Wage growth in the CEE EU countries: a Phillips curve estimation

work in progress

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Introduction and summary

Labour market conditions in Central and Eastern EU countries (CEE EU) have been tightening recently, and this has been – in contrast to the euro area and Western economies more generally - associated to a significant acceleration in nominal wage growth. This paper empirically estimates the determinants of wage growth in the CEE EU countries by applying a standard reduced form wage Phillips curve in a panel framework[1], using macro and micro data. In addition, we estimate the wage curves as a level relation, in a context of panel error correction models, which enables us to estimate the long-run relation between wages, productivity and labour market conditions in these countries.

The preliminary analysis based on macro data suggests that wage growth in the CEE EU countries can be well explained by labour market slack, past inflation and productivity growth in the full sample since 2001. Splitting the sample suggests that since 2009 the baseline Phillips curve estimates became partially instable, while additional factors, such as declining active population (to some extent due to large emigration from these countries), play a more relevant role. Turning to the dynamic panel analysis, our preliminary findings suggest the presence of long-run relationships between wages, productivity and labour market conditions, which is however yet to be studied in greater detail. In addition, in this paper we plan to estimate wage equations in the CEE EU countries using firm-level data from the Orbis database (in the frameworks consistent as applied by using macro data).

Motivation

Labour market conditions in the Central Eastern Europe have been tightening. The unemployment rate has been gradually declining, reaching close to or below estimated NAIRU in the CEE EU countries. In several cases it is at historical lows. Positive economic developments, strong demand for exports and improving business climate conditions have increasingly fuelled demand for labour in all EU6 countries. This is evidenced by the increasing vacancy rates and the indicator of labour shortages, both indicators are now at or even above the pre-crisis levels in most CEE EU countries.

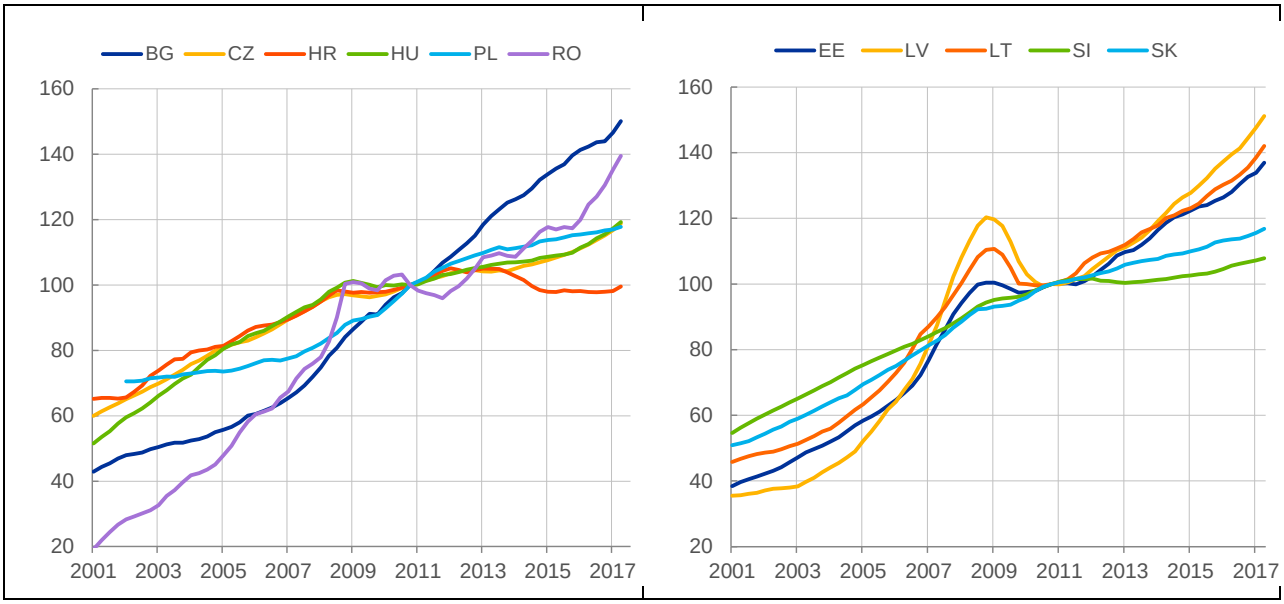
In contrast to developments in the euro area and Western Europe more generally, labour market tightening has been recently associated to a significant acceleration in nominal wage growth in the CEE EU countries (Chart 1). One contributing factor may be that tightening conditions have been exacerbated by *structural impediments to labour supply* in this region.

[1] Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

CEE EU countries suffer, often at the same time, from: (i) low labour market participation (especially of female, young and elderly); (ii) high shares of long-term unemployed; (iii) mismatches between job seekers' skills and employers' requirements in some sectors; and (iv) decreasing working age population due to negative demographics and emigration (Chart 2).

Chart 1: Compensation per employee

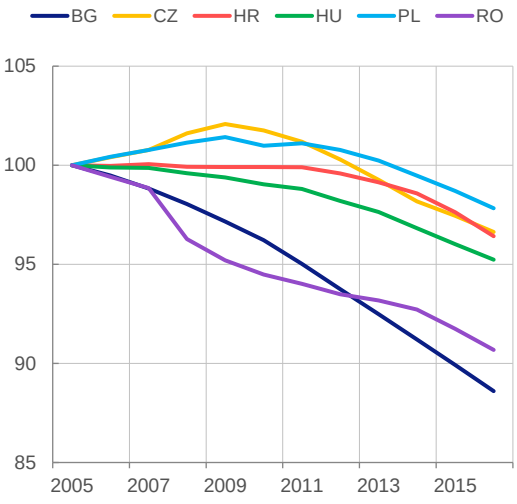
Index 2010Q4=100



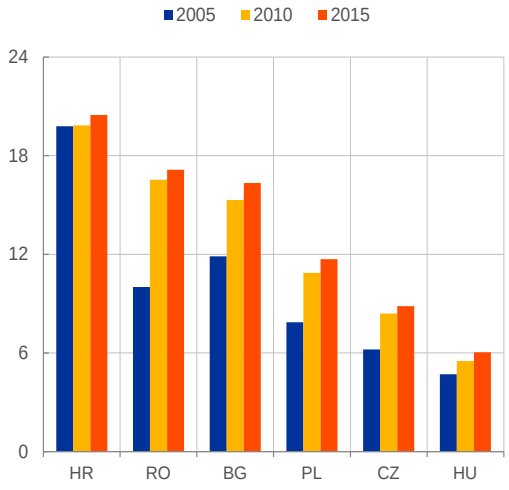
Souce: Eurostat.
Last observation: 2017Q2.

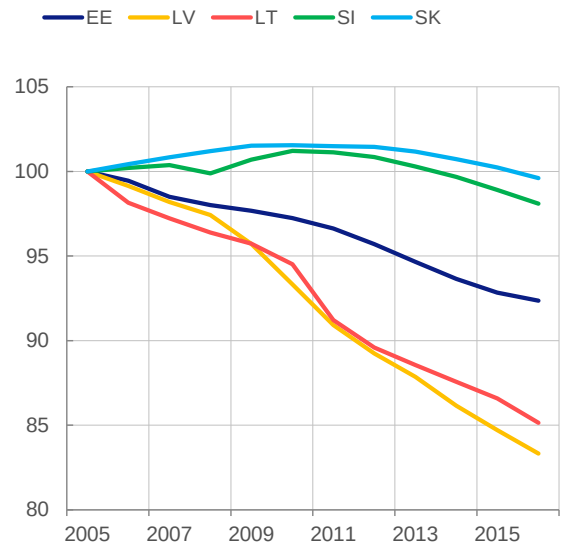
Chart 2: Working age population and international migrant stock

Population aged 15-64, index 100=2005

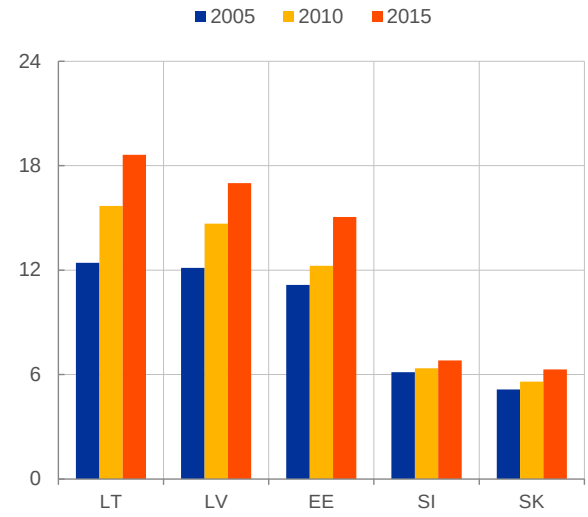


International migrant stock, % of total population





Souce: Eurostat.



Souce: United Nations, International Migrant Statistics.

Literature review

Phillips curves, originally referred to the inverse relationship between wage inflation and the unemployment rate (Phillips 1958[2]), have been one of the most active areas in economic research over the last fifty years. Based on the well accepted idea that there is a trade-off, at least in the short run, between (wage or price) inflation and real economic activity, economists have proposed a broad set of relevant extensions for anomalous wage inflation, for instance, focusing on the distinction of the "short-run" and "long-run" Phillips curves when inflation expectations come into play (Friedman and Phelps, late 1960s), "hysteresis effects" (Blanchard and Summers 1986) or "downward nominal wage rigidities" (Akerlof, Dickens and Perry 1996, Hall 2005, Taylor 2016). Gordon (2011) provides with a detailed recent survey of the literature of these topics and their implications for monetary policy and the understanding of business cycle fluctuations. In this paper, we focus on the new Keynesian Phillips curve (NKWPC) framework, which is currently one of the most widely used model, given its theoretical rigorous micro-foundations and empirical success.

More recently, Galí (2011) derived the New Keynesian wage Phillips curve (NKWPC) as a micro-founded structural equation by extending the sticky wage model of Erceg, Henderson, and Levin (2000). In the NKWPC framework, wage inflation is dynamically linked to the unemployment rate through important structural parameters such as wage stickiness and labor supply elasticity. This framework thus provides theoretical insights into the mechanism of wage determination. He also showed that once the NKWPC is augmented with wage indexation to past inflation rates (inflation indexation), the NKWPC reasonably explains the negative correlation between the unemployment rate and wage inflation, especially after the mid-1980s. On the basis of this result, he concluded that "the structural wage equation derived

[2] This study is cited as the precursor, but already in 1926 Irving Fisher demonstrated a strong correlation between U.S. inflation and unemployment.

here is shown to account reasonably well for the comovement of wage inflation and the unemployment rate in the US economy, even under the strong assumption of a constant natural rate of unemployment."

In the recent years, this framework has been used to explain why nominal wage growth in most advanced economies remains markedly lower than it was before the recession, even in countries where unemployment rates are now at, or even below their averages in the years leading up to the recession (See WEO October 2017). For example, Daly and Hobijn 2014 also uses this approach to show that downward nominal wage rigidities in the US likely have played a role in shaping the dynamics of unemployment and wage growth during the last three recessions and subsequent recoveries. In section 3.1 of this study, we estimate the wage dynamics of the CEE countries from the perspective of the NKWPC in a panel data framework, by augmenting it with past inflation term, based on Galí's findings. The aim is to examine possible structural changes in wage settings, such as wage stickiness and inflation indexation. We also add the productivity trend and the working age population, to account for the impact migration and demographics effects.

Although the Phillips Curve is now usually treated as a short-run relation, there is still controversy about whether it exists a long-run relation (e.g. Schreiber and Wolters 2007). In this regard, Blanchflower and Oswald (1995) highlight the potential of error-correction models "to distinguish between dynamics and the properties of long-run equilibrium" in the Phillips curve framework. Ammermüller et al. (2010) specified panel error-correction models (PECM) of the wage curve for Germany and Italy.

Empirical methodology and results

The determinants of wage growth in the standard reduced form Phillips curve framework

In the first part of the paper we present the empirical results of the determinants of wage growth in the CEE EU countries by applying a standard reduced form wage Phillips curve in a panel framework[3]. In the baseline specification, wage growth is regressed on labour market slack (measured as unemployment gap), past inflation and labour productivity growth. In addition, in order to capture the possible impact of emigration flows that has been observed across CEE EU countries, the baseline specification is augmented by working age population (Equation 1)[4].

$$\Delta w_{i,t} = \beta_1 ugap_{i,t-1} + \beta_2 \Pi_{i,t-1} + \beta_3 \Delta PROD_{i,t(4qma)} [+ \beta_4 \Delta\, w.a.pop_{i,t}] + \tau_t + \gamma_i + \varepsilon_{i,t} \qquad (1)$$

The analysis indicates that labour market slack, past inflation and labour productivity growth are statistically significantly associated with nominal wage growth, with expected signs (Table 1, Column 3). This suggests that nominal wage growth in the CEE EU countries is negatively associated with labour market slack and positively associated with past inflation and productivity

[3] For example, as derived in Gali (2011). A similar approach was also used for the euro area.

[4] Migration data is not available on a quarterly frequency, hence working age population is used an alternative measure.

growth. However, changes of working age population appear insignificant when added to the baseline specification (Column 4)[5].

In the next step, the sample is split into two to see the robustness of the results obtained above and to test again for the significance of the working age population in determining wage growth as migration flows appear to have accelerated in the post-crisis period. While the results of the baseline specification remain robust in the pre-crisis period (Column 5), in the post-crisis period inflation turns to be negatively associated with nominal wage growth, while changes in active population now become significantly negatively correlated with wage growth across CEE EU countries (i.e. the reduction in working age population was associated with increasing wage growth since 2009).

The fact that inflation turns negative in the subsample since 2009 (and becomes even insignificant when the subsample is more recent) points at the instability of the relationship between wage and price inflation since 2009. The decoupling of wages and inflation in the CEE EU countries is also visible in the Chart 3 below. In particular, in several countries wage growth adjusted downwards (in several cases it was negative) during the crisis, suggesting that productivity growth played a more important role in wage formation process. This is indeed confirmed in the econometric analysis, as labour productivity is the most robust variable in the estimated wage Phillips curve, remaining significant through all sub-periods. Consistently, the explanation could be that the role of inflation in wage formation process is high in “normal” times, but not during economic downturns or in times when inflation is extraordinary low (in particular due to external factors). This could, for example, be confirmed in the presence of formal indexation rules, which take into account past inflation (usually not negative/very low rates) and even productivity developments. [6]

[5] In the baseline approach, the results are robust to using alterative measures of labour market slack (past headline unemployment instead of unemployment gap), productivity (HP trend instead past average productivity growth) and past inflation (4-quarter moving average instead of lagged inflation). In addition, alternative augmented specifications were estimated (e.g. by including foreign wage growth or temporary contracts), but did not perform well.

[6] Stable relationships between wage inflation and the unemployment gap as well as between wage inflation and labour productivity growth and wage and price inflation are displayed by scatterplots of the raw data in the Annex in Annex1. At the same time, the scatterplots also reveal the instability of the relationship between wage and price inflation over time.

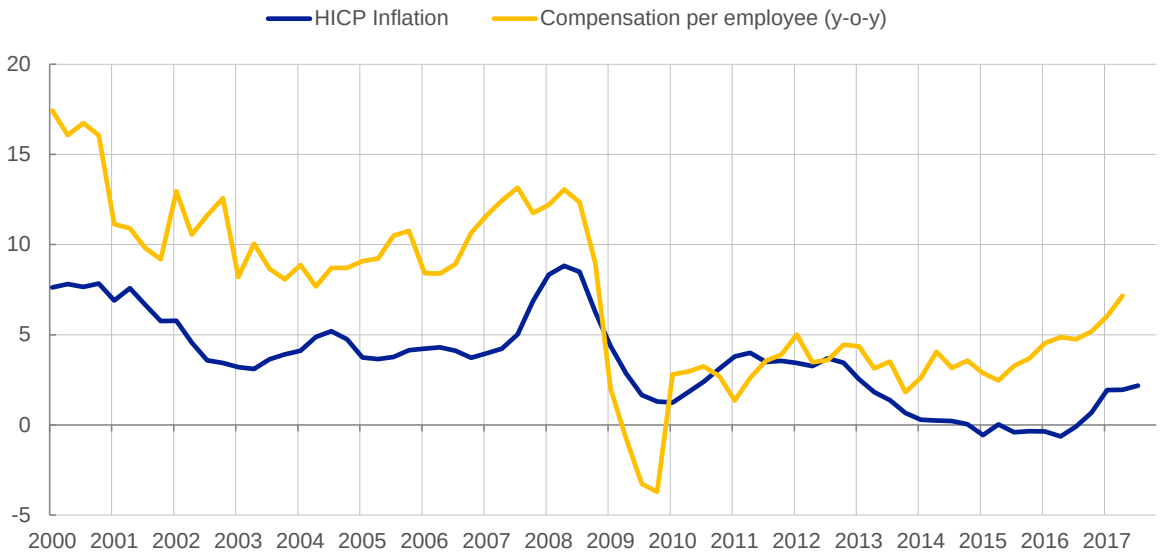
Table 1. Estimates of Wage Phillips Curves in CEE EU countries

	(1)	(2)	(3)	(4)	(5) 2001Q1-2008Q4	(6) 2009Q1-2017Q2
UE gap	-1.298***	-1.124***	-1.161***	-1.162***	-1.033***	-1.285***
	[0.131]	[0.118]	[0.114]	[0.115]	[0.166]	[0.137]
Inflation (lagged)		0.799***	0.790***	0.779***	0.770***	-0.471**
		[0.187]	[0.197]	[0.195]	[0.247]	[0.225]
Productivity[1]			0.455***	0.455***	0.363**	0.424***
			[0.099]	[0.098]	[0.161]	[0.078]
Working age Population[2]				-0.146	-0.082	-0.330***
				[0.095]	[0.209]	[0.097]
N	711	711	711	707	344	363
r2	0.537	0.605	0.631	0.633	0.604	0.562

Dependent variable: compensation per employee, annualized quarterly growth rate. UE gap=Unemployment rate-NAIRU. [1] 4-quarter moving average of past productivity growth rates (annualized). [2] annualized quarterly change
Sample is of quarterly frequency 2001Q1-2017Q2.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Country and time fixed effects were used in the OLS regression.

Chart 3: HICP inflation and compensation per employee

y-o-y change, CEEC unweighted average



Source: Eurostat

Wage growth determinants in the long-run – work in progress

In the long-run, nominal wage growth should reflect labour productivity growth and inflation. To explore whether this has been the case in the CEE countries, we estimate an Engle-Granger cointegration reduced-form relationship among nominal wages, the lag of unemployment gap, prices, and productivity variables. We run these tests country by country and in the panel data of the 11 CEE countries under review. The long term equation is:

$$ln(w_{i,t}) = \beta_1 ln(price_{i,t-1}) + \beta_2 ln(PROD_{i,t(4qma)}) + e_{i,t}$$

The short-term relationship:

$$\Delta w_{i,t} = \theta_1 \Pi_{i,t-1} + \theta_2 \Delta PROD_{i,t(4qma)} + \theta_3 ugap_{i,t-1} + \tau_t + \gamma_i + \alpha \hat{e}_{i,t} + \varepsilon_{i,t}$$

Where $\hat{e}_{i,t}$ is the error-correction term, and α is the speed of adjustment to a random shock. The convergence condition requires α to be between 0 and 1 with a negative sign.

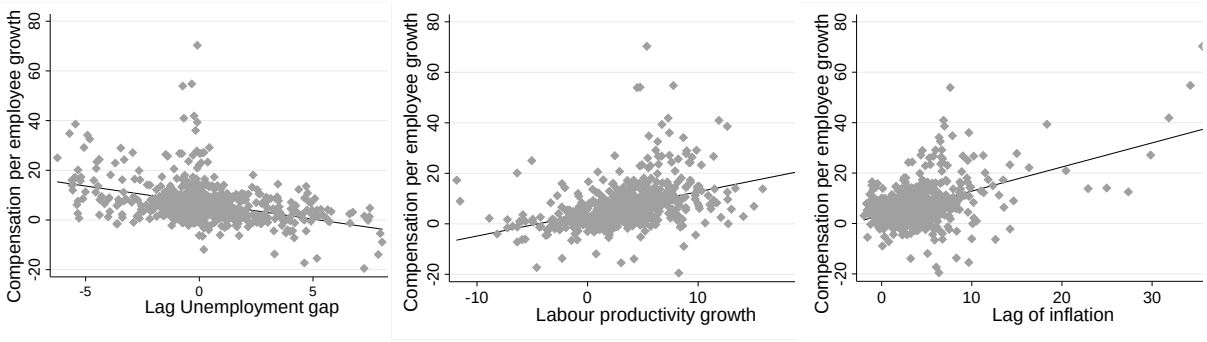
The results for various panel cointegration tests broadly support the existence of cointegrations. For the Pedroni residual cointegration tests, panel and group PP-statistics and ADF-statics support the existence of cointegration when allowing for individual intercepts. The Kao residual cointegration test also suggests the existence of cointegration.

We use the Kao & Chiang (2000) Dynamic OLS (DOLS) estimator for Cointegrated Panel Data with homogeneous covariance structure. We reject the null hypothesis of no-cointegration, so we can conclude that the series are cointegrated.

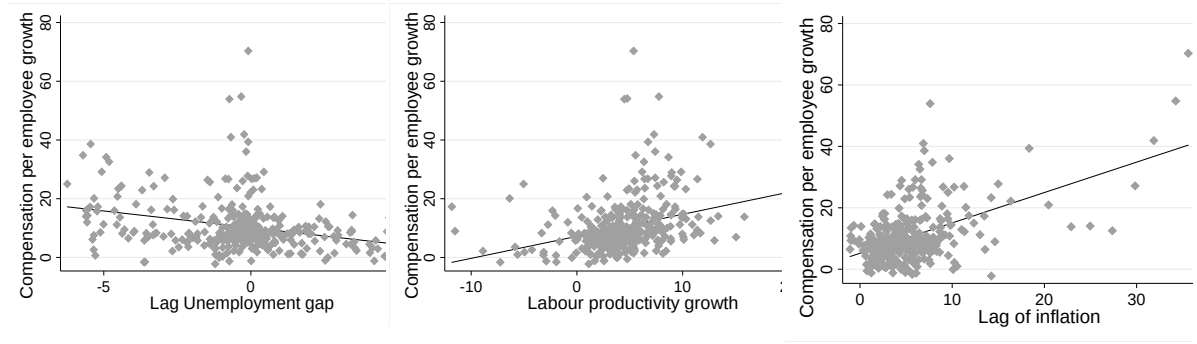
We are currently running various estimations of the long-run wage equations which we will include in the paper.

Annex1: Wage inflation and its determinants in the context of Phillips Curve estimation in CEE EU countries

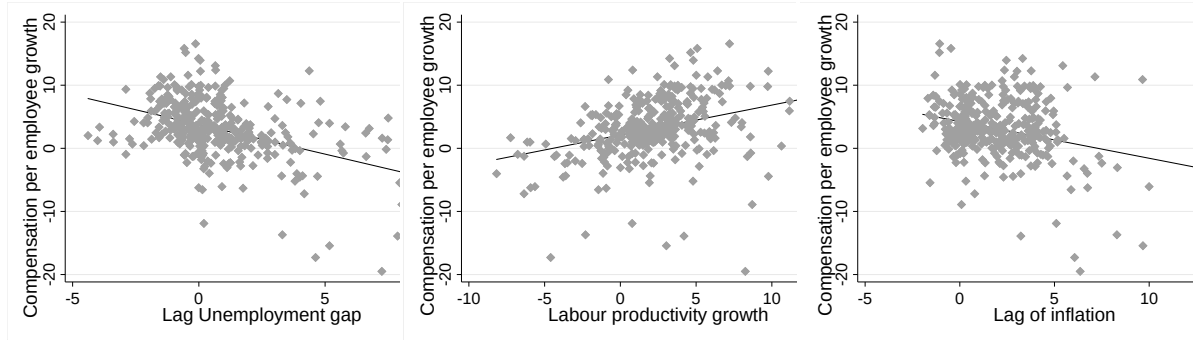
Sample: 2001Q1-2017Q2



Sample: 2001Q1-2008Q4



Sample: 2009Q1-2017Q2



Annex2: Stability of the coefficients over time (6 year rolling window estimation)