What drives the labour wedge?
A comparison between CEE countries and the Euro Area

Małgorzata Skibińska

Narodowy Bank Polski, Warsaw School of Economics

November 2015

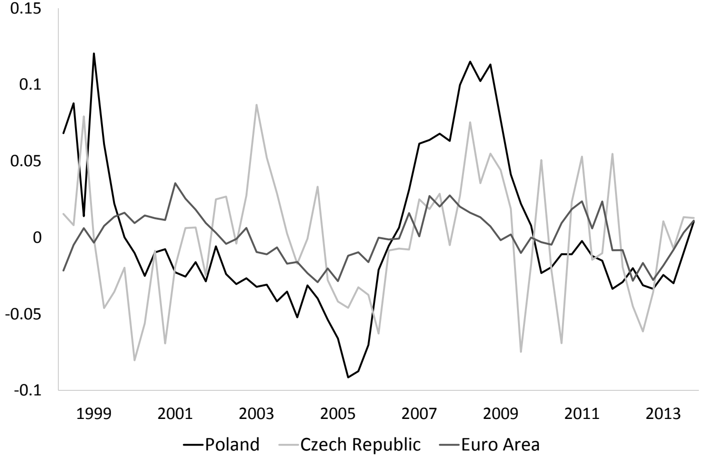
Content:

Motivation

Motivation (1)

- The standard frictionless real business cycle model assumes that wage should be equal to the firms' marginal product of labour (MPL) and the households' marginal rate of substitution (MRS)
- However, the data indicates that this relationship does not hold and that the labour wedge, defined as a gap between these two objects, is characterized by the large cyclical variations
- The labour wedge fluctuations are crucial for output variations (Chari et al. 2007, Kolasa 2013) employment dynamics (Hall 1997) and can be used to measure the welfare costs of business cycles (Galí et al. 2007)

Motivation (2)



What we do?

This paper:

- develops a DSGE model that embeds search and matching frictions in the spirit of Diamond, Mortensen and Pissarides in a small open economy framework
- estimates the model separately for Poland, the Czech Republic and the Euro Area
- identifies the main driving forces of labour wedge variations in the analysed economies

Preview

- The observed higher volatility of the wedge in the CEE region reflects mainly different characteristics of stochastic disturbances rather than country-specific features of the labour market
- The Czech Republic stands out as more similar to the EA, not only in the wedge volatility, but also in its driving forces
- Our results suggest that labour market frictions in Poland are relatively more severe and generate fluctuations that are more harmful for social welfare

Model economy

Households

Household's decision problem:

$$\max_{C_t, K_{t+1}, I_t, D_{t+1}} E_0 \sum_{t=0}^{\infty} \beta^t \varepsilon_{\beta,t} \left(\frac{\left(C_t - h\tilde{C}_{t-1}\right)^{1-\zeta}}{1-\zeta} - \kappa^L \frac{N_t^{1+\phi}}{1+\phi} \right) \quad (1)$$

subject to:

$$P_t C_t + P_t^I I_t + T_t + E_t[Q_{t,t+1} D_{t+1}] = P_t b U_t + W_t N_t + R_t K_t + \Pi_t + D_t \quad (2)$$

$$K_{t+1} = K_t(1-\delta) + I_t \quad (3)$$

Labour market

Matching function:

$$M_t = \sigma^m U_t^\sigma V_t^{1-\sigma} \tag{4}$$

Labour market tightness:

$$\theta_t = \frac{V_t}{U_t} \tag{5}$$

Probability of finding a job by the unemployed:

$$s_t = \frac{M_t}{U_t} = \sigma^m \theta_t^{1-\sigma} \tag{6}$$

Probability of filling a vacant job by the firm:

$$q_t = \frac{M_t}{V_t} = \sigma^m \theta^{-\sigma} \tag{7}$$

Labour force normalization:

$$U_t + N_t = 1 \tag{8}$$

Employment's law of motion:

$$N_t = (1 - \varrho_t) N_{t-1} + M_{t-1} \tag{9}$$

Firms (1)

Firms sectors in the model:

- final good sector
- intermediate goods sector

Final good producer's decision problem:

$$\max_{Y_t(i), Y_t} P_{H,t} Y_t - \int_0^1 P_{H,t}(i) Y_t(i) di \tag{10}$$

subject to:

$$Y_t = \left(\int_0^1 Y_t(i)^{\frac{1}{\mu}} di \right)^{\mu} \tag{11}$$

Firms (2)

Intermediate producer's decision problem:

$$\max_{\substack{Y_t(i),K_t(i),N_t(i),\\ P_{H,t}(i),V_t(i)}} \sum_{t=0}^{\infty} \beta_{0,t} \left[P_{H,t}(i)Y_t(i) - W_t(i)N_t(i) - P_{H,t}\kappa_t^v V_t(i) - R_t K_t(i)\right] \tag{12}$$

subject to:

$$Y_t(i) = \left(\frac{P_{H,t}(i)}{P_{H,t}}\right)^{-\frac{\mu}{\mu-1}} Y_t \tag{13}$$

$$Y_t(i) = Z_t K_t(i)^{\alpha} N_t(i)^{1-\alpha} \tag{14}$$

$$N_t(i) = (1-\varrho_t)N_{t-1}(i) + q_{t-1}V_{t-1}(i) \tag{15}$$

Wage determination (1)

The real wage determination: standard Nash bargaining over the match surplus given by $\mathcal{V}_t^J + \mathcal{V}_t^W(i) - \mathcal{V}_t^U$

- $\mathcal{V}_t^J$ - value of a job for the firm:

$$\mathcal{V}_t^J = mc_t f_{N,t} - w_t + E_t \beta_{t,t+1}(1 - \varrho_{t+1})\mathcal{V}_{t+1}^J \tag{16}$$

- $\mathcal{V}_t^W$ - worker's value of being employed:

$$\mathcal{V}_t^W = w_t - \kappa^L \frac{N_t^\phi}{(C_t - h\tilde{C}_{t-1})^{-\varsigma}} + E_t \beta_{t,t+1} \left[(1 - \varrho_{t+1})\mathcal{V}_{t+1}^W + \varrho_{t+1}\mathcal{V}_{t+1}^U\right] \tag{17}$$

- $\mathcal{V}_t^U$ - worker's value of being unemployed:

$$\mathcal{V}_t^U = b + E_t \beta_{t,t+1} \left[s_t \mathcal{V}_{t+1}^W + (1 - s_t)\mathcal{V}_{t+1}^U\right] \tag{18}$$

Wage determination (2)

Nash bargaining solution determination:

$$w_t^N = argmax\ (\mathcal{V}_t^W - \mathcal{V}_t^U)^{\eta_t}(\mathcal{V}_t^J)^{1-\eta_t} \tag{19}$$

Negotiated wage level:

$$w_t^N = (1-\eta_t)\left[b + \kappa^L \frac{N_t^{\phi}}{(C_t - h\tilde{C}_{t-1})^{-\varsigma}}\right] + \eta_t\left[mc_t f_{N,t} + \frac{P_{H,t}}{P_t}\kappa_t^v \theta_t\right] \tag{20}$$

Real wage rigidities - adaptive wage rule (Hall 2005):

$$w_t = \alpha_w w_t^N + (1-\alpha_w) w_{t-1} \tag{21}$$

Labour wedge

Labour wedge defined as a difference between households' (log) marginal rate of substitution and firm's (log) marginal product of labour:

$$wedge_t = mrs_t - mpl_t \tag{22}$$

Using the functional forms of the production technology and the utility function, we get, up to an additive constant:

$$wedge_t = \left(\phi \hat{N}_t + \zeta \frac{\hat{C}_t - h\hat{C}_{t-1}}{1-h}\right) - \left(\hat{Y}_t - \hat{N}_t\right) \tag{23}$$

Results

Estimation

Parameterisation: mixture of calibration and bayesian estimation (MCMC algorithm, Metropolis-Hastings implementation)

Observable variables: Y, C, U, V, w, g, Y^*

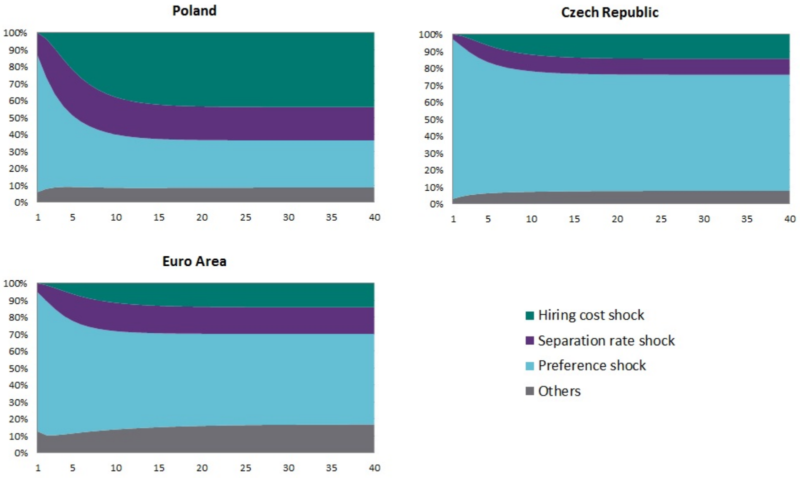
- The magnitude of stochastic disturbances in the CEE region is higher
- ... but shocks in the EA are more persistent
- The degree of wage rigidity in both CEE countries is comparable and lower than in the EA
- The estimates of the elasticity of the matching function and the workers' bargaining power in the Czech Republic resemble more those observed in the EA

Model's data fit

- The general patterns observed in the data are well reproduced
- Our model:
  - implies higher volatility of the labour wedge in the CEE region
  - generates the procyclicality in the labour wedge
  - captures the persistence of the labour wedge

	Standard deviation		Correlation wih GDP		Autocorrelation	
	Model	Data	Model	Data	Model	Data
Poland						
Y	0.018	0.014	1.000	1.000	0.922	0.883
wedge	0.037	0.049	0.415	0.668	0.746	0.869
Czech Republic						
Y	0.022	0.019	1.000	1.000	0.936	0.891
wedge	0.041	0.039	0.072	0.192	0.478	0.423
Euro Area						
Y	0.012	0.012	1.000	1.000	0.912	0.896
wedge	0.022	0.016	0.245	0.610	0.700	0.730

Shocks driving the labour wedge



Structural vs. stochastic heterogeneity (1)

- The characteristics of stochastic disturbances contribute strongly to the relatively high variability of labour wedge in CEE countries
- The preference shock plays relatively bigger role in the Czech Republic
- If shocks were the same, the labour wedge variability in the Czech Republic would be much lower than in Poland –> the structural parameters also matter

	Poland	Czech Republic
Country model	0.0371	0.0405
Preference shock as in the EA	0.0356	0.0286
Labour market shocks as in the EA	0.0280	0.0367
Euro Area shocks (all)	0.0250	0.0211

Structural vs. stochastic heterogeneity (2)

- The elasticity of the matching process with respect to unemployment and workers' bargaining power contribute to the relatively higher variability of the wedge in Poland
- The impact of heterogeneity in these parameters between the EA and the Czech Republic is rather marginal
- Real wage rigidities seem to play a minor role

	Parameters			Wedge volatility
Poland				
Country model	$\sigma = 0.55$	$\eta = 0.62$	$\alpha_w = 0.50$	0.0371
σ as in the EA	$\sigma = 0.71$	$\eta = 0.62$	$\alpha_w = 0.50$	0.0327
η as in the EA	$\sigma = 0.55$	$\eta = 0.43$	$\alpha_w = 0.50$	0.0327
α_w as in the EA	$\sigma = 0.55$	$\eta = 0.62$	$\alpha_w = 0.22$	0.0376
σ, η, α_w as in the EA	$\sigma = 0.71$	$\eta = 0.43$	$\alpha_w = 0.22$	0.0308
Czech Republic				
Country model	$\sigma = 0.70$	$\eta = 0.51$	$\alpha_w = 0.57$	0.0405
σ as in the EA	$\sigma = 0.71$	$\eta = 0.51$	$\alpha_w = 0.57$	0.0403
η as in the EA	$\sigma = 0.70$	$\eta = 0.43$	$\alpha_w = 0.57$	0.0403
α_w as in the EA	$\sigma = 0.70$	$\eta = 0.51$	$\alpha_w = 0.22$	0.0406
σ, η, α_w as in the EA	$\sigma = 0.71$	$\eta = 0.43$	$\alpha_w = 0.22$	0.0401

Conclusions

Conclusions

- The observed higher volatility of the wedge in the CEE region reflects mainly different characteristics of stochastic disturbances rather than country-specific features of the labour market
- The Czech Republic is more similar to the EA in terms of both labour wedge volatility and its driving forces
- Our results suggest that labour market frictions in Poland are relatively more severe and generate fluctuations that are more harmful for social welfare

Thanks!

References

- Blanchard, O.J., Galí, J., 2010. Labor Markets and monetary policy: a New-Keynesian model with unemployment. American Economic Journal: Macroeconomics 2 (2), 1-30.
- Brzoza-Brzezina, M., Jacquinot, P., Kolasa, M., 2014. Can we prevent boom-bust cycles during Strefa Euro accession? Open Economies Review 25 (1), 35-69.
- Bussière, M., Callegari, G., Ghironi, F., Sestieri, G., Yamano, N., 2013. Esimation Trade Elasticities: Demand Composition and the Trade Collapse of 2008-2009. American Economic Journal: Macroe-conomics 5 (3), 118-151.
- Chari, V.V., Kehoe, P.J., McGrattan, E.R., 2007. Business cycle accounting. Econometrica 75 (3), 781–836.
- Chari, V.V., Kehoe, P.J., McGrattan, E.R., 2002. Can Sticky Price Models Generate Volatile and Per-sistent Real Exchange Rates? Review of Economic Studies 69 (3), 533-563.
- Cheremukhin, A.A., Restrepo-Echavarria, P.,2014. The labor wedge as a matching friction. European Economic Review 68 (C), 71-92.
- Christiano, L.J., Trabandt, M., Walentin, K., 2011. Introducing Financial Frictions and Unemployment into a Small Open Economy Model. Journal of Economic Dynamics and Control 35 (12), 1999-2041.
- Christoffel, K., Kuester, K., 2008. Resuscitating the wage channel in models with unemployment fluc-tuations. Journal of Monetary Economics 55 (5), 865–887.
- Christoffel, K., Kuester, K., Linzert, T., 2009. The role of labor markets for Strefa Euro monetary policy. European Economic Review 53 (8), 908–936.
- Galí, J., Gertler, M., López-Salido, J.D., 2007. Markups, gaps, and the welfare costs of business fluc-tuations. The Review of Economics and Statistics 89 (1), 44–59.
- Galí, J., Monacelli, T., 2005, Monetary Policy and Exchange Rate Volatility in a Small Open Economy. Review of Economic Studies 72, 707–734.
- Gradzewicz, M., Growiec, J., Wyszyński, R., 2012. Luka nieefektywności w cyklu koniunkturalnym w Polsce. Working Paper 281, NBP.
- Gradzewicz, M., Makarski K., 2013. The business cycle implications of the euro adoption in Poland. Applied Economics 45 (17), 2443-2455.
- Gertler, M., Trigari, A., 2009. Unemployment fluctuations with staggered Nash wage bargaining. Journal of Political Economy 117 (1), 38-86.

References

- Hall, R.E., 1997. Macroeconomic fluctuations and the allocation of time. Journal of Labor Economics 15 (1), 223–250.
- Hall, R.E., 2005. Employment Fluctuations with Equilibrium Wage Stickiness. American Economic Review 95 (1), 50-65.
- Hobijn, B., Sahin, A, 2007. Job-finding and separation rate in the OECD. Staff Report 298, Federal Reserve Bank of New York.
- Karabarbounis, L., 2014. The labor wedge: MRA vs. MPN. Review of Economic Dynamics 17 (2), 206-223.
- Kolasa, M., 2013. Business cycles in EU new member states: How and why are they different? Journal of Macroeconomics 38 (2013), 487-496.
- Merz, M., 1995. Search in the Labour Market and the Real Business Cycle. Journal of Monetary Eco-nomics 36 (2), 269-300.
- Mortensen, D.T., Pissarides, C.A., 1994. Job Creation and Job Destruction in the Theory of Unem-ployment. Review of Economic Studies 61 (3), 397-415.
- Pescatori, A., Tasci, M., 2011. Search frictions and the labor wedge. Working Paper 1111, Federal Reserve Bank of Cleveland.
- Pissarides, C.A., 1985. Short-run Equilibrium Dynamics of Unemployment, Vacancies and Real Wag-es. American Economic Review 75 (4), 676-690.
- Pissarides, C.A., 2000. Equilibrium Unemployment Theory (second edition). The MIT Press.
- Sala, L., Söderström, U., Trigari, A., 2010. The Output Gap, the Labour Wedge, and the Dynamic Be-haviour of Hours. CEPR Discussion Papers 8005, C.E.P.R. Discussions Papers.
- Shimer, R., 2005. The Cyclical Behavior of Equilibrium Unemployment and Vacancies. American Economic Review 95 (1), 25-49.
- Shimer, R., 2009. Convergence in macroeconomics: The labor wedge. American Economic Journal: Macro-economics, 1 (1), 280-297.
- Smets, F., Wouters, R., 2003. An Estimated Stochastic Dynamic General Equilibrium of the Strefa Euro. Journal of the European Economic Association 1 (5), 1123–1175.
- Trigari, A., 2006. The Role of Search Frictions and Bargaining for Inflation Dynamics. Working Papers 304, IGIER, Bocconi University.

Estimation results - labour market parameters

	Prior distribution			Posterior distribution		
	Type	Mean	SD	5%	Mean	95%
Poland						
σ	beta	0.60	0.10	0.441	0.549	0.657
η	beta	0.50	0.10	0.493	0.620	0.745
α_w	beta	0.50	0.10	0.393	0.498	0.604
Czech Republic						
σ	beta	0.60	0.10	0.631	0.703	0.774
η	beta	0.50	0.10	0.393	0.505	0.623
α_w	beta	0.50	0.10	0.457	0.567	0.678
Euro Area						
σ	beta	0.60	0.10	0.636	0.714	0.792
η	beta	0.50	0.10	0.293	0.433	0.578
α_w	beta	0.50	0.10	0.144	0.220	0.290

Estimation results - utility function parameters

	Prior distribution			Posterior distribution		
	Type	Mean	SD	5%	Mean	95%
Poland						
ζ	gamma	2.00	0.25	1.327	1.668	1.988
ϕ	gamma	2.00	0.25	1.516	1.924	2.311
h	beta	0.70	0.10	0.273	0.391	0.512
Czech Republic						
ζ	gamma	2.00	0.25	1.383	1.712	2.039
ϕ	gamma	2.00	0.25	1.540	1.938	2.325
h	beta	0.70	0.10	0.453	0.564	0.671
Euro Area						
ζ	gamma	2.00	0.25	1.403	1.733	2.060
ϕ	gamma	2.00	0.25	1.535	1.930	2.321
h	beta	0.70	0.10	0.336	0.486	0.645

Estimation results - shocks' persistence

	Prior distribution			Posterior distribution		
	Type	Mean	SD	5%	Mean	95%
Poland						
ρ_β	beta	0.50	0.20	0.105	0.288	0.459
ρ_z	beta	0.50	0.20	0.656	0.778	0.904
ρ_g	beta	0.58	0.01	0.563	0.580	0.596
ρ_y	beta	0.90	0.01	0.889	0.904	0.920
ρ_ϱ	beta	0.50	0.20	0.288	0.449	0.614
ρ_v	beta	0.50	0.20	0.801	0.865	0.932
ρ_η	beta	0.50	0.20	0.032	0.148	0.256
Czech Republic						
ρ_β	beta	0.50	0.20	0.122	0.297	0.468
ρ_z	beta	0.50	0.20	0.743	0.835	0.925
ρ_g	beta	0.55	0.01	0.534	0.550	0.566
ρ_y	beta	0.90	0.01	0.888	0.903	0.919
ρ_ϱ	beta	0.50	0.20	0.476	0.620	0.760
ρ_v	beta	0.50	0.20	0.825	0.887	0.950
ρ_η	beta	0.50	0.20	0.028	0.133	0.232
Euro Area						
ρ_β	beta	0.50	0.20	0.477	0.644	0.814
ρ_z	beta	0.50	0.20	0.713	0.786	0.860
ρ_g	beta	0.88	0.01	0.863	0.880	0.896
ρ_y	beta	0.86	0.01	0.847	0.863	0.876
ρ_ϱ	beta	0.50	0.20	0.594	0.721	0.853
ρ_v	beta	0.50	0.20	0.837	0.894	0.950
ρ_η	beta	0.50	0.20	0.084	0.236	0.384

Estimaton results - shocks' standard deviations

	Prior distribution			Posterior distribution		
	Type	Mean	SD	5%	Mean	95%
Poland						
ϵ_β	inv. gamma	0.01	inf	0.013	0.020	0.025
ϵ_z	inv. gamma	0.01	inf	0.005	0.006	0.007
ϵ_g	inv. gamma	0.01	inf	0.009	0.011	0.012
ϵ_y	inv. gamma	0.01	inf	0.005	0.006	0.006
ϵ_ϱ	inv. gamma	0.10	inf	0.090	0.107	0.123
ϵ_v	inv. gamma	0.10	inf	0.090	0.117	0.143
ϵ_η	inv. gamma	0.10	inf	0.093	0.190	0.283
Czech Republic						
ϵ_β	inv. gamma	0.01	inf	0.023	0.033	0.043
ϵ_z	inv. gamma	0.01	inf	0.006	0.007	0.008
ϵ_g	inv. gamma	0.01	inf	0.016	0.018	0.021
ϵ_y	inv. gamma	0.01	inf	0.005	0.006	0.006
ϵ_ϱ	inv. gamma	0.10	inf	0.066	0.078	0.089
ϵ_v	inv. gamma	0.10	inf	0.119	0.142	0.163
ϵ_η	inv. gamma	0.10	inf	0.093	0.165	0.235
Euro Area						
ϵ_β	inv. gamma	0.01	inf	0.008	0.014	0.020
ϵ_z	inv. gamma	0.01	inf	0.004	0.005	0.005
ϵ_g	inv. gamma	0.01	inf	0.003	0.003	0.003
ϵ_y	inv. gamma	0.01	inf	0.005	0.006	0.007
ϵ_ϱ	inv. gamma	0.10	inf	0.030	0.035	0.040
ϵ_v	inv. gamma	0.10	inf	0.050	0.061	0.071
ϵ_η	inv. gamma	0.10	inf	0.094	0.196	0.295