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United in diversity. Labor markets in the CEE countries

Michal Benčík

NATIONAL BANK OF SLOVAKIA
EUROSYSTEM

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Abstract

We study supply side factors of the labor market in the Czech Republic, Hungary, Poland and Slovakia. Common economic history of these Central European economies suggests that long run relationships should have resembling patterns. While we find that while for the Czech Republic and Hungary there exists a long run relation of equilibrium unemployment rate to real wages, capital stock and terms of trade; such relationship does not hold for Poland and Slovakia. Instead labor market trends are better described by the relationship of equilibrium real wages. This finding uncovers structural differences within the Visegrad countries. These differences relate to the extent, in which labor supply can adapt to shocks. In practice this would suggest that it was more efficient for Slovakia to conduct supply driven policies, as flexible employment contracts or industrial policies, to stabilize labor market conditions. On the contrary, the more efficient tool for the Czech Republic are wage oriented demand driven policies.

JEL code: E24, J31

Key words: unemployment rate, real wage, capital stock, vector error correction

Introduction

Each national labor market has a specific structure and therefore is driven by its own set of relationships. Relationships can be formed by various responses to specific labor market characteristics. We aim to address these differences by capturing them in a simple equilibrium modelling framework for the Central European economies (further as CEEs) and offer a narrative for why these differences have emerged.

Unemployment rate can be driven by business cycle, or by reservation wages, or eventually responding to imbalances in a system with other elements, as real wages or capital stock. The long-run properties of the unemployment rate relationship are usually derived from a model specification of an equilibrium unemployment rate. There are three main approaches to determine the equilibrium unemployment rate, depending on the underlying theoretical hypothesis.

The first concept refers to the gap between the actual and equilibrium unemployment rate, which is linked to the business cycle and inflation pressures via the Phillips curve.[1] The second concept understands the equilibrium unemployment as a function of the wedge (ratio of producer and consumer wages), the replacement rate, the minimum wage rate and relative capital costs.[2] We, however, follow the third concept that embeds the rate of unemployment within a system containing also the real wage, terms of trade and the capital stock. The latter variables are linked to the supply side of the economy.
The approach is based on a vector error correction (VEC) model, which determines the long-run relationship and the rate of adjustment to disequilibrium (deviation from the long-run relationship). The closest to the analysis in this paper are Mayes and Vilmunen (1999), who apply this approach to Finland and New Zealand.[3] The appealing feature of this concept is that it does not require stationarity or differenced variables (as in VARs[4]). Instead, we focus on I(1) variables in levels and their long-run relationships. This way, we make use of a significant amount of long-run information in the data, that would otherwise (in a VAR) be omitted.

The aim of the paper is to explore the long run determinants in the labor markets in V4 countries and the relationships between them. We find that it should not be taken for granted that an equilibrium unemployment rate can be explained by supply side factors. On the contrary, when significant mismatches between labor demand and labor supply are observed, these could signal the presence of inefficiencies and rigidities in labor supply that could make labor markets unable to adjust to the medium-term demand shocks. We found that the character of prevailing labor market relations is linked to the ability of countries to cope with permanent negative population shocks.

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[1] This hypothesis is usually implemented with the Kalman filter. For example, in Turner et al. (2001) for OECD countries, in Varga (2013) for CEEs and in Gylánik and Huček (2009) and Šrámková (2010) specifically for Slovakia. This approach can also be applied by using time series methods, as in Blanchard and Quah (1989), vector error correction model containing the link between business cycle and unemployment as in Stark (1998) and Zagler (2003) or two stage least squares as in Gabrisch and Buscher (2006) who study the link between unemployment and output for the transition countries.

[2] Van der Horst (2003) investigates the wedge function in six OECD countries and provides one of the few applications of this kind (mainly due to short data history).

[3] Arestis et al. (2007) use similar hypothesis for the equilibrium unemployment, but more general, with elements of the second concept.

[4] See for instance Jakab and Kaponya (2010) or Balcerzak and Żurek (2011) for the use of VARs in the CEE countries, where the long run information is practically omitted.

The Czech Republic and Hungary were more successful countering that shock. Labor supply can therefore be explained by a standard labor supply function. Poland and Slovakia, on the other hand, were less successful in countering demography, and therefore labor markets were subject to supply shocks. Standard labor supply function does not hold here. On the contrary, we document existence of the supply shocks by isolating an (inverse) labor demand relation, i.e. an equation for real wages explained by the unemployment rate, terms of trade and capital stock.

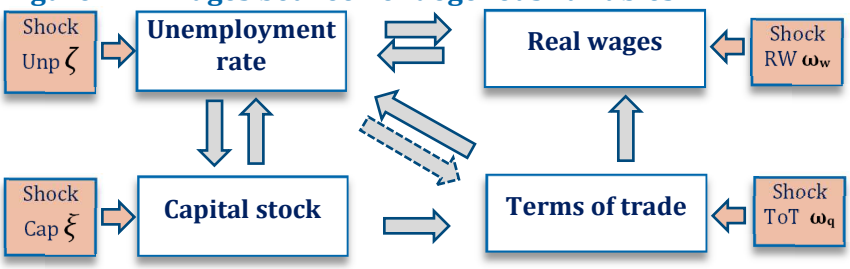
The paper is organized as follows. Section 2 summarizes the theoretical model. Section 3 presents the characteristic features of the labor markets in Visegrad countries and their consequences. Section 4 deals with technical details of testing and estimation, section 5 presents the estimation results, and section 6 concludes.

The model

In our model, long run relationship of the error correction is linked to the labor supply. More specifically, as in a standard Cobb-Douglas (CD) production function, it combines labor and capital to obtain the volume of output. Mayes and Vilmunen (1999) derive the CD function to arrive to an equilibrium unemployment and investigate to what extent unemployment has been the result of slow adjustment to large external shocks. We proceed in a similar manner.

In line with Mayes and Vilmunen (1999), we invert and extend the function so that demand for labor in a corporate sector increases with the amount of output and decreases with PPI deflated real wages. Similarly, the demand for capital is higher with more labor and lower with rising rental price of capital. Labor supply is then motivated by higher CPI deflated real wages. The wage setting then defines the real wage as a decreasing function of unemployment and terms of trade.[5] Finally, terms of trade scale down with both labor and capital.

Figure 1: Linkages between endogenous variables



Source: author.

All above relationships contain stochastic shocks, too. These relationships are then transformed into a vector autoregression. A function of the unemployment rate is defined by the means of labor supply and labor demand. The derived equation takes the following form:

$$u_t = (\theta + \gamma_2)w_t - \gamma_2(1-\phi)q_t - \gamma_1 k_t + \xi_t - \zeta_t \qquad (1)$$

[5] The sign of the terms of trade is ambiguous. It is positive, when terms of trade reflect rising productivity, or negative, when terms of trade decline and inflation pressures from import prices prevail.

Under a set of technical assumptions, the shocks ζ_t and ξ_t combine to a stationary shock, such that there exists a stationary combination of unemployment rate u_t, real wages w_t, terms of trade q_t and capital stock k_t that can be interpreted as a deviation from equilibrium unemployment. The models in the baseline specification are empirical applications of this long run relationship between the four latter variables.

The parameter values θ and γ_2 determine the character of a labor market and lead to preferred specification of the model for every country. Parameter θ represents positive elasticity of labor supply to real wage and parameter γ_2 is a transformed parameter α associated with labor in a CD function, so that it assumes positive values only.

$$\gamma_2 = \frac{1}{1-\alpha} \qquad (2)$$

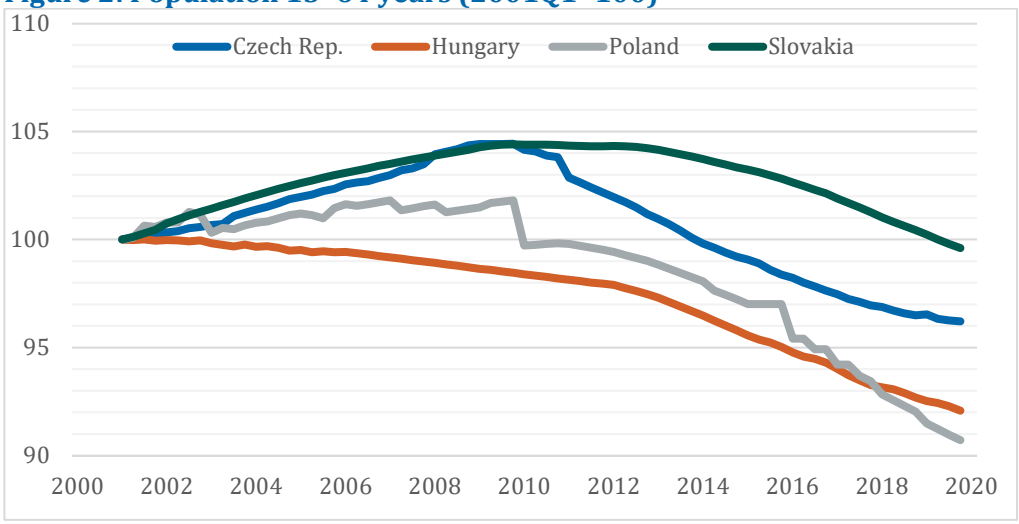
Combining (1) and (2) implies, that the parameter α strengthens the impact of labor supply component in the long run relationship. In contrast with the previous literature, the estimated value of parameter associated with wages is much lower in the case of the CEEs.

Effects of population shocks and labor market efficiency

Apparently, CEE labor markets experienced specific developments. Some of them are observable directly in the statistics published in the Labour Force Survey (LFS) by Eurostat. Two long-term trends stand out.

The first trend portrays a structural break around 2010 in productive age population (15-64 years of age). While productive cohorts were growing in the Czech Republic and Slovakia (approximately by 0.5% per year), they begun shrinking in size about the same pace then after. Hungary and Poland have also experienced the change at about the same time, but their working age population has been relatively flat before 2010 and falling faster in the last decade (Figure 2). This latter decline amounts to permanent, cumulative negative shock and naturally constrains the labor supply.

Figure 2: Population 15- 64 years (2001Q1=100)



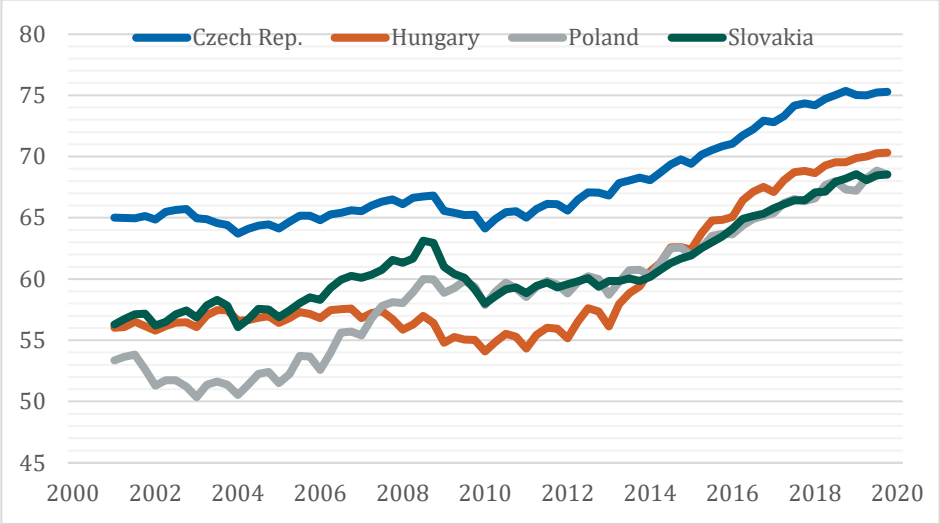
Source: own computations from Eurostat and NBS data.
Note: Data for Poland contain a break in 2010.

Since the decline in the recent decade has been in general steeper and more consistent than its prior growth, we can expect that the elasticity of labor supply to wage growth (parameter θ) for the four (CEE) countries turns negative. We can confirm this assumption also by doing a simple calculation. The share of employee compensations to GDP (a proxy for labor share parameter α) is close to 0.4 in all four countries, which implies a value of 1.7 for the parameter γ_2 (eq. 2). Since our estimate of wage elasticity $(\theta + \gamma_2)$ is significantly below this value, parameter θ turns negative.

We therefore reformulate the hypothesis in a way that the absolute value of the parameter θ depends on the efficiency of the labor market in a corresponding country. Hence, we assume that more efficient labor market can better counter negative shocks originating from population decline.

Figure 3 addresses this point. A low employment ratio implies that a significant share of eligible population does not work. Some agents choose not to search for work (inactive) and some do actively seek work, but fail to find it (unemployed). The reason for labor supply not meeting labor demand, apart from short-term fluctuations, can be a mismatch in required skills or geographic location. Since the labor market is not homogenous, both the excess supply (unemployment) and excess demand (vacancies) can and do exist at the same time. A higher degree of mismatch makes labor market function less efficiently. We see a general increase in the ratios of employed persons to population in productive age, likely also helped by increasing involvement of foreign labor force at the local labor markets.

Figure 3: Share of employed persons to population (15-64 years old)



Source: own computations from Eurostat data.

Cross checking figures 2 and 3, we can observe declines in working age population across the board, but the Czech Republic and Hungary apparently were able to counter this adverse shock more efficiently. On the other hand, Poland and Slovakia enjoyed only a moderate growth in the employment share. That means adverse shocks were countered to a lesser extent, although coming from much higher levels of unemployment rate. Our country specific estimates of θ confirm these observations, finding mildly negative parameters for Czech Republic and Hungary ($|\theta|<|\gamma_2|$) and clearly negative for Poland and Slovakia ($|\theta|>|\gamma_2|$). The character of prevailing shocks may determine whether the observed data points follow a supply or demand schedule.

Figure 4a: Identification of the supply curve in presence of demand shocks

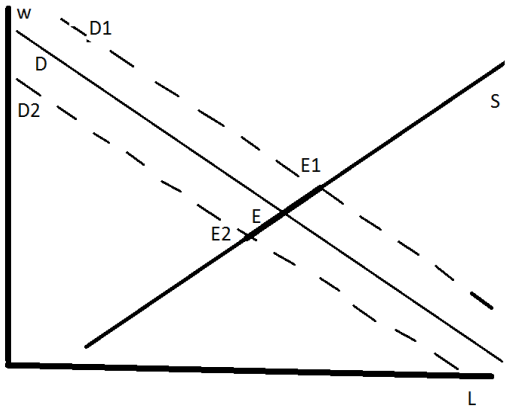
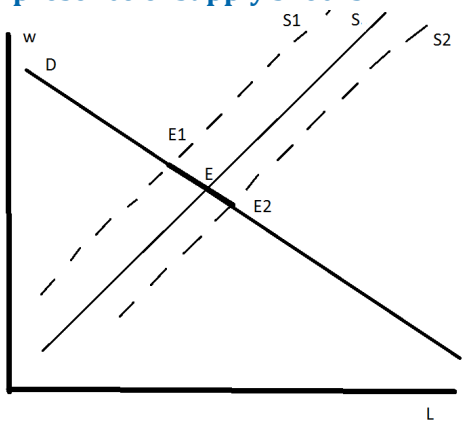


Figure 4b: Identification of the demand curve in presence of supply shocks



Source: Own calculations.

Consider a simple demand and supply system. Figure 4 and 5 shows two border case situations of pure demand and supply shocks. Demand shocks shift the demand schedule away from D (to D1 or D2) and consequently the equilibrium away from E (to E1 or E2). The highlighted part of the supply function represents the observed equilibria (Figure 4a). Similarly, supply shock shifts the supply function away from S (to S1 or S2). The highlighted part of the demand function represents the observed equilibria shifted away from E (to E1 or E2).

In practice, we will observe a combination of shocks both on the supply and demand side. The relationship between equilibrium wages and labor quantities is driven by the prevailing type of shock. We have seen above that labor markets in the Czech Republic and Hungary can better offset the unfavorable shocks from a decline in productive population. Thus, the demand shocks in these countries should prevail. On the other hand, if supply shocks are offset in a less efficient manner (as in Poland and Slovakia) supply shocks will prevail.

We aligned the modelling approach with the above narrative for the CEE countries. We identified a labor supply relationship for the former and (inverse) labor demand relationship for the latter two countries. The labor supply model setting is analogous to that for Finland in Mayes and Vilmunen (1999) (i.e. as outlined in eq. 1). The labor demand model is an augmented version of wage equation, which explains real wages as a function of the unemployment rate, terms of trade and capital stock.[6]

Tests and model setting

We used quarterly series of unemployment rate, real wages, terms of trade and capital between 1999 and 2019.[7] Wage series were converted to quarterly as period averages, imputed where necessary, and deflated by HICP to obtain real wages. We have calculated and seasonally adjusted terms of trade.[8] We have tested the series for unit root and identified long-run relationships among the endogenous variables in all the cases (see Harris, 1995), but the Czech Republic, where terms of trade could not be included (due to its stationarity).

Next, we conducted country specific Johansen tests (see Appendix 1) to determine the rank of the matrix of long-run multipliers. We found one cointegrating vector for each country model. Our baseline specification of the vector error correction is defined as

$$\Delta X = \Pi(X_{t-1}, 1) + + \sum_{i=1}^{4} \Gamma_i \Delta X_{t-i} + c + \varepsilon_t, \qquad (3)$$

where X is a (column) vector of endogenous variables[9] containing the unemployment rate, log of real wage, terms of trade (except for the Czech Republic) and log of capital stock. In an alternative specification, real wage and the unemployment rate swap position. Matrix Π contains 5x4 long run multipliers, Γ_i are 4x4 matrices of short run parameters, c is a column vector of constants and ε_t is the error term. Inclusion of the constant term in the cointegrating space (consolidated to unity, see eq.1) is due to differing means and drift in some variables.

The matrix of long run multipliers can be expressed as a product of factor loadings α and matrix of cointegrating vectors β (including constant), i.e. $\Pi = \alpha\beta'$. Since we have one cointegrating

[6] Microeconomic theory stipulates that wages should be linked to marginal labor productivity and that depends on capital stock per capita. Since the variance of capital stock is greater than the variance of employment, movements of capital stock per capita are predominantly caused by changes in aggregate capital stock. Thus, we include capital stock (that is the part of the endogenous vector already) as a proxy for non-cyclical increases in labor productivity.

[7] All series origin in Eurostat. Capital stock was sourced from the AMECO database.

[8] We have defined the terms of trade as a ratio of export deflator and import deflator (these were computed from national accounts). The real wages were seasonally adjusted by X12 ARIMA with additive seasonal factors. We have applied HP filter in case of Poland, where terms of trade exhibited pronounced irregular short-term swings.

[9] There is a separate model for every country, but we omit the country subscripts for simplicity. Four lags are included in every model.

vector for each country, α and β reduce to row vectors. After normalizing β and shifting other variables to the right side, we end up with a long-run relationship for the unemployment rate in the baseline specification and for the real wages in the alternative one.[10]

Thus, we have reached the baseline and alternative specification for every country, reflecting the sign of parameters in the cointegrating vector. This means, that if the unemployment rate was increasing along growing real wage, labor supply prevails, and baseline specification features the unemployment rate as a dependent variable of a long-run relationship. Vice versa, if the unemployment rate was falling along growing real wage, the model was reparametrized in a way to reflect the labor demand function, and baseline specification features the real wage as a dependent variable of a long-run relationship. This set up was used to disentangle the two estimating strategies, the baseline used for the Czech Republic and Hungary and the alternative for Poland and Slovakia.

Results

We only report the long run parameters of the preferred model (cointegrating vector β and factor loadings α) in Table 1. The cross product of cointegrating vectors and the vectors of corresponding dependent variables shall be interpreted as a short-run deviation from the long run relationship.

Table 1: Parameters of the VEC models for the CEE countries.

	Cointegrating vectors		Factor loadings	
	CZ	HU	CZ	HU
Unemployment rate	1.000	1.000	-0.066***	-0.02*
			-3.3	*-1.5*
Terms of trade		1.56**		-0.001
		2.7		*0*
Real wages	-0.180*	-1.11***	-0.334***	0.125**
	-1.8	*-5.5*	*-3.3*	*2.4*
Capital	0.440***	1.3***	0	-0.002***
	3.0	*5.50*	*-0.2*	*-4.1*
Constant	-12.42	-37.17		

	Cointegrating vectors		Factor loadings	
	PL	SK	PL	SK
Real wages	1.000	1.000	-0.258***	-0.337***
			-4.0	*-4.0*
Unemployment rate	2.86***	1.12***	-0.049***	0.058*
	7.8	*6.5*	*-2.9*	*1.7*
Terms of trade	1.56***	0.53*	0	-0.185**
	3.3	*1.4*	*0*	*-2.1*
Capital	-0.35***	-0.63***	0.001	0.003*
	-9.8	*-4.7*	*1.1*	*1.5*
Constant	-0.02	8.58		

Note: t-values are displayed in italics below parameters.

Variables that do not respond to disequilibrium are perceived to be exogenous. The factor loadings show that wages are flexible and do react to the disequilibrium in the labor market. This is made possible by inflation, that is higher than in advanced EU member countries and provides a cushion allowing the real wages to drop, when nominal wages remain unchanged.

The cointegrating relationships for Poland and Slovakia lead to wage equations, indicating that the real wage is a decreasing function of unemployment rate and terms of trade and an increasing function of capital stock. The capital stock causes productivity to grow, which supports wages. More generally, capital and labor are complements in those countries, rather than substitutes. This is to be expected in countries that are catching up.

The sign of the terms of trade reflects inflation pressures, since the terms of trade include import deflator in denominator and relatively great share of consumption goods is imported in the CEE small open economies. The character of the cointegrating relationships allows us to

[10] The matrices Π in the baseline and alternative specification differ only in order or rows and columns.

make a statement about the shocks driving the system. The prevalence of labor supply shocks (originating in the demography and sluggish labor market efficiency) leads to the identification of the long run relationships in Poland and Slovakia as an inverse labor demand function.

On the contrary, the cointegrating relationships for the equilibrium unemployment as proposed by Mayes and Vilmunen (1999) hold for the Czech Republic and Hungary. The labor markets in these countries were able to offset the decline in population in productive age and identify the labor supply relationship.

We can draw several policy implications from the results. First, we have shown that labor markets in the Czech Republic and Hungary work rather efficiently. They are capable of accommodating medium and long-term demand shocks that have their origin abroad or arise from the catching-up process. The equilibrium unemployment rate is relatively well explained by capital and real wages in the long run. More specifically, additional capital tends to attract new employment and reduce the unemployment rate. This is a phenomenon often observed in labor markets with higher level of skill. However, higher real wages then suppress employment and therefore make the unemployment rate rise.

The case is largely different in Poland and Slovakia. Labor market inefficiencies that originate from mismatches in human capital seem to cause significant frictions. Inefficiencies are the result of incoherence between labor demand and labor supply across regions and job seekers' skill sets. Consequently, these inefficiencies make labor supply rigid and unable to adjust to abundance of shocks that were hitting these economies from the demand side during transition. It is also for this reason, why estimating an equilibrium unemployment rate for these economies is quite a challenge.[11]

The labor market is capable of reaching equilibrium, if economic policy is able to smooth out prevailing shocks. We have demonstrated that individual countries may need to address labor market adjustment in a different manner to prove effective. Following the above findings, the focus of economic policy in the Czech Republic and Hungary should be on steering wages to a sustainable level. Thus, market will respond with reaching a sustainable level of unemployment rate. On the other hand, economic policy in Poland and Slovakia should focus on counteracting the labor supply shocks first. The real wages will then adjust until labor market converges to the equilibrium.

As a result, conducting supply driven policies (as for instance flexible contracts, industrial policies etc.) to stabilize labor market conditions should be effective in Slovakia, but not as much in the Czech Republic. On the contrary, wage-oriented economic policies (as for instance inclusive wages and minimum wage policies) that support labor demand should be an effective tool in the Czech Republic, but not in Slovakia.

[11] Gylanik and Hucek (2009) also struggle with structural mismatches and their estimated NAIRU for Slovakia is unusually volatile.

Conclusion

All four CEE countries have experienced a brisk transition to market economies in 1990s, but lengthy transformation of their economies was exposed to many shocks on the way. We find that despite cultural and structural proximity of these countries, there is a clear split in their ability to adjust to labor market shocks.

We used an error correction setup to asses if country-specific labor market trends are predominantly driven by supply or demand factors. First, we have identified a structural break in productive age population in all four countries and found that labor markets in the Czech Republic and Hungary could offset these shocks more efficiently than the labor markets in Slovakia and Poland.

Both the observed data in labor force survey and the estimates of long run relationships imply that demand shocks prevail in the former pair of countries. Based on the prevailing shocks, we distinguish two separate settings of long run relationships among endogenous variables. We derive a long run relationship for equilibrium unemployment rate, explained by real wages, capital stock and terms of trade in the case of Hungary and the Czech Republic. We find that these two countries are capable to accommodate medium and long-term demand shocks rather efficiently.

We found that this is not the case for the latter pair of countries. The mismatches in labor force (rigidities arising from regional disparities and gaps between supply and demand for skills) are causing inefficiencies that make labor supply rigid and unable to adjust to the demand shocks. This makes estimating equilibrium unemployment rate a challenging task. Labor markets of Poland and Slovakia therefore need to be described instead by a long run relationship of equilibrium real wages. We found them to be well explained by trends in unemployment, capital stock and terms of trade. However, we have also found that real wages are flexible in all countries, most likely owing to higher inflation relative to original EU member countries.

The identified long run relationships imply that labor supply policies are more effective in Poland and Slovakia (for example flexible employment contracts), while policies affecting labor demand (inclusive wages) will lead to more effective adjustment to labor market equilibrium in the Czech Republic and Hungary. Still, one needs to bear in mind that although these findings come from a long run analysis, they are not set in stone and also long run relationships may be altered over time as a result of changing nature of the shocks affecting the labor market.

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Appendix 1: Johansen tests 1

Test	Trace test			Maximum eigenvalue test		
Country \ H0	r=0	r<=1	r<=2	r=0	r<=1	r<=2
Czech Rep.	34.74*	11.09	1.535	23.652*	9.551	1.535
Hungary	62.69*	28.80	8.163	33.890*	20.63	7.180
Poland	63.50*	27.42	9.669	36.077*	17.75	9.598
Slovakia	53.64*	21.30	8.321	32.339*	12.98	7.194

Notes:

All tests are done for models with four lags, a constant in cointegrating space and linear trends in the data. Tests for r<=3 are not shown for space reasons, null hypothesis is never rejected. Asterisks mean rejection or the null hypothesis of the test at 5% significance level.