RIGA TECHNICAL UNIVERSITY
Faculty of Engineering Economics
Institute of National Economy and Regional Development

Valerijs SKRIBANS

LATVIAN CONSTRUCTION BRANCH FORECASTING MODEL

Doctoral Dissertation Compendium

Academic Advisor
Professor J. SAULITIS, Dr. oec.

Riga - 2006

GENERAL CHARACTERISTIC OF THE RESEARCH

Relevance of the research

The scope of executed civil construction in Latvia has essentially increased during the last years. Since 2002, the construction ratio in the Gross Domestic Product (GDP) in Latvia has exceeded 6.1% and has grown steadily each year. For example, in 2005 the construction turnover reached 818,1 million Ls, which is by 15.5% (at constant prices) higher than in 2004. Currently the construction branch employs about 6,5% of the people occupied in the national economy and about 13% are employed in the branches related to construction. Construction legislative base has become stronger, professionalism of market participants has grown, new technologies have appeared, improving both design stage and montage and supervision. The level of competition has increased. Now among primary factors of competition are not only construction costs, but also effective organization of the whole process of construction. More successful are those businessmen who are using modern technologies not only in construction process, but also in its management and economic substantiation of projects.

One of the main economic milestones is planning. In construction, planning plays a special role because the construction process is long, labour- and capital intensive. Construction characterizes complex technological production; multilateral economic communications with other branches of national economy, plenty of participants of investment process, and features of construction products: individual character, long service time etc. Modern management and planning are based on forecasts. Forecasts determine both commercial and national entity behaviours.

The aim of the research:

- To develop a forecasting model of construction branch, which would be appropriate for the current conditions of Latvian construction branch and based on the economic interrelations pertaining thereto.

The enabling objectives:

1) To collect economic forecasting methods used in construction, to investigate their classification. To provide recommendations for the use of methods.
2) To design forecasting models appropriate for the current conditions in Latvia, by using the most prevalent methods for the construction branch;
3) To analyze the construction branch as a single socio-economic system (by using a system approach) and to establish the main parameters of the system;
4) To develop an appropriate economic forecasting model for the construction branch, by using a system approach;
5) To forecast the major indices of the development of the Latvian construction branch by using the selected methods and models.

The object of the research is the Latvian construction branch.

The subject of the research are the forecasting methods and models of the Latvian construction branch, interrelation with other branches and areas of economy and joint mechanism of economic development.

To conduct the research, the received data are processed by supervision and synthesis, logic, abstract and statistical **methods** (grouping, distribution, comparison of parameters, etc.), and mathematical methods of economic forecasting: expert estimations, methods of regress and EXPO, and for the most part - modelling.

The input data for the research were derived from statistical data from LR Central Statistical Board (CSB), LR EPRDM (VARAM) Construction Department, Latvian Association of Builders, the collected data and databases from the following enterprises: world leaders in the construction industry - construction material manufacturers - Forbo (Sweden), Tarket-Sommer (France), Zabudova (Byelorussia); design&build concerns for building materials factories: Wehrhahn, Masa-Henke (Germany), the biggest Russian construction enterprise SKF-XXI-GLAVMOSSTROJ, as well as the biggest Latvian construction materials wholesaler SIA "Reaton Ltd." and the biggest

Latvian construction materials retailer SIA PPU "Polyplast". For mastering the relevant theory, scientific literature from Latvia, USA, Germany, France, UK, Russia and other countries was used.

Scientific novelty of the research

- **Recommendations for the use of** economic forecasting **methods** in construction area for the current situation in Latvia **are produced;**
- **The construction branch system analysis is developed.** The technique of the analysis consists of 5 groups (of more than 85 parameters).
- **The construction branch dynamic forecasting model is developed.** The model shows and forecasts parameters of the offered technique of the analysis. The model is developed on the basis of economic interrelations between parameters. The model consists of forecast block of construction sector and forecast block of construction industry. The model contains the following main economic coherences:

  1. Government, private and enterprises construction demands are emphasized in the model of construction demand.
  2. Private construction demand is calculated and forecasted, taking into account residents' incomes and average use of construction products. Residents are divided into 5 income groups (in quintile groups). A system determining how residents transfer from one income group to the next one is developed.
  3. The construction demand of enterprises is calculated and forecasted as the number of means which were spent in order to renovate buildings of the enterprises, multiplied by increase coefficient (increase of GDP).
  4. The offer model consists of the following industrial factors: natural factor (in work - raw materials), work factor (staff), capital (fixed capital -industrial funds, circulating capital - cash assets), entrepreneurial capacity (and information) factor. Each factor has its own offer model. Offered money assets are divided between industrial factors in strict ratio -according to Leontyev's industrial function.

Elaborated forecasts for the development of the Latvian construction branch.

The results of the author's research are shown in 8 international scientific publications:

1. Skribans V. Būvmateriālu ražošanas un būvniecības ietekmējošie faktori Latvijā. Starptautiskās konferences "Rūpniecības attīstība pārejas periodā" materiāli. Rīga, RTU, 2000.-169. lpp.
2. Skribans V. Prognozēšanas metodes uzņēmējdarbībā. Starptautiskās zinātniskās konferences "Inženierekonomikas nozīme uzņēmējdarbības attīstībā" materiāli. Rīga, RTU, 2002.- 204. lpp.
3. Skribans V. Jaunā ekonomika un jaunie tirgi: pamatprincipi un veidošanās problēmas. Starptautiskās zinātniskās konferences "21. gadsimta universitāte" materiāli. Rīga, RTU, 2001.- 146. lpp.
4. Skribans V. Būvniecības tirgus novērtēšana jaunās ekonomikas apstākļos. Starptautiskās zinātniskās konferences "Izglītota sabiedrība un jaunā ekonomika kvalitatīvā mijiedarbībā" materiāli. Rīga, Banku augstskola, 2001.-334. lpp.
5. Skribans V. Būvnozares prognozēšanas modelis un tā izstrādāšanas metodika. Starptautiskās zinātniskās konferences "Tradicionālais un novatoriskais sabiedrības ilgspējīgā attīstībā" materiāli. Rēzekne, Rēzeknes augstskola, 2002.- 518. lpp.
6. Skribans V. Construction industry forecasting model. Zinātniskie raksti. Rīga, RTU, 2002.-119.lpp.
7. Skriban V. Construction Demand: a Model of Research and Forecast for Latvia from 2002 to 2025. LU raksti. Rīga, LU, 2003.- 365.lpp.
8. Skriban V. Latvian construction branch development forecast (submitted for publication).

The results of the author's research are also shown in special economic and construction publications:

1. Skribans V. Būvniecības materiālu rūpniecība pārejas periodā. Starptautiskas konferences "Rūpniecības attīstība pārejas periodā" tēžu krājums. Rīga, RTU, 1999.- 64. lpp.
2. Skribans V. Prognozēšanas metodes uzņēmējdarbībā. Starptautiskās zinātniskās konferences "Inženierekonomikas nozīme uzņēmējdarbības attīstībā" tēžu krājums. Rīga, RTU, 2000.- 70. lpp.
3. Skribans V. Būvindustrijas prognozēšanas modelis. Starptautiskās zinātniskās konferences "Tautsaimniecības un izglītības attīstības problēmas mūsdienu periodā" tēžu krājums. Rīga, RTU, 2002.- 85. lpp.
4. Skribans V. Latvijas būvniecības tirgus aicina ārzemju būvniekus. Konferences "Latvijas būvniecības bizness un Eiropas Savienība: iespējas un izaicinājumi" materiāli. - Rīga, "Bizness&Baltija Communications" sadarbībā ar LR EM un Latvijas Būvnieku asociāciju, 2003.- 104. lpp.
5. Скрибан В. Зодчество в ожидании иностранных игроков.- Рига, "Бизнес&Балтия", 2003.- 21. августа.
6. Skribans V. Latvijas būvniecības nozares attīstības nosacījumi. Starptautiskās zinātniskās konferences "Tautsaimniecības un uzņēmēj-darbības attīstības problēmas" tēžu krājums. Rīga, RTU, 2003.- 91. lpp.

The results of the author's research have been discussed at the following conferences:

1. Rūpniecības attīstība pārejas periodā. RTU, 2000.
2. Inženierekonomikas nozīme uzņēmējdarbības attīstībā. RTU, 2000.
3. Izglītota sabiedrība un jaunā ekonomika kvalitatīvā mijiedarbībā. Banku augstskola, 2001.
4. 21. gadsimta universitāte. RTU, 2001.
5. Tradicionālais un novatoriskais sabiedrības ilgspējīgā attīstībā. Rēzeknes augstskola, 2002.
6. Tautsaimniecības un izglītības attīstības problēmas mūsdienu periodā. RTU, 2002.

7. RTU 43. Starptautiskā zinātniskā konferencē. RTU, 2002.
8. LU 61. Starptautiskā zinātniskā konferencē. LU, 2003.

Materials of the research were used in preparing study courses in Investment, Project Management, and Operation Research, which were presented at the Moscow State University of Economics, Statistics and Informatics (MESI) in Moscow and Lithuanian branch, as well as at the MESI department in Latvia.

Structure of the research

The promotion paper is an independent scientific research written in the Latvian language and containing an introduction and 3 chapters:

1. CLASSIFICATION AND APPLICATION OF CONSTRUCTION BRANCH FORECASTING METHODS
    - 1.1. Application of expert methods in construction branch forecasting
    - 1.2. Application of time series methods in construction branch forecasting
    - 1.3. Application of net methods in construction branch forecasting
    - 1.4. Application of imitation methods in construction branch forecasting
    - 1.5. Application of regression methods in construction branch forecasting
2. ECONOMIC AREAS FORECASTING MODELS OF CONSTRUCTION BRANCH
    - 2.1. Construction branch analysis system
        - 2.1.1. Macroeconomic analysis of construction
        - 2.1.2. Analysis of construction structure, current situation and trends
        - 2.1.3. Investment analysis
        - 2.1.4. Analysis of individual construction markets
        - 2.1.5. Analysis of construction contractors
    - 2.2. Construction branch forecasting model

MAIN SCIENTIFIC DEVELOPMENT OF RESEARCH

1. CLASSIFICATION AND APPLICATION OF CONSTRUCTION BRANCH FORECASTING METHODS

The efficiency of forecasts largely depends on methods used for forecasting. All research methods can be divided into three main groups: methods based on experts' knowledge and intuition; methods of formalized perception (formal modelling methods of predictable processes), based on the use of mathematical and economic and mathematical methods and models; and complex methods that are formed by combining experts' and formalized methods: combinatorial theory, situations simulation, topology, graphic semiotics, etc.

There exist many forecasting methods, which generally should be examined according to some classifications. The author offers a classification of the forecasting methods, which consists of the following groups:

1) methods of quality;
2) forecasting of time rows;
3) main indicators, the connections in the net method;
4) imitation, modelling method;
5) methods of regression and analysis of the sensitivity.

Experts' methods and polis make a separate group. As in any other sector, construction can be forecasted, taking into consideration unjustified experts' opinions and total disposition of market participants. The qualitative analysis of construction branch in Latvia is often connected to Latvian Statistics Institute and its research "Analysis of environment and consumers' survey". However, in this research the enterprises assess incorrectly their current orders. This fact has an objective reason: taking into consideration large proportion of hidden economy in construction, enterprises experts are not willing to show the real situation to fiscal institutions. In this case, as well as theoretically, experts'

interests influence the quality of forecast. For construction branch it is recommended to use experts' methods as rarely as possible if the results are not confirmed by the results of other methods.

The group of time series forecast methods displays the possibility to forecast some indices using statistic methods in the construction branch without entering into cause-effect coherences of indices. While analysing the practical situation in Latvia, we stated that both trend and seasonality influence Latvian construction branch. Forecast methods of time series provide objective and independent assessment. However, forecast methods of time series also have imperfections. They only take into consideration statistics. It is not possible to make impact forecast based on statistic data, in other words it is not possible to observe the impact of influencing factors. Forecast methods of time series display fixed statistic coherences. Taking into consideration the fact that these coherences can change, elaborated models could give inadequate forecast. In order to avoid this defect in using methods of time series, these methods can only be used for short-term forecast (2-4 year time periods), but elaborated models must be corrected.

The novelty of the proposed classification is connected to the characteristics of using the methods in construction branch. Work sequence is undisputable in construction. By the scope of previous work it is possible to defme the scope of the next or further work and to forecast it accordingly. Net method uses this coherence of strictly defined technologic work as an indicator; this is why proposed classification is put into a separate group which comprises net models. Net method in construction is one of the most significant sources of information. Net method can be used in some segments of construction branch for short-term forecasts. As the result of its use data obtained will be indisputably adequate in future situations, but their defect is short forecast period.

Dynamic modelling makes forecasts based on analytically determined or otherwise changeable rules of system development, i.e. statistic approach does not have to be used in rules elaboration. Accordingly, dynamic modelling is more economic, unlike mathematical or statistical forecasting. Taking this fact into consideration, it is advised to use new dynamic modelling for development forecasts of construction branch.

Regression method makes forecasts based on real influencing factors. Regression method is similar to dynamic modelling, but it has an advantage - regression method is the dominating forecast method at the level of macroeconomics and branch sectors. Regression method also has its deficiencies; it records statistically determined coherences at a defined time, but these coherences can change. These coherences are not defined in dynamic modelling.

2. ECONOMIC AREAS FORECASTING MODELS OF CONSTRUCTION BRANCH

Prior to elaboration of the forecast model it is necessary to analyze the specificity of construction economics, its complex, as well as the current features of the construction branch.

In order to choose the adequate forecast method, we should take into account forecast features of the construction branch and the construction market. Forecast features of the construction branch result from the structure of the construction project. While making statistic forecasts about branch indices, *i.e.* using methods of time ranges and with experts' assistance or using net method, inner cause-effect coherences are not necessary. However, using methods which are employed in mutual connections of indices, it is necessary to know branch connections perfectly well. The objective of Subchapter 2.1 is to show the specificity of construction economics, its analysis and forecast features in comparison with other sectors of the national economy.

Unlike other branches of the national economy, the development of construction is long-lasting and gradual. Construction is characterised by a complicated technological process of production; a variability of economical connections with other branches of the national economy and also peculiarities of construction products: individual character, long endurance time, etc. one process of the construction branch includes extractive industry, manufacturing industry (manufacture of building materials), construction contractors and construction consumers. The research also characterises theoretical technical and economical peculiarities of the construction branch.

The construction branch consists of consumers and producers of the construction. Producers of construction products, suppliers of materials and extractive industry are united into one industry. The purpose of the construction industry is to satisfy effectively the existing demand for construction products. The forecasting model is a means for reaching this purpose both in industry as a whole and in a particular enterprise.

The current situation in the construction market and its particularities can be established by analyzing the market. To evaluate the construction market, the following method composed of several elements is offered: Macroeconomic (national economy's) analysis in the context of the construction; The analysis of finished construction and construction under way (current situation and trends); The analysis of the structure; The analysis of investments and capital investments; The analysis of the individual construction market; The analysis of the construction contractors.

The types of the mentioned analysis divide the indices into groups. The analysis according to different groups may cause a problem - the same indices can repeat in different groups. The scheme of the reciprocal usage of the indices is shown in Fig. 1.

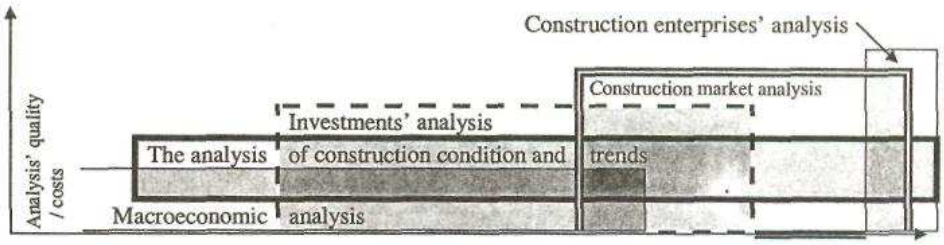


Fig. 1. The indices' groups of the construction analysis.

In addition, Fig. 1 shows the types of analysis, the costs and the quality. The more types of analysis and indices are used, the bigger the costs will be and the higher the quality of the analysis. Performing the analysis and taking into account the objective, it is necessary to state the level of the information needed and to act according to the given scheme (Fig. 1).

The method of analysis suggested in the research displays the present totality of construction indices. There is only one generally accepted analysis system in economics literature: it is a macroeconomic analysis system. It is appropriate to create unified analysis methods for each sector or each market. Unification of methods allows making analyses faster and more efficiently, accelerates planning and forecasting processes in economics. Unfortunately statistic structure of construction in Latvia has been changed substantially 3 times since 1991, which negatively impacts the possibilities of analyses and forecasting. The proposed method can be a sample or a proposal of a unified analysis method in construction. In the present research, we have used this as a basis for elaborating an economic forecasting model for construction branch, which combines analysis indices into a unified system, as well as displays internal and external connections of indices system.

The model offered for forecasting of the construction branch consists of two basic parts: formation of demand and supply. The structure of the model is shown in Fig. 2.

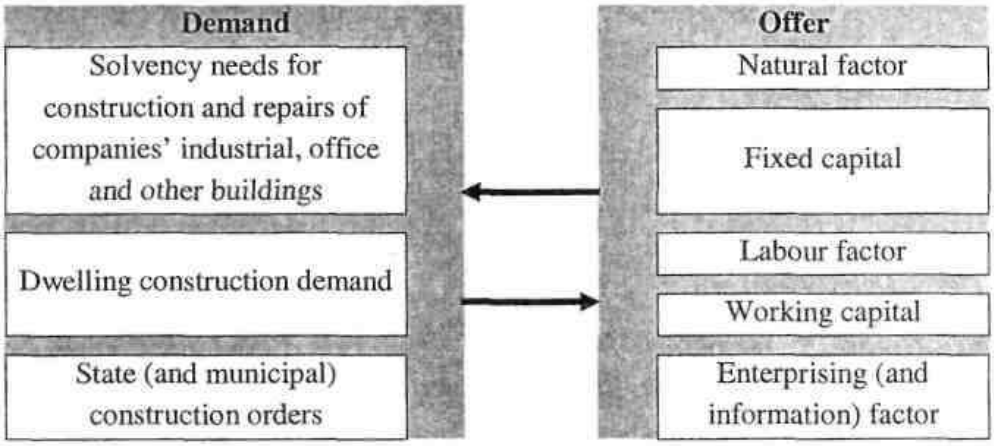


Fig. 2. Model structure

Demand for construction products forms three components: 1) Solvency needs for construction and repairs of companies' industrial, office and other buildings, 2) demand on dwelling construction and 3) state (and municipal) construction orders.

The scope of state and municipal (hereinafter - state) construction orders depends on means incorporated in the state investment programme. The state investment programme is accessible to businessmen, making plans for next years, but in reality, in intermediate and long-term periods state consumption is a forecasting object. It is assumed that general economic growth, state incomes and costs growth are directly interconnected and proportional to growth of the state investment programme and number of state construction orders.

Determination of private demand is based on a principle that private consumers spend a part of their income on construction products. The bigger the consumers' income is, the bigger is the construction products consumption. General consumption of construction products in the country depends on the number of residents and their income. By ascertaining the share of the average residents' income spent on construction products, and multiplying it by the number of residents, we may obtain approximate private demand in construction.

In private demand forecasting it is recommended to divide residents into five groups according to their income level. Simple division of residents into groups increases the quality of forecasting. This is due to the deletion of the first group (the first group does not participate in the construction market), as well as due to improvements in mathematical sampling and processing of data. However, a qualitative shift in forecasting cannot be reached with this tool. To this end, it is also necessary to take into account such characteristics as: 1) population growth, including natural growth, 2) increase of residents' income along with economic growth, 3) structural changes in population along with economic growth.

It is known that the number of residents in the subsequent period naturally depends on the number of residents in the given period, on the number of births, deaths and migrations in and out of the country in the given period. The number of births and deaths also depends on the number of residents in the given period, and this parameter is also influenced by general economic growth - the more the economic growth is, the bigger is the coefficient of natural population growth. Migration processes in countries with high living standards and constant economic growth lead to the increase in population. The abovementioned parameters are related to the level of well-being of the population. Economic growth causes increase in the level of well-being and influences the population increase. Fig. 3 reflects a model of population increase.

The model can be shown as a formula (see formula 1).

$$P_t = P_{t-1} * (1 + IDp_t) \quad (1.)$$

$$IDp_t = \Delta * (IDs_t - IMs_t + Ms_t) / P_{t-1} ,$$

Where: P_t - Number of residents, IDp_t - coefficient of population growth, Δ - economic growth in comparison with the previous period, IDs_t - number of births, IMs_t - number of deaths, Ms_t - number of migrations.

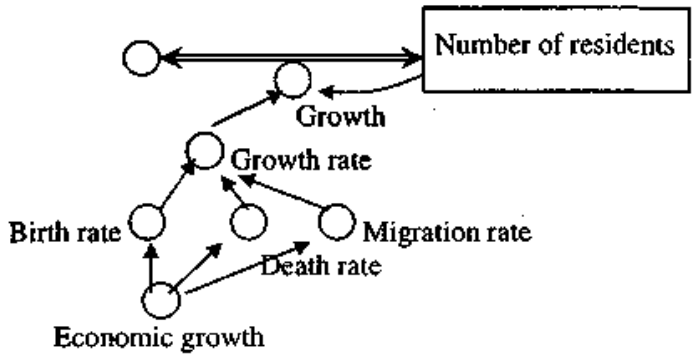


Fig. 3. Model of population increase

Fig. 3 shows the abovementioned model of the population growth. Economic growth influences population groups differently. The most prominent impact is on the poorest residents. Taking into account population growth, it is possible to essentially improve the quality of forecasting of private demand.

The offered model of forecasting of private demand is based on an assumption that during constant economic growth the level of well-being of the population and population incomes grow. Part of population proceeds to the group with higher incomes, with the average income of each group increasing at the same time. Fig. 4 shows a model of structural changes in the population.

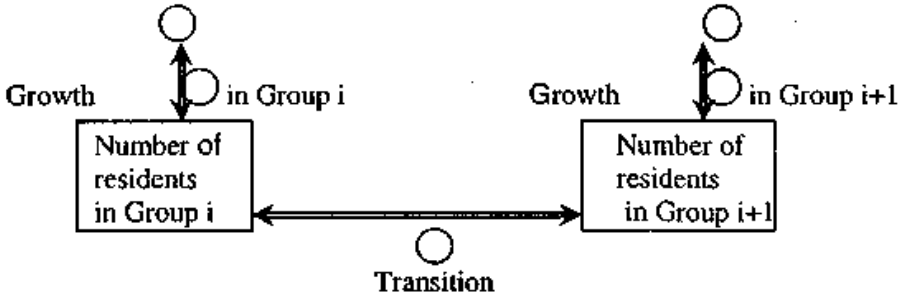


Fig. 4. Model of structural changes in population

From Fig. 4 it is obvious, that amount of population in group is influenced by growth and transition from one group to another which is determined by transition ratio. Transition ratio shows which part of the group under these circumstances will proceed to the group with higher incomes. The paper

describes more thoroughly transition ratio, its economic essence and methods of formation.

The model can be shown as a formula (see formula 2).

$$P^i_t = P^i_{t-1} + (IDp^i_t - x_t) \quad (2.)$$
$$P^{i+1}_t = P^{i+1}_{t-1} + (IDp^{i+1}_t + x_t - x2_t)$$
$$P^{i+2}_t = P^{i+2}_{t-1} + (IDp^{i+2}_t + x2_t),$$

Where: P^i_t — number of residents in group i, IDp^i_t - growth of population in group i, x_t - transition from i group to i+1, $x2_t$ - transition from i +1 group to i+2.

To understand the economic essence of the transitional ratio, it is necessary to abstract from population increase and increase in population incomes. This means that in the object under analysis the amount of population divided into groups in any period is constant and the average income of a resident in any group is constant in time. Under such conditions economic growth can be reached only by improving general level of well-being (due to transition of population to groups with higher incomes), in other words, can be reached by changing the population structurally. Knowing the level of economic growth and incomes and amount of residents in each group, it is possible to define the number of residents who will proceed from one group to another and their relation to the number of residents in various groups, i.e. transitional ratio. Theoretically, the given situation is presented in formula 3.

$$\Delta - 1 = [\Sigma (R^i * P^i_{t+1}) - \Sigma (R^i * P^i_t)] / \Sigma (R^i * P^i_t) \quad (3.)$$

Where: Δ - economic growth in comparison with the previous period, R^i - average income in group i, P^i_t - number of residents in group i in period t, P^i_{t+1} - number of residents in group i in period t +1, $P^i_{t+1} = F(P^i_t) = k_i * P^i_t$; $\Sigma P^i_t = \Sigma P^i_{t+1}$; $\Sigma P^i_{t+1} = a*P^1_t + b*P^2_t + c*P^3_t + d*P^4_t$, k - transition ratios according to each group; a, b, c, d -transition ratios from the 1st group to the 2nd; from the 2nd to the 3rd; from the 3rd to the 4th; from the 4th to the 5th.

Formula 3 shows that economic growth with our assumptions (made in the previous paragraph) depends only on structural changes of the population. Structural changes of the population determine transitional ratios a, b, c, d. The economic problem is to define the influence of each variable ratio on the formation of general growth. There are following economic approaches to solve this problem:

1. Influence of each group on the formation of general growth is directly proportional to the number of residents in the group (method of simple average).
2. Influence of each group on the formation of general growth is directly proportional to aggregate profits of group (method of weighed average).
3. Transitional ratios for groups with smaller incomes are bigger than transitional ratios of groups with biggest incomes (differential method). The largest economic growth is formed by the transition of population from poor groups to groups with average incomes, and the smallest growth when the transitions occurs from average income groups to prosperous. The advantage of the given approach is that the economic growth has a bigger impact on the poor layers of population, as it is observed in practice. To overcome poverty is easier than to become a millionaire.
4. Transitional ratios for groups with smaller incomes are smaller then transitional ratios of groups with bigger incomes. The approach is opposite to clause 3 (to the differential method) and may exist only in exceptional cases, therefore it is not described in this paper.

Using given approaches, it is possible to determine economic growth along with structural changes of population. Formulas for determining transitional ratios taking into account population increase and changes of the average income among groups are shown in Table 1.

Table 1

Definition of transitional ratios formulas

	Simple average method	Weighed average method	Differential method
a	$(\Delta^{[1.59*B]}-1)*P_i/\Sigma P_i$	1) $(\Delta^{[1.89*B]}-1)*R_i*P_i / \Sigma(R_iP_i)$ or 2) $((\Delta^{[2.08*B]}-1)/\Delta)*R_i*P_i / \Sigma(R_iP_i)$	1) $(\Delta^{[1.49*B]}-1)*P_1/\Sigma P_i$ or 2) $(\Delta^{[2.65*B]}-1)*R_1*P_1/\Sigma(R_iP_i)$
b			$a*P_2/P_1$
c			$b*P_3/(P_1+P_2)$
d			$c*P_4/(P_1+P_2+P_3)$

Where: a, b, c, d - transitional ratios, Δ - economic growth,
$B = (Dt/Dt-1)^{\wedge}2$; $D = \Sigma (RiPi)$
Ri - average income in group i, Pi - number of residents in group i.

Table 1 shows constant multipliers calculated on the basis of realistic Latvian data. Mathematical mistake is the smallest when the simple average method, 2nd weighed average method and 1st differential method are used, but it does not mean, that they should be used everywhere.

In simple average method all ratios are designed using only one formula (see table 1). The shortage of this method is that it does not take into account incomes of population; also it does not react to changes of incomes by groups, and also to changes in aggregate income. This method is recommended for use when economic growth depends on the increase in population.

The weighed average method provides calculation of transitional ratios using two formulas. For all groups irrespective of the income, the formula for calculation of transitional ratios is identical (see Table 1). The formulas do not differ in their essence, but the second formula has a bigger emphasis on the role of economic growth in calculating transitional ratios. Thorough calculation of economic growth allows reducing mistake of the method essentially. The shortage of this method in comparison to other methods is the occurrence of mistake under the conditions of structural changes in the population. If ratio of population growth in separate groups coincides with population general growth ratio, the mistake of the method is the smallest in comparison with other methods.

Differential method provides that for each group transitional ratios should be calculated using different formulas. Transitional ratio a (transition from the 1st group to the 2nd) can be calculated using both the method of simple average, and the method of weighed average. Other ratios are calculated taking into account previous level ratios (b is calculated taking into account a, etc.) and relation of residents in a group to the total accumulated number of residents in previous groups (see table 1). The mistake of the differential method is small for the simplest (first) formula. The shortage of the differential method is similar to other methods. The method takes into account the new economic quality, but it does not improve accuracy essentially. The mistake of the 1st differential method is only a little smaller than the mistakes of the simple average and the 2nd weighed average methods.

Thus, knowing the population structure, it is possible to proceed to a general model of private demand forecasting shown in Fig. 5.

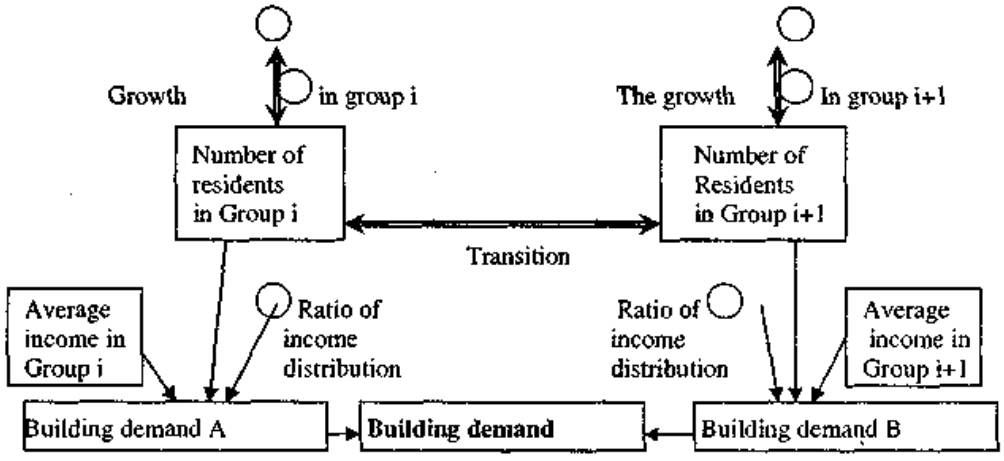


Fig. 5 Model of private demand forecasting in construction

Fig. 5 shows that general private construction demand consists of the total amount of demands of separate groups of residents; demand of residents in a group depends on the number of residents in this group, income, and the ratio of income distribution.

The model can be presented as a formula (see Formula 4).

$$B\,pop_t = \sum_{i=1}^{5} B\,pop^{i}_{t} \qquad (4.)$$

$$B\,pop^{i}_{t} = P^{i}_{t} * R^{i} * APC\,b^{i}$$

$$P^{i}_{t} = P^{i}_{t-1} + (IDp^{i}_{t} - x_t)$$

$$P^{i+1} = P^{i+1}_{t-1} + (IDp^{i+1}_{t} + x_t - x2_t)$$

$$P^{i+2}_{t} = P^{i+2}_{t-1} + (DIDp^{i+2}_{t} + x2_t),$$

Where: $B\,pop_t$ - general private construction demand, $B\,pop^{i}_{t}$, - private construction demand in group i, P^{i}_{t} - number of residents in group i, R^{i} - average income in group i, $APC\,b^{i}$ - income distribution ratio (average propensity of construction production consumption), IDp^{i} - increase of population in group i, x_t - transition from i group to i + 1, $x2_t$ - transition from i +1 group to i + 2.

Further part of construction demand is commercial construction demand. The main assumption in forecasting of commercial construction demand is that enterprises continuously renovate buildings, using the means obtained from business activities. In fact, this assumption may not be effective in a short and medium period, as buildings may function without repair for 10 - 15 years. However, in a long-term period this assumption proves itself completely under the conditions of an effective business environment.

In the work process it is common that the building requirements of an enterprise are equal to decreasing the value of premises, which the enterprise has at its disposal. The decreasing occurs because of natural wear of premises during the process of manufacture. It is possible to determine the building requirements by using the value of natural wear. The real wear does not link to the economic and accounting wear (amortization). The actual wear is determined by the intensity of manufacture and technical indicators. Technically, the premises require smaller amounts of investments for repair in the initial years of operation, but they require larger investments in the subsequent years. It is necessary to build a new premise when the amount of money invested in repairs creates a smaller enlargement of the premise lifetime in comparison with the amount of money invested in the building of a new premise.

Most frequently, enterprises build and use premises on the basis of the aforementioned. However, the contemporary operational practice includes the notion of moral ageing of premises, to which the aforementioned connections are not inherent. The moral ageing of premises is a situation when the profit obtained from the use of the premises during their lifetime is smaller that the profit possible after the reconstruction. The moral ageing also creates changes in building technologies and encourages economic development.

If technical and economic indicators are known, the wear can be forecasted along with financial means, which will be necessary for renovation, or the commercial building requirements.

The aggregate construction demand is formed by solvency needs for construction and repairs of companies' buildings, demand for residential dwellings and state construction orders.

The model of construction industry characterizes the level of development of the enterprise environment and national economy efficiency. There are several model components, which reflect major factors of production and activities of an enterprise:

- natural factor (availability of resources),
- fixed capital (availability of production means),
- labour factor,
- working capital (availability of money resources),
- enterprising factor (entrepreneurial spirit and availability of information).

Each production factor has its own offer model. The factors which are not specified in the given classification can be equated to one of the mentioned factors (models). Money resources from the request are distributed between production factors in fixed proportions according to Leontyev's industrial function.

Models of the offer of production factors are based on the following assumptions: it is possible to receive the required factor (to buy from the outside or to receive (to produce) in the internal environment), taking into account available financial resources, to spend, to lose (in production, in the course of time, sell in the external environment). The balance of acquisition and loss of factors (their presence) is determined by production potentialities and their demand.

The implementation of the model and its use in life may help solve a number of significant problems in Latvian construction. There will be a modern economic forecasting tool available in this country, which makes adequate forecasting possible.

While forecasting branch development, there are possibilities to decrease uneven development, as well as the impact of other negative factors. It is possible to organize training of the staff in construction industry in a more efficient way (currently this is one of the biggest problems in the branch); to organize purchase of capital assets in a more efficient way; to optimize use of capital; to enable obtaining, production and use of local construction resources and materials; to increase the efficiency of construction entrepreneurial work, to provide enterprises with useful information about current market tendencies.

3. PRACTICAL APPLICATION OF CONSTRUCTION BRANCH FORECASTING MODEL

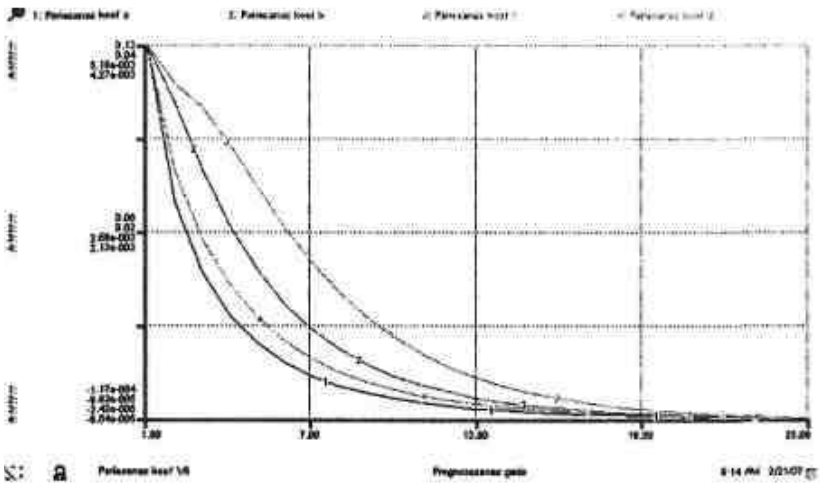
In Section 2 of the paper we have specified the indices of construction demand and construction industry. Using the displayed data and the demo version of the special software "Stella7" which is intended for modelling dynamic processes for instructional, scientific and non-commercial tasks - the forecast of development and dynamics was elaborated for Latvian construction branch. The implementation of practical model (forecasting) is possible also using other programmes, for example, *Vensim, Powersim, Arena, SIMSCRIPT;* partially

GPSS, P3 (Primavera), R, SLAM, GASP, COMFAR (UNIDO), PROPSPFN (UNIDO), ТАНЯ.

The research does not reflect the results of forecasting of all parameters. It shows the parameters connected with the novelty of the research and/or are common in the construction branch. Among them are:

- Transition rates; transition of residents from one income group to another; distribution of residents in groups of incomes; incomes in groups;
- Age of buildings in the country;
- Private, enterprise, state and general construction demand;
- Basic parameters of construction branch: construction materials, including natural resources; monetary capital, basic means, information, personnel; including ratios of their sufficiency;
- Manufacture of construction products, import (export).

The calculated transition rates, which are related to the general novelty of the research, are shown in fig 7. (This and other figures in this Chapter, which graphically show model forecasting results and its analysis, are presented as original figures from the analysis programme "Stella".)



Forecasting year	1	6	11	16	21	26
transition rate *a*, %	11.91	1.75	0.45	0.12	0.02	-0.02
transition rate b, %	4.35	1.32	0.37	0.1	0.01	-0.01
transition rate c, %	0.52	0.26	0.09	0.02	0	0
transition rate d, %	0.43	0.09	0.02	0.01	0	0

Fig. 7 Transition rates forecast

The ratios shown in Fig. 7 are calculated using the method of simple average (see Table 1).

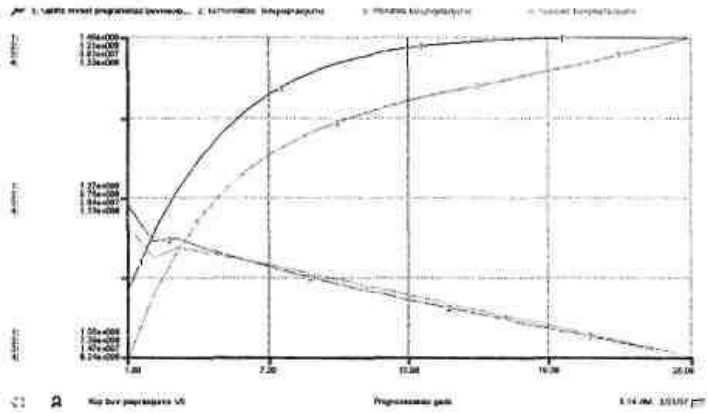
The increase of population in income groups 2, 3 and 5 is similar to the general increase of population. It means that the transition of residents from one group to another for the given groups is balanced. It fully complies for income group 3 (middle class P3). Entering this group and leaving it is equally easy. (Income groups 2 and 4 are also middle class). However, in income group 5 (group of millionaires) the increase of population and changes as a result of transitions do not occur. In group 2 there is a difference in a gain comparing to income groups 3 and 5. This difference is formed as a result of transition of residents of group 1 (poor) to the following group. Moreover, this occurs faster than the residents leave group 2.

Knowing incomes, number of residents and propensity of consumption of construction products in each group, it is possible to determine the amount of financial resources, which the residents plan to spend on construction products, presented in the model as private construction demand. Summarizing private construction demand in groups, the total private construction demand is determined (see Fig. 8).

Construction demand consists of state (1), commercial (2) and private (3) construction demands; summarizing them, it is possible to calculate the general construction demand (4) that is shown in Fig. 8.

Analyzing the results, it is possible to conclude that:

1) The state construction demand depends on the general economic growth;
2) The private construction demand is influenced not only by the general economic growth, and also changes in population and transition of residents from one income group to another;



Forecasting year	1	6	11	16	21	26
State construction demand, mil. Ls	114,6	138,0	145,2	147,2	147,7	147,7
Commercial construction demand, mil. Ls	958,1	880,1	837,2	800,5	765,9	731,7
Private construction demand, mil. Ls	177,4	321,2	383,7	410,6	432,0	457,1
Total construction demand	**1250,1**	**1339,3**	**1366,1**	**1358,4**	**1345,6**	**1336,4**

Fig. 8. Forecast of the general construction demand

In the event that the number of residents decreases, the state construction demand increases quicker than the private construction demand grows and vice versa. Transition of residents from one income group to another accelerates and strengthens the existing tendencies.

3) At present the residents' impact on the construction market is insignificant. More than 70% of residents do not participate in construction market: they cannot make the required running repairs due to their financial situation. Only 5.5% of the residents are potential participants of primary housing market: i.e. buy flats in new residence buildings and can afford to build a house. The proportion of private construction (i.e. attracting cash assets of individuals into construction) is about 1.2% of the total scope of new construction. Changes in this field are expected in Latvia, as it is foreseen that in the next 8-10 years the proportion of individuals in construction demands will increase up to 30%. It is foreseen that the number of residents who do not participate in the construction market will decrease. According to the forecast, the number of such residents will decrease every year from 71% in the first forecasting year up to 47% in the 26th forecasting year.

The increase in individuals' construction demands is directly connected to the increase of prosperity level, i.e. with the growth of national economy. The following fact has been established: the higher the growth of gross domestic product is, with its rate is stable from year to year, the bigger is construction growth. Construction growth and its connection to the general economic growth is explained as follows: if there is economic growth, residents and enterprises spend more on purchasing goods. If this growth is lower than a determined level, then they mostly buy everyday and medium-term consumer goods. However, if the growth is higher that the determined level, they buy long-term consumer goods, which in this case are construction products. The impact of GDP growth on the increase of individuals' construction demand in Latvia is displayed in Table 3.1 for the next 10 years.

Table 3.1

The impact of GDP growth on increase of individuals' construction demand

GDP growth, %	Increase of individuals' construction demand, %
6.17	30.37
4.61	16.62
3.49	11.08
2.67	7.82
2.06	5.73

The main state objective is to ensure the high growth rate in national economy. Although in the next years we expect the growth rate to stabilize, a decrease is also possible, and accordingly, the development rate of construction branch can also decrease. Despite this, the private construction will be the most attractive market segment in the future.

4) Commercial construction demands are mostly influenced by construction costs of new buildings (other groups are connected to expenses for existing buildings reparations);

Despite the decreased significance, commercial (enterprises) construction will also keep dominant position in the future. At present there are no preconditions for essential increase of commercial construction. The following units are built

in Latvia: infrastructure (bridges and roads) and shopping centres. We expect an increase in the construction of entertainment units and multi-storey offices.

5) A recession in Latvian construction branch is expected due to the decrease in commercial construction demand. By analyzing the results, we can state that the essential component of this group in Latvia has been construction of large commercial buildings, which will decrease in the nearest future. However, the expected increase in construction of multi-storey buildings has not occurred. This question has been examined in the construction market of Lithuania, where the conclusions were made that the secondary market of real estate and construction of detached houses only develop after the housing development programme, after the liberalization of mortgage market, whereas the construction of large multi-storey buildings will not start for at least 5 years.

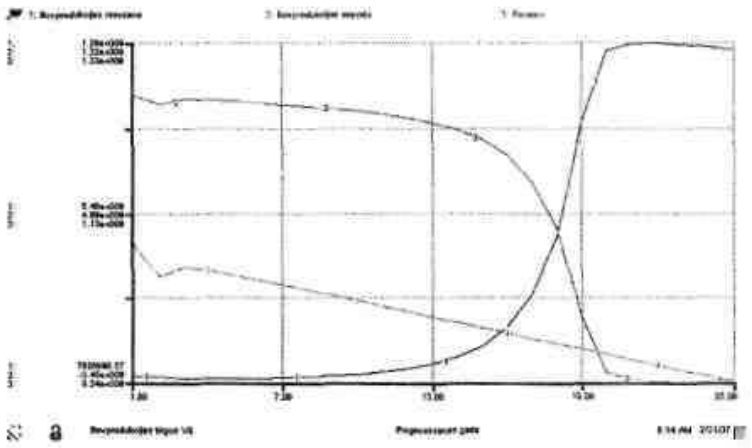
6) Summarizing state, commercial and private construction demands the general construction demand is calculated. The major part of the general construction demand is commercial demand. The major part of commercial construction demand is the construction of new buildings. Taking this into consideration, it is possible to formulate one of the main conclusions of the forecasting model: in current conditions in Latvia **the development of construction branch is promoted by construction of new buildings** for company's financial resources to satisfy their needs.

In the proposed model the indices of GDP growth and construction increase are connected to complicated coherences. The summarized result is as follows: if GDP growth rate slows down, there will be construction increase in the country. We can indirectly conclude: in the situation of constant GDP growth there is no construction increase; in the situation when GDP growth rate decreases, the rate of construction increase is negative. It is assumed in this research that GDP growth decreases, and according to the abovementioned theoretical conclusions the construction increase is negative, as shown in Figure 3.2. By examining the abovementioned indirect theoretic conclusion, where the construction increase

does not occur in the event of constant GDP growth, and by verifying it in practice, we have stated that in the event of constant GDP growth the construction increase does occur and the rate of this construction increase rises every year. By examining the results of model forecast in a more detailed way and analysing Figure 3.2, we can see that in the event of positive GDP growth the construction increase is negative. Earlier it was explained by he negative dynamic of GDP. We have determined in practice that in the event of small GDP growth the construction in the country decreases, regardless the positive dynamic of GDP growth. The proposed model shows that in order to create construction increase in Latvia we need total (GDP) growth, which is higher than 1.88%.

The construction increase and its connection with the total economic growth can be explained as follows: if there is economic growth, residents and enterprises spend more for purchasing goods. If this growth is lower than the determined level, they mostly buy everyday and average-term consumer goods. However, if the growth is higher that the determined level, they buy long-term consumer goods, in this case - construction products. In the event of economic growth, the enterprises foresee that the sales market will expand, but the production capacity is not enough to satisfy the growing demand; so they expand their production capacity, first of all, providing buildings (i.e. construction products). We should take into account that while planning building construction, enterprises expect to use the new buildings for a long time without considerable renovations, i.e. new buildings are always built with a reserve. The existence of building reserve delays the construction increase if the economic increase is lower than the determined level. The necessity of reserve comparing to economic growth accelerates the construction increase if economic growth is higher that the determined level.

The model of construction offer, the next part, shows the manner in which construction demand will be satisfied. Fig. 9 shows the forecasted scope of construction offers and its sources.



Forecasting year	1	6	11	16	21	26
Construction products manufacture, mil. Ls	22,4	11,3	15,2	29,1	90,4	653,5
Construction products import, mil. Ls	1226,6	1346,4	1357,7	1333,5	1260,0	688,7
Construction demand (consumption), mil. Ls	1249,1	1357,7	1372,9	1362,6	1350,4	1342,2

Fig. 9. Forecasted volume of construction products

Fig. 9 shows the market of construction products. Its main components are construction demand (3), manufacture of construction products in the country (1) and import of products (2). By summarizing manufacture and import of products, we obtain the scope of construction demand. Fig. 12 shows that in the beginning of forecasting construction manufacture is insignificant, while import dominates. Further one manufacture develops and manufactured products replace import.

Regression method is a prevailing forecasting method on the level of macroeconomics and branches. Many scientists can easily understand economic regularities described using the language of regression method. The displayed dynamic method has a specific forecasting set, but irrespectively the method gives the same result. In order to prove it, regression forecasting model is shown in this chapter, which corresponds to the dynamic model specified above.

Comparing regression equation with the dynamic equation, we can say that the dynamic model is analytically easier, whereas regression has an advantage - it considers random deviates. Dynamic model does not allow for deviates from the foreseen result, but regression model indicates the limits of fluctuations, using error rate. Regression model can simplify calculations, without decreasing the quality of forecasting. However, on the other hand, significant intermediate indices with high theoretical, social and economic importance can be lost. We can conclude that the regression method is more convenient for mathematic calculations, whereas the dynamic method emphasizes the economic essence.

For example, the commercial building requirements may be determined by the method of regression using the following equity: (see Formula 5):

$$B\,ent_t = 23{,}047 * Re_t - 0{,}321 * E^3_{t-1} + 4{,}904 * E^4_{t-1}, \qquad (5.)$$

(2,476) (-2,889) (12,062)

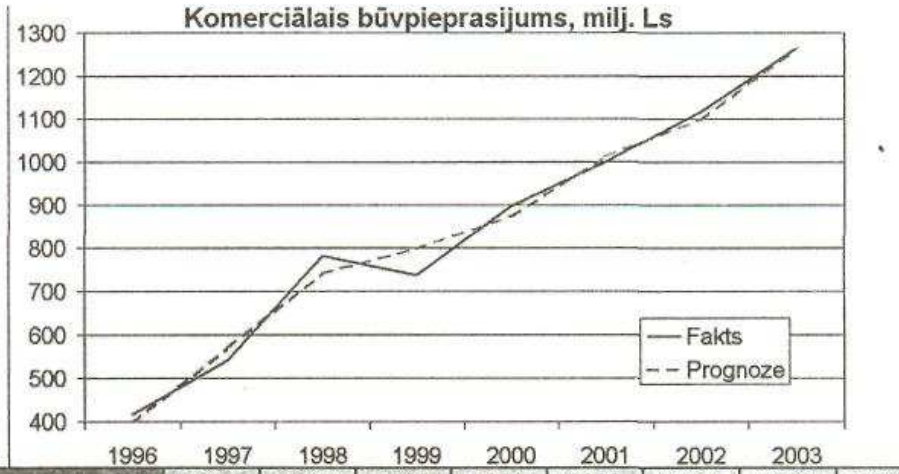
$R^2 = 0{,}986$ DW = 3,572

Where: $B\,ent_t$ - general building requirements in the anticipated (t) period of time; Re_t - building of new premises in the anticipated (t) period of time; E^i_{t-1} - the number of premises in the group i (in monetary terms), in the period of time, which precedes forecasting; E^3_{t-1} - the number of premises in group 3 (period of building development from 1957 to 1992 or 10 - 45 years before forecasting); E^4_{t-1} - the number of premises in group 4 (built after 1992 or in the period of time less than 10 years before forecasting).

As it follows from Formula 5, not all theoretically significant indices statistically influence the forecasting quality. Each group of premises, the number and the division of premises have an effect on the building of new premises. However, the number of premises in group 3 (with the period of building development from 1957 to 1992 or 10 - 45 years before forecasting) and in group 4 (built after 1992 or in the period of time less than 10 years before forecasting) have an additional direct impact on the building of new premises. From the theoretical point of view, entrepreneurs repair all the premises

irrespective of the determined groups of premises (i.e. regardless of the time of construction) and build new buildings instead of the old ones. Formula 5 shows that only repairs of premises, which were built after 1957, are important statistically in the forecasting the general commercial building requirements of enterprises. From the aforementioned we may draw a conclusion that the number of old premises have more influence on the building of new premises statistically instead of direct enlargement of the general building requirements of enterprises in the form of repairs.

The coherences indicated graphically in Formula 5 are displayed in the Figure 3.5.



Year	1996	1997	1998	1999	2000	2001	2002	2003
Forecast (Prognoze)	395.9	571.3	741.4	799.6	871.9	1012.5	1099.0	1266.0
Fact (Fakts)	417.2	541.5	782.8	737.1	896.7	999.5	1117.9	1265.0

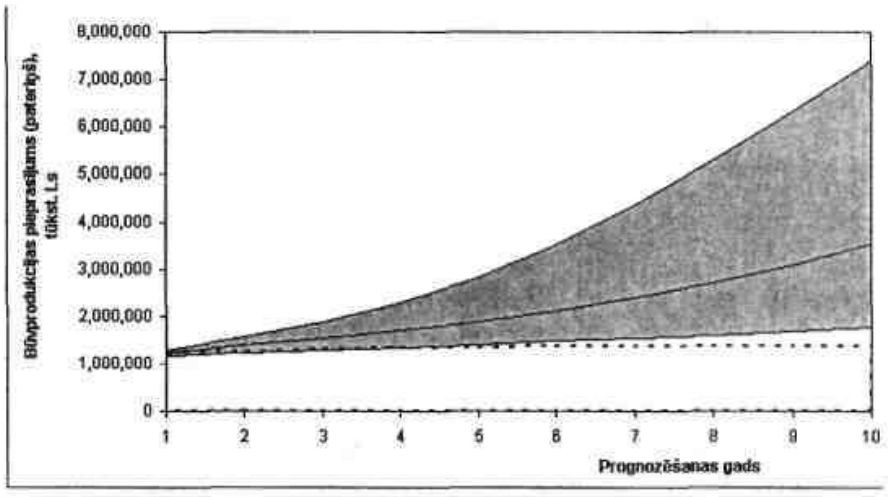
Fig. 3.4. Commercial construction demand forecasting in regression model

The example provided in Fig. 3.4 shows that the regression model gives a quality forecast of the commercial demand.

Regression model within this research is elaborated for the purpose to examine far and wide the forecasting possibilities of the construction branch. The displayed regression model is similar to the abovementioned dynamic model.

Taking into consideration the fact that the proposed model is based on methods of systemic dynamics, the preparation of data output (mostly acceptance of GDP growth) is also based on the methods of systemic dynamics. This assumption is one of the most disputable points of this research, and all forecasting results depend on it. Considering the disputable character of data output, it is necessary to work out a forecast based on alternatively determined data.

The alternative version takes into consideration the opinion of some experts that GDP growth will be from 3% to 9% per year in the nearest future. Taking into account alternative opinions about the most significant data output (GDP growth, etc.), an alternative forecast has been worked out, using the abovementioned coherences. The comparison of the alternative and the above proven forecasts of construction production demand can be found in Figure 3.4.



where: demand of construction production according to accepted GDP growth,

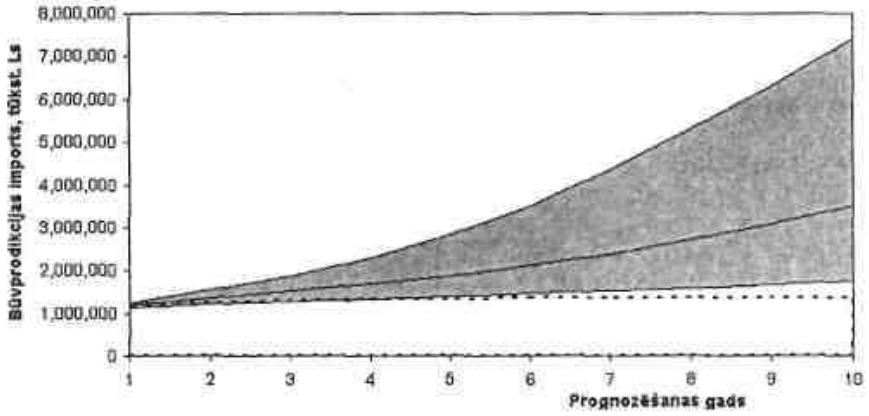
demand of construction production according to experts' GDP growth.

Figure 3.4. Sensibility analysis of construction production demand

As it can be seen in Figure 3.4, demand for construction production according to the accepted GDP growth in the first years of forecasting does not exceed the

total demand of construction production according to the experts' GDP growth. The difference can be noticed only 5 years later (demand according to the accepted GDP growth is lower).

The way of satisfying the building requirements may be interesting from the practical point of view. Figure 3.6 reflects the anticipated amount of import of construction products.



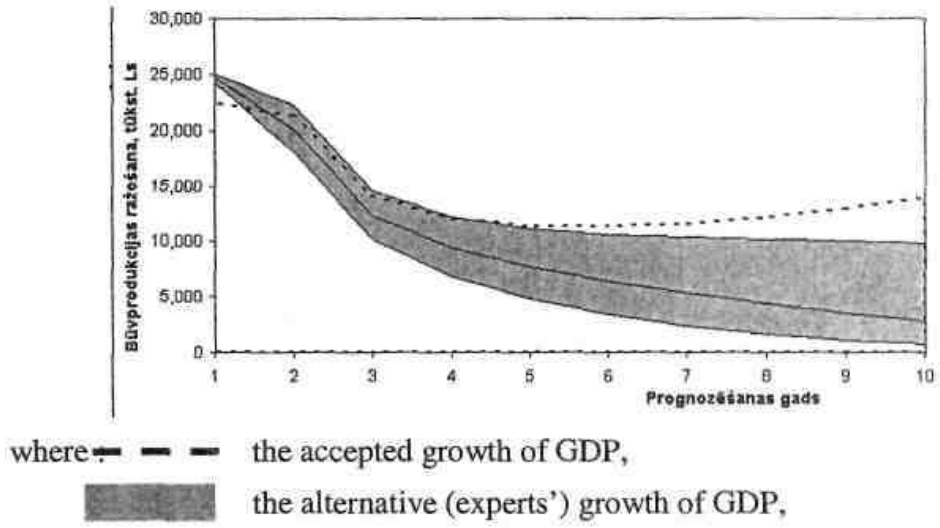
where: — — — accepted growth of GDP,

alternative (experts') growth of GDP,

Figure 3.6. Construction products import

Figures 3.5 and 3.6 show that the import and the demand for products (consumption) increase in direct ratio. Now the branch develops consuming imported materials, which is not favourable for the macroeconomic environment. Further development is more propitious for foreign manufacturers, but the Latvian manufacturers of the internal market do not use their opportunities. The anticipated situation is already seen in the market of cement.

Figure 3.7 shows the forecast for the development of construction products manufacture in the national economy.



where — — — the accepted growth of GDP,

the alternative (experts') growth of GDP,

Figure 3.7. Development of domestic manufacture of construction products

Figure 3.7 reflects a predictable decrease of internal manufacture of construction products. This is also one of the most important findings within this research. The more developed is the branch, the bigger will be the number of foreign representatives interested in competition in the internal market. However, the local entrepreneurs are less competitive (in comparison with the entrepreneurs and builders from the EU and other countries).

CONCLUSION AND PROPOSALS

To sum up, in the present research the methods used in economic forecasting are collected and investigated, construction economy specific character is investigated, the model of forecasting of construction branch is developed and the development of the branch in Latvia is forecasted.

The following results were obtained in the promotion paper:

1. Forecasting methods classification is designed.
There exist many forecasting methods and usually they should be examined according to specific classifications. The author offers a classification of the forecasting methods, which consists of the following groups:

- the methods of quality;
- the forecasting of time series;
- the main indicators, the connections in the net method;
- imitation, modelling method;
- the methods of regression and the analysis of the sensitivity.

The proposed classifications and the novelty of the approach are connected with use of methods in the construction branch. Sequence of tasks is undisputable in construction. The scope of further and subsequent work can be determined and forecasted accordingly on the basis of the scope of the previous work. The net method uses this coherence of strictly defined technologic work as an indicator; this is why proposed classification is put into a separate group, which comprises net models.

2. The opportunities for using forecasting methods in construction branch are researched.
    - It is established that quality forecasting method (expert and interview methods) do not give the correct information about the actual situation in the branch, even if respondents fulfilling 65 % of the branch turnover are interviewed.

- Forecast methods of time ranges give objective and independent assessment. However, they only take into consideration statistics. Taking into consideration the fact that these coherences can change, the elaborated models could give inadequate forecast. In order to avoid this defect in using methods of time series, these methods can be only used for short-term forecast.
- Net method can be used in some segments of construction branch for short-term forecasts. As the result of its use, the data obtained will be indisputably adequate in future situations, but their defect is a short forecast period.
- Dynamic modelling makes forecasts based on analytically determined or otherwise changeable rules of system development, i.e. statistic approach does not have to be used in elaborating the rules. Accordingly, the dynamic modelling is more economic, not mathematical or statistical forecasting. Taking this fact into consideration, it is advised to use new dynamic modelling for developing forecasts of construction branch.
- Regression method makes forecasts based on real influencing factors. Regression method is similar to dynamic modelling. However, regression has an advantage - regression method is the dominating forecast method on the level of macroeconomics and branch sectors. Regression method also has its deficiencies; it records statistically determined coherences at a defined time, but these coherences can change. These coherences are not defined in dynamic modelling. Most often, the rules of dynamic modelling and statistical regularities of the regression method describe the essence of one and the same economic process equally. Accordingly, for medium-term forecasting (approximately from one to five years) it is appropriate to use regression method, but for long-time forecasting (approximately starting from four years) method of dynamic imitation should be used.

3. The construction branch forecasting model is developed.

- Summarizing state, commercial and private construction demands the general construction demand is calculated.

- The major part of the general construction demand is commercial demand. Influence of commercial demand on the general construction demand is 7 times bigger than state demand and 2-8 times bigger than private.
- The major part of commercial construction demand is construction of new buildings. Therefore it is possible to formulate the main conclusion of the forecasting model: in current conditions in Latvia **the development of construction branch is promoted by construction of new buildings** for company's financial resources to satisfy their needs. Residents and the state, using investment programmes in the available scope, are not capable to provide essential growth of the construction branch. Residents are capable of building only private houses (a house for one family), but not capable of joining together to build multi-storey houses, which constitute the major part of real estate and housing. Construction of multi-storey houses is the subject of activity of the enterprises.
- Division of residents into groups, as well as the consideration of group incomes and sizes significantly expands the forecast possibilities in determining private demand.
- The offer model consists of the following industrial factors: natural factor (herein - raw materials), labour factor (staff), capital (fixed capital -industrial funds, circulating capital - cash assets), entrepreneurial capacity (and information) factor. Each factor has its own offer model. Offered cash assets are divided between industrial factors in strict ratio - according to Leontyev's production function.

The results obtained in the research lead to the following conclusions:

1. The total economic growth (GDP) which is bigger than 1,88% is necessary to provide an increase in construction in Latvia.
2. Considering the existing rate of extraction, the amount of non-renewable resources of building materials in Latvia will last for 250-300 years. It is also possible to develop new types of mining, taking into account the reserves, which are unknown or which have been evaluated before.

3. The amount, which is necessary to enlarge the housing fund by 5-7%, or 700th. m^2, is equal to the amount, which is necessary for the heat insulation of all common buildings in the ownership of the state and municipalities. The present sum amounts to about 200 million. As the state gives priority to the increase in the efficiency of energy, the opportunities of the consumer's choice are limited. Therefore the development of the construction branch may decrease. If the state encourages the projects of heat insulation, in other words, repairs, the lifetime of old premises will increase, whereas the amount of new premises will not increase. The Latvian construction branch would gain much more if the existing non-efficient old premises were replaced by modern premises. The construction of modern premises would provide a considerable increase for the branch.

4. Currently, the influence of residents on the building market is insignificant. More than 70% of residents do not participate in the building market; they cannot perform the ordinary repairs financially. Only 5.5% of residents are the potential participants of the primary housing market and can afford to buy a flat in a new premise or to pay for the construction of a house. The proportion of private construction (i.e. attracting the monetary funds of private persons) amounts to about 1.2% of the total scope of new construction. It is forecasted that the proportion of private persons will increase up to 30% in the next 8-10 years.

5. Multi-storey residential buildings are very important in the creation of demand. Flats in new buildings are very marketable, because there is no construction of multi-storey residential buildings in large quantities. Nowadays their construction in large quantities is risky for the builders. Market situation can change if their construction starts. The first projects of multi-storey residential buildings will be more expensive that the next ones. The builders have to master and to renew the potential opportunities of the

construction of multi-storey residential buildings. Accordingly, the additional expenses will occur.

6. Building industry is a labour force-including sector, and its demand for skilled specialists grows quickly. There is a lack of specialists in the sector, because the skills and qualifications of young specialists do not comply with the requirements of the market of today, for the most part, in terms of experience. The lack of skilled specialists increases wages of employees in the building sector.
7. Most materials used in Latvia are produced in foreign countries. Almost all wall blocks, warming wadding and electric cables are imported. The situation is expected to change in 5-7 years.
8. It is known that the sector undergoes to cyclic fluctuations in hiring personnel. The length of one cycle is about 6 years.
9. Most technical equipment, which is used now, was bought in the late 80s and early 90s of the last century. Use of worn-out equipment diminishes costs, but the situation cannot last endlessly. The renewal of means of production increases the costs of building, which, in turn, diminish the competitiveness of the builders.
10. The problem of low enterprise of Latvian builders is known. This is supported by the fact that nowadays the accounting (official) profitability is 10% only, but the actual one is about 35%. The real level of development of business (entrepreneurship) becomes apparent in comparison with Lithuania, the neighbouring country. The real indicator of profitability in Lithuania is 10% only. The local builders, working under the conditions of low competitiveness, are not competitive on the international level. Meanwhile Latvian builders are competitive on the international market, using cheap resources (labour force, etc.) After joining the EU, the increase in the level competitiveness is anticipated. For many Latvian builders it will be difficult to survive under the conditions of increased competitiveness.

11. Assessing the competitiveness on the international level, it should be noted that the current Latvian building market is too small to rouse interest in foreign builders. The situation may change if the scope of the market increases. The more developed the branch will be, the more foreign representatives will be interested in competition in the internal market. The goal of Latvian builders is to grow along with the branch.

The theoretical conclusions obtained within the promotion paper, the research made and the designed model lead to the following proposals:

1. The application of the dynamic modelling is most efficient to make long-term forecasts under the conditions of uncertainty, for the purpose of obtaining an economically sound forecast, as well as to obtain information of influencing factors and of the situation in general.

2. The models of demand, of supply and of their mutual interaction described in the paper can be used as a theoretical basis in the economic forecast of the branch as well as in the forecasting related to other branches of the national economy.

3. There is a strategic necessity to develop the manufacture of local building materials, otherwise the increasing demand for construction will also increase the amount of purchases of foreign products.

4. It is necessary to pay more attention for the training of specialists in construction. The aim is not only to increase the number of builders and engineers, but also to achieve improvement of qualifications and to develop practical skills. It is also important to create a new generation of economists.

5. It is necessary to create building corporations and joint systems of information and knowledge for the purpose of raising competitiveness. At the same time it is necessary to develop the use of new technologies not only in the construction process itself, but also in its planning and management, because this indicator in particular determines the competitiveness in the XXI century.