reliable assessment of the actions of economic factors. In conclusion, the applicability and effectiveness of the checked economic forms indicates their advantages and disadvantages compared with the existing ones, the feasibility of applying them in practice, the possibility of disseminating the results of the experiment not only in the experimental conditions, but also to the entire structure in the industry or region. Experiments are conducted with the aim of mastering and implementing the achievements of science and best practices, as well as to identify the economic feasibility of the recommended system of measures. For example, they can be set to study the yield of new varieties of crops; the effectiveness of mineral and organic fertilizers, various types of crop rotation, as well as the effect of this or that economic phenomena, etc.

The next method is the method of constructive calculation. The given research method is used to characterize phenomena and processes, as well as to identify some established patterns existing among them and to develop a scientifically based development of phenomena and processes for the future. This method allows to draw up projects, forecasts and recommendations for the future based on the study and analysis of the source information. The research method of constructive calculation includes a certain set of scientific methods: identifying the main link in design decisions, weighing methods, design calculations using existing data characterizing the phenomenon, while taking into account seasonal changes in the phenomenon in previous years, decomposition of the absolute increase in proportion to the growth rate, enlarged and element-by-element calculations, planning from achieved with

respect for identity, the use of moving time series, extrapolation, design calculations using statistical and economic groups, etc.

The other method, which can also be used in the research connected with domestic production or import, is the expert method [7, P. 23]. This method is based on the judgment (opinion) of highly qualified specialists in the corresponding field of knowledge (science, technology, economics, etc.). In the expert assessment of phenomena, it is necessary to clearly formulate the purpose of the study, correctly determine the time of the event, develop the organization of a survey (interview) and questionnaires, form a group of experts, ensure mutual independence of their judgments, the lack of authority of the position or person, affecting the choice of alternatives, and generalize the results. The essence of the expert method is an individual and logical analysis of the judgments of experts and their quantitative assessment of the researched problem.

Besides, there is one sufficient method which is widely used when solving various problems – the modelling method. Modeling is the study of economic phenomena and processes by creating models of objects that can be constructed in the form of formulas, numerical expressions, tables (matrices), graphs, or logical expressions.

Its essence is to create such an analogue of the studied phenomena, processes and objects, which would reflect their most important features, internal structural and cause and effect relationships, laws and conditions of development, as well as exclude insignificant properties.

An important final stage of the study is the correct presentation of results. They can be stated orally, in writing, or in the form of statistical tables and graphs using technical media or without them. At this stage it is very common to use the tabular and graphical method.

1.3 Methodology of solving the problem with improving the efficiency of import substitution

While solving the problem with improving the efficiency of import substitution, we decided to use a combination of various methods. The first main method, which created a base for the given study is the statistical and research method. We used various official databases of governmental statistical organizations to get the most verifiable data, such as the database of Food and Agriculture Organization of the United Nations, Federal State Statistic Service and Federal Customs Service. After that we compared the data on the macrolevel with different countries operating in the same industry and tried to formulate the main hypothesis regarding the researched subject.

In the second part we tried to analyze the problem from the microeconomics perspective. As an example, we used a JSC Sad-Gigant, which mainly operates in Krasnodar Region and is supposed to be successful in the sphere. We compared this company with other companies in the industry and tried to identify some problems existing in the company, which can slow down its growth. Next, we decided to solve the problem on the example of import substitution in the apple industry. The apples problem is a clear one. The policies should be revised in the long term, and we need to analyze the import from various countries and its influence on the domestic producers.

In the third part the major research method we used was the method of econometric modelling. We tried to get a verifiable multiple linear regression model, which we will use in the construction of forecast for the future using the method of constructive calculation. The given methods are described below.

Econometrics is an economic analysis method that combines economic theory with statistical and mathematical methods of analysis. This is an attempt to improve economic forecasts and make successful planning possible. In econometrics, economic theories are expressed as mathematical relationships and then verified

empirically by statistical methods. This system is used to create models of the national economy in order to predict many important indicators [8, P. 128].

In the current research we will use the linear regression analysis. There are two main types of the linear regression – simple and multiple linear regression modeling.

Simple linear regression analysis is used for analysis of relationship between two variables, X and Y

$$Y_i = \beta_0 + \beta_1 X_i + u_i \quad (1)$$

where

Y_i – an independent variable;

X_i – a dependent variable;

β_0 – an intercept;

β_1 – a coefficient;

u_i – error term.

Y is usually described as a dependent variable, and X as an independent variable u_i is a random variable referred to as the error term. The error term accounts for the variability in y that cannot be explained by the linear relationship between X and Y [9, P. 58].

While estimating the output of a simple regression model, we get several coefficients: correlation and determination. The correlation coefficient shows the measure of association between two variables X and Y. Its formula has the following view

$$\text{Corr}\,(X, Y) = \frac{\text{Cov}\,(X,Y)}{\sqrt{\text{Var}\,(X)\text{Var}\,(Y)}} \quad (2)$$

where

X and Y – the two variables;

Corr – correlation;

Cov – covariance;

Var – variance.

The values of correlation coefficient can vary between -1 and 1. If it is equal to zero, the variables X and Y do not have any relationship and there is non-linear relationship. 1 or -1 are maximal and minimal values, they show a perfect positive/negative linear relationship. Values between 0,7/-0,7 and 1/-1 indicate a strong positive/negative linear relationship. It means that our model is rather good, and the data is reliable [10, P. 79]. Values between 0,3/0,3 and 0,7/-0,7 indicates a moderate positive/negative relationship, and between 0,1/-0,1 and 0,3/-0,3 show non- positive/negative linear relationship.

The other coefficient is determination, R^2, which is the percentage variation explained by the given regression analyses. It is the proportion of the total sum of squares explained by the regression line [10, P. 107]

$$R^2 = \frac{ESS}{TSS} = \frac{\sum_{i=1}^{n}(\hat{Y}_i - \bar{Y})^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2} \quad (3)$$

where

R^2 – a coefficient of determination;

ESS – explained sum of squares;

TSS – sum of squared total;

$\hat{Y}_i$ – the Y value for observation I;

$\bar{Y}$ – the mean of Y value;

Y_i – predicted value of Y for observation i.

The maximum value of R^2 is 1. This occurs when the regression line fits the observations exactly, so that $\hat{Y}_i = Y_i$ in all observations and all the residuals are zero. If there is no apparent relationship between the values of X and Y, R^2 will be close to zero [11, P. 365].

Multiple linear regression model is used in case we need to understand the influence of several independent variables (X_1, X_2, …, X_i) on an independent variable Y. Multiple linear regression modelling is a statistical technique that uses several independent variables to predict the outcome of a dependent variable. The

goal of multiple linear regression (MLR) is to model the linear relationship between the independent variables and dependent variable. Multiple regression equation has the following view

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_n X_n + u_i \quad (4)$$

where

Y_i – a dependent variable;

$X_1 \dots X_n$ – independent variables;

β_0 – an intercept;

$\beta_1 \dots \beta_n$ – the coefficients;

u_i – an error term.

While analyzing the relationship between the independent and dependent variables, we can also look at the multiple correlation and determination coefficients. Also, there is another coefficient we can estimate here – adjusted $\bar{R}^2$. This coefficient is most often used in multiple regression estimation as well as the determination coefficient, it shows goodness of fit. [12, P. 265] If adjusted $\bar{R}^2$ > 0,80, then it is considered a good fit

$$\bar{R}^2 = R^2 - \frac{k-1}{n-k}(1 - R^2) \quad (5)$$

where

$\bar{R}^2$ – the adjusted R squared;

R^2 – the coefficient of determination;

n – the number of data points;

k – the number of independent variables.

As k increases, $\frac{k-1}{n-k}$ increases, and so the negative adjustment to $\bar{R}^2$ increases. The adjusted R^2 can be negative, and its value will always be less than or equal to that of R^2. Unlike R^2, the adjusted R^2 increases only when the increase in R^2 (due to the inclusion of a new explanatory variable) is more than one would expect to see

by chance. Adjusted R^2 can be interpreted as an unbiased (or less biased) estimator of the population R^2, whereas the observed sample R^2 is a positively biased estimate of the population value [8, P. 374].

To estimate the variables, we can use the theory of hypothesis testing.

The first test we would like to use when testing the model is the F-Fisher test. The F-test of overall significance indicates whether the linear regression model provides a better fit to the data than a model that contains no independent variables. The overall F-test compares the model that we specify to the model with no independent variables. This type of model is also known as an intercept-only model. The F-test for overall significance has the following two hypotheses:

- the null hypothesis states that the model with no independent variables fits the data as well as your model

$$H = 0 \quad (6)$$

- the alternative hypothesis says that the model fits the data better than the intercept-only model

$$H \neq 0 \quad (7)$$

The F-Fisher test allows us to compare the magnitude of the sample variances of two independent samples. The formula for calculating the F-Fisher criterion is as follows

$$F = \frac{RSS_R/m}{RSS_N/n-k} \quad (8)$$

where

m – the number of restrictions;

k – parameters in unrestricted model;

RSS_N – unrestricted residual sum of squares;

RSS_R – restricted residual sum of squares.

F-Fisher test is used to test the significance of a whole model. We take the interval F<0,05. If it is true, then we accept the null hypothesis and state that the model is statistically significant.

After that we can assess the coefficients separately. The P-value column shows us the number, which we can use for testing as well. It also must be less than 5% value:

If p-value < 0,05, we reject null hypothesis, H_a: $\beta_i \neq 0$, and it means that the initial data is statistically significant for the regression model. If p-value > 0,05, we have the null hypothesis: H_0: $\beta_i = 0$ [10, P. 465].

We can also check the model for multicollinearity and heteroscedasticity. Multicollinearity happens when there is a high correlation between the independent variables. In this case coefficients are subject to the lack of precision. To check if there is multicollinearity in a model, we need to calculate the correlation coefficients between the independent variables.

Heteroskedasticity is a property of the data used to construct the regression model, when the dispersion of residuals is uneven and at the scatterplot the points are not spread along the regression line.

To check the model for heteroscedasticity, we can use White test. The test uses the residuals of a regression estimated using the conventional least squares method. For the test, we use and estimate an additional regression of the squares of these residues to all regressors (also by the usual OLS)

$$e_t^2 = a_0 + a^T x_t + x_t^T A x_t + u_i \quad (9)$$

where

e_t – the regression residuals;

x_t – the factors of an initial regression;

a_0, a, A – the parameters of an additional (auxiliary) regression (accordingly, a constant, a vector of linear coefficients and a matrix of coefficients for squares and pairwise factors summarized);

u_i – an error term.

The test verifies the null hypothesis of the absence of heteroskedasticity (that is, model errors are assumed to be homoscedastic, with constant dispersion). In this case, the auxiliary regression should be insignificant. So, we can check it using the F-statistics. In this case if F<0,05, there is heteroscedasticity, and if F>0,05, then the auxiliary model is insignificant and there is no heteroscedasticity.

After constructing the econometric model, we would like to give the forecast of the future situation regarding the import substitution. In general, forecasting means predicting the future situation, in econometrics we can use some independent variables to predict what values of dependent variables there can be in the future.

Forecasting in econometrics can be divided into two main steps [8, P. 354]:

1. Specify and estimate an equation that has as its dependent variable the item that we wish to forecast. In this step we do the regression analyses, analyze the properties of the initial data, estimate the regression model and find the equation showing how independent variables influence the dependent one. The equation is

$$\hat{Y}_t = \hat{\beta}_0 + \hat{\beta}_1 X_{1t} + \hat{\beta}_2 X_{2T} \quad (10)$$

where

$\hat{Y}$ – the value of the dependent variable used for prediction;

X_1 and X_2 – the independent variables;

$\hat{\beta}_0$ – the intercept coefficient for the predicted values;

$\hat{\beta}_1, \hat{\beta}_2$ – the coefficients for the predicted values;

t = 1,2,3, …, T – stands for time.

2. Obtain values for each of the independent variables for the observations for which we want a forecast and substitute them into our forecasting equation. To calculate the equation 1 we need to find the independent variables X_1 and X_2 for the period T+1. Finally, we get the next equation

$$\hat{Y}_{T+1} = \hat{\beta}_0 + \hat{\beta}_1 X_{1T+1} + \hat{\beta}_2 X_{2T+2} \quad (11)$$

where:

$\hat{Y}_{T+1}$ – the prediction of Y on the basis of the independent variables;

X_{1T+1}, X_{2T+2} – the predicted independent variables;

$\hat{\beta}_0$ – the intercept coefficient for the predicted values;

$\hat{\beta}_1, \hat{\beta}_2$ – the coefficients for the predicted values.

As a result, after passing these two steps we get the forecast for the future.

Though, there can exist some problems, one of them is conditional forecasting or unknown independent variables. In case we need to do an adequate forecast with unknown data, we must forecast the independent variables [9, P. 228]. For example, we can use a simple regression equation to forecast each of the independent variables and after that to substitute them into the multiple regression equation.

Confidence intervals are also commonly used while calculating forecasts. In MS Excel regression analysis these intervals are usually given at 95% confidence. Confidence intervals are created with the same technique as hypothesis testing

$$Confidence\ interval = \hat{Y}_{T+1} \pm S_p t_c \quad (12)$$

where

S_p – the estimated standard error of the forecast;

t_c – the critical t-value (for the desired level of confidence);

$\hat{Y}_{T+1}$ – the prediction of Y on the basis of the independent variables.

Finally, we should understand that forecasting is one of the main reasons for constructing an econometric model. Working with such economic indicators as import and production, it helps to understand how the situation will be changing in the future. What trends exist and what we can expect.

As a result of the first chapter, we have analyzed various research on the topic of import substitution and found the most appropriate objectives of import substitution, which might force a country pursue this strategy, also, we have discussed different tools of improving efficiency of import substitution and gave

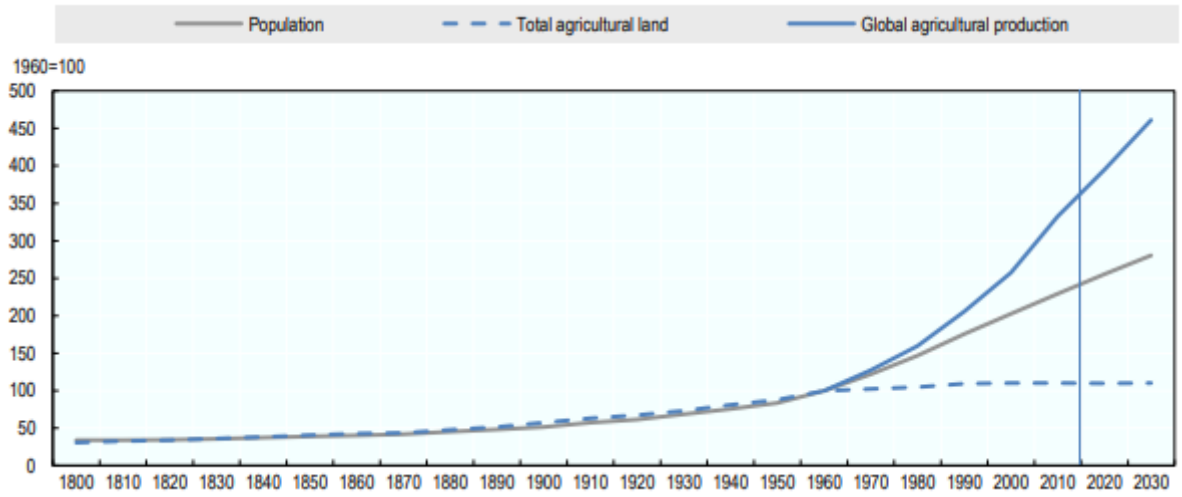
some examples with foreign experience. We have shown various methods used by different researchers for solving this type of problems and formulated our own analysis methodology. We have decided that in the third chapter, when we take a more specific and real-life problem, we will use the method of regression analysis.

2 Analysis of the import substitution in the agrifood sector

2.1 Macroeconomic state of the agrifood sector

Agricultural production is one the most powerful tools to tackle extreme poverty [13]. Growth in the agriculture sector allows to feed the poorest and let poor working adults make a living. At the same time agricultural production does not include only food production. Agriculture is the art and science of cultivating the soil, growing crops and raising livestock. It includes the preparation of plant and animal products for people to use and their distribution to markets [14]. Agrifood sector is included into agriculture industry, it is directly connected with the production of edible items, but excludes such goods, as leather, timber or paper products.

According to OECD and FAO data, if we look at Picture 1, we can see the statistics collected over the previous two centuries shows the numbers of world agricultural production, population, and agricultural land [15, P. 43].

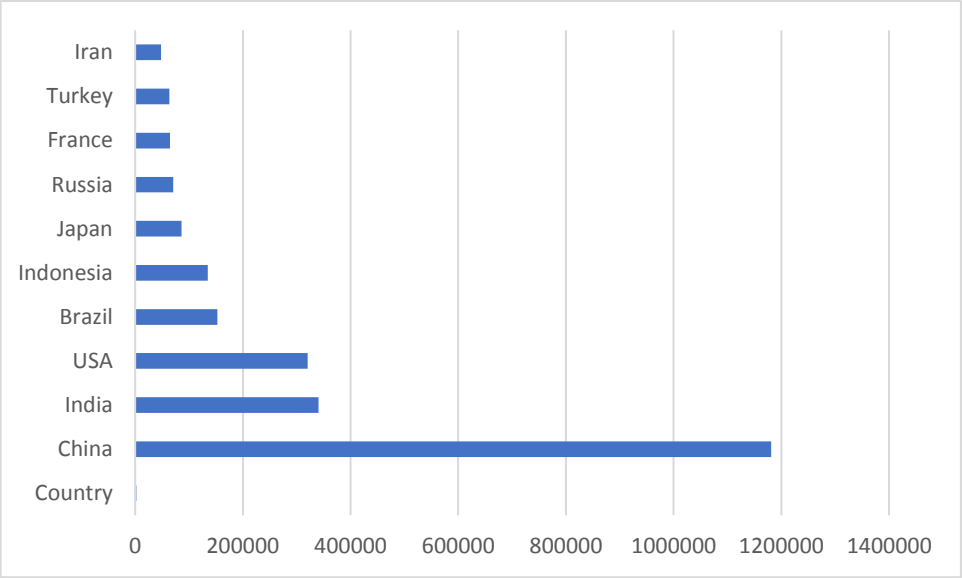


Picture 1 – Agricultural production, population, and agricultural land [15]

We can notice that there is a trend that all the three numbers have always been growing, but not gradually. If we take the three numbers in 1960 as 100%, we will be able to clearly see the proportions in which the numbers are growing. Since 1960s the production numbers started to increase drastically, even in comparison with the

world population numbers. While agricultural land has increased only by 10%, the amount of world population has doubled, and agricultural production has nearly tripled. It happened as a result of "Green Revolution", when farmers started to use fertilizers and pesticides, improved irrigation and ongoing breeding to increase yields and production intensity. The Outlook projections show the continuation of the described trends. It expects the increase in the numbers of agricultural production by 14% by 2030 [41], while the agricultural land stays the same. This projection is based on the fact that by 2030 the needs of population will have been drastically growing, but many countries will not have had an opportunity to increase the territory for agriculture.

In Picture 2 below we can see the top 10 countries on the total number of agrifood production. We can notice that Russia got only 7th place in 2016. Unfortunately, the most current statistics is not available on the FAO website [41]. According to the data presented in the picture, China is an absolute leader in agrifood production with 1181290 mln. US dollars agrifood production. It is 3,5 times bigger than the second biggest agrifood producer – India.

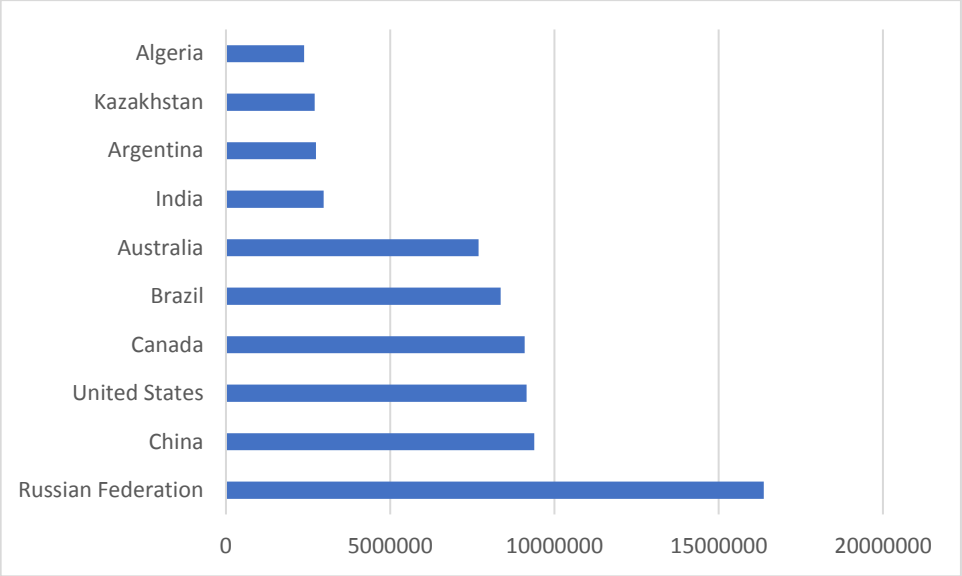


Picture 2 - Top 10 countries on agrifood production in 2016, mln. US dollars [41][1]

In Picture 3 we can notice that according to World bank statistics [42], in 2018 Russia had the biggest amount of agriculture land with 16376870 square hectares,

[1] Created by the author.

which is nearly 2 times bigger than China (9388210 square hectares), the second country in the list.



Picture 3 – Top 10 countries on the number of agricultural land in 2018, sq.km. [42][2]

The comparison of pictures 2 and 3 shows that Russia, being the first country on the number of agricultural lands, is quite inefficient in its agrifood production. China, on the contrary, has got two times less agriculture territory than Russia and produces nearly 17 times bigger amount of agrifood products. The other countries, such as the US, India, Brazil, Indonesia and Japan also produce bigger amounts of agrifood output having less agricultural land.

In Table 1 below we are presented the top agrifood producers on commodities. According to the data, Russia is the top producer of barley and sugar beet, it got the 2nd place in the production of pea and sunflower, 3rd in wheat, rye and potato and 4th in cereal. Again China and the US in 2018 got the top places nearly in the production of all commodities presented in Table 1.

[2] Created by the author.

Table 1 – Top agrifood producing countries by commodity in 2018, mln. tonnes [41][3]

#	Commodity	The top places			
		1	2	3	4
1	Cereal	China (540,9)	USA (464,6)	India (260,9)	Russia (109,5)
2	Wheat	China (131,5)	India (99,7)	Russia (72,1)	US (51,3)
3	Maize	US (392,5)	China (257,4)	Argentina (43,46)	Ukraine (35,8)
4	Rice	China (214,08)	India (172,6)	Indonesia (83,04)	Thailand (32,19)
5	Barley	Russia (17)	France (11,19)	Germany (9,6)	Australia (9,25)
6	Rye	Germany (2,2)	Poland (2,17)	Russia (1,9)	China (1,04)
7	Potato	China (90,32)	India (48,5)	Russia (22,39)	US (20,6)
8	Sweet potato	China (53,25)	Malawi (5,67)	Nigeria (4,03)	Tanzania (3,83)
9	Soybean	US (123,66)	Brazil (117,89)	China (14,19)	India (13,79)
10	Bean	India (6,22)	Myanmar (4,78)	Brazil (2,92)	US (1,7)
11	Pea	Canada (3,58)	Russia (2,3)	China (1,53)	India (0,92)
12	Apple	China (39,24)	US (4,65)	Poland (4)	Turkey (3,6)
13	Tomato	China (61,63)	India (19,38)	US (12,61)	Turkey (12,15)
14	Sugar beet	Russia (42)	France (39,58)	US (30)	Germany (26,19)
15	Rapeseed	Canada (20,34)	China (13,28)	India (8,43)	France (4,95)
16	Sunflower	Ukraine (14,17)	Russia (12,76)	Argentina (3,54)	Romania (3,06)

[3] Created by the author.

We have already explained why it is so important to improve agriculture industry, as well as agrifood sector as its part.

There are several tendencies which drive the improvement of agrifood sector [16, P. 95], which are presented below.

1) If a country has an opportunity to increase its own production of an item, it has to revise its customs policies to support domestic producers and limit imports.

2) On the other hand, market liberalization is also quite important for some special items, which cannot be produced domestically in the necessary volumes. Price of imported inputs (fertilizers and machinery) falls as tariffs fall [17, P. 153].

3) Growing population, urbanization, and increase in incomes makes the necessity of agrifood industry development even more important and vital.

4) Population outflow from rural areas creates the demand in agriculture workers. Small cities and towns can play a catalytic role in rural transformation, as points of intermediation and agro-industrial development.

5) In late-transforming countries with limited prospects for industrialization, agro-industry may be an important source of employment for those exiting agriculture [18, P. 3].

All the above-mentioned problems and tendencies are incredibly vital to solve as early as possible as the increased food demand and the ability to satisfy it are the major indicators on the way to prosperity and progress.

2.2 Microeconomic assessment of the agrifood production

To get the deeper understanding of the problem of improving the efficiency of import substitution in Russia, we need to analyze it on the microeconomic level. We have decided to analyze JSC Sad-Gigant as it represents one of the biggest agrifood companies in Russia. On the example of Sad-Gigant we will be able to understand the operations of microeconomic units in Russia, we will learn in what ways it is possible to improve organizational performance and what problems exist in the company which slow down its growth.

JSC Sad-Gigant is located in Slavyansk region of Krasnodar Territory eighty kilometers from Krasnodar. The company was founded in 1929. Over its more than 90-year history, the company has produced more than 1 million 400 thousand tonnes of fruit and berries [19].

The main activities of the enterprise are:

- production and sale of fruits and berries;
- production and sale of planting material of fruit trees;
- production and sale of green crops;
- production and sale of seedlings of vegetable crops.

The land of the enterprise occupies 3,5 thousand hectares, of which 2,3 thousand are perennial plants of almost all species recommended for the conditions of the South of Russia, including 90% of the fruit plantations are of intensive type. The annual gross production of fruits is 50-60 thousand tonnes, with an average yield of 35-40 tonnes per hectare.

Table 2 – Composition of gardens in JSC Sad-Gigant [19]

#	Type of gardens	Square, ha	Share of plant square, % of all
1	Seed fruit gardens	1950	85
1.1	Apple	1913	83
1.2	Pear	37	2
2	Drupaceous fruit gardens	353	15
2.1	Sweet cherry	115	5
2.2	Plum	219	9
2.3	Peach	19	1

As we can see in the table, 83% of gardens in JSC Sad-Gigant are used to grow apples, so the company mainly works in the apple production industry. The 2% are pear gardens and the other 15% are sweet cherry, plum and peach gardens.

Sad-Gigant is a joint-stock company of an “open” or “public” type. The company is owned by its shareholders and has limited liability (the shareholders are only liable for the company's debts to the face value of the shares). Members of the company are not liable for its obligations and bear the risk of losses associated with the activities of the company. Shares may be publicly traded without the permission of other shareholders.

The average annual number of employees is 2000 people, including permanent employees (1100 people), tractor drivers (200 people), gardeners (170 people), specialists (200 people), fruit storage workers (100 people).

JSC Sad-Gigant has one affiliate – LLC Sad-Gigant Ingushetia, which was found in 2013 and every year drastically increases its production amounts.

Table 3 – Production in JSC Sad-Gigant, thous. tonnes [19][4]

Year	Production
2017	10
2018	19,8
2019	24,2

As we can see in Table 3, LLC Sad-Gigant Ingushetia in 2018 doubled its production volumes. Currently its production gets nearly a third of average gross production of JSC Sad-Gigant.

One of the major competitors of Sad-Gigant in Russia is LLC Alma Holding, which has more than 400 hectares in Krasnodar Territory. In 2018 its production was about 13,1 thousand tonnes. There are also many other companies engaged in fruit production – LLC Agronom and LLC Svetlogorskoye. Table 4 below gives the comparative data on the sales of the two companies – JSC Sad-Gigant and LLC Alma Holding. As we can notice, the production amounts of JSC Alma Holding are comparatively low. This fact shows us that JSC Sad-Gigant has a much bigger share of the market, and it might give the company comparative advantage.

[4] Created by the author.

Table 4 – Sales of JSC Sad-Gigant and LLC Alma Holding, Rub [20], [21][5]

Year	JSC Sad-Gigant	LLC Alma Holding
2015	1 891 370 000	44 225 000
2016	3 037 290 000	41 921 000
2017	2 042 080 000	158 510 000
2018	3 296 960 000	116 297 000

To get a better view of the sales in both companies, we present the graph in Picture 4. Although the sales of JSC Alma Holding are quite low in comparison with JSC Sad-Gigant, their growth is stable enough. On the contrary, Sad-Gigant has got unstable sales and production volumes.

Picture 4 – Sales of JSC Sad-Gigant and JSC Alma Holding [20], [21][6]

We have completed the SWOT analyses in Table 5 to show the strong and weak sides of the company. As far as we know, JSC Sad-Gigant is one of the biggest fruits producing companies in Russia, which is its stronger side. It might give the company comparative advantage over its competitors, such as JSC Alma Holding. The major weakness of the company is that it has 40% seasonal employees and unstable sales volumes. The main threat for the organization is high inflation rate in

[5] Created by the author.
[6] Created by the author.

Russia, and the opportunity for the company is incredibly high apples consumption, which creates a favorable situation for apple producers within a country.

Table 5 – SWOT analysis[7]

Strengths	Weaknesses
1. The biggest fruit producer in Russia. 2. Significant production volumes every year. 3. Larger choice of planting breeds.	1. Unstable sales volumes. 2. The majority of workers are seasonable. 3. Inefficient use of workers. 4. Inefficient use of resources. 5. It is impossible to immediately increase or decrease production volumes as it can be made with tomatoes or cucumbers.
Opportunities	Threats
1. Opening new gardens every year. 2. Increasing tariffs for imports. 3. Sanctions against biggest agrifood producers in EU. 4. Necessity to improve production volumes to satisfy consumption.	1. Fierce competition. 2. High inflation. 3. Possibility to substitute production by import if imported goods are cheaper.

Let us show the annual sales, profits and assets in Table 6, which will also help us to analyze the efficiency of the company.

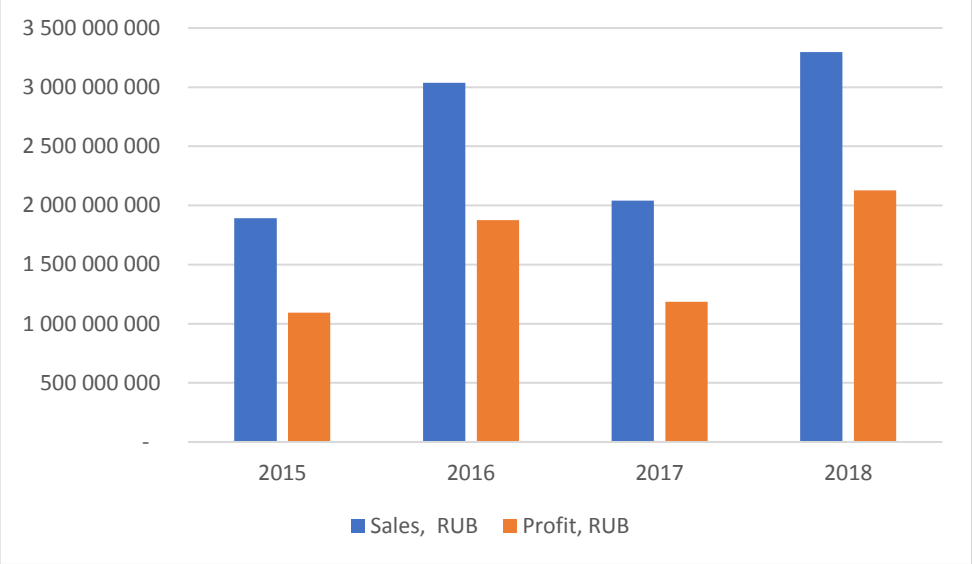
[7] Created by the author.

Table 6 – Analysis of the efficiency of JSC Sad-Gigant [20][8]

Year	Sales, RUB	Profits, RUB	Assets, RUB	Asset Turnover	Profit Margin	ROA
2015	1891370000	1093950000	3235900000	0,58	0,58	0,34
2016	3037290000	1875140000	4010180000	0,76	0,62	0,47
2017	2042080000	1186120000	4072820000	0,50	0,58	0,29
2018	3296960000	2128520000	4170580000	0,79	0,65	0,51

If we look at asset turnover of JSC Sad-Gigant, we will see that asset turnover is too low. It means that the company fails to use its assets efficiently, and the company's governance should pay their attention to this ratio. Probably, the reason is that the company mainly operates seasonally, and fruits are produced once a year. Though unstable, there is growth in both asset turnover and ROA.

Furthermore, we will present a graph in Picture 5 showing the difference between sales and profit of JSC Sad-Gigant for the last 4 years.



Picture 5 – Sales and Profit at JSC Sad-Gigant [20][9]

Picture 5 represents that the values are unstable. Moreover, we can clearly see the difference between sales and profit, which usually consists of taxes paid, expenses, etc.

[8] Created by the author.
[9] Created by the author.

The main directions are the production and sale of pome fruits and stone fruits. It includes a full cycle: fruit cultivation, storage, commodity processing and sale.

1) For more than ten years, the agricultural company has been cultivating fruits using intensive technology [16, P. 95].

2) Seedlings on dwarf rootstocks allow planting from 3 to 6 thousand plants per hectare, which makes it possible to receive the first yields in the second year after planting. And since the fourth year, these orchards yield up to 50 tonnes of fruits per hectare and fully pay off.

3) The planting of perennial plantations of intensive type on an area of more than 1000 hectares was carried out using all the advanced scientific developments.

4) A number of new varieties of apples have been introduced into production.

5) A differentiated irrigation and nutrition system for perennial plantings based on instrumental monitoring of the condition of trees, fruits and data from leaf and soil diagnostics was developed and introduced, which minimized the use of mineral fertilizers.

6) A comprehensive program for the mechanization of production processes was developed and systematically implemented.

7) The company has built modern fruit storages, in which fruit can be stored throughout the year without loss of quality and nutritional properties through the use of a regulated temperature and environment, the essence of which is to reduce the oxygen content in the chamber to 1%. Under such conditions, life processes in the fruits slow down. For the fruit storage the company uses 9 specialized refrigerators, the storage capacity of which is 30 thousand tonnes.

8) 4 packaging lines with calibration by weight and color have been introduced, which allow you to pack and ship up to 400 tonnes of products per day. Unloading apples from containers on the lines is done carefully in the water.

9) Fruits are delivered to 44 regions of the country and even to the international space station.

In Table 7 we can see the statistics regarding the production and revenues of JSC Sad-Gigant.

Table 7 – Production and revenues of JSC Sad-Gigant [20][10]

Year	JSC Sad-Gigant, production, tonnes	Revenues, thous. rub.
2015	70000	1891370
2016	95038	3037290
2017	77900	2042080
2018	113000	3296960

As we can see from the table 7, the production and revenues of JSC Sad-Gigant have been gradually increasing. Since 2015 production and revenues have increased by nearly a third.

For the better understanding of the existing problems within the company, we need to calculate some of the ratios. We used the balance sheet of the company.

Table 8 - Financial ratios of JSC Sad-Gigant [20][11]

Indicator	2016	2017	2018	Growth, %
Part 1 Efficiency Ratios				
Asset turnover	0,76	0,5	0,79	3,95
Receivables turnover	2,53	1,80	2,19	-13
Average collection period, days	144,41	202,28	166,36	15
Profit margin	0,62	0,58	0,65	4,83
Operating profit margin	0,62	0,58	0,65	4,57
Part 2 Leverage Ratios				
Long-term debt ratio	0,72	0,53	0,84	17
Long-term debt-equity ratio	0,23	0,30	0,48	104
Total debt ratio	0,25	0,36	0,36	47

[10] Created by the author.
[11] Created by the author.

Table 8 (continued)

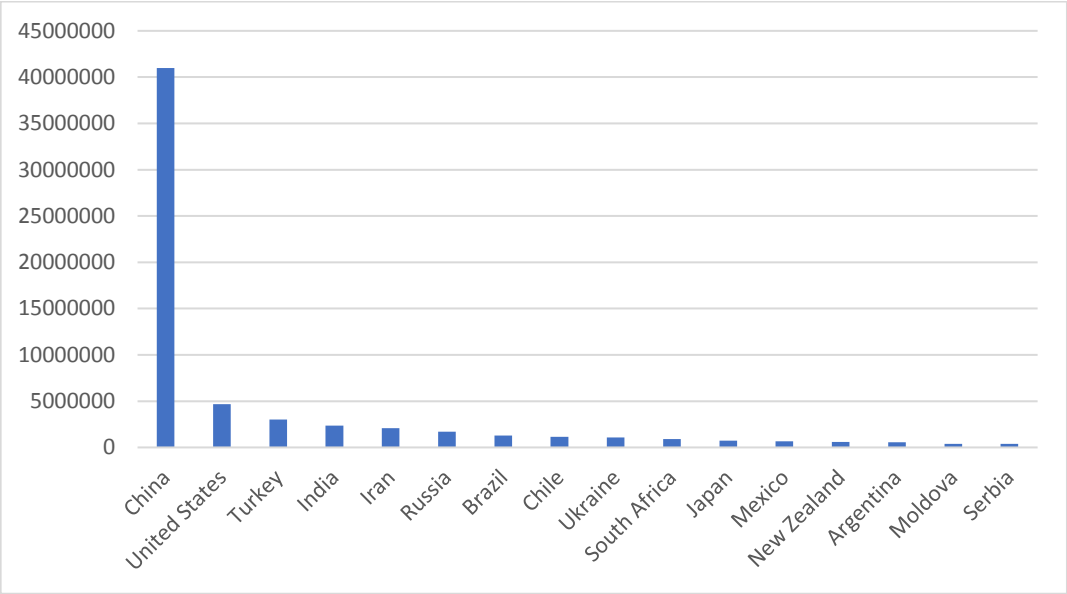
Part 3 Liquidity Ratios				
Net-working-capital-to-total-assets	0,42	0,34	0,48	15
Current ratio	7,07	2,97	9,36	32
Cash ratio	0,10	0,05	0,01	-95

After having calculated the necessary financial ratios, we can say that the asset turnover is quite low, and assets are used inefficiently. Average collection period was 166 days a year, which means that receivables are collected 2,19 times per the given number of sales. One more weak point in the company is also cash ratio, which is too low, and continues to decrease. The cash ration equals the difference between cash and current liabilities, and it is obvious that the company has cash problems, and probably the company should strictly revise its financial management.

2.3 Comparative analysis of the import substitution on the example of apples industry

We have already discussed that the efficiency improvement of the import substitution strategy is incredibly important for a country [22, P. 72]. In this part we are going to show the problem from a narrower side on the example of apples industry. We would like to compare the apples production in Russia and present the results. Every year Russia becomes one of the biggest fresh apples' importers in the world. The consumption of fresh apples in Russia is incredibly high, and importers must satisfy the needs and wants of the population with the comparably high numbers of fresh apples' import. This fact makes the problem quite interesting for discussion. Why being the top country on the number of agricultural land Russia cannot satisfy its own apples consumption? The answer to the question states is complicates and it should be taken into account that it includes many factors.

Further we will compare the apples production in different countries with Russia and show the apples import structure in 2019. First of all, Picture 6 we can notice that the world first apples producer is China.

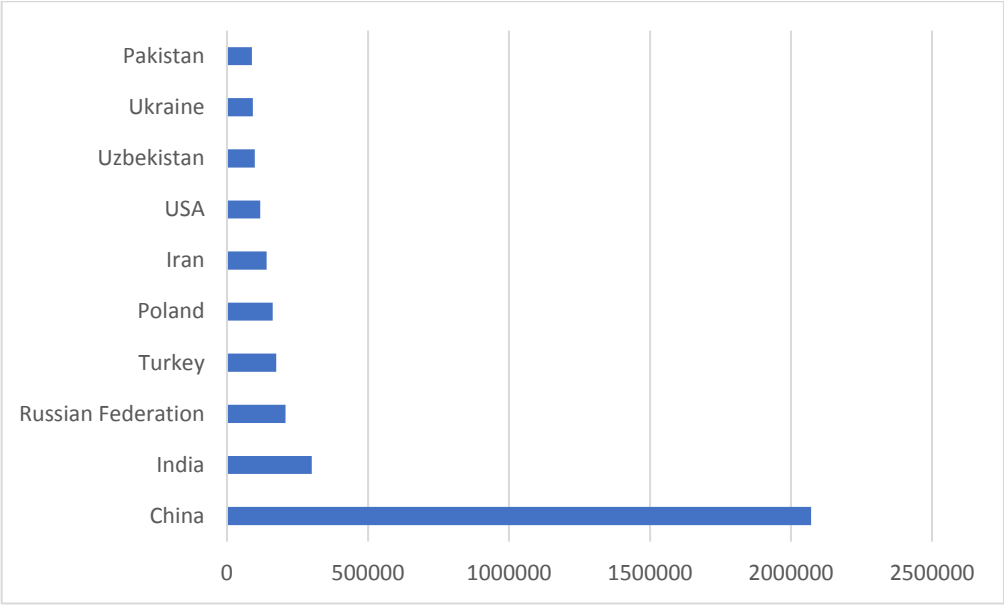


Picture 6 – Top apples producing countries in 2019, tonnes [41][12]

In 2019 China produced 41 000 000 tonnes of apples. It is nearly 9 times bigger than the second apples producer – the US (4665199 tonnes). According to the statistics presented, Russia got the 6th place with its apples production volume of 1713600 tonnes of apples. The production volume is quite low, given that the apples demand in Russia is one of the biggest in the world. It results in the necessity to saturate this demand and import apples from other countries in large quantities [23, P. 98].

In Picture 7 below we are given the statistics on the amount of agriculture land used for apples gardens as for 2018.

[12] Created by the author.



Picture 7 – Top 10 countries on the apples area harvested in 2018, ha [41][13]

As we can see in the picture, China is obviously the first country in the list with 2071674 hectares, which is nearly 7 times bigger than the second country in the list – India. Russia has the 3rd place. We know that Russian apples producers laid and continue to lay new apples gardens every year. It results in bigger numbers of land used for apples gardens.

Although Russian apples producers have an opportunity to lay new gardens with the help of government subsidies, EU import embargo, and higher import tariffs, it is still impossible to immediately increase the production volumes and fully saturate the domestic demand due to the fact that apples gardens need at least 2 years before they start to give first fruits, and 3 to 4 years before they achieve the full production volumes [24, P. 32].

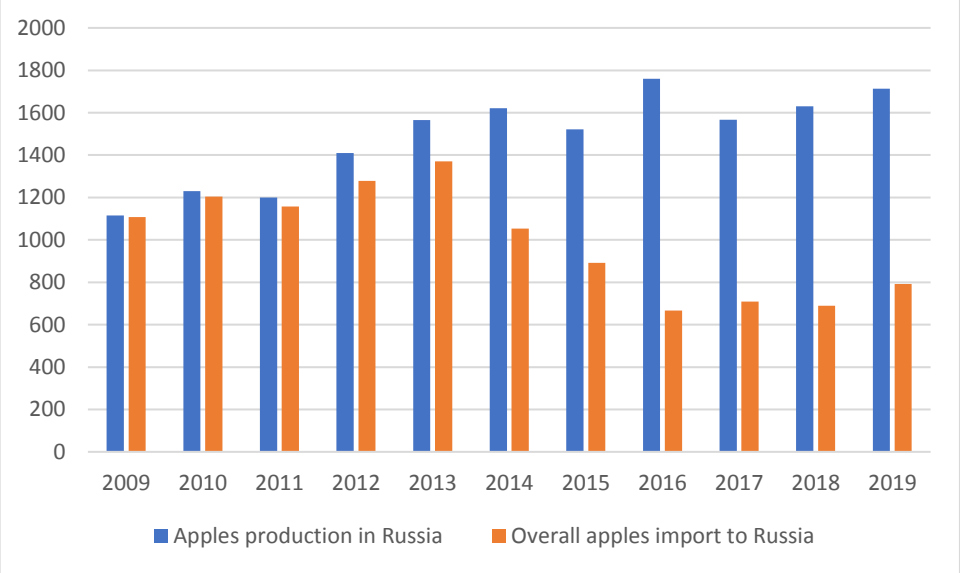
In Table 9 we can find the overall apples production and import for the last 11 years. The tendency is quite interesting. We can notice that Russia has significantly increased its apples production for this time from 1115 thousand tonnes in 2009 to 1713 thousand tonnes in 2019. The overall import has also significantly decreased – by nearly 300 thousand tonnes. In chapter 3 we are going to conduct the regression analysis of this data and give further details.

[13] Created by the author.

Table 9 – Apples import and production, thous. tonnes [41], [45][14]

Year	Apples production in Russia	Overall apples import to Russia
2009	1115,0	1108,0
2010	1230,0	1204,0
2011	1200,0	1157,0
2012	1409,0	1278,0
2013	1565,0	1371,0
2014	1621,0	1053,0
2015	1522,0	892,0
2016	1760,0	666,0
2017	1567,0	709,0
2018	1630,0	690,0
2019	1713,6	792,1
Growth, %	53,7	-28,5

To give a better understanding of the production and import of apples, in Picture 8 we give the graphical representation to show the data in comparison.

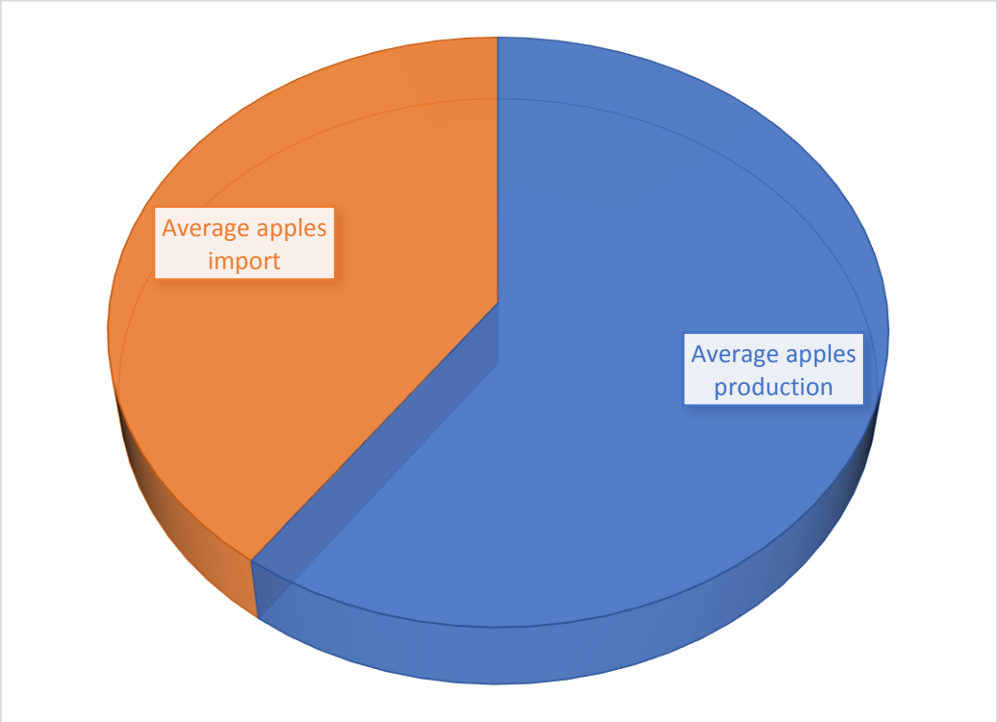


Picture 8 – Apples import and production, thous. tonnes [41], [45][15]

[14] Created by the author.
[15] Created by the author.

Although we can see the significant increase in production and decrease in import, for the last 4-5 years the numbers stay nearly on the same levels. It might be connected with the fact that the overall import from Poland, then from China had been gradually substituted by some other countries like Moldavia or Serbia.

Moreover, we constructed a pie chart in Picture 9 showing the average numbers of apples import and production for the last 11 years.

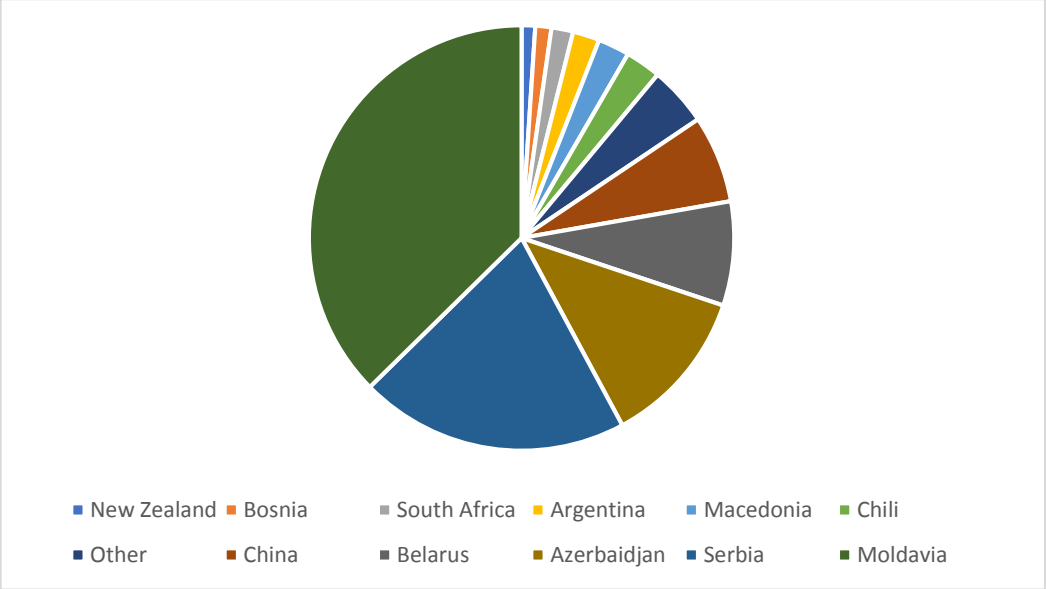


Picture 9 – Average apples import and production [41], [45][16]

It can be clearly seen in the picture that apples import has a significant share in the apples consumption – even more than a third.

Countries which imported apples to Russia in 2019 we can see in Picture 10.

[16] Created by the author.



Picture 10 – Countries which imported apples to Russia in 2019 [45][17]

We know that before 2014 Poland was the first apples importer to Russia, then it was China, which exchanged its place in 2015 [25, P. 59]. And in summer 2019 Russia stopped the import of fruit and berries from China due to some sanitary reasons. Currently Moldavia is the first apples importer to Russia with 37% of the whole apples import, Serbia is the third one (21%), next we have Azerbaijan, Belarus, and others with the shares lower than 10%.

Russia has got all the necessary resources to produce big quantities of apples and satisfy its own demand, but till now still it imports big volumes of apples from other countries [26, P. 96]. Some measures should motivate the apples producers, such as embargo imposed on the import from EU, state subsidies or higher import tariffs, but since 2014 it resulted only in not sufficient increase of apples production. The problem is quite complicated and should be observed in the next chapter with the help of regression analysis.

Finally, we have analyzed the agrifood production on the macroeconomic level and found out that Russia has got perspectives in the development of the sector. On the microlevel we have researched JSC Sad-Gigant and given some recommendations on the ways of its development. We have investigated the apples industry and shown the data on apples production and import to Russia.

[17] Created by the author.

3 Econometric modeling of the import substitution in the agrifood sector on the example of apples import and production

The given chapter gives the solution of the problem with apples import substitution. We will introduce the data analyzed, construct the multiple linear regression model, use tests to analyze the significance of the model, and forecast apples import and production.

3.1 Construction of methodological solution of the problem with import substitution

While analyzing the problem of import substitution in the apples industry, it might be useful to construct a linear regression model to show the current trends and forecast some future values. This powerful statistical tool helps to look at the problem accurately and thoroughly.

First of all, we have to find the data for the analysis and decide, which factors have a significant influence on the apples production in Russia, and which of them are insignificant and should not be used in the model. The data shown in Table 10 below gives the statistics on the overall production and import of apples to Russia, apples import from China, Poland, Serbia, and all the other countries (except the listed three) for the previous 11 years.

Table 10 – Data on apples import and production, thous. tonnes [45][18]

#	Year	Production in Russia	Overall import	Import from China	Import from Poland	Import from Serbia	Import from all the other countries
1	2009	1115,0	1108,0	175,0	334,6	31,0	567,4
2	2010	1230,0	1204,0	156,2	348,0	88,4	611,4
3	2011	1200,0	1157,0	138,2	288,8	93,7	636,3

[18] Created by the author.

Table 10 (continued)

4	2012	1409,0	1278,0	126,3	601,2	58,6	491,9
5	2013	1565,0	1371,0	110,5	705,6	69,0	485,9
6	2014	1621,0	1053,0	86,1	419,0	123,8	424,1
7	2015	1522,0	892,0	83,3	0,0	157,0	651,7
8	2016	1760,0	666,0	113,0	0,0	193,0	360,0
9	2017	1567,0	709,0	102,0	0,0	168,0	439,0
10	2018	1630,0	690,0	112,0	0,0	90,9	487,1
11	2019	1713,6	792,1	52,6	0,0	162,4	577,1

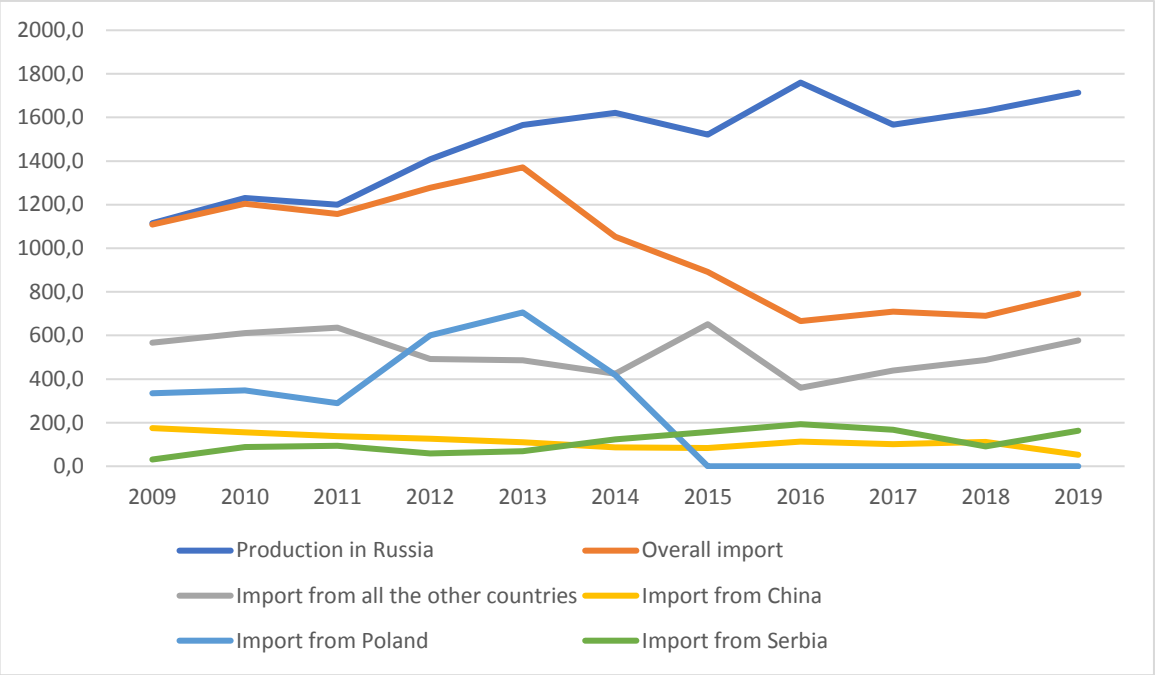
To give a better view of the statistical data from table 10, we would like to show it graphically with the help of Picture 11. In the picture we can see that the production of apples in Russia is growing gradually, while the overall import is decreasing, so there might be correlation between these variables.

Besides, we can see some interesting tendencies among the apples import from different countries. We should notice that due to the embargo imposed by Russian government on import from EU countries, the biggest apples importer – Poland – was forced to suspend its export to Russia, and since the middle of 2014 apples import from Poland equals zero [27, P. 53]. The amount of overall import decreased substantially after the suspension of apples import from Poland [28, P. 312]. Although there is no export from Poland now, the value might have influence on the apples production in Russia and can be useful for the model.

Moreover, we can notice that the export from China has significantly decreased since 2009 and became more than 3 times lower than it used to be. Up to 2014 and in 2018 China was the biggest apples importer to Russia, but in July 2019 Federal Service for Veterinary and Phytosanitary Surveillance of Russia stopped the import of apples, pears, and other drupaceous and seed-bearing fruit from China and the amount of apples import from China was 52,6 thousand tones [29].

Currently the import from all the other countries except China, Poland and Serbia has the biggest share of the overall import to Russia, while in 2009 it got only

half, and in 2013 – a third of the overall import. This value should be highly significant for the model. We have decided not to divide this value into separate countries because the values taken separately will probably become insignificant for the model.



Picture 11 – Graphical representation of production and import, thous. tonnes [45][19]

After the analysis of the statistical data, we would like to observe if there is relationship between the values. So, we decided to get the regression statistics, which shows the main coefficients and standard errors (Table 11) within the taken time period for 11 years (11 observations). Analysis was performed in Microsoft Excel with the help of data analysis tool. As a dependent variable we took the production of apples in Russia and import from different countries was taken as an independent variable. If we look at the correlation coefficients, which is calculated with the help of formula 2, presented in part 1.3 of the given work, we can easily notice that the apples import from China has the strongest correlation (0,83). Values between 0,7/-0,7 and 1/-1 have strong positive/negative correlation, so the import of apples from Serbia also has a strong correlation with the apples production in Russia. These variables might be useful while constructing an econometric model [30, P. 395]. The

[19] Created by the author.

other values have moderate correlation with the apples production. The lowest correlation among the presented variables is between apples import from Poland and apples production in Russia, still this correlation is moderate, and we can use it while constructing the model.

Table 11 – Regression statistics with the dependence from production of apples[20]

Regression Statistics	Overall import	Import from China	Import from Poland	Import from Serbia	Import from all the other countries
Correlation coefficient	0,61	0,83	0,40	0,71	0,61
Determination coefficient (R^2)	0,37	0,69	0,16	0,51	0,37
Adjusted $\bar{R}^2$	0,30	0,65	0,06	0,45	0,30
Standard Error	181,97	128,21	209,88	160,30	181,09
Observations	11	11	11	11	11

The determination coefficients, which show the percentage variation explained by the model, we can also see in the table. Import from China has the biggest coefficient equaling 0,69. It means that 69 percent variation between the variables can be explained by the model if we decide to construct it.

Adjusted $\bar{R}^2$ is usually used only in multiple regression models for the interpretation of results. The standard errors show the probable difference between the regression line and the real result. The errors presented in the table do not show very high numbers.

As a next step, we have to construct an econometric model with the use of the variables shown in Table 12. We decided to use multiple linear regression modelling. An important requirement for an econometric model is its adequacy to the original object: the model should, with the necessary degree of accuracy, reflect the patterns

[20] Created by the author.

of the functioning of a real object or system [31, P. 65]. Due to this fact, it will be necessary to do the testing of the model, which we are going to construct.

As a result, we will be able to use the model constructed in forecasting of the apples production in Russia. It might be also useful to calculate the forecast of the overall apples import to show the graphical representation of the results.

3.2 Econometric modelling of the impact of the apples import on apples production in Russia

After choosing the data, which we need to analyze, we would like to perform the multiple linear regression modelling in Microsoft Excel [32, P. 243]. First of all, we will use the equation 4 from the part 1.3 of this work.

We will take apples production in Russia as a dependent variable (Y_1) and apples import from China (X_1), Poland (X_2), Serbia (X_3), and all the other countries (X_4) as independent variables. The results are shown in table 12.

Table 12 – Regression statistics for the construction of econometric model #1[21]

Regression Statistics	
Correlation coefficient	0,96
Determination coefficient (R^2)	0,93
Adjusted $\bar{R}^2$	0,88
Standard Error	76,07
Observations	11

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	4	436105,66	109026,42	18,84	0,00
Residual	6	34716,77	5786,13		
Total	10	470822,44			

[21] Created by the author.

Table 12 (continued)

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2630,77	307,49	8,56	0,00	1878,36	3383,1
Import from China (X_1)	-4,42	1,00	-4,41	0,00	-6,87	-1,97
Import from Poland (X_2)	-0,13	0,15	-0,86	0,42	-0,48	0,23
Import from Serbia (X_3)	-0,12	0,97	-0,12	0,91	-2,50	2,26
Import from all the other countries (X_4)	-1,15	0,29	-4,02	0,01	-1,84	-0,45

Based on the offered statistical output, the multiple linear regression model will have the following view (taken from the multiple linear regression equation 4 in part 1.3)

$$Y_i = 2630{,}77 - 4{,}42 * X_1 - 0{,}13 * X_2 - 0{,}12 * X_3 - 1{,}15 * X_4 + u_i \qquad (13)$$

where

Y_i – a dependent variable;

$X_1 \ldots X_4$ – independent variables;

u_i – an error term.

To analyze the regression statistics shown in the model, we should first look at the coefficients. The first coefficient is the correlation coefficient, which shows the power of relationship between the dependent and independent variables. Equation 2 from part 1.3 shows how to calculate the coefficient. In the given regression statistics, it equals 0,96, which means there is strong correlation. Moreover, the value is very close to 1. So, this indicator shows valuable and sufficient result for the model.

The next coefficient is the coefficient of determination, equation 3 from part 1.3. It shows $R^2 = 0,93$, which means that 93% variation is explained by the model. This result is also good and favorable enough.

Afterwards we look at the third coefficient – $\bar{R}^2$. It equals 0,88. This coefficient is also close to 1 and shows the goodness of fit for the given multiple regression model.

In the third part of the table the intercept β_0 shows the value 2630,77, which means that if all the other coefficients are equal to zero, the minimal result of the dependent variable is 2630,77. So, the result cannot be lower.

The standard error for the intercept is 307,49, which is not too high, and for the other coefficients they are also not even bigger than 1.

To assess the model further we would like to use the F-test.

According to the statistical output, we can see that F-test in ANOVA table shows the result of 0,00, which is lower than 0,05. So, we reject null hypothesis, which means that the model is significant and the data fits better than the intercept-only model.

In addition to the F-statistic, we need to assess the p-values for each of the variables [33]. P-value is the value used in testing statistical hypotheses. In fact, this is the probability of error in rejecting the null hypothesis. The p-values in the given statistical output show that import from China and import from all the other countries are statistically significant for the model – their p-values are 0,00 and 0,01 and they are lower than 0,05. For these values we reject the null hypothesis [34, P. 393]. But import from Serbia and Poland are statistically insignificant as they show values lower than 0,05. It means that we accept null hypothesis. In this case it might be better to exclude these variables from the model and recalculate the model.

To process the next action while recalculating the model, we need to take the significant variables for the model. They are import from China (X_1) and import from all the other countries (X_2) except China, Poland, and Serbia as independent variables and apples production in Russia as a dependent variable (Y_i). Using MS

Excel data analysis tool, we recalculate the model. The result is presented in Table 13.

Table 13 – Regression statistics for the construction of econometric model #2[22]

Regression Statistics	
Correlation coefficient	0,95
Determination coefficient (R^2)	0,91
Adjusted $\bar{R}^2$	0,89
Standard Error	72,62
Observations	11

ANOVA	*df*	*SS*	*MS*	*F*	Significance F
Regression	2	428637,01	214318,50	40,64	0,00
Residual	8	42185,43	5273,18		
Total	10	470822,44			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2595,86	139,82	18,57	0,00	2273,44	2918,27
Import from China (X_1)	-4,68	0,68	-6,93	0,00	-6,24	-3,12
Import from all the other countries (X_2)	-1,11	0,25	-4,48	0,00	-1,68	-0,54

Using the output calculated and equation in formula 4 from part 1.3 we calculate the multiple regression model

[22] Created by the author.

$$Y_i = 2595{,}86 - 4{,}68 * X_1 - 1{,}11 * X_2 + u_i \quad (14)$$

where

Y_i – a dependent variable;

$X_1 \ldots X_4$ – independent variables;

u_i – an error.

The overall statistical output shows quite good performance. To assess the model, we first look at the correlation coefficient, which is 0,95. The correlation coefficient shows strong correlation. This result is favorable for the model.

The determination coefficient R^2 now equals 0,91, which shows that 91% variance is explained by the model.

Adjusted $\bar{R}^2$, which means goodness of fit for the model, shows 0,89. The coefficient assesses the whole model as statistically significant and shows very good result.

If we look at the third part of the table, the intercept value equals 2595,86. It means that even if all the variables are zero, the minimal number of the dependent variable is still 2595,86.

While performing F-test, the result of F-significance is 0,00. F<0,05. We reject the null hypothesis. It means that the model fits the data better than the intercept-only model and makes our model 14 statistically significant and reliable.

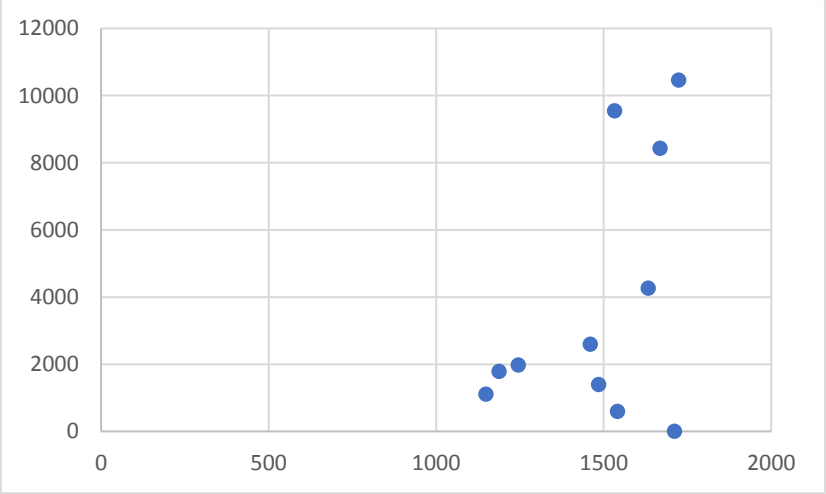
After that we look at the p-values of the variables. They are all 0,00, which is lower than 0,05 and makes all the variables statistically significant for modelling.

Next, we would like to check the model for heteroscedasticity with the help of White test. The residuals table, calculated in Microsoft Excel, we can see in Table 14 below.

Table 14 – MS Excel table with residuals[23]

Observation	Predicted Production in Russia	Residuals	Residuals squared	Predicted production in Russia squared
1	1148,29	-33,29	1108,44	1318577,36
2	1187,69	42,31	1790,35	1410601,40
3	1244,46	-44,46	1977,12	1548692,81
4	1459,97	-50,97	2597,79	2131508,02
5	1540,63	24,37	594,12	2373526,57
6	1723,30	-102,30	10466,25	2969779,05
7	1484,62	37,38	1397,31	2204094,62
8	1668,20	91,80	8426,96	2782896,36
9	1632,33	-65,33	4268,39	2664510,77
10	1532,27	97,73	9551,02	2347853,41
11	1710,83	2,77	7,67	2926944,15

The given table shows predicted production in Russia value and residuals. We calculate the squared residuals to construct the scatterplot to check the model [35, P. 187]. For the scatterplot we take first two columns with residuals squared and predicted production.



Picture 12 – Scatterplot with the heteroscedasticity check[24]

[23] Created by the author.
[24] Created by the author.

As we can see from the scatterplot, the points get dispersed, but not too much. So, the heteroscedasticity is not obvious, and we need to process the White test for heteroscedasticity to check it for sure. To construct the auxiliary multiple regression with residuals we take two independent variables – import from China (X_1) and import from all the other countries, except Poland and Serbia (X_2). For the dependent variable we will take the residuals squared. In the table 15 you can see the result of calculations in MS Excel.

Table 15 – Auxiliary regression model table[25]

ANOVA	df	SS	MS	F	Significance F
Regression	2	71400234,36	35700117,18	3,85	0,07
Residual	8	74211246,12	9276405,76		
Total	10	145611480,48			

Table 15 shows the regression statistics for the residuals and we need to check the table for significance. For that purpose, we can also use the F-significance, which is 0,07. F>0,05, which means that this model is insignificant, and there is no heteroscedasticity in residuals.

Finally, we take the multiple linear regression model in formula 14 as significant and verifiable.

3.3 Forecasting the production of apples in Russia using regression analysis

After checking the significance and reliability of the model, we need to draw the forecast for the next 5 years. The forecast might give us the better representation of the problem and enhance the understanding of the existing trends in the apples import substitution in Russia. The major function of forecasts is to identify some

[25] Created by the author.

existing problems and prevent their further extension when taking some countermeasures [36, P. 153].

As a result of the given chapter, we will construct the forecast of apple production in Russia using 5 steps for forecasting explained in part 1.3 of this work and we will be able to assess the further trends existing in the overall apple import. Finally, we will compare the numbers and draw a conclusion with necessary recommendations.

First of all, we need the multiple regression model (14) presented in part 3.2 of the given work. The model was constructed based on apple import from China and all the other countries except Poland and Serbia as independent variables and apples production in Russia as an independent one. The equation for the forecast will have the following view

$$\hat{Y}_t = 2595{,}86 - 4{,}68 * X_{1t} - 1{,}11 * X_{2t} \quad (15)$$

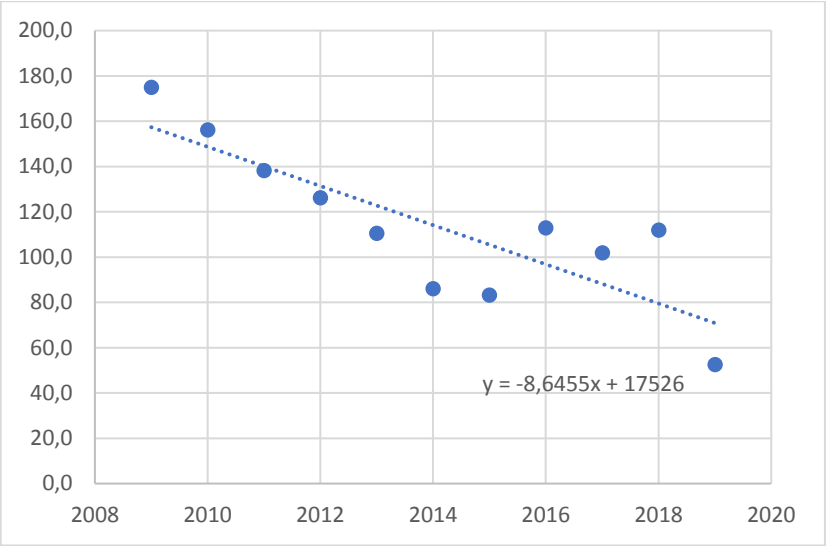
where

$\hat{Y}$ – a forecasted value of the dependent variable;

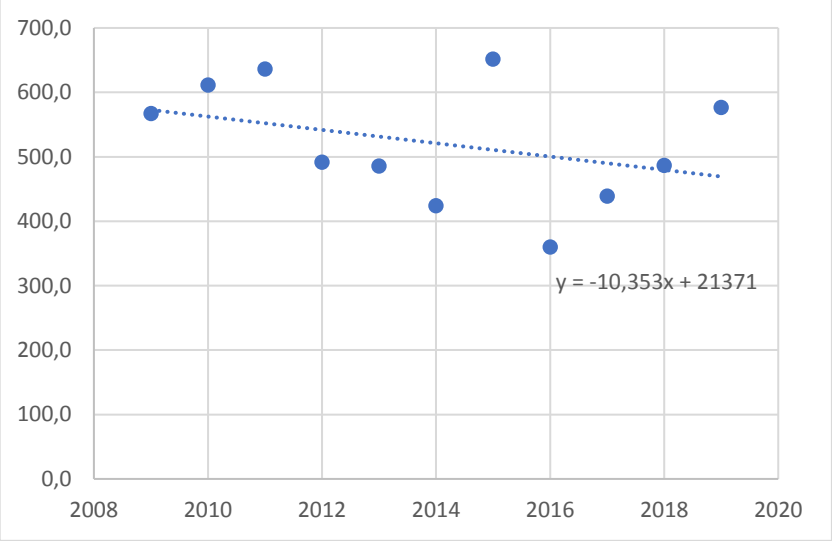
X_1 and X_2 – independent variables;

t – stands for time.

When performing the second step of forecasting, we take the linear regression equations for the two independent variables and predict their future values for the next 5 years. For that we need the following two pictures 13 and 14.



Picture 13 – Regression equation with the apples import from China[26]



Picture 14 – Regression equation with the apples import from all the other countries except Poland, and Serbia[27]

After processing this step, we get the two equation for constructing the forecast of apples import from China and all the other countries except Poland and Serbia

$$Y = 17526 - 8{,}6455 * X \quad (16)$$

$$Y = 21371 - 10{,}353 * X \quad (17)$$

[26] Created by the author.
[27] Created by the author.

where

Y – a dependent variable;

X – an independent variable.

Based on these equations, we get the forecast presented in Table 16 below.

Table 16 – Forecast for the independent variables, thous. tonnes[28]

Year	Forecast for import from China	Forecast for import from all the other countries
2020	62,09	457,94
2021	53,44	447,587
2022	44,80	437,234
2023	36,15	426,881
2024	27,51	416,528

Finally, after we have constructed the forecast for the independent variables, we can use them in the equation for the forecast and predict the apples production in Russia for the next 5 years. The forecast is presented in Table 17 below.

Table 17 – Forecasted apples production, thous. tonnes[29]

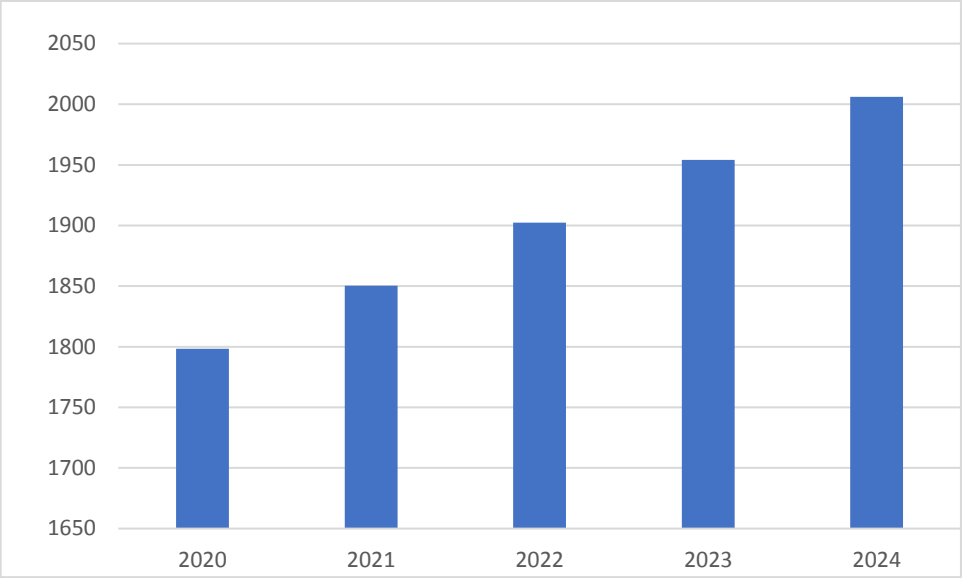
Year	Forecast
2020	1798,347
2021	1850,303
2022	1902,258
2023	1954,214
2024	2006,17

We would like to show the forecasted values graphically to give the better representation of the further trend in the apples production industry in Russia. As we

[28] Created by the author.

[29] Created by the author.

can in Picture 15, apples production will be gradually increasing, which is favorable enough for the import substitution in Russia. The forecast shows that the apples production in Russia will increased from 1713,6 thousand tonnes in 2019 to 2006,17 thousand tonnes by 2024.



Picture 15 – Forecasted apples production, thous. tonnes[30]

We should also notice that the fruit industry is a difficult one for predicting as it is impossible for the producers to increase their production at once [37, P. 24], for example, in the situation with the production of tomatoes or potatoes. Even using high technology gardens, farmers can get first fruit only in 2 years after laying a garden. That is why if there is a favorable situation in the economy and it might be incredibly profitable to produce more apples right now, it is still impossible to immediately increase the produced amounts [38, P. 72]. Due to this fact, such a big apples consumption should be satisfied with the help of import, while we are waiting for new gardens to be laid.

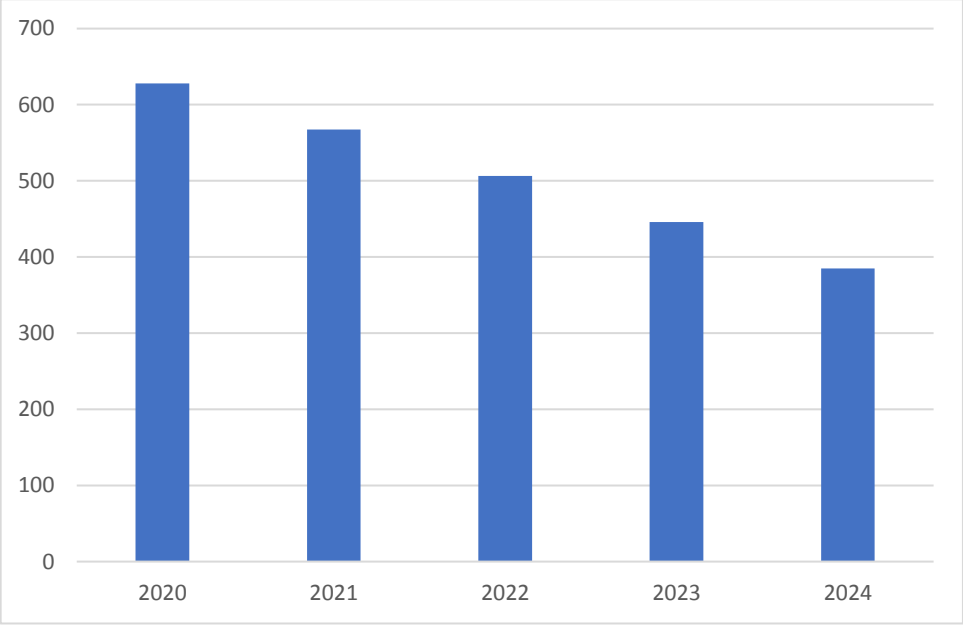
To perform the better analysis of the problem, we also need to forecast the apples overall import to Russia. Following the steps described previously, we calculate the import values for the next 5 years. The results are shown in Table 18.

[30] Created by the author.

Table 18 – Forecasted apples overall import, thous. tonnes[31]

Year	Forecast
2020	628,02
2021	567,271
2022	506,522
2023	445,773
2024	385,024

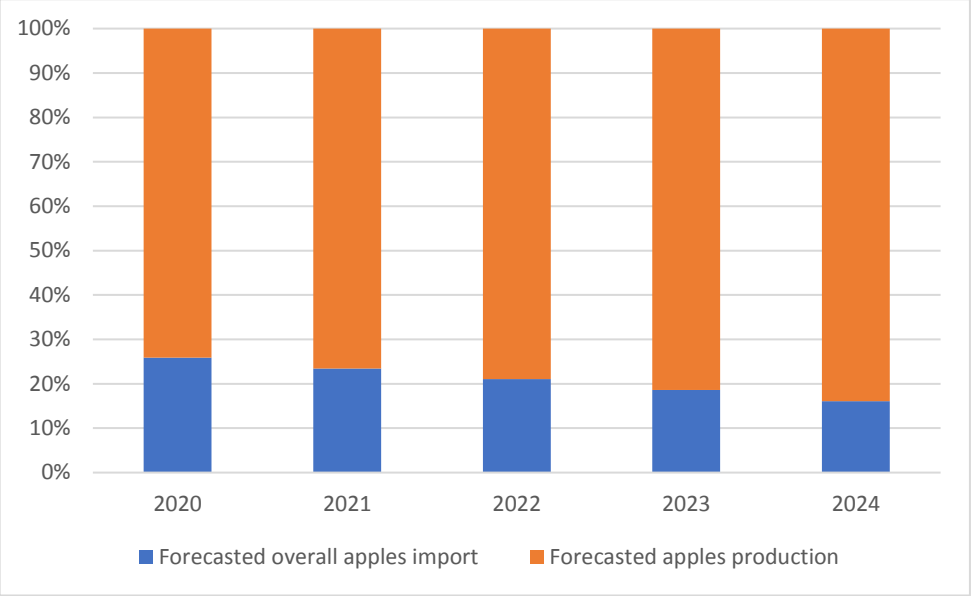
Picture 16 is the graphical representation of the forecast for the apples import to Russia. We can clearly the current trend in the overall apples import currently existing in Russia. According to the forecast presented the overall import will decrease from 792,1 thousand tonnes in 2019 to 385 thousand tonnes by 2024.



Picture 16 – Forecasted overall apples import, thous. tonnes[32]

Finally, after forecasting both apples production in Russia and overall import of apples to Russia, we can construct the graph shown in Picture 17. If we take the sum of apples import and production for 100%, we will be able to clearly observe how apples production will be gradually substituting apples import.

[31] Created by the author.
[32] Created by the author.



Picture 17 – Predicted values for the analysis of apples import substitution, thous. tonnes[33]

As a result of the given research, we can say that the apples import from different countries significantly influences the apples production in Russia. Although it is impossible to eliminate import at the moment due to low domestic production volumes [39, P. 97] and the necessity to saturate the incredibly high demand [40, P. 25], the apples import substitution should become a strategy at the long-term.

We have constructed the econometric model on apples production in Russia and understood that import has got a significant influence on the apples production in Russia, especially import from China and all the other countries except Poland and Serbia. We have also presented a forecast of apples production in Russia for the next 5 years and realized that the apples production will be substitution apples import.

[33] Created by the author.

CONCLUSION

Finally, we would like to note that the report shows measurable results and offers ways for implementation of the import substitution strategy. Also, it discusses why countries should not tend to have zero imports, while wishing to gain competitive advantage and superior trade balance.

As a result of the first chapter, we have studied economic and social objectives of improving the import substitution efficiency. In general, if a country decides to implement the strategy aimed at import substitution, the reasonable application of this strategy leads to better domestic output, increased GDP growth, limited dependency from import, lower unemployment rate and well-balanced social and economic growth. There are also various tools, which help to improve the import substitution effectiveness, such as customs tariffs and quotas, tax stimulation, government procurement, standardization and certification and offset agreements. We observed several methods of research which can be used for analysis and copiled our own methodology for the further research. We understood if countries have necessary resources to produce their own goods and satisfy domestic demand, government should reasonably choose measures to motivate its internal producers with the help of tools offered in the chapter.

The second part of the work includes macro and micro analysis of the sector as well as the comparative analysis of an apple industry in particular. Macroanalysis shows that in comparison with the other countries, Russia does not use its resources efficiently enough. When analyzing the problem on the microeconomic level, we used a JSC Sad-Gigant, which mainly operates in Krasnodar Region and is successful in the sphere of fruit production. We compared this company with other companies in the industry and tried to identify some problems existing in the company, which can slow down its growth. The comparative analysis of an apple industry shows the current state state of apples import and the development of apples production and import over the last decade. We found out that there has been the significant increase in

production and decrease in import, although for the last 4-5 years the numbers stay nearly on the same levels.

The final, third part of the work represents econometric analysis of the apple industry as a part of agrifood sector. It shows main trends and gives forecast for 5 years. In general, the forecast is quite favorable, although the industry needs to be closely monitored and supervised. As a result of the given research, we can say that the apples import from different countries significantly influences the apples production in Russia. Although it is impossible to eliminate import at the moment due to low domestic production volumes and the necessity to saturate the incredibly high demand, the apples import substitution should become a strategy at the long-term.

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