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Labour Elasticity in V4 countries: Structural decomposition analysis

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Abstract

In the present paper, we analyse determinants of labour elasticity in V4 countries. While the standard approach relies on the parametric estimation of labour elasticity coefficients, we employ a novel approach based on structural decomposition analysis. This allows us to identify several determinants that mitigate the effects of economic growth on employment. We decompose the overall change in employment into the contribution of six factors: changes in labour productivity, changes in import of intermediate products, changes in the structure of production, changes in the final demand structure by industries and by sectors, and a change in final demand volume. We show that besides generally accepted influence of labour productivity growth on employment other factors such as structural changes and changes in final demand played an important role in employment changes. These results shed some light on low labour elasticity in V4 countries that goes beyond the simple labour productivity growth argument.

Keywords: structural decomposition analysis, labour elasticity, V4 countries, input-output analysis
JEL codes: C67, J21

1 Introduction

The jobless growth phenomenon attracted significant portion of attention in academic papers. Authors utilizing employment elasticity approach studied large sample of countries around the world to explain why such a phenomenon occurred in economies in recent decade. Kapsos (2005) estimated that globally world employment elasticity is around 0,3 with significant differences from region to region. Such estimation means response of employment to economic growth approximately by 30 % intensity. For region of V4 countries the estimated elasticity was far below original estimation, approximately around 0,1. In the paper, they argued that main determinant of such unresponsiveness of labour market is caused by growth of labour productivity. Döpke (2001) estimated the employment intensity of economic growth on sample of 10 largest states in USA to be 0,5 due to more flexible labour market and again, due to growth of labour productivity. Furceri, Crivelli, and Toujas-Bernate (2012) were the first to test the role of economic structure on employment elasticity with positive effect result, but did not perform any further explanation of it. Such absence of real determinant in mentioned papers created demand for use of new analytical tool – structural decomposition analysis.

The topic of structural change and labour productivity impact on economy has been widely studied across the globe mostly at national level. Structural decomposition became main analytical tool for such studies since the first regularly published input-output tables became available. Due the complexity of their construction, most studies utilize just a couple of input-output tables even

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though they cover long period of time. Skolka (1989) studied structural changes of Austrian economy during the period of 1964 – 1976. One of analysed factors was a change in employment. The analysis came to conclusion that aggregate change in structure of domestic and foreign final demand was the main driver of employment development. The changes in industry structure of employment changed mainly due different rates of labour productivity growth among individual industries. Also change in technologies used in economy expressed by changes in Leontief inverse matrix played significant role in explaining the development of the whole economy and employment as well. Ciobanu, Mattas, and Psaltopoulos (2004) used structural decomposition approach in two European south-east region development analysis. They conclude that in case of employment, the contribution of technology change had great impact on labour requirements reduction in period 1980 - 1997. Huachu (2008) focused on development of China in years 1997 and 2002. Based on the decomposition analysis, he created individual scenarios for development of employment according to performance of selected variables. The highest contribution to employment growth was recorded in export, on the other hand, the major negative effect had the technological progress of economy. Wider time span (1985 – 2007) was used to study effects of structural change on labour productivity in the same country in analysis by Yang and Lahr (2010). They argue that main factor causing great increase of labour productivity was low comparison level mainly in agriculture sector. Gunluk-Senesen and Senesen (2011) utilized structural decomposition of labour demand for identification of industries capable of generating the highest amount of job positions in Turkey for year 2002. Motivation for such analysis was similar situation in labour market as occurred in V4 countries as well - strong economic growth with almost none effect on total employment in country. Authors identify the highest potential job creation industry for males in trade and for women in textile industry. The paper by Vries and Erumban (2012) is the first analysing also an employment development in group of BRIC countries. They identify positive contribution of labour force reallocation to employment growth in Russia, India and China. And the latest paper in field of structural decomposition focused on employment changes is by Tin (2014) where he pays attention to development of Malaysian economy. There are three input-output tables used for decomposition (1970, 1991 and 2000). The main contributor to employment growth was in first period 1970 – 1991 the change in structure of domestic final demand, in second period 1992 – 2000 the change in export. So far, there has been none paper published yet focusing on the development of employment in the area of Central Europe with the use of structural decomposition approach. However the phenomenon of jobless growth creates ideal conditions to perform such analysis. Also use of continual structural decomposition of employment for each year of study and in such detailed breakdown composition of determinants is to our knowledge new approach and has not been conveyed on any data yet.

2 Data and Methodology

The data used in the analysis are taken from World Input-Output Database[2] (WIOD). The database covers 27 European Union countries and other 13 major countries in the world for the period from 1995 to 2009. We use the data for V4 countries (Czech Republic, Hungary, Poland and Slovak Republic). Two types of sources are used from this database. First, world input-output tables in previous years´ prices, denoted in millions of dollars. Second, Socio Economic Accounts, were employment data by industries are available. World Input-Output Tables are constructed for 35 industries. More information on the construction of the World Input-Output Tables can be found in Dietzenbacher, Los et al. (2013).

[2] World Input-Output Database in available at: http://www.wiod.org/new_site/home.htm.

2.1 Input-output model with employment effects

Open Static Leontief model is a widely used empirical method that allows us to analyse the complex linkages among industries. Assuming the fixed industrial input structure it is able to compute the total production that is necessary in order to satisfy exogenously given final demand. The basic equation of the model looks as follows

$$\mathbf{x} = \left(\mathbf{I} - \mathbf{A}^D\right)^{-1}\mathbf{f} \tag{1}$$

Where $\mathbf{x}$ stands for a total production vector, $\mathbf{f}$ for a final demand vector and $\mathbf{A}^D$ for a matrix of input coefficients. The upper index *D* indicates the use of domestic intermediate products. Matrix $\left(\mathbf{I} - \mathbf{A}^D\right)^{-1}$ is called Leontief inverse and its elements represent the amount of production from industry *i* that is necessary to satisfy one unit of final demand for commodities from industry *j*. Detailed description of the properties and assumptions behind the input-output model can be found in Miller and Blair (2009).

If we assume fixed proportions between labour requirements and total production by industries, that can be expressed in following way

$$l_j = \frac{e_j}{x_j}, \quad j = 1 \ldots n \tag{2}$$

then the model can be augmented for the effects of final demand on total employment in the economy. The elements of vector $\mathbf{l} = \{l_j\}$ are direct labour coefficients computed as a ratio between employment in industry *j* and total production of industry *j*. The inverse value of direct labour coefficients is a labour productivity. Augmented input-output model then takes this form

$$E = \mathbf{l}'\left(\mathbf{I} - \mathbf{A}^D\right)^{-1}\mathbf{f} \tag{3}$$

where E is a total employment in the economy. There are three determinants of the employment given by equation (3): labour requirements per one unit of production (inverse of labour productivity), structure of the production represented by Leontief inverse matrix, and final demand vector $\mathbf{f}$. Further, we can decompose the input coefficient matrix $\mathbf{A}^D$ into two components and final demand vector $\mathbf{f}$ into three components. The use of domestic intermediate products per unit of production is given by the total use of intermediate products and corresponding share of domestic intermediates on total inputs. Thus, matrix $\mathbf{A}^D = \mathbf{D} \circ \mathbf{A}^T$, where $\mathbf{D}$ is a matrix of import shares of domestic products, $\mathbf{A}^T$ is a matrix of total input coefficients based on domestic and imported commodities and symbol $\circ$ represents the element-wise multiplication of the matrices (Hadamard product). Input-output tables provide the information about the final demand according to industries as well as final demand categories (final consumption expenditures of households, final consumption of government, gross capital formation and export). So, we can calculate the share of each final demand category on final demand $\mathbf{s}$ and the share of each industry on total final demand of particular final demand category $\mathbf{B}$. Final demand vector is then given by this expression $\mathbf{f} = \mathbf{Bs}F$, where F is the total volume of final demand. Taking these factors explicitly into account, we can rewrite the equation (3) like this

$$E = \mathbf{l}'\left(\mathbf{I} - \mathbf{D} \circ \mathbf{A}^T\right)^{-1} \mathbf{B}\mathbf{s}F \qquad (4)$$

From equation (4) if follows, that the total employment in economy depends explicitly on six factors. The volume of final demand F is just one of these determinants. We will elaborate more on this in the following sections.

2.2 Multiplicative structural decomposition analysis

Structural decomposition analysis aims at disentangling an aggregate change in a variable into its n factors. It can be done in additive form where the aggregate change in variable is the difference between its value in comparison period 1 and value in base period 0 ($\Delta V = V_1 - V_0$), or in a multiplicative form ($DV = \frac{V_1}{V_0}$). We will focus on multiplicative decomposition while our goal is to decompose the index of employment growth into the contribution of particular determinants. We can illustrate the decomposition into 2 factors o prices and quantities. Let's assume there is a price vector $\mathbf{p}_1$ and vector of quantities $\mathbf{q}_1$ in comparison period and corresponding vectors of prices $\mathbf{p}_0$ and quantities $\mathbf{q}_0$ in base period. Then, the aggregate value V in both periods equals to

$$\begin{aligned} V_1 &= \mathbf{p}_1'\mathbf{q}_1 \\ V_0 &= \mathbf{p}_0'\mathbf{q}_0 \end{aligned} \qquad (5)$$

The aggregate change in a multiplicative form is thus given by

$$DV = \frac{V_1}{V_2} = \frac{\mathbf{p}_1'\mathbf{q}_1}{\mathbf{p}_0'\mathbf{q}_0} \qquad (6)$$

Structural decomposition analysis aims at decomposition of equation (6) into the contribution of the change in prices and quantities. The first elementary decomposition equals to

$$DV = \frac{\mathbf{p}_1'\mathbf{q}_0}{\mathbf{p}_0'\mathbf{q}_0} \times \frac{\mathbf{p}_1'\mathbf{q}_1}{\mathbf{p}_1'\mathbf{q}_0} = P^L \times Q^P \qquad (7)$$

The change in prices is weighted by quantities from the base period while the change in quantities is weighted by prices in the comparison period. This decomposition is exact because the multiplication of both factors leads to the aggregate change. In index number theory, the first term is the Laspeyres price index and the second one the Paasche quantity index. The second elementary decomposition is obtained by reversing the time periods in the weights.

$$DV = \frac{\mathbf{p}_1'\mathbf{q}_1}{\mathbf{p}_0'\mathbf{q}_1} \times \frac{\mathbf{p}_0'\mathbf{q}_1}{\mathbf{p}_0'\mathbf{q}_0} = P^P \times Q^L \qquad (8)$$

Now, the change in prices is weighted by quantities in comparison period, the Paasche price index, and the change in quantities is weighted by prices in the base period, the Laspeyres quantity index.

Neither the first nor the second decomposition can be preferred to the other one from theoretical point of view. On the other side it is obvious that the contribution of the factors differs. The typical solution adopted in structural decomposition analysis is to take the geometric mean of the two elementary decompositions.

$$DV = \left(P^L \times P^P\right)^{1/2} \left(Q^P \times Q^L\right)^{1/2} = P^F \times Q^F \qquad (9)$$

The first term is the Fisher price index and the second one is the Fisher quantity index. This decomposition meets the requirement of time reversal as well as of factor reversal (De Boer 2009).

2.3 Multiplicative structural decomposition analysis of employment changes

If we use an index 1 for a comparison period and index 0 for a base period then the index of employment between two periods is given by

$$\frac{E_1}{E_0} = \frac{\mathbf{l}_1' \left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1} \mathbf{B}_1 \mathbf{s}_1 F_1}{\mathbf{l}_0' \left(\mathbf{I} - \mathbf{D}_0 \circ \mathbf{A}_0^T\right)^{-1} \mathbf{B}_0 \mathbf{s}_0 F_0} \qquad (10)$$

The overall change in employment, measured as employment index, is given by the change in six factors described above, such that

$$D_E = \frac{E_1}{E_0} = D_l \times D_D \times D_A \times D_B \times D_s \times D_F \qquad (11)$$

where D_E - the index of employment

D_l - weighted change in labour productivity (or direct labour intensity)

D_D - weighted change in import shares

D_A - weighted change in total input coefficient matrix

D_B - weighted change in final demand structure by industries

D_s - weighted change in final demand structure by sectors (by final demand categories)

D_F - weighted change in final demand volume.

The first polar decomposition starts with the weights in the base period for the first factor and ends with the weights in the comparison period for the last factor. In this way, the first polar decomposition takes following form

$$D_l^1 = \frac{\mathbf{l}_1' \left(\mathbf{I} - \mathbf{D}_0 \circ \mathbf{A}_0^T\right)^{-1} \mathbf{B}_0 \mathbf{s}_0 F_0}{\mathbf{l}_0' \left(\mathbf{I} - \mathbf{D}_0 \circ \mathbf{A}_0^T\right)^{-1} \mathbf{B}_0 \mathbf{s}_0 F_0}$$

$$D_D^1 = \frac{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_0^T\right)^{-1}\mathbf{B}_0\mathbf{s}_0F_0}{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_0 \circ \mathbf{A}_0^T\right)^{-1}\mathbf{B}_0\mathbf{s}_0F_0}$$

$$D_A^1 = \frac{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_0\mathbf{s}_0F_0}{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_0^T\right)^{-1}\mathbf{B}_0\mathbf{s}_0F_0}$$

$$D_B^1 = \frac{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_1\mathbf{s}_0F_0}{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_0\mathbf{s}_0F_0}$$

$$D_s^1 = \frac{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_1\mathbf{s}_1F_0}{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_1\mathbf{s}_0F_0}$$

$$D_F^1 = \frac{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_1\mathbf{s}_1F_1}{\mathbf{l}_1'\left(\mathbf{I} - \mathbf{D}_1 \circ \mathbf{A}_1^T\right)^{-1}\mathbf{B}_1\mathbf{s}_1F_0} \qquad (12)$$

The second polar decomposition is obtained by reversing the index for weights. So factors weighted by base period become weighted by comparison period and the other way round. In this way, we decompose the overall change in employment D_E into the contribution of $D_l^2, D_D^2, D_A^2, D_B^2, D_s^2$ and D_F^2 (where upper index indicates the second polar decomposition).

From these two polar decompositions we obtain the final decomposition calculating the geometric mean for contribution of each factor. This leads to decomposition based on Fischer index. The contribution of the change in labour productivity is for example given by $D_l^F = \left(D_l^1 \times D_l^2\right)^{1/2}$. The final decomposition presented in the paper is thus given by following formula

$$D_E = \frac{E_1}{E_0} = D_l^F \times D_D^F \times D_A^F \times D_B^F \times D_s^F \times D_F^F \qquad (13)$$

where the upper index indicates the Fisher index decomposition.

3 Empirical analysis

The use of structural decomposition approach allows us to elaborate the influence of particular determinants to employment development. Among most interested determinants is the contribution of labour intensity (inverse relationship to labour productivity), contribution of change in economic structure and contribution of change in final demand. However, such decomposition would provide just limited view to influence of mentioned factors. In further process of disaggregation of particular

factors influence we enriched the previous factor of economic structure change with contribution of import share of intermediate consumption on total intermediate consumption. The factor of final demand change was divided to three components. Change in structure of final demand by industries, change in final demand by sectors and changes in final demand by volume of final demand.
For better understanding of results, the whole period of years 1995 – 2008 has been split into two qualitatively different periods. First is 1995 – 2002 is characteristic by decay of transformation process from central planned to market oriented economic system. The second period 2003 – 2008 is characterized by favourable development of economic growth across whole V4 group. After analysis of these two sub-periods results are interpreted for the whole period 1995 – 2008 in order to obtain conclusive results.
Original results of structural decomposition are expressed in indices due to use of multiplicative form of decomposition.[3] Multiplication of indices among themselves must be equal to values of employment growth index. This feature of decomposition allows the creation of various development scenarios where abstraction of development in certain variables is employed. This means creation of such scenarios where one or more variables remain at same value as they were at the beginning of analysed period.

3.1 Contribution of labour productivity changes

Catching up process of technological gap to developed western countries has played significant role on employment development during early stages of transformation. Such technological gap and its continuous diminishing reflected in strong increase of labour productivity growth. From overall point of view the increase in labour productivity has positive influence on growth of added value, but from employment point of view such strong growth of labour productivity hampers adequate growth of employment.
Table 1 shows that during first period 1995 – 2002 the average annual employment growth was negative in 3 out of 4 countries in V4 group. Only Hungary experienced positive average annual growth of employment mainly due large increase of employment growth in years 1998 – 2000. This increase was mainly caused as result of stability measures adopted in previous years when economy was experiencing strong internal and external imbalance. Following slowdown and quick recovery of economy encouraged employment growth in following years 1998 – 2000.
The most hampering effect on employment growth was contribution of labour productivity changes in Poland. With certain level of abstraction and omitting positive influence of labour productivity growth on economy we can conclude that changes in labour productivity lowered average growth of employment by 4.5 % a year. Very similar to Poland was this effect in Czech Republic and Slovakia with average value of 4 %.
Second period 2003 – 2008 can be mainly characterized by very positive trend in economic growth. Employment was developing at substantially better characteristics. Annual average growth of employment reached in Poland level above 2 %. If Hungary experienced in first period positive average annual employment growth and rest of countries negative, the situation in second period turned around. Only Hungary had annual average decline of total employment by 0.4 %. Slovakia was successful in area of employment growth with average growth 1.6 % a year. This growth could be even stronger if there would not be a rapid growth of labour productivity which lowered average employment growth by more than 4 % a year. It was the largest effect among countries in the whole V4 group.
From the period 1995 – 2008 perspective we can conclude that overall growth of employment was very close to zero percent a year in all four countries in Visegrad group. Average annual employment

[3] Results used here are for better understanding expressed in percentage.

growth was between 0.2 – 0.4 %. The negative impact of labour productivity growth on employment growth performance was recorded in this period as well. In case of Slovakia the productivity growth crippled employment growth by 4 % a year. Similar results can be observed for development in Czech Republic and Poland. In Hungary, the analysed effect was equally negative, but in comparison to other countries of V4 significantly lower.

The results prove that labour productivity development is one of crucial determinants of employment changes in V4. However, sole labour productivity is not able to explain employment behaviour and further determinants need to be included into analysis.

Table 1: Year-on-year employment growth in V4 (1995 – 2008, %)

	Czech Republic	Hungary	Poland	Slovakia
	% growth of employment			
1996/1995	0.91	0.12	1.94	2.08
1997/1996	0.19	-0.09	2.78	-1.03
1998/1997	-1.54	1.75	2.34	-0.47
1999/1998	-3.42	2.72	-2.69	-2.53
2000/1999	-0.18	1.00	-2.33	-1.95
2001/2000	0.46	-0.44	-5.48	0.58
2002/2001	0.56	-0.19	-3.02	0.09
2003/2002	-1.35	0.07	-1.16	1.08
2004/2003	0.34	-1.44	1.23	-0.23
2005/2004	1.04	-0.24	2.19	1.61
2006/2005	1.94	0.62	3.24	2.08
2007/2006	2.66	-0.30	4.43	2.09
2008/2007	1.24	-1.28	3.78	2.95
1995-2002	**-0.44**	**0.69**	**-0.97**	**-0.47**
2003-2008	**0.97**	**-0.43**	**2.27**	**1.59**
1995-2008	**0.21**	**0.21**	**0.41**	**0.41**

Source: WIOT, authors' calculations

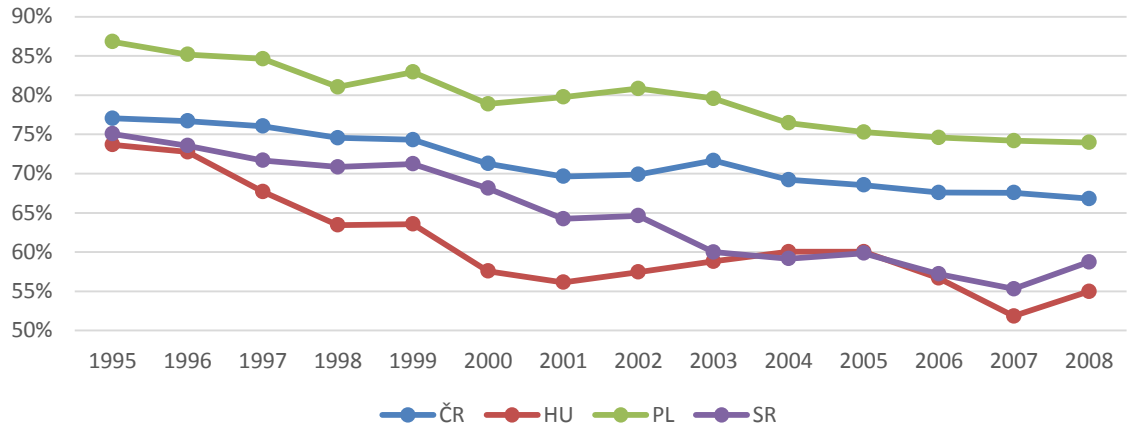
3.2 Contribution of structural changes

As mentioned above, labour productivity was just one of factors with influence on employment. The changing economy structure has also played significant role in the process among other variables. Such influence of economic change was further divided into two specific factors. The first is the share of intermediate consumption of imported products on the total intermediate consumption. Second one is overall change of economy structure (as direct and indirect effects) which can be expressed by means of input-output analysis.

The first factor has an intuitive economic interpretation. The larger share of imported intermediate products from abroad for final production, then the contribution to the employment is lower, because domestic demand for intermediate products generates employment abroad. There is large number of reasons for such development. One of them is cheaper labour costs or overall price competitiveness of intermediate consumption products abroad, when there are more benefits for manufacturers to import such products then to produce them by themselves. Another possible reason is when manufacturer has no cost advantage in production of all subcomponents in domestic country due the capacity reasons and decide to focus its production just on more sophisticated goods. Then remaining low sophisticated products are left to be produced by subcontractors elsewhere abroad. Whether first or second motive prevails the final effect for employment

development is the same: larger share of imported intermediate products reduces employment growth in domestic country.

Figure 1: Development of percentage share of domestic intermediate consumption on total intermediate consumption in V4 countries (%, 1995 – 2008).



Source: WIOT, authors' calculations.

View on the development of domestic intermediate consumption share on total intermediate consumption points out negative trend when in each involved country the share of imported intermediate consumption products was gradually increasing. From the overall economy point of view, such development represents positive effect of increasing international trade, but from the employment point of view, this development was deteriorating the possible employment growth. In first period 1995 – 2002, the contribution of import changes had the largest effect in Hungary. The other V4 countries showed a negative contribution of this development as well with average size of effect around 0.8 %. This means that import was lowering the employment growth on average of 0.8 % per year. In the second period 2003 – 2008, however, the size of this determinant contribution decreased and lowered employment growth approximately by 0.5 % per year.

In the entire period view (1995 – 2008) had this factor negative impact on employment growth with largest effect in Hungary, where the average contribution to employment changes was around 1 %. Slightly lower values, even though still negative, were reported also in other countries of V4 group. Based on these results, we can classify the development of intermediate products import as not that important determinant to the employment growth as changes in labour productivity (in terms of magnitude), however the employment is still negatively affected by its development.

The second factor when considering changes in the economy structure is the change of links within the economy among all sectors. The structure of links among the sectors is expressed in Leontief inverse matrix, which indicates how much of product in *i-th* sector must be produced in order to supply one more unit of final demand in the *j-th* sector (Miller a Blair, 2009). The change itself in Leontief inverse matrix represents the change of technology used by various sectors and how they evolve over time.

When observing the impact of changes in technology that have been used in an economy, the only country where the changes have had positive impact on employment development is the Czech Republic. Especially in the first period, changes in technology affected employment growth positively in magnitude about 1 % per year. In the second period, such positive effect almost disappeared and

came close to insignificant values. On the contrary, the contribution of changes in technology was negative in the remaining V4 countries although its size was only marginal. The only exception was contribution of this variable in second period in SR when originally almost insignificant contribution grew to a value over 1%.
In total we can conclude that the contribution of changes in the level of technology used by economy is almost insignificant regarding to employment effects especially in Hungary and Poland. However, in Czech Republic was the average contribution of technology change to employment approximately 0.5 %. Slovakia reached similar values to Czech Republic in magnitude, but in the opposite trend.

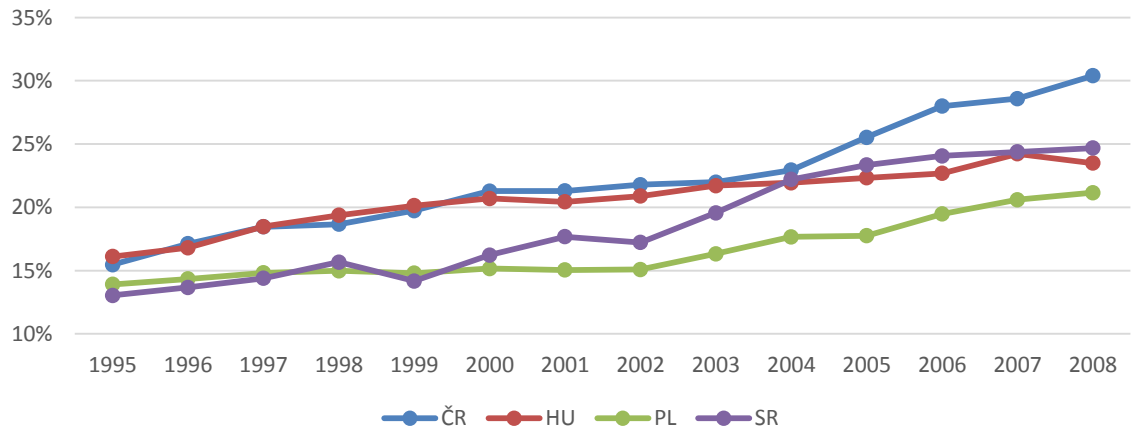
3.3 Contribution of final demand changes

The last determinant of employment development included in our analysis is contribution of final demand changes. But this specification is too bold for our analysis and further disaggregation to more detailed three determinants is necessary. Changes in final demand can evolve in three dimensions.

3.3.1 Changes in industrial structure of final demand

The first dimension is change in industrial structure of final demand. It represents how the production was produced within all industries. Every V4 economy went through some changes with gradual development of certain industries that have become pillars of the economy. In the case of the V4 countries there was significant inflow of FDI, mainly in the manufacturing.
Transformation process which took place in all V4 countries did not contributed to employment growth positively. Partly due the situation when the transformed companies were exposed to global competition many of them went bankrupt. Partly because transformation process led indirectly to structural change of economy with similar negative effect on employment. Labour intensive branches in manufacturing, such as textile industry gradually disappeared and were replaced by new branches, which are characteristic by their lower labour intensity of production. Manufacturing of vehicles or electronic and optic equipment can be included into these "new" industries.

Figure 2: Development of industry added value share on total added value in V4 (%, 1995 – 2008).



Source: WIOT, authors' calculations.

This change has negatively affected employment development in all V4 countries during first period 1995 – 2012. But mostly in Hungary and Slovak Republic, where the average annual contribution of

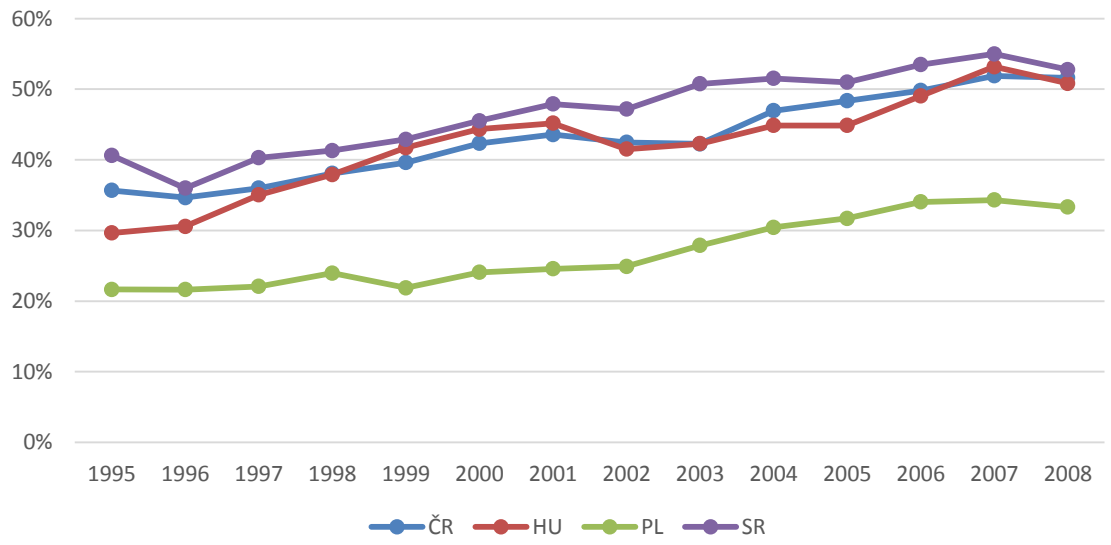
this determinant deteriorate employment growth by more than 1 % per year. In the second period 2003 – 2008, the negative contribution to employment growth slowed down to level 0.6 % per year in all countries expect Slovakia where sectorial structural change weakened employment development by approximately 1.3 % per year. By extending the decomposition to total period 1995 – 2008 we can conclude that negative tendencies which occurred had largest impact on employment development in Slovakia and in the first period on Hungary. In Czech Republic and Poland such industrial structural change did not have substantial impact on employment development, although it is still necessary to take into account at least not positive influence of determinant at all.

3.3.2 Changes in sectorial structure of final demand

Three out of four V4 countries gradually became small open economics with significant part of their production meant for export. Only Poland represents with its size major independent economy where domestic demand prevails upon export. This is confirmed in figure 3 where significant and rapid growth of export share on total production can be identified in case of Slovakia, Czech Republic and Hungary. Poland shares same growth as other countries, but at substantially lower level.

As the role of export sector was becoming more and more important in the structure of V4 countries, consequently the level of domestic demand share was declining. This is in line with previous findings about small open economies of V4. The highest change dynamics in export a domestic demand occurred in Hungary, when export sector grew at the highest rates and domestic demand dramatically declined.

Figure 3: Development of export share on total final demand in V4 (%, 1995 – 2008).



Source: WIOT, authors calculations.

Habrman (2014) concludes that export oriented industries are generating less jobs than industries oriented for domestic demand production. Our results support such findings, because mainly increase in export sector and decline of domestic demand share on total production led to negative contribution of sectorial structure change to development of employment. The strongest effect was recorded in Hungary where this determinant was deteriorating employment growth by more than 1 % per year. On the other hand, this sectorial structure change had no significant influence on

employment in Slovakia. This changed in second period 2003 – 2008 which became known for rapid growth of export sector. That resulted in negative contribution to employment growth on average by 1.5 % per year.
In total period 1995 – 2008 this determinant became similarly significant as previous change in industrial structure. The strongest impact was recorded in Hungary and Slovakia (mainly due significant growth in second period). Czech Republic was affected by this structural change as well, but with lower strength. Relatively lower ratio of export to total production in Poland caused the lowest impact of the change among all V4 countries in first and also in second period.

3.3.3 Changes in volume of final demand

The last dimension which was analysed in case of structural change of final demand was its volume. It can be vaguely perceived as economic growth of country measured by GDP, even though they are not the same categories. GDP measured by expenditure way similarly to final demand includes final consumption, gross capital formation and export, but in case of GDP import is subtracted from export so final value differs from final demand category. However, with certain level of caution, results can be interpreted as substitute of economic growth itself.
Results of decomposition clearly refer to change of final demand as only determinant with positive contribution to employment change in V4 countries expect Czech Republic. There was also secondary positive contribution to employment recorded in change of technologies expressed in Leontief inverse matrix. Average annual contribution of volume change was highest in Hungary during first years 1995 – 2002. The value of this contribution exceeded 8 % what represent potential growth of employment per year in scenario where no structural change or productivity growth would appear. Other countries experienced significant potential growth of employment due the volume changes. In Czech Republic at level 4 % per year, in Slovakia even higher 6 % per year. Second period 2003 – 2008 is known for strong economic growth spread across all V4 countries. Especially Slovakia was growing by that time very quickly. Even though the country was growing very fast, its effect on employment growth was in comparison just marginal. Average potential growth of employment was almost 11 % per year, but employment growth was just 1.6 %. This very positive effect was blocked by all other determinant contributing negatively what resulted in very small increase of employment rate. In the second period 2003 – 2008 the contribution of volume change in Hungary remained still positive, but on significantly lower level 4 % per year what reflects its relatively weaker economic performance in this period of time. Remaining countries Czech Republic and Poland increased the level of this contribution to almost 7 % per year.
In total the contribution of volume change of final demand was very strong positive determinant of employment growth in every V4 country. The highest effect was recorded in Slovakia due to rapid economic growth of country in second period. Poland, Hungary and Czech Republic benefited from rapid economic growth as well, but with lower pace by 2 – 3 percentage points. Such huge contributions of volume change contributed to employment growth just potentially. All other determinants were acting against employment growth what resulted in very mild and relatively poor results on labour market in V4 countries.

4 Conclusions

In recent years, the jobless growth phenomenon received much attention both in media and academic literature. While this phenomenon prevailed in many developed countries to some extent it has been even more pronounced in V4 countries over the past decade. High economic growth in these countries led to increases in employment to some extent but the employment elasticity in these countries ranks amongst the lowest ones. A general explanation "blames" the labour productivity

growth as a main determinant behind the low employment elasticity. This then leads to contradictory policy conclusions. On the one hand side, it is argued that these countries need high labour productivity growth in order to close the technological gap with respect to most advanced countries, on the other hand, it is argued that lower labour productivity growth would be more favourable to employment growth. In this paper we show that besides labour productivity growth some other factors play an important role in labour elasticity determination as well. Among these, the changes in the structure of production and changes in final demand structure (both at industry and sector level) are very important. These results provide more policy options that could go beyond the trade-off between labour productivity growth and employment growth. We list just two policy recommendations. First, higher share of intermediate products delivered by domestic suppliers could strengthen the link between final demand growth and employment growth. Second, the support of various services for industrial production could mitigate the problem with low labour elasticity to much extent.

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APPENDIX

Table 2 Structural decomposition analysis of employment growth in the Czech Republic, 1995-2008

	Employment growth index	Changes in labor productivity	Changes in import of intermediates	Changes in the structure of production	Changes in the industrial final demand structure	Changes in the final demand structure by sectors	Change in the final demand volume
1996/1995	1.0091	0.9522	0.9996	1.0145	1.0041	0.9969	1.0441
1997/1996	1.0019	0.9746	0.9888	1.0209	0.9906	0.9993	1.0287
1998/1997	0.9846	0.9727	0.9918	1.0103	0.9977	0.9920	1.0206
1999/1998	0.9658	0.9633	0.9865	0.9979	0.9941	0.9981	1.0264
2000/1999	0.9982	0.9580	0.9749	0.9975	0.9856	0.9964	1.0909
2001/2000	1.0046	0.9439	0.9992	1.0113	0.9945	0.9962	1.0631
2002/2001	1.0056	0.9727	1.0024	1.0087	0.9928	1.0024	1.0274
2003/2002	0.9865	0.9333	0.9959	1.0180	0.9996	0.9987	1.0443
2004/2003	1.0034	0.9604	0.9853	1.0006	0.9892	0.9836	1.0891
2005/2004	1.0104	0.9679	1.0024	0.9872	0.9972	0.9928	1.0657
2006/2005	1.0194	0.9384	0.9973	1.0063	0.9911	0.9883	1.1051
2007/2006	1.0266	0.9579	0.9961	1.0102	0.9942	0.9882	1.0841
2008/2007	1.0124	1.0001	0.9912	0.9917	0.9912	0.9967	1.0424
1995-2002	**0.9956**	**0.9624**	**0.9919**	**1.0087**	**0.9942**	**0.9973**	**1.0428**
2003-2008	**1.0097**	**0.9594**	**0.9947**	**1.0023**	**0.9937**	**0.9914**	**1.0715**
1995-2008	**1.00021**	**0.9610**	**0.9932**	**1.0057**	**0.9940**	**0.9946**	**1.0559**

Table 3 Structural decomposition analysis of employment growth in Hungary, 1995-2008

	Employment growth index	Changes in labor productivity	Changes in import of intermediates	Changes in the structure of production	Changes in the industrial final demand structure	Changes in the final demand structure by sectors	Change in the final demand volume
1996/1995	1.0012	0.9796	0.9953	1.0044	0.9957	0.9957	1.0312
1997/1996	0.9991	0.9773	0.9761	0.9945	0.9725	0.9900	1.0938
1998/1997	1.0175	0.9766	0.9799	0.9970	0.9835	0.9813	1.1050
1999/1998	1.0272	0.9718	0.9975	0.9972	0.9739	0.9864	1.1062
2000/1999	1.0100	0.9526	0.9641	1.0031	0.9733	0.9763	1.1538
2001/2000	0.9956	0.9581	0.9970	0.9958	1.0097	0.9945	1.0424
2002/2001	0.9981	0.9971	0.9960	0.9924	0.9975	1.0039	1.0114
2003/2002	1.0007	0.9756	1.0025	0.9979	0.9891	0.9997	1.0370
2004/2003	0.9856	0.9449	0.9921	1.0030	1.0027	0.9894	1.0566
2005/2004	0.9976	0.9570	1.0036	1.0056	1.0006	0.9860	1.0468
2006/2005	1.0062	0.9597	0.9828	0.9989	0.9899	0.9821	1.0986
2007/2006	0.9970	1.0209	0.9869	0.9915	0.9762	0.9716	1.0522
2008/2007	0.9872	0.9590	0.9941	1.0129	1.0084	0.9992	1.0147
1995-2002	**1.0069**	**0.9732**	**0.9865**	**0.9978**	**0.9865**	**0.9897**	**1.0767**
2003-2008	**0.9957**	**0.9692**	**0.9936**	**1.0016**	**0.9944**	**0.9879**	**1.0507**
1995-2008	**0.9979**	**0.9715**	**0.9895**	**0.9994**	**0.9899**	**0.9889**	**1.0654**

Table 4 Structural decomposition analysis of employment growth in Poland, 1995-2008

	Employment growth index	Changes in labor productivity	Changes in import of intermediates	Changes in the structure of production	Changes in the industrial final demand structure	Changes in the final demand structure by sectors	Change in the final demand volume
1996/1995	1.0194	0.9612	0.9889	0.9947	0.9960	0.9970	1.0798
1997/1996	1.0278	0.9873	0.9901	0.9892	0.9898	0.9964	1.0778
1998/1997	1.0234	0.9744	0.9778	1.0008	1.0054	0.9914	1.0767
1999/1998	0.9731	0.9405	0.9929	0.9939	0.9937	1.0055	1.0493
2000/1999	0.9767	0.9516	0.9926	0.9944	0.9609	0.9969	1.0856
2001/2000	0.9452	0.9196	1.0063	1.0010	1.0146	0.9954	1.0104
2002/2001	0.9698	0.9519	0.9963	1.0045	0.9993	0.9990	1.0197
2003/2002	0.9884	0.9558	0.9973	0.9929	0.9924	0.9963	1.0562
2004/2003	1.0123	0.9715	0.9918	0.9894	0.9960	0.9928	1.0739
2005/2004	1.0219	0.9948	0.9991	0.9952	0.9938	0.9973	1.0424
2006/2005	1.0324	0.9640	0.9903	0.9951	0.9908	0.9914	1.1063
2007/2006	1.0443	0.9727	1.0048	1.0046	0.9883	0.9933	1.0834
2008/2007	1.0378	0.9836	0.9966	1.0015	0.9955	1.0001	1.0618
1995-2002	**0.9903**	**0.9550**	**0.9921**	**0.9969**	**0.9941**	**0.9974**	**1.0566**
2003-2008	**1.0227**	**0.9737**	**0.9967**	**0.9964**	**0.9928**	**0.9952**	**1.0705**
1995-2008	**1.0041**	**0.9630**	**0.9940**	**0.9967**	**0.9935**	**0.9964**	**1.0625**

Table 5 Structural decomposition analysis of employment growth in Slovakia, 1995-2008

	Employment growth index	Changes in labor productivity	Changes in import of intermediates	Changes in the structure of production	Changes in the industrial final demand structure	Changes in the final demand structure by sectors	Change in the final demand volume
1996/1995	1.0208	0.9405	0.9873	1.0064	0.9934	0.9949	1.1052
1997/1996	0.9897	0.9228	0.9941	1.0014	1.0146	0.9923	1.0699
1998/1997	0.9953	0.9627	0.9999	0.9901	0.9763	1.0029	1.0666
1999/1998	0.9747	0.9904	1.0016	1.0029	0.9823	1.0174	0.9803
2000/1999	0.9805	0.9762	0.9732	0.9896	0.9818	1.0018	1.0603
2001/2000	1.0058	0.9563	0.9783	0.9998	0.9860	1.0019	1.0883
2002/2001	1.0009	0.9610	1.0027	0.9991	0.9897	0.9948	1.0559
2003/2002	1.0108	0.9897	0.9901	0.9681	0.9794	0.9935	1.0950
2004/2003	0.9977	1.0047	0.9867	0.9664	0.9892	0.9695	1.0859
2005/2004	1.0161	0.9362	1.0003	0.9993	1.0031	0.9905	1.0928
2006/2005	1.0208	0.9331	0.9915	0.9941	0.9717	0.9814	1.1638
2007/2006	1.0209	0.9386	1.0012	0.9974	0.9842	0.9784	1.1311
2008/2007	1.0295	0.9548	0.9990	1.0062	0.9940	0.9956	1.0839
2009/2008	0.9747	1.0440	1.0132	1.0164	1.0045	1.0227	0.8825
1995-2002	**0.9953**	**0.9583**	**0.9910**	**0.9985**	**0.9891**	**1.0008**	**1.0603**
2003-2008	**1.0159**	**0.9591**	**0.9948**	**0.9885**	**0.9869**	**0.9848**	**1.1084**
1995-2008	**1.0041**	**0.9587**	**0.9926**	**0.9942**	**0.9882**	**0.9939**	**1.0806**