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DEVELOPMENT OF THE LATVIAN MACROECONOMIC MODEL IN THE CONTEXT OF COMPETITIVENESS[22]

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Introduction

Competitiveness is very important for the development of any company, industry or country. It is even more significant in small open economies like Latvia, where local companies compete with foreign ones in the domestic market, and where exports are the major driving force of economic development due to the small domestic market. Therefore governments tend to find ways to help exporters and thus stimulate the economic growth of the country. However, the question arises as to whether any successful company can be supported, or should support be focused only on companies in particular industries or companies exporting to particular countries? It is important to note that within the European Union, according to the legislation the member states are allowed to support national companies only in special cases, as all the companies compete in the common market.

A similar question can be posed by banks, which make decisions regarding loans to particular companies, investment organizations, and other interested parties. Moreover, the question is relevant not only in present terms, but also in regards to the future. Therefore it is important to determine which indicators illustrate competitiveness and how they can be incorporated in the macroeconomic model.

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The aim of the study is to distinguish which competitiveness indicators can be incorporated into the Latvian macroeconomic model to evaluate sectoral competitiveness.

1. Theoretical and practical aspects of the competitiveness studies

The concept of competitiveness has been widely discussed in many publications resulting in a wide range of definitions of competitiveness. These definitions differ depending on particular issues, which have been investigated in particular research projects. Thus there is not one single, common definition of this concept. It is also clear that there are differences when applying the concept of competitiveness to different objects of interest – regions, countries, industries and organizations. Therefore it is obvious that there are similar and distinct aspects that have to be taken into account at different levels of competitiveness analysis. The summary of the thoughts of several authors (Sirikrai & Tang, 2006) even stresses that the divergent nature of competitiveness implies that competitiveness has to be analyzed from different aspects and using different theories to better appreciate its complexity.

There are many studies of competitiveness at a national level. Some researchers (Bellak, Leibrecht, & Damijan, 2009; Egger & Raff, 2015; Hristu-Varsakelis, Karagianni, & Saraidaris, 2011) analyze the competitiveness of countries in the context of the investment attraction. The study on the global competitiveness of Latvia in the post-crisis period (since 2011) focuses also on labor productivity and economic growth as major indicators (Auzina-Emsina, 2014). Other studies (Kancs, 2011; Kutasi, 2005) concentrate more on labor migration. Technological advancement usually means a higher level of competitiveness, therefore it is crucial for developing countries to increase the fixed capital formation (Özçelik & Taymaz, 2004). Also, the industrial perspective is found to be very important and sometimes even crucial to ensure sustainable development of countries. Industrial policy can enhance economic efficiency and increase the national output, however, there has to be a balancing policy to ensure income equality, for example, by means of progressive household income tax (Field & Wongwatanasin, 2007). Another interesting focus of the studies are the relations among competitiveness at various levels. For example, about the ways strong development of the competitive industries can help in the regional development of the country (Chico, Sánchez, & García, 2014). One conclusion is that only the actions producing uniform increases in

regional productivities, such as infrastructures and human capital, should be the focus of the regional development policies (Esteban, 2000).

There are many indicators, which can be used in analysis as measures of competitiveness. There are some indicators, which can give an insight into trends of competitiveness. However, it is more common to analyze competitiveness with respect to the competitors, that is, by looking at the market shares or other relative indicators. One example in this case is the Revealed Comparative Advantage Indexes (Laursen, 2015; Silgoner, Steiner, Wörz, & Schitter, 2015). There are also several complex competitiveness indexes as well, like the Global Competitiveness Index (GCI), which helps to rank the countries focusing on different aspects of the competition in a certain year. GCI can be used to compare the performance of countries in a certain time period and reveal general relative dynamics. However, as the number of countries included in GCI annual reports varies, it has to be done with caution.

There are several indicators, which are used in competitiveness analysis by industries (Auziņa-Emsiņa & Ozoliņa, 2014; Keiko, Junko, & Asia, 2013; Özçelik & Taymaz, 2004; Ozolina & Auzina-Emsina, 2013). Some of the competitiveness indicators are exports of goods and services (as a percentage of GDP), the real export growth rate (%), gross labor productivity (employment here can be measured as the number of employees, hours worked or as a full-time equivalent of the number of employees), the ratio of value added to compensation of employees, the ratio of value added to unit spent on labor, the labor input coefficient, the ratio of value added to output, export dependency, and the speed of structural change (adjustment of the export specialization towards the higher value added). Unit labor costs and nominal effective exchange rates are used in the context of technology transfer. Additionally, foreign direct investment (flow and stock), R & D expenditures, capital productivity, imports of technology, and innovations can be attributed to export growth as factors related to competitiveness. International competitive advantages from the sectoral perspective can be analyzed by using specialization expressed as exports in a given sector over total exports of a country, and competitiveness as a share of exports of a given country in a given sector over total exports of all countries in the same sector standardized by population (Guerrieri & Meliciani, 2005). Inter-industry linkages are also stated as important facilitators of competitiveness (Evangelista, Lucchese, & Meliciani, 2015).

The choice of appropriate competitiveness indicators is quite wide, however, it is usually limited by data availability and approaches (including tools) used in research. Therefore it is necessary to determine which indicators can be used in the context of macroeconomic modeling in order to cover all industries and, at the same time compute and

analyze structural, inter-industry, and macroeconomic effects. It should be stressed that the analysis and modeling of competitiveness of an individual industry or economic activity can be more sophisticated and detailed (special indicators, even technical indicators, etc.), but in most cases the specific indicators used for one certain industry cannot be applied to all other industries due to technological, data availability, and logical reasons, etc.

Analysis and predictions of competitiveness by industries can be computed in several ways. Moreover, disaggregated calculations tend to be more precise than aggregated ones (Lee, 1997). One of the best ways to do that is using an INFORUM (Interindustry Forecasting at the University of Maryland) type model, which can be characterized as an I-O (input-output) Econometric model. The core of such a model consists of multi-sectoral quantity and price relationships based on I-O representation of the economy. Thus many important variables are calculated by industry, taking into account the inter-industry relationships, and are later added up as the macroeconomic aggregates (by bottom-up approach), including GDP (Almon, 1991; Bockermann, Meyer, Omann, & Spangenberg, 2005; Grassini, 2001; Meade, 2014; Su, Yang, Huang, Lin, & Chang, 2015). Using this kind of model, it is possible not only to analyze trends of competitiveness by industry, but also the influence of changes in competitiveness on the development of other industries and the whole economy.

Analysis of main relationships of the inter-industry macroeconomic models provides information on competitiveness indicators, which can be calculated in the majority of the models. However, each model is individual, and thus it depends on the structure of a particular model and whether all the necessary data are included. On the other hand, it is possible to introduce additional data and relationships into the model and thus enable the model user to obtain more information on competitiveness by industry.

One of the central equations of the INFORUM models is the I-O solution relating output to intermediate and final consumption. Thus the output and demand components by industry are included in the model. The second central component of the INFORUM models is the I-O price solution relating the unit price vector to the unit material cost and the unit value added cost. Value added components – wages, depreciation expenses, operating profits and indirect taxes – are calculated as well together with labor productivity and labor demand. This allows using a wide range of indicators in competitiveness studies as well.

On the other hand, input-output data are not published as frequently as other statistics, therefore other types of models such as econometric models have to be considered. Such models can also incorporate some

industry structure and thus be used as the tools for competitiveness analysis by industry (Ozolina & Pocs, 2013).

Competitiveness indicators can be incorporated in the models in two ways: 1) as exogenous indicators, which show the assumptions of scenarios regarding the possible development of competitiveness; and 2) as endogenous indicators showing the results of activities towards higher competitiveness, or consequences of changes in the economic environment. In both cases it is possible to get important insights into the competitiveness issue.

2. Competitiveness indicators

Within the research several competitiveness indicators are chosen for analysis, which might be incorporated in the Latvian macroeconomic model. As competitiveness demands complex studies, there is a need for several competitiveness indicators in the model, each of them capturing different aspects of competitiveness. Seven indicators are used in this study in order to reveal competitiveness trends by industry in Latvia. The selected indicators are as follows:

1. specialization;
2. export dependency;
3. value added per unit of output;
4. real labor productivity;
5. value added per employee;
6. value added per unit spent on labor; and
7. unit labor costs.

Additionally, the real growth rate of the exports and the ratio of the nominal exports to GDP are calculated in order to reveal the overall trend of export-orientation of Latvia.

Analysis of the specialization indicator (1) or the export structure shows which industries are dominating exports at present and which industries could become the export leaders in the future. Increase of the value of the specialization indicator shows that the export value of a particular industry grows comparatively faster than in other industries. However, it shows not only the result of the changes in competitiveness, but also the changes in the demand, prices and other factors.

$$\exp\_spec_{i,t} = \frac{\exp_{i,t}}{\sum \exp_{i,t}} 100\% \qquad (1)$$

where $exp_{i,t}$ is the nominal exports of goods and services of the industry i in the time period t. If only total exports are calculated in the model,

this indicator can be used as an exogenous variable, otherwise it will be endogenous.

The export dependency ratio (2) shows the fraction of the output, which is exported in each industry. In other words, it shows the dependency of a certain industry on the economic activity abroad.

$$\exp\_dep_{i,t} = \frac{\exp_{i,t}}{out_{i,t}} \tag{2}$$

where $out_{i,t}$ is the nominal output in industry *i* in time period *t*. This indicator is endogenous in the model.

The ratio of value added to output is calculated using Equation (3). This indicator helps to distinguish the actual higher-, medium-, and lower-value added industries in the economy.

$$r\_v_{i,t} = \frac{r\_va_{i,t}}{r\_out_{i,t}} \tag{3}$$

where $r\_va_{i,t}$ is the value added in industry *i* in time period *t*, and $r\_out_{i,t}$ is the real output in industry *i* in time period *t*. This indicator can be exogenous or endogenous, if the elements of the value added are calculated within the models.

Real labor productivity (4) shows the volume of output produced per one unit of labor. The usual choice of the labor indicator is between the hours worked and the number of full-time equivalent employees, although sometimes also the number of employees as such is used.

$$r\_p_{i,t} = \frac{r\_out_{i,t}}{empl_{i,t}} \tag{4}$$

where $empl_{i,t}$ is the number of employees in full-time equivalent. This indicator can be exogenous or endogenous, calculated with the formula or depending on other factors.

Value added per employee (in full-time equivalent) as computed in Equation (5) is sometimes associated with labor productivity. It also shows to what extent employees in each industry facilitate economic activity. This indicator is endogenous in the model.

$$r\_pvu_{i,t} = \frac{r\_va_{i,t}}{empl_{i,t}} \tag{5}$$

The ratio of value added to the unit spent on labour (6) is a significant indicator as it shows how much value added is generated per one unit spent on labor. The higher the values, the greater positive impact each industry has on the whole economy.

$$pvu\_lc_{i,t} = \frac{va_{i,t}}{lc_{i,t}} \tag{6}$$

where $lc_{i,t}$ are the labor costs in industry i in time period t. This indicator is endogenous in the model.

Unit labor costs (per full-time equivalent employee) are calculated using Equation (7).

$$ulc_{i,t} = \frac{lc_{i,t}}{empl_{i,t}} \quad (7)$$

Unit labour costs capture one of the aspects of cost competitiveness. This indicator is endogenous in the model.

The main sources of data for this study are the database of the Central Statistical Bureau (CSB) of the Republic of Latvia (CSB, 2017) and the Eurostat database (Eurostat, 2017a). In the research, more attention is paid to high-technology industries (according to NACE classification Rev.2. codes of industries: 21 and 26), medium-high-technology industries (20 and 27 to 30) and medium-low-technology industries (19, 22 to 25 and 33). The data for 2005–2016 are mainly analyzed, however, in some cases the data were missing, thus a shorter period is used.

3. Data analysis

Analysis shows that exports is one of the drivers of Latvian economic development (see Fig. 1). During the crisis there was also a fall in export volumes, but it lasted for only one year (GDP fell 3 years in a row) and afterwards presented considerable positive annual growth rates (9.8–13.4 %). In 2013, the export growth rate was comparatively low due to the export sanctions of Russia (this market accounted for 11 % of Latvia's exports of goods in 2012) and the weak demand in other countries.

There are two dominating industries in exports – manufacturing and trade. It is understandable as goods can be exported directly and

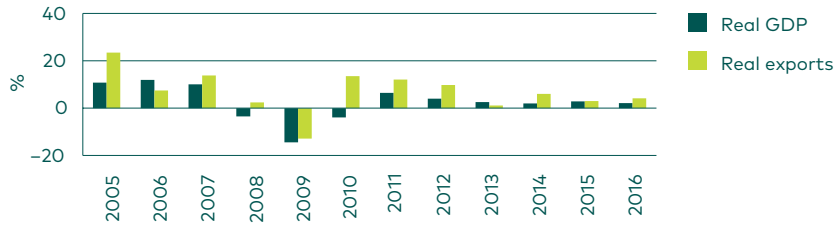

Fig. 1. Real GDP and exports of goods and services growth rate, %. (Source: Authors' calculations based on the CSB database)

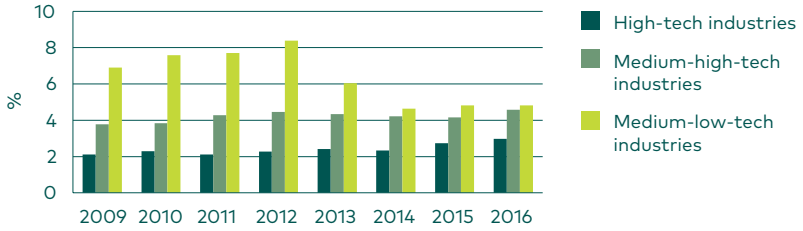

Fig. 2. Specialization indicators in manufacturing in Latvia, %. (Source: Authors' calculations based on the CSB database)

indirectly – via distributers and other third parties, which are mainly related to the trade sector. The main commodity groups (CN) associated with the trade sector in 2009 and in 2016 are machinery and mechanical appliances (XVI), vegetable products (II), products of the chemical and allied industries (VI), base metals (XV), wood and articles of wood (IX), mineral products (V), prepared foodstuffs (IV) and transport vehicles (XVII). The total share of manufacturing in total exports of goods has decreased from 43.8 % in 2009 to 37.5 % in 2014, but since has slightly increased to 40.6 %. About 30 % of the manufacturing exports are associated with the manufacture of wood and wood products. The share of trade has increased from 38.0 % in 2009 to 46.7 % in 2017 and is mainly related to wholesale trade.

Analysis of the specialization indicators by groups of industries (Fig. 2) shows that the shares of exports of high-tech and medium-high tech industries (the grouping of industries performed on the Eurostat methodology basis (Eurostat, 2017b)) are stable or slightly increasing, however, the share of medium-low-tech industries falls dramatically in 2013–2014. As these data are in nominal terms, it can indicate both the fall of export volumes as well as the decrease in prices of the products.

The importance of exports in Latvia has increased substantially during the global financial crisis – from about 40 % of GDP in 2005–2009 to more than 60 % in 2012–2016. This means that during the crisis, the Latvian economy became more export-oriented.

Higher export-orientation leads to higher export dependency. In Latvia, the ratio of exports to output has increased from an average of 20.3 % in 2005–2009 to 30.6 % in 2012–2016. Export dependency ratios by industry are slightly imprecise as 4.0–9.7 % of the total exports of goods are not distributed by industry. However, it is clear that high-tech industries, as expected, are highly export-dependent (see Fig. 3). The overall export dependency of medium-high-tech industries is more than

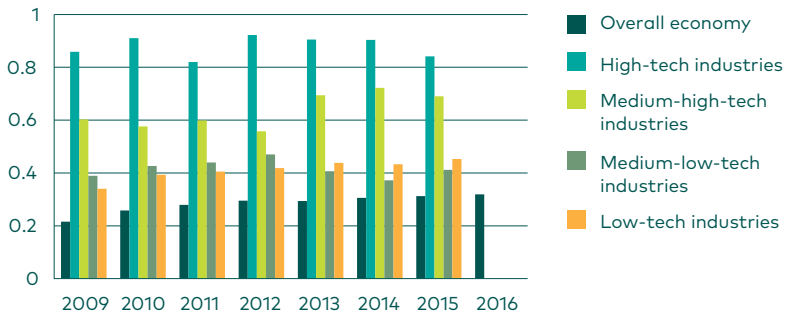

Fig. 3. Export dependency ratios in manufacturing industries in Latvia. (Source: Authors' calculations based on the CSB and Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2016 are not available.

50–60 %, but the overall export dependency of medium-low-tech and low-tech industries fluctuates around 40 %. Thus the competitiveness in export markets is crucial in these industries.

The Latvian economy generates on average 0.42–0.45 units of value added per unit of output (see Fig. 4). The values of the ratio are comparatively higher in high-tech industries, but lower in medium- and low-tech industries. It is interesting to note that value added per unit of output in medium-high-tech industries was comparatively high in 2005–2007, but sharply decreased in 2008, when the global financial crisis began.

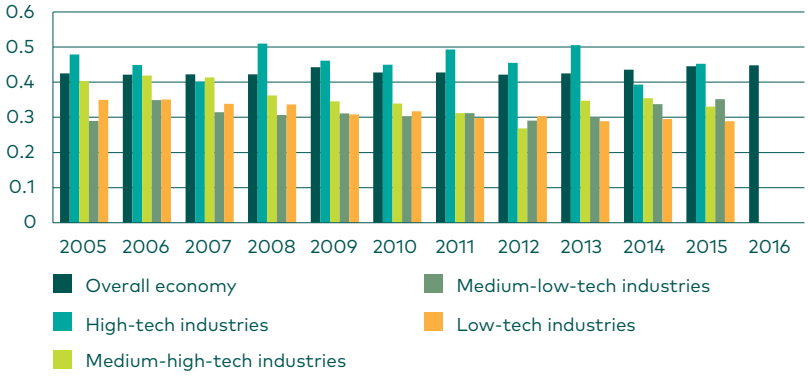

Fig. 4. Real value added per unit of output in manufacturing industries in Latvia. (Source: Authors' calculations based on the Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2016 are not available.

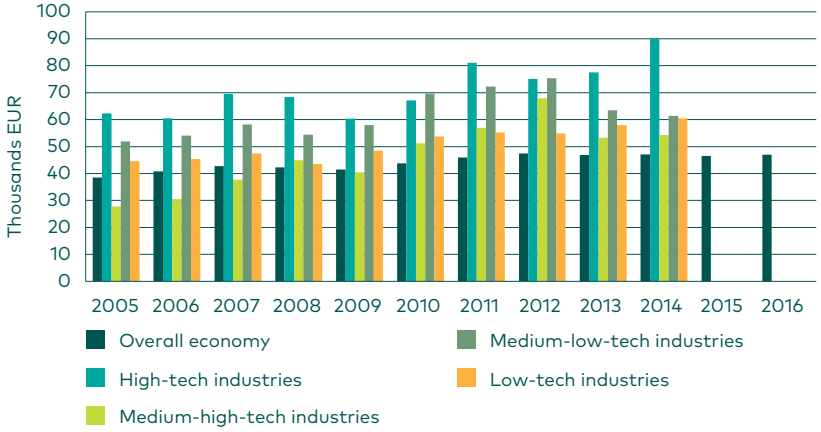

Fig. 5. Labor productivity in high- and medium-tech industries in Latvia, thsd EUR per person. (Source: Authors' calculations based on the Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2015 and 2016 are not available.

Contrary to value added per unit of output, productivity has increased considerably during the crisis, especially in medium-high-tech industries, although this trend did not continue in 2013–2014 (see Fig. 5). The productivity indicator is calculated using the data on number

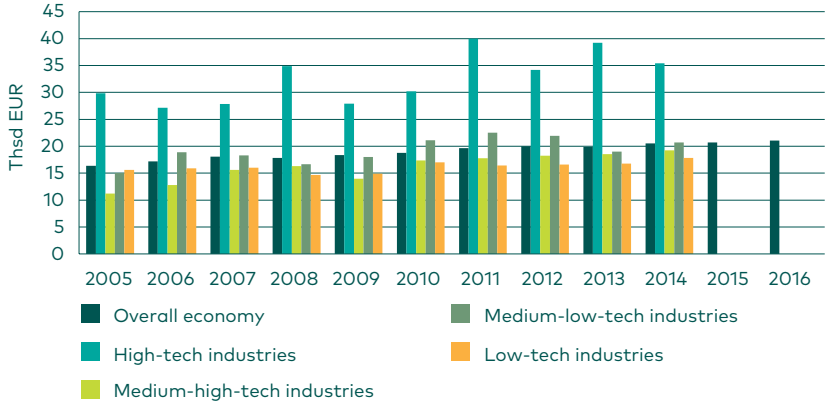

Fig. 6. Real value added per employee (full-time equivalent), thsd EUR per person. (Source: Authors' calculations based on the Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2015 and 2016 are not available.

of employees as the labor indicator, however, the general trend in manufacturing is similar as the number of hours worked is used instead. It is important to note that productivity in all the industry groups of manufacturing is higher than the average in the economy.

Real value added per employee is considerably higher in high-tech industries, as expected (see Fig. 6). However, the difference between the medium-high- and medium-low-tech industries is not that large. Moreover, real value added per employee is higher in medium-low-tech industries.

Value added per unit spent on labor is generally considerably higher than in the economy as a whole (see Fig. 7). However, for medium-low-tech industries the values were higher only in 2006 and 2010–2011. It is interesting to note that this value was very high for low-tech industries in 2005–2007, but then it began to decrease, reaching a value only slightly higher than in medium-tech industries.

There is a general increasing trend in unit labor costs in Latvia with a decrease during the crisis (see Fig. 8). The unit labor costs in high-tech industries are considerably higher than on average, but only slightly higher in medium-tech industries. One possible reason might be that the number of specialists needed in high-tech industries is very limited and companies must pay higher wages to keep their high-skilled employees. Unit labor costs are lower in low-tech industries.

In summary, high-tech industries stand out in most aspects of competitiveness except value added per unit of output, when compared with the overall economy. Analysis of manufacturing sectors also shows that competitiveness patterns are different among industries, thus a detailed macroeconomic model is needed for competitiveness analysis.

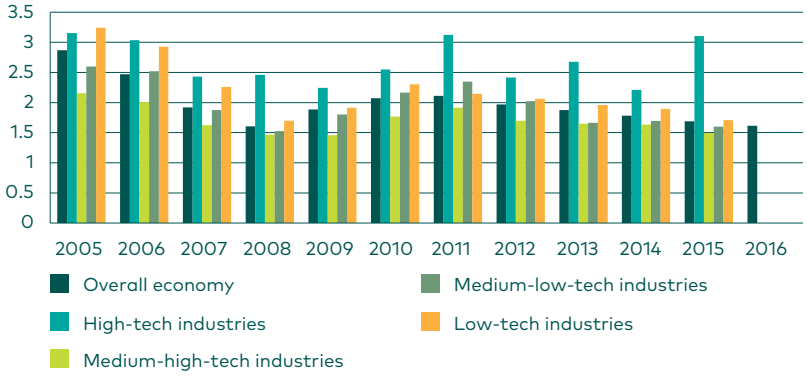

Fig. 7. Value added per unit spent on labour. (Source: Authors' calculations based on the Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2016 are not available.

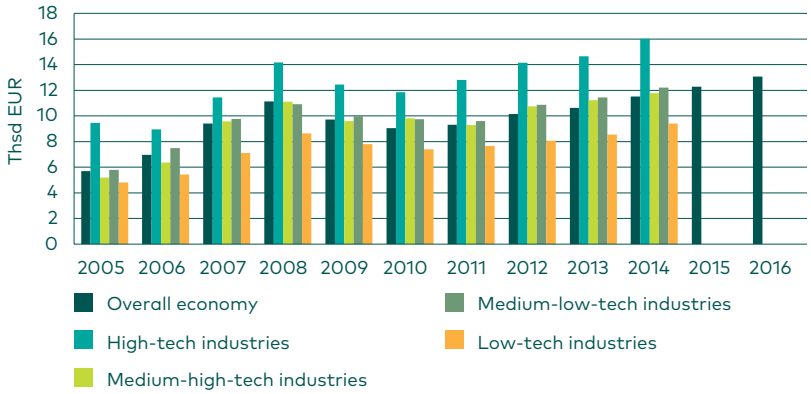

Fig. 8. Unit labor costs, thsd EUR. (Source: Authors' calculations based on the Eurostat database)
Note: Disaggregated data in NACE classification Rev. 2. for 2015 and 2016 are not available.

4. Current state of the Latvian macroeconomic model

As mentioned above, macroeconomic models, which combine input-output and econometric equations, are very useful for economic analysis by industry. On the other hand, if reliable input-output data are not available, macro-econometric models are the second best choice. However, such models cannot incorporate highly detailed data. Therefore at present, competitiveness indicators are incorporated in the Latvian macro-econometric model with 10 industries disaggregation. The next step is to incorporate input-output relationships and add more detail, including distinction among high-tech, medium-high-tech and low-tech industries.

The current stage of the model incorporates only a part of the selected competitiveness indicators by industry. The ratio of real value added to output ($r\_v_{i,t}$) and real labor productivity ($r\_p_{i,t}$) are used as the exogenous indicators by industries, while real value added per employee ($r\_pvu_{i,t}$) is endogenous. It is assumed that, if the ratio of value added per unit of output increases due to higher competitiveness, real labor productivity should increase as well. Export orientation, unit labor costs and the ratio of value added to labor costs is calculated only at the aggregate level for the whole economy.

Conclusions

There are many competitiveness indicators, some of which can be used also at the industry level, but data availability issues limit the options to incorporate all of them in the model. Therefore there is a need for further research on how to adapt valuable competitiveness indicators or estimate the lacking data in order to cover all the necessary aspects of competitiveness.

Inter-industry linkages are important in competitiveness studies by industry, therefore input-output econometric models are appropriate instruments for competitiveness analysis. When adequately formulated, such a model can provide an outlook in competitiveness positions of industries in the future.

The high-tech industries are high-value added industries in Latvia, however, labor costs are higher in these industries. The medium-low-tech industries are more developed than the medium-high-tech industries, indicating the potential of development in medium-high-tech industries. Thus the requirements for such development have to be analyzed in more detail, using appropriate macroeconomic models.

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