Investigating the relationship between employment and real economic activity

Even though the growth rate of the Slovak GDP is markedly lower than in the pre-crisis period, it is sufficient to spur a comparable growth of employment on an aggregate level. Given the institutional and structural changes brought about by the 2008-2009 economic crisis, we find it necessary to revisit the relationship between the real economic activity and employment implied by the Okun's law and investigate its implications for future development in the labour market. We found that the relation varies to a considerable extent over time – elasticities of employment with respect to the real economic activity increased during the 2008-2009 crisis and the estimates of break-even point (i.e. a rate of real economic growth that leads to a zero growth of employment) declined from values close to 3 % to values between 1.3 % and 1.8 %.

Identified changes in the relationship can be mainly explained by the long-run economy-wide shift from industrial sectors toward more labour-intensive sector of services. This structural shift makes the employment more sensitive to the growth of GDP especially when the economic growth is generated by the domestic demand as opposed to the growth led by the foreign demand. Also, the substantial reduction of the number of employees during the crisis may have led to a situation when the employers are quite willing to rehire some employees when even a mild recovery occurs in order to restore more operational conditions. Therefore, a part of the post-crisis decline of the break-even point can be only temporary.

Introduction

Recent period of world-wide economic difficulties and unprecedented changes in the world economy incited renewed interest in the well-known relationship between real economic activity and unemployment known as **Okun's law**, equally in the academic as well as in the professional circles. Its common rule-of-thumb formulation says that a **2-3% increase of real output leads to a decline of unemployment by approximately 1%**. The relationship was identified by Arthur Okun in the data of the U.S. economy in 1962 and its stability in time as well as its applicability to other economies is continuously examined in the literature ever since. While some authors, such as Ball et al. (2012), confirm the stability of the Okun's law in time, others, like Anderton et al. (2014), find statistically significant changes and suggest that the sources of the economic growth matter for the labour market implications. Since the export industries are usually less labour-intensive in the developed economies, an increase in the foreign demand affects the employment to a smaller extent than domestic (especially private consumption) demand that strongly affects the labour-intensive sector of services.

In this analytical commentary, **we investigate the relationship between the real economic activity and employment in the Slovak economy**. We are mainly interested in the job creation consequences of Okun's law and that is why we abstain from examining the original specification with unemployment. Based on the estimated Okun's relationship between employment and real GDP, we then calculate the so called **break-even point**[1]

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[1] The break-even point is calculated as minus intercept divided by the sum of the remaining model coefficients (elasticities with respect to real GDP).

(BEP). It is a value of **annual rate of real GDP growth that would lead to a zero growth of employment in the long run**. Values around 3 % are commonly assumed in the Slovak economy. We will investigate the stability of the relationship in time as well as its sector-dependent implications.

Methodology and data

We estimate the **relationship between the economic activity and employment** using quarterly and annual growth rates (QoQ and YoY), see equation 1. The development of the growth rate of employment is explained by the contemporaneous and lagged[2] growth rate of economic activity. Statistically insignificant variables are then omitted from the model.

$$\Delta \ln L_t = \alpha + \beta_0 \Delta \ln Y_t + \beta_1 \Delta \ln Y_{t-1} + \beta_2 \Delta \ln Y_{t-2} + \beta_3 \Delta \ln Y_{t-3} + \beta_4 \Delta \ln Y_{t-4} + \varepsilon_t \qquad (1)$$

This model specification captures the dynamics of the analyzed time series and, unlike the specification in levels, it does not require the estimation of natural (or potential) levels. Since the potential levels may change over time, the relationship specified in relative changes is more robust and was preferred.

As a measure of employment we used the seasonally adjusted time series of ESA employment – heads. As a measure of economic activity a seasonally adjusted time series of real GDP, real domestic demand and real exports together with Gross value added by sectors were used. The data covered the period between 1997Q1 and 2014Q3.

Stability of the relation between employment and GDP

First we looked at the relationship between the employment and real GDP. Results of the estimations are presented in Tables[3] 1 and 2. The models are estimated on different time horizons in order to assess the stability of given relationship.

Table 1 Results of estimation by period (QoQ data, GDP)

QoQ	Total employment				Employment in private sector			
	$\bar{R}^2$	sum coeff.	intercept	BEP	$\bar{R}^2$	**sum coeff.**	intercept	**BEP**
1998Q2-2014Q3	0.39	0.44	-0.33	3.02	0.37	**0.54**	-0.40	**2.98**
2005Q1-2014Q3	0.69	0.46	-0.25	2.21	0.60	**0.54**	-0.29	**2.15**
2008Q1-2014Q3	0.72	0.61	-0.28	1.80	0.68	**0.74**	-0.34	**1.85**
2010Q1-2014Q3	0.49	0.84	-0.32	1.50	0.32	**0.71**	-0.23	**1.28**

Source: SO SR, NBS calculations.

Based on the models working with **QoQ** growth rates, the **elasticity of private[4] employment with respect to GDP increased during the 2008-2009 crisis**. On the interval 2005Q1-2014Q3 we get values of approx. 0.5 while for post-crisis period between

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[2] Using the U.S. data, Ball et al. (2012) found that the explanatory variables in their model are statistically significant for a maximum lag of two quarters. Due to a higher rigidity of the Slovak labour market, we start with a maximum lag of four quarters and then omit the statistically insignificant explanatory variables.

[3] $\bar{R}^2$ is the adjusted index of determination; sum coeff. represents the total effect of 1% increase in the QoQ (YoY) growth rate of GDP on employment; BEP is the break-even point expressed as YoY growth rate in per cent.

[4] Since the development of total employment is influenced by administrative measures (e.g. subsidized jobs and EU funds) and discretionary decisions of the government and not solely by the economic conditions, we find it more useful to look at the employment in the private sector.

2010Q1 and 2014Q3 we get values above 0.7.[5] Since the estimates of the intercept change in time as well as the remaining model parameters, the **break-even point declined** from 3 % to around 2 % in the pre-crisis period and further **to values around 1.3 %** after the crisis. Results for the total employment are roughly equivalent. However, the **BEP for the total employment** did not decline as significantly as in the private sector during the crisis and **is currently estimated at 1.5 %**.

Models estimated on **YoY** growth rates yield similar results[6]. Again, we can see an **increase in the elasticity of employment** with respect to GDP during the period of crisis and especially in the period of recovery after 2010. Estimates of the **BEP are virtually the same as in the QoQ alternative** in the long-run. However, in the more recent periods, the estimated BEP is estimated to be higher. In the period after the crisis the BEP is estimated close to 1.8 %.

Table 2 Results of estimation by period (YoY data, GDP)

YoY	Total employment				Employment in private sector			
	$\bar{R}^2$	sum coeff.	intercept	BEP	$\bar{R}^2$	**sum coeff.**	intercept	**BEP**
1999Q1-2014Q3	0.61	0.41	-1.24	3.05	0.58	**0.52**	-1.55	**2.98**
2005Q1-2014Q3	0.83	0.41	-0.91	2.22	0.82	**0.52**	-1.14	**2.21**
2008Q1-2014Q3	0.84	0.57	-1.17	2.05	0.83	**0.63**	-1.31	**2.07**
2010Q1-2014Q3	0.81	1.14	-2.12	1.86	0.87	**1.36**	-2.47	**1.82**

Source: SO SR, NBS calculations.

According to the quarterly average hours worked per employee[7], that are depicted in Figure 1, the intensive margin[8] of the labour supply in Slovakia is quite rigid (standard deviation 14.9 hrs.) and even more so after the year 2005 (standard deviation 4.6 hrs.). This means that **the variations in the economic activity are mostly reflected in the changes of the number of employed people rather than in the hours worked per employee.** Therefore, the increased rigidity of the average hours worked also suggests that the **elasticity of employment with respect to real output increased after 2005**, which is in line with our estimates presented above.

These observations are illustrated in Figure 2, which contains the development of the number of employees and total and average hours worked. We can see that the total hours worked declined faster than the number of employees **during the first half of 2009**, and thus, **the average hours worked per employee slightly declined. However, in the second half of 2009**, the total hours worked increased while the number of employees

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[5] This means that an increase of real GDP growth rate by 2 percentage points was needed for an acceleration of the employment growth by 1 percentage point before the crisis. Since the crisis, an increase of approx. 1.4 percentage points seems to be sufficient in order to generate the same effect.

[6] YoY models are estimated mainly to check the robustness of the obtained results. Some caveats apply in case of the YoY specification. The error term follows a MA(4) process, not a white noise, and there is also potential risk of multicollinearity of regressors.

[7] The ratio was calculated using the time series of seasonally adjusted quarterly ESA time series of the total quarterly hours worked by the employees and the number of employees in the economy.

[8] The hours worked per employee represent the *intensive margin* of the labour supply, while the number of employed people corresponds to the *extensive margin*.

continued to slide and **the average hours worked returned to the pre-crisis levels**.[9] Previous observations are also in line with the fact, that the share of part-time jobs in the Slovak economy is very small (approx. 4.5%). **Rigidity of working hours can**, therefore, **result in bigger and more painful job losses** during periods of weaker economic activity.

Figure 1 Average hours worked per employee
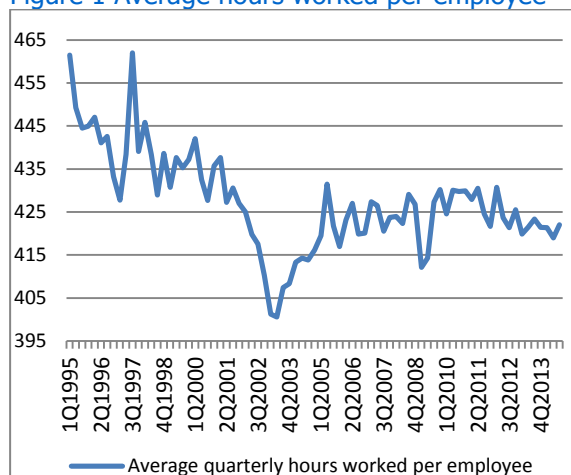
Figure 2 Average hours worked per employee (index, 2008Q3=100)
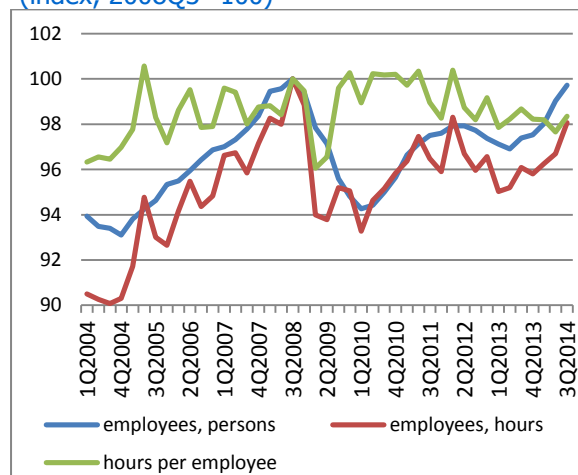
Overall, the changes of the elasticity of employment with respect to GDP as well as the decline of the BEP are considerable. In part, **the increasing sensitivity of employment** to the economic activity **could be explained by the institutional and legislative changes**. According to the OECD's employment protection indicator, which is presented in Figure 3, the flexibility of the Slovak labour market indeed increased in 2004 and 2012. The reduction of job protection makes it easier for the employers to dismiss redundant employees in times of lower demand, which in turn makes them more willing to hire additional employees in times when the demand is high.

Figure 3 Strictness of employment protection

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[9] Imagine a situation during the crisis, when the firm would be able to keep the number of employees unchanged only at the cost of large wage cuts. In an environment of downward wage rigidity and unavailability of part-time job contracts, the situation often resulted in more painful termination of the job contract.

Another possible explanation of the increased elasticity of employment with respect to the GDP is closely related to **the period of crisis and the development in the period of recovery**. While the GDP recovered relatively quickly and exceeded its pre-crisis peak in the second half of 2011, the employment has yet to regain its pre-crisis level (see Figure 4). On the other hand, the growth of employment between 2010Q3 and 2011Q2 and since 2013Q3 is comparable to the pre-crisis period while, at the same time, the growth rate of GDP is significantly lower than it was before the crisis (see Figure 5). This development would suggest that **the employers cut down the numbers of employees during the crisis as low as possible** (perhaps to a skeleton crew) and, even though they are still very cautious, (see period 2012Q2-2013Q2 in Figure 5) **they are now quite willing to rehire some employees** when even a mild recovery sets in.

Figure 4 Total employment and GDP since crisis (index, 100=2008Q4)
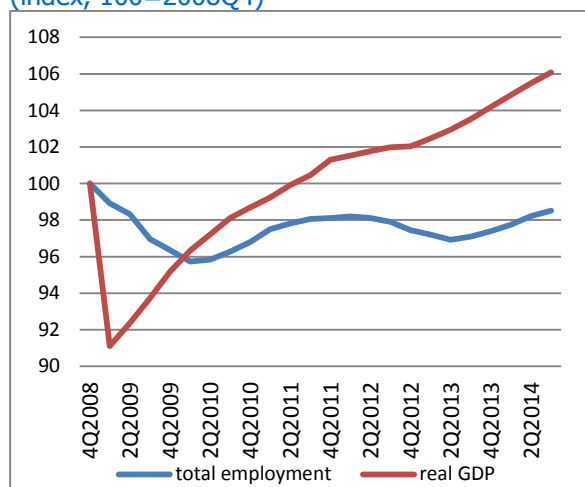
Source: SO SR, NBS calculations.

Figure 5 Total employment and GDP (QoQ growth rates, %)
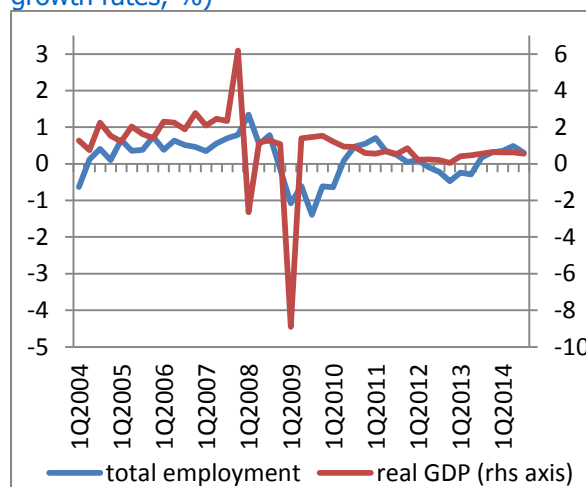
Source: SO SR, NBS calculations.

The role of domestic and foreign demand

In the following section, inspired by Anderton et al. (2014), we examine the importance of the sources of growth of the economic activity, i.e. whether the GDP growth is driven by domestic or foreign demand. The models considered in this section contain **two explanatory variables** – domestic demand (i.e. the sum of real private and government consumption and real investment) and foreign demand (proxied by the volume of real exports). Otherwise, the lag structure and elimination of statistically insignificant variables stays the same as in the previous section.

Results of the estimation are presented in Tables[10] 3 and 4. We find that in general the models with domestic and foreign demand as explanatory variables can explain the dynamics of employment better than the baseline models in previous section and achieve higher $\bar{R}^2$. In general, the **elasticity of employment with respect to domestic demand is estimated to be much higher** (0.2 − 0.6) **than the elasticity with respect to the foreign demand** (0 − 0.16). Anderton's explanation suggesting that this result is given by

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[10] $\bar{R}^2$ is the adjusted index of determination; sum dom. (for.) dem. coeff. represents the total effect of 1% increase in the QoQ (YoY) growth rate of domestic (foreign) demand on employment; BEP is the break-even point expressed as YoY growth rate in per cent, it is the growth rate of the economic activity that would lead to a zero growth of employment in the long run and can be calculated as –intercept/sum coeff., BEP1 – only domestic demand grows, BEP2 – only foreign demand grows, BEP3 – both demands grow, foreign demand grows twice as fast (a balanced growth in case of the Slovak economy).

the fact that the export industries are less labour-intensive than the sectors that are primarily driven by the domestic demand (e.g. services) seems to be also valid for the Slovak economy.

Table 3 Results of estimation by period (QoQ data, domestic and foreign demand)

Total employment	$\bar{R}^2$	sum dom. dem. coeff.	sum. for. dem. coeff.	intercept	BEP1	BEP2	BEP3
1998Q2-2014Q3	0.47	0.32	0.04	-0.22	2.81	20.18	2.20
2005Q1-2014Q3	0.64	0.21	0.10	-0.15	2.75	6.13	1.45
2008Q1-2014Q3	0.84	0.54	0.12	-0.19	1.40	6.12	0.96
2010Q1-2014Q3	0.59	0.40	0.10	-0.16	1.55	5.93	1.02
Employment in private sector	$\bar{R}^2$	sum dom. dem. coeff.	sum. for. dem. coeff.	intercept	BEP1	BEP2	BEP3
1999Q1-2014Q3	0.47	0.34	0.09	-0.30	3.63	14.03	2.39
2005Q1-2014Q3	0.60	0.32	0.11	-0.20	2.50	7.48	1.50
2008Q1-2014Q3	0.83	0.64	0.16	-0.25	1.57	6.33	1.05
2010Q1-2014Q3	0.53	0.40	0.00	0.16	-1.64	-	-1.64

Source: SO SR, NBS calculations.

The results of the model estimated on the **QoQ** data show an **increase in the elasticity of employment with respect to the domestic demand** in the period of 2008-2009 crisis and a slight correction afterwards. The estimates of the **elasticity with respect to the foreign demand** are **more stable** and after 2005 they oscillate in a narrow band around 0.1.[11] The **decline of the BEP**, which was observed in the previous section, is also present here but only in case of the growth of domestic demand. The estimates decline from approx. 2.5 % before the crisis to around 1.5 % in the period of recovery. Since 2005, The BEP of the economic growth driven by the foreign demand is estimated close to 6 %. Results obtained for the total employment and for the employment in the private sector are to a large extent analogous.

Table 4 Results of estimation by period (YoY data, domestic and foreign demand)

Total employment	$\bar{R}^2$	sum dom. dem. coeff.	sum. for. dem. coeff.	intercept	BEP1	BEP2	BEP3
1999Q1-2014Q3	0.71	0.25	0.06	-0.86	3.46	14.54	2.35
2005Q1-2014Q3	0.81	0.21	0.09	-0.67	3.14	7.58	1.72
2008Q1-2014Q3	0.96	0.47	0.12	-0.79	1.69	6.76	1.13
2010Q1-2014Q3	0.96	0.51	0.08	-0.46	0.90	5.45	0.68
Employment in private sector	$\bar{R}^2$	sum dom. dem. coeff.	sum. for. dem. coeff.	intercept	BEP1	BEP2	BEP3
1999Q1-2014Q3	0.74	0.37	0.08	-1.25	3.37	15.60	2.35
2005Q1-2014Q3	0.84	0.29	0.11	-0.90	3.14	8.06	1.77
2008Q1-2014Q3	0.97	0.54	0.17	-1.14	2.11	6.72	1.30
2010Q1-2014Q3	0.97	0.65	0.12	-0.61	0.95	5.29	0.70

Source: SO SR, NBS calculations.

Since the crisis, the models estimated on the **YoY** data show an **increasing elasticity of employment with respect to the domestic demand and to a smaller extent also**

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[11] However, the equation for the employment in private sector could not be estimated correctly on the post-crisis horizon. Effects of the foreign demand were estimated to be statistically insignificant and the intercept was estimated to be positive. This is probably a result of the small number of observations.

with respect to the foreign demand. The **BEP** of the economic growth that is driven by the domestic demand **declines** from pre-crisis estimates around 3 % to values near 1 %. The BEP of the economic growth driven by the foreign demand declines from approx. 8 % before the crisis to around 5.3 % in the period of economic recovery.

We found that the **employment in the Slovak economy is more sensitive to the development of domestic demand as compared to the foreign (export) demand.** Also, the **elasticity of employment with respect to the foreign demand and implied BEP is relatively more stable than the elasticities and BEP of the domestic demand.** It therefore appears to be the **development in the labour-intensive sectors of the Slovak economy (services)** that **is the main driving force of the changes in the relation between employment and real economic activity** described in previous section.

### Relation between the employment and economic activity by sectors

The relationship between the employment and real economic activity in the Slovak economy seems to be on an aggregate level significantly affected by the **development of the labour-intensive sector of services**. The sectoral composition of the total employment comparing the situation in 1995Q1 and 2014Q3 is presented in Figures 6 and 7. Apart from the decline of the share of people employed in agriculture and to a smaller extent also in manufacturing, the most outstanding difference is the **increase of the share of people employed in private services. From 31 % in 1995** the share of people employed in services increased **to 45 % in 2014**. This structural change could potentially explain large part of the changes in the relation between the employment and GDP described above.

Figure 6 Employment by sectors in 1995Q1

Figure 7 Employment by sectors in 2014Q3
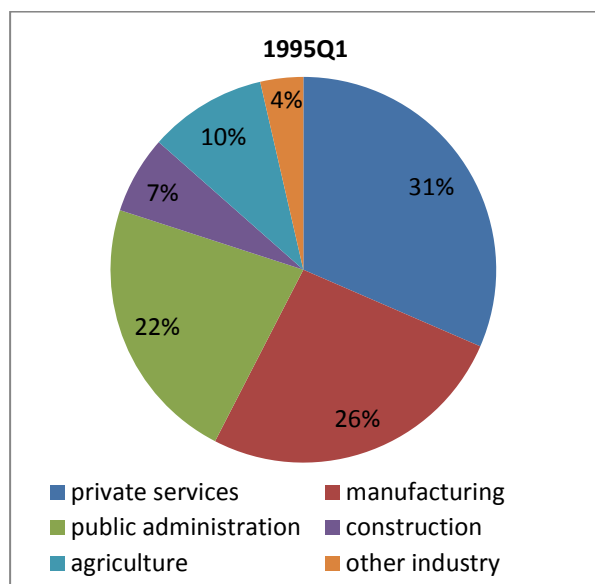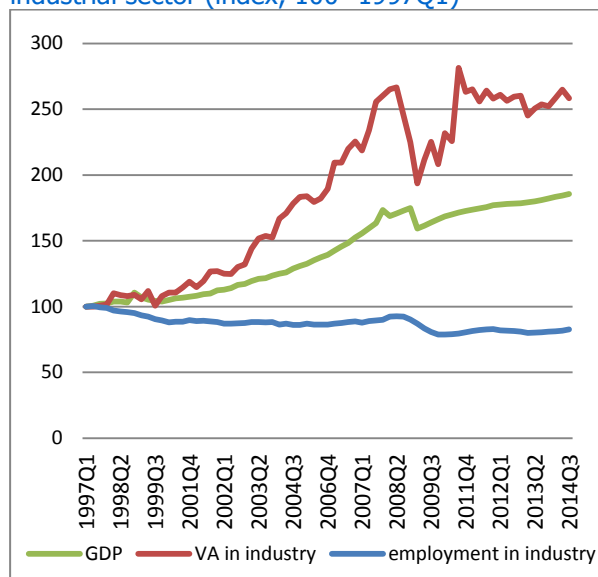

Source: SO SR, NBS calculations.
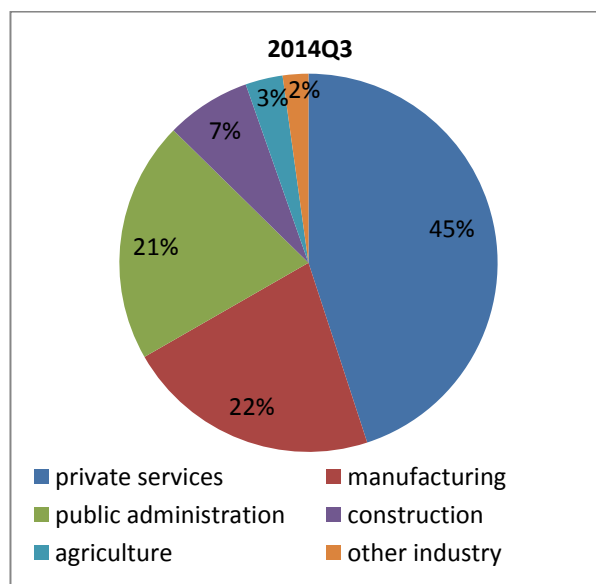
Source: SO SR, NBS calculations.

Figures 8 and 9 depict the development of employment and value added in the industrial sector, while Figures 10 and 11 describe the development in the sector of private services.

In industry we can see a steep **rise in value added** until 2008Q1 that was accompanied by a slight **decline of employment** in this sector. During the 2008-2009 crisis, both the output and employment declined but only the volume of the production returned to its pre-crisis levels afterward. Due to a high capital intensity of the industrial sector, the dynamics of
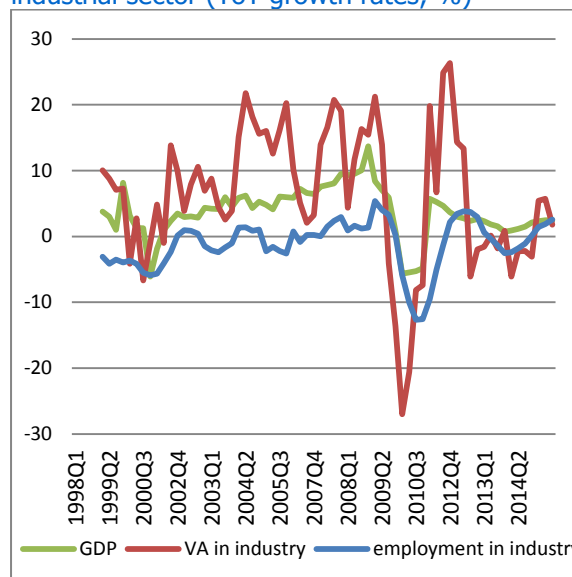
employment in this sector follow the value added only partially. Mostly, the growth in the volume of production in the industrial sector is achieved via **investment and increasing labour productivity**.

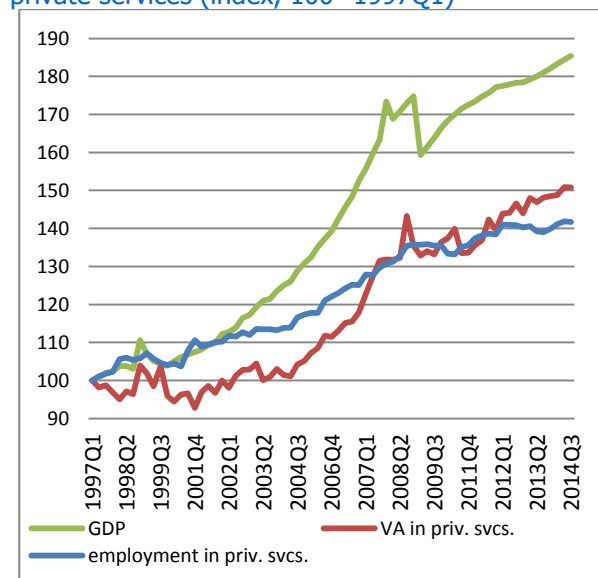Figure 8 Employment and value added, industrial sector (index, 100=1997Q1)

Figure 9 Employment and value added, industrial sector (YoY growth rates, %)
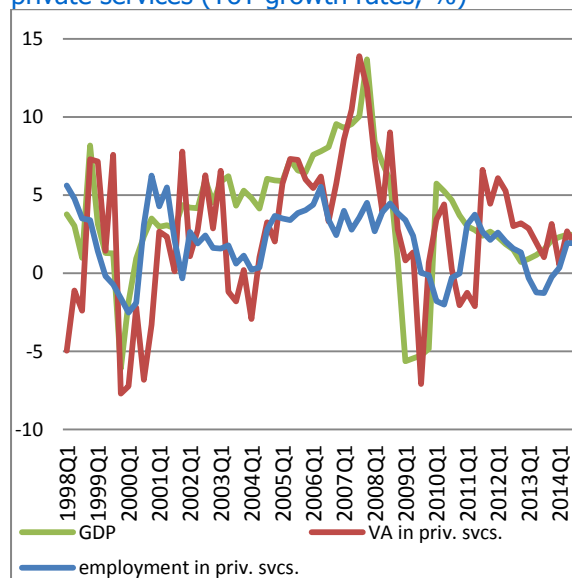
In the sector of private services, the situation is very different. Until 2008Q1, the **employment in services grew by virtually the same factor as the value added** in this sector. After the crisis the growth of employment together with the value added in the sector of services returned, albeit with a slower pace. As the sector of services is highly **labour-intensive**, the dynamics of employment in this sector roughly correspond to the dynamics of value added.

Figure 10 Employment and value added, private services (index, 100=1997Q1)

Figure 11 Employment and value added, private services (YoY growth rates, %)

In the remaining part of this section, we investigate the relations between the employment in a given sector and the **economic activity of that sector** and also between the employment in a given sector and the **overall economic activity** using an econometric model. The model structure is the same as in the aggregate baseline model. QoQ models are estimated using the data covering the period of 1998Q2-2014Q3 and the YoY models are estimated on the 1999Q1-2014Q3 interval.

According to the results based on the **QoQ** data, the sectors where the employment is sensitive to the real economic activity in that sector are the **industry and manufacturing**. However, in comparison to the overall estimates for the total employment or the employment in the private sector, the elasticities are lower and the BEPs are much higher. On the other hand, when the whole GDP grows, the employment in industry, manufacturing and also in construction reacts much more vigorously and also the BEPs are somewhat closer to the aggregate estimates. Models for the remaining sectors achieved only very low $\bar{R}^2$ (less than 0.2) and are not discussed.

Models based on **YoY** data show very similar results for the industry, manufacturing and construction sectors as in the QoQ exercise. However, based on the YoY data, statistically significant estimates were obtained for the sectors of services, private services, trade and finance as well. The models of **services and private services sectors show lower $\bar{R}^2$ and markedly lower elasticities** of employment with respect to the gross value added and also with respect to the GDP as compared with the industrial sectors and even aggregate models. The employment in the sectors of trade and finance seem to be more dependent on the aggregate economic activity than on the value added in given sector. The elasticity in the trade sector is comparable to the aggregate model and in the sector of finance it is as high as in the industry. Notably, the **estimates of the intercept in the trade sector, private services and also general services are positive**, which means that **the employment in these sectors** on average **grows, even in a situation of negative growth of GDP** or value added.

Conclusion

In this analytical commentary we studied the **relationship between employment and real economic activity in the Slovak economy**. We found that the relation **varies to a considerable extent over time** – elasticities of employment with respect to the real economic activity increased during the 2008-2009 crisis and the **estimates of break-even point declined from values close to 3 % to values between 1.3 % and 1.8 %.** Identified **changes in the relationship can be mainly explained by the long-run economy-wide shift from industrial sectors toward more labour-intensive sector of services**. This structural shift makes the **employment more sensitive to the growth of GDP especially when the economic growth is generated by the domestic demand** as opposed to the growth led by the foreign demand. Also, the **substantial reduction of the number of employees during the crisis** may have led to a situation when the **employers are quite willing to rehire** some **employees** when even a mild recovery occurs in order to restore more operational conditions. Therefore, a part of the **post-crisis decline of the break-even point can be only temporary**. Partially, the changes in the relationship of employment and real economic activity could be also explained by the **legislative and institutional changes** in the labour market in years 2004 and 2012 that reduced the job protection and made the labour market more flexible.

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Stanislav Tvrz (analytici@nbs.sk)