

## ANALYSIS OF LATVIAN INTEGRATION PROCESSES IN EU USING SYSTEM DYNAMICS MODEL

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**Abstract.** Recent years were significant for the economy of Latvia due to essential changes in structure of economic system. Often in terms of changed economic conditions traditional statistical and econometric methods are not appropriate in order to specify main ways of further development. The current paper is focused on developing of model of economic integration of Latvia in the European Union. The novelty of the paper is related to the application of system dynamics method and to the study of integration processes in the European Union. The developed model considers basic elements of international economy and principles of European Union: free goods and capital movements, migration, contributions and grants; and, also, evaluates the influence of the European Union on economic development of the country. Results of the model show both, positive and negative influence of the process of integration on the economic development of the country. The developed model can be applicable for analysis of economic situation in other countries of European Union.

**Keywords:** system dynamic, economic development, simulation, integration, migration.

**Jel classification:** A12, C12, C13, C51, C52, C53, C63, C73, E20, E21, E22, E23, E24, E27, E62, F15, F22, F40, F41, F43, F47

### 1. Introduction

International integration is one of the most important factors contributing to the economic development in Latvia. International integration process received a strong impetus to the development after Latvia's entering the European Union (EU) in 2004. Since then it has accumulated enough statistical data about integration process, but is still lacks research, which could indicate the main parameters of development, which could quantitatively estimate Latvia's gains and losses from incoming in the EU.

In the paper researched problem is related to the external (international) economic part of Latvian economy estimation.

Novelty element relates with the integration and globalization process quantitative estimation, using the system's principles.

The object of research is the Latvian economic integration in the EU and the international economy. The research subject is the Latvian economy changes as result from Latvia entering to the EU.

The paper aim is to comprehensively analyze the effects of international integration process of the Latvian economy.

The study shall use both traditional mathematical, statistical, economic and econometric analysis methods, such as time-series trends, regression

method, and specific modeling method - system dynamics method.

The system dynamics method is chosen take into account both Latvian specific – rapidly changes in economy, in this circumstances econometric methods does not operate correctly and the system method specific – it's allow to combine analytical reasoning and mathematical, statistical calculations. It is the study limitation.

As the information base of study is used LR CSB, European Communities, Eurostat and LR Financial and Capital Market Commission (FCMC) data. Some materials are taken from experts, news agencies, newspapers and the Internet. The base of research is LAS Institute of Economics, LR President's Strategic Analysis Commission, LR Ministry of Foreign Affairs and LR Ministry of Welfare completed researches. Methodological basis of research based on the Latvian and world's top scientists works: international economic theory - MacConell and Brue (2003), Latvia EU integration processes – Karnite (2007), Brivers (2008), system dynamics - Sterman (2000), Yamaguchi (2010), Wheat (2009), Chevalley (1992).

### 2. Literature review

Process of formation of the EU wasn't discussed in system dynamics community. There was only one

attempt to create model which would explain processes of integration and cohesion in the EU. This model was developed by Thierry F. D. Chevalley (1992). If to divide the EU formation into three stages: association of the Western Europe countries, joining of the Central Europe countries in the EU and joining of Eastern Europe countries; than this model describes the beginning of the second stage. Chevalley's paper describes and understands the transition in Central Europe. Regions considered for this study include Poland, former East Germany, former Czechoslovakia, Hungary, Rumania, Bulgaria and former Yugoslavia. The authors criticize the approach of Chevalley to model development. It is not advisable to develop a model for such a large group of states. Chevalley has united absolutely different countries in one group. From this group Hungary and Bulgaria have entered EU only in 2007, three years later after the Baltic States joining the EU. After several wars Yugoslavia has been split in seven small countries. Chevalley has prepared paper, disregarding specificity of the analyzed countries, i.e. not considering political, social and economic characteristics – presence of natural resources in the country, industrial development, economic specialization of the country, etc. However Chevalley has offered theoretically qualitative, correct model scheme of cohesion of technologies and life standard levels in the analyzed countries. Chevalley has developed model of movement from the centralized planning economy to market economy. Important steps in this transition are the privatization of state-owned enterprises, the reorganization of ministries, creation of a modern communications infrastructure and the introduction of financial intermediation and legal operating frameworks. Today the given paper and its offered model are already outdated. Privatization basically was completed ten years ago, in all European countries the market economy dominates. But process of integration in the EU proceeds, that once again underlines importance of this research.

In this study much attention is paid to the explanation of Latvian economy features. Exceptional circumstances require a specific model. Even comparing the three Baltic States, one model can't be transferred from one state to another. There is a common perception that the Baltic States are similar by population, area, region, mentality, and by level of economic development. However, on the way to integration in the EU each state has its own achievements. Estonia entered the euro zone in 2011, but in Latvia since 2008 a long, deep crisis is observed. The first part of the paper is devoted to specificity the Latvian economy.

It is important to note that in the system dynamics many models of regional development planning are developed. Their updates are develop almost every year in different countries, adapting models to current conditions (Stark *et al.* 1976; Rivera 1980; Li Zhou, Zhou 1991; Lytchkina 2009; Lektauers *et al.* 2010). One of the ways to develop a model of European integration can be revising an existing regional model. In other words, it is formation of macro-regional model. The authors haven't chosen this way considering the restrictions of paper topic – to deal only with economic integration.

In system dynamics community, models of macroeconomic development are developed (Yamaguchi 2010; Wheat 2009). The authors suggest adapting them to development of economic integration model. Existing macroeconomic models do not display broadly international economy; therefore without improvements these models can't be applicable to estimate the integration of state in the economic union.

### **3. Background and context: analysis of Latvia integration in the EU**

This section explains specifics of the integration of Latvia into the European Union.

#### **3.1. Latvia's entering into the EU direct financial effect**

For Latvia, joining the EU, the new financial contributions were formed. Contributions are directed to the EU's budget. Also, from the EU received funds significantly increase. The difference between received funds and contributions increased national income, which is the direct benefit of the Latvia's accession to the EU.

Big part of Latvian contributions to the EU is based on the national income. Significantly smaller is VAT based contributions, the UK rebate and customs duties. Latvian contributions to the EU limit the domestic consumption: part of VAT contribution, as well as customs duties, increases prices, which is consumption limiting factor; national income part contribution also limits domestic consumption. Contrary, the received EU budget funds promote natural resource conservation and domestic production increase.

From authors's point of view, these contributions, grant system does not encourage the development of Latvian economy. To successfully develop the production, demand is necessary. The Latvian market is small; it is not profitable to produce all range of goods in Latvia. For Latvia it is sufficient small producers, but they can not com-

pete with large producers, considering the higher cost per production unit. Problem-solving way might be Latvia's specialization in specific products' production. Latvian specialization is wanted for several years, the priority directions are given to a highly technological and / or natural, environmentally friendly products. By authors's opinion, wanted product class may be supplemented with products whose mass production is difficult or output growth does not lead to costs decrease.

### 3.2. Influence of free movement of goods and services on the Latvian economy

According to economic theory one of the ways to develop the country's economy, is to increase net exports. One of the Latvia's benefits from incoming the EU is growths of market, the removal of barriers to exports goods to EU.

For Latvian net exports calculation the authors uses LR CSB data on exports and imports. Through net exports, exports and imports data analysis using time series (trend) modeling techniques have made conclusion that all three indicators' trends are similar.

In Latvia net exports are positive (greater than zero) only for wood and wood products group. In some groups, such as textiles and textile articles, in some years also have been seen a positive net exports, but these groups have such a low share of net exports, that they may be disregarded in the analysis.

Wood and wood products net exports from 2001 to 2007 grow gradually, with the linear trend. Net export growth in this group was related with gradual development, with previously established cooperative extension. Latvia's accession to the EU had no effect on net exports increased in this group. It can be concluded that with contemporary globalization level, national independence from various unions and associations can not stay competitive goods exports. Authors's opinion, even more, incoming into economic union does not encourage competitive exports, because competitive products would be required not only in union countries, but also in third countries, which can fully use internal potential of exporting country.

It is important to note that in 2008 wood and wood products net exports fell, which is related to the global economic crisis and reduction in foreign trade.

In another key product groups and total net exports were negative. Other groups' net exports changes were gradual, with linear trend. Only if the wood and wood products group net exports grew, in the other groups it fell. This would indicate that Latvia is not fully using the opportunities

form accession to the EU. Net exports were not expanded, imports dominated in foreign trade.

### 3.3. Influence of free capital movement on the Latvian economy

Availability of capital in country can be an economic development factor. Economic theory defines that in closed economic system, availability of capital or investment in the country can be less or equal to savings. Savings that population placed in bank accounts and deposits become available for investment in the form of loans. Small offset from this equilibrium can form banks capital. Bank with its own resources also can participate in the credit market. In theory, after Latvia's accession to the EU, capital can come to Latvia in the loan form or as investments in banks capitals and leave Latvia by placing credits or investments in other countries. Actual capital changes in Latvia before and after joining the EU are visible in Fig. 1.

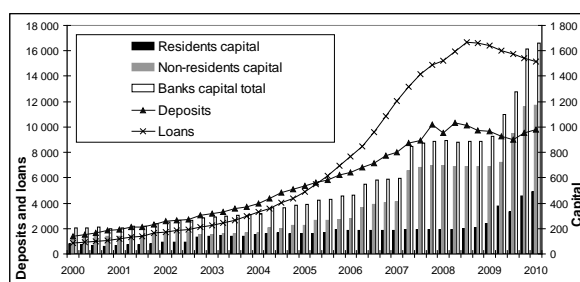


Fig.1. Banks capital, deposits and loans growth in Latvia, mln. LVL (Source: Authors's figure on the basis of FCMC data)

Analyzing banking capital increase in Latvia, we can say that its development was gradual. Analyzing the structure of capital allocated in Latvia, that consists of residents' capital and non-residents' capital, it is evident that capitals have a different dynamic. Residents' capital increased by 46 % per year from 2003 to 2008, in this time non-residents' capital increased by 347 %. Capital growth rates differ almost 8 times. Total banks capital increase in Latvia is formed with non-residents' capital increase. It can be concluded that the international capital came to Latvia. But to draw conclusions, that it was related with the Latvia's joining the EU, it is not possible.

Before Latvia's accession to the EU foreign (non-residents') capital also have important role. Its share in total banks capital was from 70 % (in 2000) to 51 % (2003), and its minimum (51 %) directly before Latvia's incoming to the EU. Later, foreign capital share in total banks capital grew and reached 78 % (in 2008). Also, to approve the

capital flow to Latvia can deposit and loan volumes, which also are shown in Fig 1.

Before Latvia joined the EU savings were more than granted loans about 20–25 %. Local resources were sufficient to cover domestic demand in the capital. A few months after the EU integration credit and deposit ratio started to fall. Granted loans grew faster than growing deposits. In September 2005 loans were balanced with deposits, but since then, granted loans have become significantly greater than deposits. Additional resources for loans banks attract from international capital markets. Latvia's entering the EU is related with the credit system development and credit boom in Latvia. In contrast, entering the EU did not increase amount of deposit, deposits grew gradually.

The rapid credits growth could trigger economic development, if credits are directed towards to industry. Analyzing credit structure, from 30 % (in 2000) to 50 % (in 2010) credits are issued to non-residents, households and for other purposes. Of these credit types, consumer credit growth could contribute to economic development if consumers choose to buy domestically produced goods. But in reality, consumer loans stimulated import or/and increased prices in the country. Foreign trade growth after Latvia's joining the EU is discussed in the previous section.

Only 14 % of loans were allocated in manufacturing, which explains why, despite the loan portfolio growth in Latvia, internal production growth did not happen. Granting credits to the "air" (Karnite *et al.* 2007), with financial transformation related sectors, does not lead economic development. Thus, capital incoming is not being used to promote positive changes in the Latvian economy.

### 3.4. Influence of labour free movement on the Latvian economy

In 2004 several EU states opened their labour markets to workers from Latvia. The largest amount of labour force went to Ireland, Great Britain and Sweden. In these countries salaries were substantially higher than in Latvia, which contributed to labour migration from Latvia. The hypothesis of the research is that labour migration is determined primarily by the payment level in the countries under consideration and the indicator derived from it – payment differences in the countries compared; as well as employment level, unemployment level, number of work places (market capacity) and number of vacant work places. Secondary factors influencing migration may be costs connected with labour migration, formal legal bar-

riers to migration and personal propensity for migration. First of all the main indicators of Latvia's labour market, represented in Table 1, will be analyzed.

**Table 1.** The main indicators of Latvia's labour market 2004-2008 (Source: Authors's summary of the CSB and the Eurostat data, more detailed statistic is available in Skribans's works (2007, 2009b, 2009c))

	2004	2005	2006	2007	2008
Average wage, EURO/month	403	449	552	719	865
Working age population (thous.)	1584	1580	1573	1584	1568
Number of employees (thous.)	1018	1034	1087	1118	1125
Number of vacancies (thous.)	...	12	19	20	11
Number of unemployed (thous.)	118	101	80	71	91

From Table 1 it is evident that since entering the EU, both the average wage and the number of employees in Latvia have grown along with the increase in the number of vacancies. At the same time the number of unemployed persons decreased as well. Data show that the number of employees has increased almost by 10 % during the period analyzed, the number of unemployed persons decreased by 23 %. This does not automatically mean that previously unemployed people have moved to the group of employed ones. Employed and unemployed people in total form labour force. During the period under examination the amount of labour force in Latvia increased by 7 %, but the amount of working age population decreased by 1 %, which is the factor, influencing labour market.

Decrease in working age population in Latvia may be connected with the negative natural increase of population as well as migration processes. Indirect calculations using LR CSB data, taking into account population reaching pension age, increase of young people under working age, as well as death rates in working age, show that the decrease of natural labour force is 20 thousand persons. The number of migrating persons differs in various sources, for example, Eurostat data show that from 2004–2005 on average 981 people a year left Latvia, in 2006 this indicator increased 2.1 times. LR CSB data show that the population of Latvia during this time decreased by 4.7 thousand persons. But all these data do not explain the difference of approximately 352 thousand persons between working age population and labour force.

Such large labour force differences can be associated with long-term unemployment, which is excluded from the number of unemployed persons, as well as with migration processes, which are not properly registered and estimated. The first reason, increase of the hidden unemployment along with

the increase of the number of employees and vacancies is not possible. Experts have other thoughts about labour migration process.

Labour migration data are relative and varying, and therefore cannot be exact. Some experts consider that about 50 thousand people (Indans *et al.* 2006) have emigrated from Latvia, other estimations show that totally about 100 thousand (LETA, 2008) or even 110 thousand (LETA 2007) job migrants, students and their family members have left Latvia. If data taken from statistical sources are too small and do not show unofficial migration, then the estimations of experts are sometimes unrealistically large, because none of the population groups or total population showed that large decrease. Variation of data indicates that labour migration statistics cannot be applied in such researches.

Further it is important to examine migration from another angle, that is, why workers go abroad. The situation in Latvia and in foreign countries is compared in Table 2.

**Table 2.** Comparison of Latvia's and foreign labour market from 2004–2008 (Source: Authors's summary of the CSB and the Eurostat data)

	2004	2005	2006	2007	2008
Ratio of wages					
• in the EU 27 and in Latvia	6.4	6.0	4.4	3.5	3.0
• in Sweden and in Latvia	10.1	9.2	7.7	6.0	5.1
• in Great Britain and in Latvia	9.3	9.0	7.6	6.2	5.3
Ratio of the number of employees					
• in the EU 27 and in Latvia	204	204	198	196	197
• in Sweden and in Latvia	4	4	4	4	4
• in Great Britain and in Latvia	28	28	27	26	26
Number of vacancies in Sweden (thous.)	38	42	47	55	49
Number of vacancies in Great Britain (thous.)	629	617	597	656	616

As Table 2 shows, wages in Latvia are much lower compared with the average level of the EU and particular EU member states. At the moment of entering the EU, difference between wages was even 10-fold, but since that the difference is decreasing, as wages in Latvia are increasing.

Further analysis of data in Table 2 indicates that the Latvia's labour market forms only half percent of the whole EU labour market and is 26 times smaller than that in Great Britain. Comparison of data in Tables 1 and 2 shows that the number of vacancies in Great Britain exceeds the number of unemployed persons in Latvia more than 9 times. Moreover, vacancies in Great Britain can be filled by more than a half of all Latvian labour force. But these data represent only one developed EU country. In total, it is possible to find a vacancy for each Latvian worker in the developed

EU countries with the income at least two times as high as an average level in Latvia. These data show that actually labour migration from Latvia is not limited by employers, as well as that there are no restrictive formal barriers.

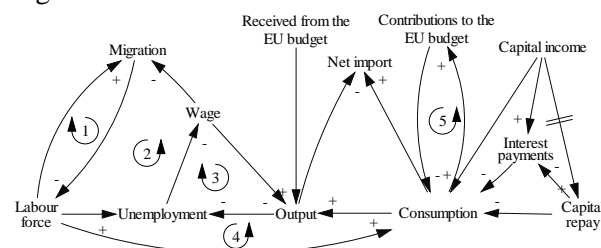
From the authors's point of view labour migration in Latvia is limited only by propensity to migrate. It is hard to estimate this indicator; however, taking into account population polling results, 19 % of Latvia's population is ready to leave (Delfi 2008) and 40 % of population have at least once considered the possibility to leave Latvia (Lotina 2008).

#### 4. Model of Latvia's integration in the EU

Based on the relationships defined in the previous chapter, the system dynamics model of Latvia's integration in the EU is developed.

##### 4.1. Developing of the conceptual model

The conceptual scheme of the model is shown in Fig. 2.



**Fig.2.** Conceptual model of Latvia's integration in the EU (Source: Authors's figure, elements description is given in Skribans and Pocs (2008))

The Fig. 2 shows that the model consists of parameters that affect integration: migration; contributions to the EU budget, subsidies from the EU, net import and the movement of capital, as well their impact on key macroeconomic processes in Latvia is shown.

The greatest influences on the Latvian economy have migration processes. Migration is formed by the difference of wages in the EU and Latvia. Latvia's accession to the EU did not change wages in the EU, thus the wages in the EU are taken as a constant pointer. Low wages in Latvia defines migration from Latvia. Wage increases in Latvia will reduce migration. Between these parameters there is a negative relationship, as indicated by a minus sign near the arrows.

With migration increasing, size of the workforce also will be reduced. Migration has a negative impact on the workforce. Workforce reduction will lead to a reduction in migration that means, the amount of labor has a positive effect on migration. The relationship between migration and

amount of labor describes the first feedback loop displayed in the Fig. 2.

Changes in labor force volume cause changes in the same direction among the unemployed. In circumstances of constant number of jobs, labor force reduction leads to a reduction in the number of unemployed. Increase in the labor force, with constant number of jobs, leads to an increase in unemployment. Between these indicators there is a positive relationship. Changes in the labor force have influence not only on the number of unemployed, but also on consumption. In this case, the labor force serves as a measure of the population, which can be changed only with mentioned factors of the model that means, based on the migration processes. Changes in consumption are proportional to changes in the labor force, between these relationships there is a positive relationship.

One of the factors determining the level of wages from the supply side is the level of unemployment. The fewer unemployed in the system, the higher wage growth. In conditions of high unemployment wage growth stops, and, as in Latvia in recent years, wages may decrease. The unemployment has a negative impact on wages.

Wages, migration, labor force, unemployed form a second feedback loop displayed in the Fig. 2. Low wages lead to migration, which reduces the amount of labor force and unemployed in the system, reduction of the number of unemployed will increase wages. This part of the system will be closer to equilibrium when the level of wages in Latvia will be approximately at the average level of wages in the EU.

Wages growths in the country not only affects on the willingness of labor force to participate in the labor market, but also the demand of it. Wage growth reduces the business profitability, and the output level of production in the country decreases. This reduces employment and increase unemployment. Unemployment growth reduces wages, which again increases production. It describes the third feedback loop, Fig. 2.

EU policies through subsidies encourage business development and growth of Latvia's production. The model envisages that increase in subsidies increases production volume in Latvia. Production increase is also affected by the growth of the consumption. The relationship between consumption and production are included in the fourth feedback loop. Changes in consumption and production change the number of unemployed, wages, migration and amount of labor force.

As shown above, changes in the labor force change consumption. Without taking into account other feedback, this loop can exponentially affect the system. Any increase in consumption causes

forced growth of consumption, as well as any reduction in consumption causes forced reduction in consumption. This is a very important element of the system, because contributions to the EU budget and capital flows affect consumption.

In previous section it was determined that contributions to the EU budget depend on consumption, and likewise they reduce consumption in Latvia. This is shown in the fifth feedback loop. Consumption growth in Latvia will increase payments to the EU budget, and these payments will reduce consumption.

More significantly consumption affect capital flows. Firstly, as defined in the previous section, the inflow of capital causes increase of consumption in Latvia. After some time, capital leaves the system, which leads to decrease in consumption. Inflow and outflow of capital will form a cyclical loop in consumption by increasing consumption when capital inflows and reducing consumption when capital goes out.

The inflow of capital has one more effect. Incoming capital increases the cost of maintenance of capital, i.e., interest payments. These payments are taken out of the economic system and are transferred to owners of capital. Interest payments for foreign capital decrease consumption in Latvia.

There is no feedback in the capital flows, because usually in Latvia capital is not reinvested, it has mostly speculative nature that was shown in the previous section. Fig.1 also shows net imports. The indicator of imports has an important role in the economy of Latvia. Latvia cannot produce all necessary goods, import substitute domestic production.

The aim of the European subsidies is to create a competitive environment in Latvia, assisting substituting import with internal production. Fig. 1 shows that development of production (output grow) reduces import. These indicators have negative relationship. Import changes also have influence on the changes in consumption. Increase in consumption will increase net import, because the production can not satisfy growing demand. These indicators are connected with positive relationship. In fact, increase in consumption is distributed between increase in production and increase of import.

#### 4.2. Integration model with limited number of economic indicators

Developing a model, the main task was to research the direct impact of integration on the state economy. The developed model stock-flow diagram is shown in Fig. 3.

Comparing the diagram to the general scheme of the model we can see some differences. In the

diagram, there is no indicator “unemployed”. The workforce reduction has a direct impact on wage growth. Labour migration is determined not only by the quantity of labour, wages in the EU and Latvia, but also by the propensity to migrate. This ratio generally reflects all non-formalized migration barriers, such as the language barrier, patriotism, etc.

Production and consumption are analyzed in two parts: in a long-term and in actual indicators. Actual output and consumption are based on a long time period output and consumption, taking into account the short-term influencing factors. They are for consumption – the inflow of capital and payments to the EU budget, for the production – changes in consumption.

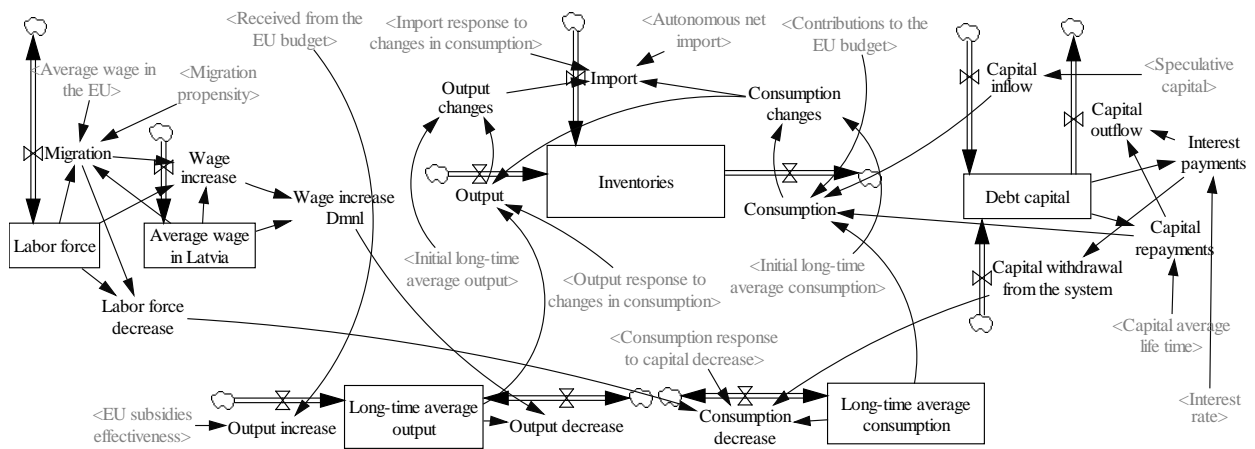


Fig. 3. Stock -flow diagram of model of Latvia's economic integration in the EU (Source: Authors's figure)

Capital inflow and payments to the EU budget are considered as short-term factors, because as soon as their effect will disappear, the volume of consumption will return to a balanced level in the long run. Similarly, short-term fluctuations in production are determined by changes in consumption. The reaction of production to changes in consumption shows factor “Output response to changes in consumption”.

Changes in long time period output and consumption are associated with fundamental factors. For the production it is amount of EU subsidies, which are aimed to foster the business environment, and the efficiency ratio of these grants. For consumption it is capital withdrawn from the system (interest payments for foreign capital) and the ratio of consumption reaction to capital withdrawal. EU subsidies are defined as long-term influencing factor, because at the expense of an effective entrepreneurial activity it continues to operate despite the termination of grants.

Similarly, withdrawn from the system capital (interest payments) reduce the consumption forever. According to economic theory capital inflow, its removal, as well as maintaining costs (interest

payments) are associated with the development of production output. In Latvia, as defined in the previous section, capital flows are directed to the speculation and to consumption, thus repayment of capital and interest payments in the model are also associated with the consumption.

In the diagram (Fig. 3) production and consumption are combined within the inventory reservoir. The output increase material reserves in the system and the consumption reduces them. The difference between consumption and production is covered with material stock changes, as well as net imports. After consumption and output changes follow changes in imports and / or in material stock.

### 4.3. Calibration of the model. Simulation runs results

Implementing the model in practice, some parameters are impossible to obtain from the statistics or to calculate from available data using mathematical methods. That would be the propensity to migrate, the effectiveness of EU subsidies, the consumption reaction to capital decrease in the country, the output response to changes in consumption. To obtain information on the effect of these coefficients to the system, authors have conducted several experiments with the model. Firstly, for all coefficients boundary fluctuations from 0 (no influence) to 1 (fully correlated) were determined.

Secondly, experiment with zero values of all coefficients was conducted. And thirdly, the experiments were conducted with increasing coefficient values up to 0.5, keeping other coefficients at zero level. In experiments coefficient “import reaction to changes in consumption” refers to the coefficient “output response to changes in consumption”, they correlate negatively. Changes in consumption are covered with import or output, small deviations from this rule is related with

changes in inventories. The results of experiments are the following.

In the first experiment, with all zero coefficients, all researched indicators (consumption, output, labor force, the average wage in Latvia, import) were constant, indicators did not respond to Latvia's accession to the EU. Migration did not occur, wages, imports, long-term consumption and production remained unchanged. It is important to tell, that in this experiment inventories show a slight growth, i.e. import and production were slightly higher than consumption. This experiment is the starting point, which allows to estimate and to compare the net effect of factors on the behavior of the system.

The first examined parameter is propensity to migration. Its influence on the system is reflected in Fig. 4.

Fig. 4 shows that with migration propensity coefficient increasing to 0.5 in Latvia consumption, production and labour force will decrease, at the same time the wages will increase. Changes in import are negligible. This situation corresponds to the shown relations. High migration propensity coefficient and low wages in Latvia leads to migration, a direct consequence of migration - rising wages and decreasing labor force (population).

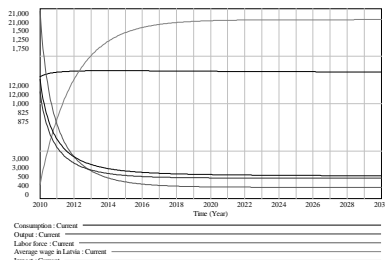


Fig.4. Migration propensity influence on the system (Source: Authors's figure)

Reduction of population causes reduction of consumption. Both consumption reduction and wages increase cause the decline of producing. Migration propensity coefficient 0.5 is a very high coefficient. In 6–8 years it will reduce the population almost 3 times. In addition, the decrease of consumption and producing will be similar. At the same time, wages in Latvia will reach EU level. Development of the state due to migration is not available. According to the authors's opinion, the coefficient of migration propensity should be around 0.01.

The next examined coefficient is EU subsidies efficiency. The reaction of the system on its changes is shown in Fig. 5.

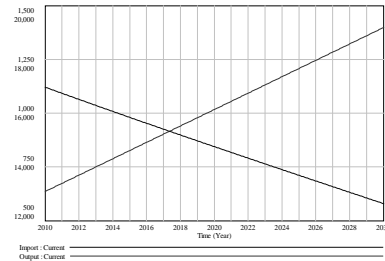


Fig. 5. EU subsidies efficiency influence on the system (Source: Authors's figure)

In Fig. 5 the amount of analyzable indicators is considerably abated, because, according to the results of the experiment, EU subsidies does not affect consumption, labour force and wages in Latvia. This corresponds to the facts. Most often, with the means from subsidies new, efficient equipment has been bought abroad to replace old. Employment does not change, consumption and wages in the country remain unchanged, but increased production displaces import, as shown in Fig. 5.

From the authors point of view, in Latvia the EU subsidies efficiency is not so high, it is closer to zero. The simulation results show, that such high efficiency may lead to overproduction in Latvia because production grows faster than import reduction. In Latvia the EU subsidies efficiency coefficient should be around 0.25.

In the next Fig. 6 there is analyzed the influence of coefficient "consumption reaction to capital decrease" on the system.

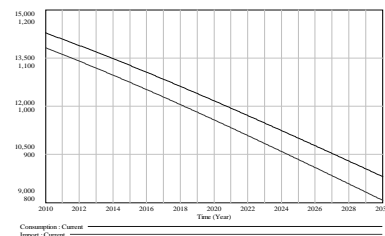


Fig. 6. Coefficient "consumption reaction to capital decrease" influence on the system (Source: Authors's figure)

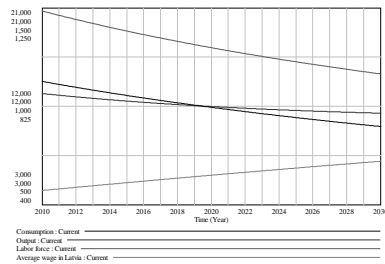
The Fig. 6 shows that coefficient "consumption reaction to capital decrease" affects only consumption and imports. Capital reduction in the system reduces consumption, reduction of consumption reduces import (in this experiment, the output does not react to changes in consumption). All other indicators do not depend on reduction of capital in the system.

According to experiment's logic, next experiment should be carried out with coefficient "output response to changes in consumption". Unfortunately, this experiment is not possible to implement, according to the above scheme. If all



other parameters have no effect on the system, then there is no change in consumption. In the absence of changes in consumption, it is impossible to study the reaction on it.

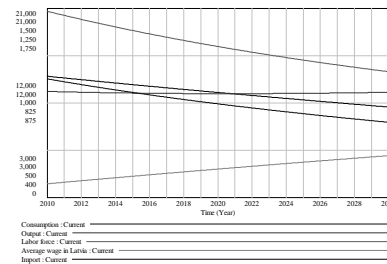
The impact of coefficient “output response to changes in consumption” on the system will be evaluated later. In the next experiment there are examined the parameters defined by expert way. This experiment represents the most likely scenario for the Latvia's economy integration into the EU (Fig. 7).



**Fig. 7.** Expert way defined parameters influence on the system (Source: Authors's figure)

The Fig. 7 does not show a net import, because import and export will be kept at initial level. Changes in other indicators explain the next. Labour force will be reduced, that leads to wages increase and consumption decrease. As a result decrease in output will happen. Increasing wages would not only reduce production, but also substitute production with import. This expected increase of import will be compensated by diminishing of import, which will be related to reduction of consumption in the country. Therefore, the import remains unchanged, at steady state. EU subsidies will contribute to industrial development, despite of increase in labor force cost. Production will exceed consumption, there can be over-production in the system and inventories increase. This could mean that EU subsidies have limited effectiveness. After a certain stage, to encourage business development in Latvia would be useless. Deeper crisis will be caused by the lack of demand. Production without the sales market is useless.

For objectivity, it is important to remind, that previously it was not estimated how production would respond to changes in consumption. In the previous experiment, the reaction level was at the expert determined level of 45 %; the change in consumption caused almost by half smaller changes in output. The following Fig. 8 analyzes the behavior of the system, provided that the production does not respond to changes in consumption (with a zero coefficient), keeping the other coefficients at the level determined by the experts.



**Fig. 8.** Coefficient “output response to changes in consumption” influence on the system (Source: Au-thor's figure)

The Fig. 8 shows that the production has remained almost unchanged. In a previous experiment constant import at this time will decrease. All other indicators (labor force, consumption and wages) are the same as in the previous experiment. This could mean that if the output does not depend on domestic demand, production could replace imports and form export capacity. But this is utopian situation.

Export potential form the stable operating companies whose products are demanded in domestic and foreign markets. In Latvia, there are almost no such companies and the small domestic market does not allow forming them. Also there are no opportunities that well-known producers will build their factories in Latvia. There are no cheap resources in Latvia. Soon the volume of labor force will diminish and a wages will be near to the EU level.

Unfortunately, Latvia does not look for exit from this deadlock. Priorities of Latvia at present are financial stability of the state (avoidance of default) and, in the longer term, accession to the euro zone.

These scenarios of economic development in Latvia are connected to the integration processes. They do not take into account the reaction of domestic economy to integration processes.

## 5. Conclusions

In the paper comprehensively analysed the effects of international integration process of the Latvian economy in EU, the work purpose it is reached, all planned tasks are reached.

In the paper is defined that Latvia's entering the EU increased net funds from the EU budget. But subsidies system does not encourage the development of Latvian economy, more stimulating domestic speculative demand.

To satisfy growing demand in underdeveloped domestic production conditions, various goods from other countries are imported in Latvia, thus increasing exports and imports negative balance.

Capital incoming in Latvia is not being used to promote positive change in the Latvian economy, but is focused on the sectors related to financial transformation. In fact, industry has not felt a significant investment growth.

After joining the EU, Latvia exports labour resources. Labor migration decreased unemployment, increased wages and labor costs, which reduced the internal production export potential.

These processes are mostly temporary. Migration would fall under wage increases or/and population resources reductions. Speculative capital flow will be stopped by lack of pledge. It is possible to conclude that temporary processes will be stopped when living standards in the EU and Latvia will be approximately at the same level, i.e., in the end of cohesion process in the EU.

Immune subsidies and import relation. The subsidies are intended to reduce the country's dependence on imports, but now it is become vice versa - subsidies tend to increase import. Latvia is still unable to determine its specialization in the EU and global markets, and thus become depended on the EU subsidies and international aid.

These conclusions are based on the statistical analysis of a situation. Developed models, simulations runs show that the crisis has the system reasons.

EU subsidies have limited effectiveness. After a certain stage, to encourage business development in Latvia would be useless. Deeper crisis will be caused by the lack of long time demand. Production without the sales market is useless. The small domestic market does not allow forming production in Latvia.

Results of the paper show failure of the mechanism of EU operations. The available mechanism contradicts EU principles; it doesn't promote the cohesion in European Union, but quite opposite - leads to solving problems of well-developed EU countries at the expense of developing countries. In the given conditions the example of Latvia shows that there is no possibility to overcome the system crisis. These circumstances specify necessity of changes in EU internal migratory policy, changes in principles of developing countries' support in EU, and changes in distribution of EU means, taking into account internal migration. The authors will show the study of migration economic indemnification mechanism in a following paper.

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