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Oil shocks on unemployment in

Central and Eastern Europe

Juan Carlos Cuestas
EestiPank

Luis A. Gil-Alana
University of Navarra

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ABSTRACT

The aim of this paper is to shine some light on the effect of oil price movements on unemployment in Central and Eastern Europe. In order to do so, we disentangle oil prices movements by their sign. From there we analyse the separate effect of positive and negative movements of oil prices on unemployment rates. We find that although oil prices and unemployment are not very much correlated in the short run, the effect of oil price shocks on the natural rate of unemployment goes in the same direction, i.e. increases or decreases in oil prices increase or decrease the natural rate of unemployment.

Juan Carlos Cuestas
EestiPank

Luis A. Gil-Alana
University of Navarra

Oil shocks on unemployment in Central and Eastern Europe[†]

Juan Carlos Cuestas*
Economics and Research Department
Research Unit
EestiPank

Luis A. Gil-Alana**
Department of Economics
ICS – NCID
University of Navarra

Abstract

The aim of this paper is to shine some light on the effect of oil price movements on unemployment in Central and Eastern Europe. In order to do so, we disentangle oil prices movements by their sign. From there we analyse the separate effect of positive and negative movements of oil prices on unemployment rates. We find that although oil prices and unemployment are not very much correlated in the short run, the effect of oil price shocks on the natural rate of unemployment goes in the same direction, i.e. increases or decreases in oil prices increase or decrease the natural rate of unemployment.

Key words: Unemployment rates; oil prices shocks; Central and Eastern Europe.

JEL code: C22, E39, Q43

1.   Introduction

In both 2008 and 2015 oil prices reached levels similar to that of 2005, just before the housing market bubble got bigger and the world economy nearly collapsed in 2008. Concerns about the consequences of these recent declines in oil prices, and more pertinently the reasons for them, have gathered momentum, as falling oil prices may be illustrating a drop in global aggregate demand. Oil prices have driven inflation rates close to zero and even negative in some European countries since the Global Financial Crisis erupted in 2007.

As has been established by economic theory (see Hamilton, 1983, 1988, and Carruth et al. 1998, amongst others), oil shocks may affect both the short-run, but more likely the long-run unemployment. We focus on the effect of oil shocks on unemployment rather than on GDP, as changes in GDP are not always transmitted to unemployment; see Okun (1962). However, the short-run Phillips curve indicates that there may be a negative relationship between prices and unemployment. We follow here Carruth et al.'s (1998) model, where oil price changes affect the equilibrium unemployment rate (see next section).

In this paper we seek to shed some light on the effect that oil price movements have on unemployment in a group of Central and Eastern European Countries (CEECs), namely the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. We do this in two different ways: (1) we distinguish between positive and negative shocks from oil prices in unemployment, (2) we analyse the effect of oil price movements on the unemployment rate, its dynamics, and the natural rate of unemployment. Distinguishing between positive and negative movements in oil prices is relevant as it permits measurement of whether unemployment reacts in a different way when the oil price falls or when it rises. Our initial hypothesis, as established by Carruth et al. (1998) model, is that decreases in the price of oil reduce the unemployment rate in equilibrium. Likewise, an increase in the price of oil will increase the unemployment rate in equilibrium.

The group of countries considered here is of key importance for the future of the enlarged European Union (EU). Unemployment has been in general higher than that of western Europe, and given that net migration to the rest of the EU is negative for the CEECs, since there is freedom of labour movement within the EU. Hence, assessing the effects of supply shocks on the unemployment rate, and how the equilibrium unemployment rates evolves after a supply shock,

can provide insights about migration flows. In addition to that, it can explain the high persistence of shocks on the unemployment rates of these countries, for both western and eastern, which has been found in previous papers such as Cuestas et al. (2011), Gozgor (2013) and Marjanovic et al. (2015) for the CEECs, and Cuestas and Harrison (2014) for the EU-15.

There are a number of papers that analyse the persistence of shocks on the unemployment rate and that also aim to test the natural rate of unemployment or NAIRU hypothesis. Cuestas et al. (2011) showfor instance that for the CEECs, there might be rigidities which generate long memory behaviours and a slow speed of adjustment towards the equilibrium. More recently, Møller (2013, 2016) analyses potential sources of hysteresis in the unemployment rate. His focus is on the United Kingdom and he shows that the main source of sluggishness in unemployment is not prices, wages or output, but oil price shocks. This justifies the analysis of the relationship between oil prices and unemployment if the goal is to shed some light on the effect of supply shocks on unemployment. However, to the best of our knowledge there is no other paper that has looked into the relationship between unemployment and oil price shocks for the CEECs.

There are a number of studies analysing the effect of oil price shocks on GDP which incorporate the possibility of asymmetries for OECD countries; see for instance Jimenez-Rodriguez and Sanchez (2005) and Jimenez-Rodriguez (2009) and the references therein. The reason for incorporating non-linearities is straightforward: positive supply shocks may have a different effect on economic variables than negative supply shocks due to rigidities in the transmission mechanism for oil price shocks into the real economy (Acurio-Vasconez, 2015, and Bampinas and Panagiotidis, 2015).

The analysis of the relationship between unemployment and input prices is not new. Caporale and Gil-Alana (2002), Gil-Alana and Henry (2003), and Gil-Alana (2003, 2006) estimate fractional integration and cointegrated relationships between unemployment and oil prices for Canada, Australia and the United Kingdom, respectively. For emerging markets, Doğrul and Soytas (2010) find for Turkey that the oil price helps to improve forecasts of unemployment in the long run. Similarly, but within the non-linear modelling literature, Andreopoulos (2009) uses Markov Switching models and finds that oil prices can predict unemployment during recessions.

More recently, Katircioglu et al. (2015) apply panel data cointegration techniques for a group of OECD countries and find that the impact of oil price shocks is negative on

macroeconomic variables such as unemployment and GDP. To the best of our knowledge only Marjanovic et al. (2015) analyse the relationship between a broad definition of inflation and the NAIRU, for a group of CEECs, finding that the NAIRU tends to decline with increases in the inflation rate.

So given that, to the best of our knowledge, there is no empirical evidence about oil price shocks on unemployment in the CEECs and that it is important to distinguish between the effects of negative and positive shocks, in the remainder of the paper we analyse the relationship between positive and negative movements in oil prices and the unemployment rates of the CEECs. In this paper, we apply the Non-linear AutoRegressive Distributed Lag (NARDL) method by Shin et al. (2014) and the fractional integration methodology by Robinson (1994) to disentangle the effect of positive and negative oil price shocks on unemployment.

The remainder of the paper is organised as follows. In the next section we discuss briefly the economic theory behind our hypothesis. In section 3 we discuss the methods used for our empirical application. In section 4, we present the results and we conclude in the last section.

2.   Economic background

In this section, we describe Carruth et al. (1998) model, which relates oil price movements with changes in equilibrium unemployment rate.   The model is based on the efficiency-wage framework by Shapiro and Stiglitz (1984). The model by Carruth et al. (1998) states that the equilibrium wage can be explained by the following equation:

$$\log w = \log b + e + \frac{e \cdot d}{[1 - a(U)](1 - d)} \, ,$$

(1)

where w is the wage, b is the level of unemployment benefits, e is the level of on-the-job effort, d is the probability of successfully shirking, i.e. zero effort at work , U is the unemployment rate, and $a(U)$ is the probability of finding a job for an unemployed individual. Equation (1) implies that the equilibrium wage depends on the value of not working, the level of effort on-the-job and a declining function of U. Carruth et al. (1998) remind us that the utility of a worker is $u = log\ w – e$, that is, utility will be higher, the greater the gap between wage and level of effort at work. If the worker is caught shirking, then he or she is fired and hence has to find a job elsewhere.

Hence, the wage of a fired individual is a weighted average by the probability of finding work of the in-work utility *log w – e* and unemployment benefits *log b*. Equation (1) can be obtained by a solving a problem of efficiency wages, i.e. the firm needs to pay enough so as to discourage zero effort by all workers. Otherwise, all workers would be fired and there would not be any production.

The production function presents constants returns to scale and labour, capital and oil are used as inputs. It is also assumed that there is perfect competition in the markets for goods. Given this assumption, firm profits are zero, meaning that prices are equal to marginal cost, which depends on wages, *w*, rental rate, *r,* and oil price, p_o. That is, the real prices of this economy can be written as

$$\mu = c(w, e, p_o)$$ (2)

The equilibrium unemployment rate can be obtained by solving (1) and (2) for *U*:

$$U^* = U^*(r, p_o, b(\mu), e, d),$$ (3)

with $\frac{\partial U}{\partial r} > 0$ and $\frac{\partial U}{\partial p_o} > 0.$

The mechanism works as follows: let's consider that there is an increase in oil prices. This affects the cost of production. Now, firms may go bankrupt and close, firing workers, or if they can, they may as well restore the zero profit condition. Capital is fixed, so the only way is to reduce labour costs by firing workers, which will then increase the unemployment rate in equilibrium. This will, as a consequence, induce workers to accept lower wages in order to keep their jobs, restoring, finally the zero profit condition. In theory, the same would apply when there is an increase in the real interest rate.

However, Carruth et al. (1998) show that for the case of the United States, there seems to be weak evidence that real interest rate actually Granger-cause unemployment rates, hence our focus on this paper relies on the relationship between unemployment rates and oil prices. Recently, Møller (2013, 2016) find similar empirical results for UK data.

3.   Methodology

In order to assess the relationship between positive and negative movements of the price of oil on the unemployment rates of our target countries, in this paper we base our empirical analysis upon the AutoRegressive Distributed Lag (ARDL) models and bound tests proposed by Pesaran et al. (2001). One of the main advantages of this method is that it is possible to estimate error correction models for I(1) and I(0) variables together. We also estimate a non-linear ARDL (NARDL), suggested by Shin et al. (2014), with the aim of estimating possible different effects on unemployment of positive and negative shocks to oil prices.[1] The NARDL is based on the following equation:

$$\Delta u_t = c + \alpha_0 u_{t-1} + \alpha_1^+ p_{t-1}^+ + \alpha_1^- p_{t-1}^- + \theta_i \sum_{i=1}^{p} \Delta u_{t-i} + \gamma_i^+ \sum_{i=1}^{q} \Delta p_{t+1-i}^+ + \gamma_i^- \sum_{i=1}^{q} \Delta p_{t+1-i}^- + \varepsilon_t$$

(4)

where

$$p_t^+ = \sum_{j=1}^{T} max(\Delta p_t, 0)$$

(5)

and

$$p_t^- = \sum_{j=1}^{T} min(\Delta p_t, 0)$$

. (6)

Hence, the long-run parameters are the α's. The cointegrating relationship can be obtained by simply dividing the alphas by $-\alpha_0$ and testing for a long-run relationship by means of the bound test for the null

$$H_0: \alpha_0 = \alpha_1^+ = \alpha_1^- = 0.$$

(7)

In addition, evidence of asymmetries in the long run and in the short run can be tested for:

$$H_0: \alpha_1^+ = \alpha_1^-$$

(8)

and

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[1]See Bampinas and Panagiotidis (2015) for non-linear dynamics of oil price.

$$H_0: \sum_{i=0}^{q-1} \gamma_i^+ = \sum_{i=0}^{q-1} \gamma_i^- \quad , \tag{9}$$

by means of a Wald test.

In order to present the effects of both positive and negative changes in oil prices on unemployment visually, we also show graphical representations of the dynamic multipliers. These multipliers show the effect of a unit change in p_t^+ and p_t^- on the unemployment rate. The cumulative dynamic multiplier effects can be written as $m_h^+ = \sum_{j=0}^{h} \frac{\partial u_{t+j}}{\partial p_t^+}$ and $m_h^- = \sum_{j=0}^{h} \frac{\partial u_{t+j}}{\partial p_t^-}$, for $h = 0, 1, 2, \dots$ (see Shin et al. 2014 for further details).

In order to gain robustness in the analysis, we also apply fractional integration techniques, which take into account the persistent effect of the variables under examination. Fractional integration techniques relax the assumption of an integer order of integration, $I(d)$, where d stands for the order of integration, which can be non-integer for fractional integration. This adds flexibility to the analysis since $0 < d < 1$ means long memory but mean reversion to the equilibrium after a shock. In cointegration analysis this relaxes the assumption of no cointegration to the case of fractional cointegration, where the residuals can be integrated of any real number. We use the Whittle function in the frequency domain (Dahlhaus, 1989) though we use it in the context of a regression model of form:

$$y_t = \beta z_t + x_t, \qquad t = 1, 2, \dots, \tag{10}$$

where x_t is fractionally integrated of order d, or I(d), and β is a transpose vector of parameters and z_t is a vector of exogenous variables, so

$$(1 - L)^d x_t = \mu_t, \quad t = 1, 2, \dots, \tag{11}$$

where L is the lag operator, and therefore μ_t is I(0), defined for this as a covariance stationary process with spectral density function that is positive and finite at the zero frequency. This set-up is also used in Robinson (1994), who tests the null hypothes is through a Lagrange Multiplier (LM) test:

$$H_0 : d = d_o, \tag{12}$$

for any real value of d_o. Thus, under H_0 (12), the null model becomes:

$$\tilde{y}_t \ = \ \beta \, \tilde{z}_t \ + \ \mu_t \,, \qquad t \ = \ 1, 2, \ .... \tag{13}$$

where

$$\tilde{y}_t \ = \ (1 - L)^{d_o} \, y_t \,, \quad \text{and} \, \tilde{z}_t \ = \ (1 - L)^{d_o} \, z_t \,,$$

and from the I(0) stationary assumption for the error term μ_t in (13), β can be consistently estimated by standard least squares methods. As in other large sample testing situations, Wald and LR tests against fractional alternatives will have the same distribution as the LM tests of Robinson (1994). Lobato and Velasco (2007) employed, for instance, a Wald test procedure, but such a method requires a consistent estimate of d, unlike Robinson's (1994) method, which is valid in nonstationary contexts (d $\geq$ 0.5) and seems computationally simpler and more attractive than other methods.

4. Empirical analysis

3.1 The data

Our data consist of quarterly seasonally adjusted unemployment rates from 2000Q1 to 2015Q4 obtained from Eurostat for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. We decided to start the sample in 2000 to the inclusion of high unemployment years due to structural change and transition from planned to market economy (Sorm and Terrell, 2000, Haltiwanger and Vodopivec, 2002, 2003). Data for oil prices, p_t, have been obtained from the US Energy Information Administration and are for Europe Brent Spot Price FOB (Dollars per Barrel), which have been deflated using the US harmonised index of consumer prices obtained from *Eurostat*. We have taken natural logs for both unemployment and real oil prices. In Figure 1 we display the unemployment rates and the oil prices. The figures seem to suggest that there is a negative correlation between the variables until 2011, but after this the decline in oil prices appears to occur together with a reduction in unemployment rates. This conclusion is corroborated by Figure 2, where the average unemployment rate and the oil price are displayed. Hence, overall, we cannot be certain of whether the data supports our hypothesis that oil price and unemployment move in the same direction. Instead of estimating a broken-type of equation *à la* Bai and Perron (2003), with a potential break around 2007-8, we divide oil price movements into increases and decreases, to see the potential different effect of positive and negative shocks on unemployment.

3.2 Results

Unemployment rates and oil prices

We first show the tests for long-run relations between the unemployment rates of our target countries and the price of oil found from equation (1) with 8 lags.

Table 1, where a negative sign in column 5 implies that a drop in the oil price affects the unemployment rate negatively, suggests that oil price movements only affect unemployment in the long run for Slovenia at the 10% significance level.

As a robustness check we estimate the long-run equations for (+) and (-) oil price movements using fractional integration. The estimated model is:

$$u_t = \beta_0 + \beta_1\, p_t^+ + \beta_2\, p_t^- + x_t; \quad (1 - L)^d x_t = \mu_t^{\square} \tag{11}$$

and their results are shown in Table 2, for white noise disturbances, and Table 3 for Bloomfield type errors (Bloomfield, 1973). The latter is a non-parametric approach for modelling I(0) errors that produces autocorrelations that decay exponentially as in the AR case, but with a small number of parameters. Moreover, this approach has been very popular in the context of fractional integration (see, e.g., Gil-Alana, 2004).

The results from Tables 2 and 3 do not show statistically significant effects, with in general quite high orders of integration, which show lack of long run relationships. There may be two reasons for the lack of significant results for the long-run equation: first, movements in oil prices better explain changes in unemployment rates, and, second, given that we are modelling a clear supply shock, the target variable should be the natural rate of unemployment rather than the unemployment rate. We tackle these issues in the remainder of the paper.

In order to model how positive and negative movements in oil prices may affect the changes in unemployment rates, we estimate the following equation, using fractional integration techniques once again:

$$(1-L)u_t = \delta_0 + \delta_1 p_t^+ + \delta_2 p_t^- + y_t; \quad (1-L)^d y_t = \varepsilon_t \qquad (12)$$

The results are displayed in Tables 4, and 5 for different specifications of the error term. Specifically, we assume white noise disturbances in Tables 4 and we impose Bloomfield-type disturbances in Table 5.

[Tables 4 and 5 about here]

The results show similar results than those obtained in Tables 2 and 3, namely that oil price shocks do not have an impact on short run unemployment dynamics.

Oil prices and the natural rate of unemployment

As mentioned above, a second reason why we did not find long-run relationships between oil prices and unemployment is that oil shocks would affect the natural rate of unemployment in the long run. As Carruth et al. (1998) theory establishes, supply shocks tend to affect the equilibrium unemployment rate, so to isolate the effect of aggregate supply shocks from aggregate demand shocks, we estimate the NARDLs, with 4 lags, using the unemployment trend obtained with the Hodrick-Prescott filter.

In Table 6 we present the long-run effects. In all significant cases, except Poland, an increase in oil prices increases the equilibrium rate of unemployment and a decrease in the price of oil reduces the unemployment equilibrium rate. Also, for Estonia only negative shocks have an effect over the equilibrium rate of unemployment, whereas for Hungary only positive shocks have a significant impact. This is good news for the Estonian economy as increases in oil price do not transmit into higher unemployment rates, whereas not so good for the case of Hungary as drops in oil prices do not convert into a reduction in unemployment. The results for the latter country, along with the case of Poland, may be explained by the fact that both countries produce comparatively natural gas. As oil prices and natural gas prices have been positively correlated, we may expect some negative impact on unemployment when oil prices drops.The results also

seem to suggest that in countries with high trade union density, such as the Czech Republic, Slovakia and Slovenia, oil price movement do not have an effect on unemployment in equilibrium, as the labour markets are less flexible. For the case of Estonia, the fact that increases in oil prices do not affect equilibrium unemployment may have to do with the flexibility of nominal wages to increase, increasing prices and not affecting much firm's real profits (Druant et al. 2012 and Eamets, 2013).

In Figure 3, we show the cumulative multiplier effects. In general, we see that there is evidence of asymmetric effects only for the cases of the Baltics, the Czech Republic and Poland (at some point the confidence intervals do not contain the zero line).

Our results are somehow the opposite of those found by Marjanovic et al. (2015), who find that the NAIRU holds a negative relationship with inflation. However, in the current paper we focus exclusively on oil price shocks and not on a broad definition of inflation. In general, we observe that the positive effect on unemployment of a fall in oil prices is stronger in magnitude than the negative effect of an increase in oil prices on the natural rate of unemployment.

5.   Conclusions

In order to clarify the controversial issue on whether oil price falls are a sign of economic weakness and whether they can negatively affect the unemployment rate, we have estimated in this paper the relationship between unemployment rates, the natural rate of unemployment and its dynamics for a group of CEECs.

We have divided increases and decreases in oil prices in order to analyse the possibility of oil price movements having an asymmetric effect on unemployment rates. In addition we run the analysis using the unemployment rate untransformed, its first difference to capture dynamics, and the natural rate of unemployment obtained by means of the Hodrick-Prescott filter.

In general we find in general that there are no clear short run effects of oil prices changes on unemployment dynamics. However, when we look at the natural rate of unemployment, we observe that in general positive oil price shocks tend to reduce the unemployment rate and negative shocks to raise it. We also find that negative shocks tend to have a stronger effect in magnitude than positive shocks. We also find some correlation between our results and trade union density which match the labour market structure.

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Table 1: Long-run effects based on a NARDL

Country	Long-run effect (+)			Long-run effect (-)		
	Coef.	F-stat	p-value	Coef.	F-stat	p-value
Czech Rep.	-0.143	0.389	0.536	0.074	0.042	0.838
Estonia	0.444	0.131	0.719	-0.512	0.088	0.768
Hungary	0.009	0.000	0.988	0.509	0.204	0.653
Latvia	0.245	0.043	0.837	-0.204	0.014	0.906
Lithuania	0.321	0.044	0.834	-0.174	0.007	0.932
Poland	0.472	0.138	0.712	-1.087	0.335	0.566
Slovakia	-1.008	0.717	0.402	1.429	0.528	0.471
Slovenia	-0.241	2.059	0.159	0.512	3.758	0.059

Table 2: Estimates of d and the 95% intervals, β-coefficient and t-values, based on white noise disturbances

Series	d	β_0	β_1	β_2
Czech Rep.	1.70 (1.43, 2.04)	**2.2345** **(64.35)**	-0.0699 (-0.89)	0.0172 (0.36)
Estonia	1.41 (1.21, 1.68)	**2.6268** **(30.71)**	-0.1082 (-0.58)	0.0100 (0.09)
Hungary	1.43 (1.30, 1.60)	**1.9023** **(63.54)**	0.0721 (0.41)	-0.0411 (-1.05)
Latvia	1.29 (1.16, 1.47)	**2.6667** **(35.93)**	0.1036 (0.67)	**-0.2551** **(-2.78)**
Lithuania	1.64 (1.46, 1.86)	**2.7230** **(48.53)**	-0.1846 (-1.76)	-0.0169 (-0.22)
Poland	1.53 (1.34, 1.69)	**2.7314** **(80.73)**	-0.0760 (-1.00)	-0.0107 (-0.24)
Slovakia	1.65 (1.44, 2.07)	**2.0031** **(101.1)**	-0.0368 (-0.57)	0.0201 (0.52)
Slovenia	1.22 (1.03, 1.42)	**1.9135** **(34.79)**	0.0050 (0.04)	-0.0140 (-0.21)

Note: In the second column the numbers in the first line are the differencing parameter and the estimated confidence interval appear in parentheses. In columns3, 4 and 5 we numbers in parentheses are t-statistics. We highlight in bold face the significant cases at the 5% level.

Table 3: Estimates of d and the 95% intervals, β-coefficient and t-values, based Bloomfield disturbances

Series	d	β_0	β_1	β_2
Czech Rep.	1.38 (0.74, 1.93)	**2.2330** **(54.02)**	-0.0184 (-0.20)	-0.0162 (-0.30)
Estonia	1.48 (1.06, 2.02)	**2.6250** **(31.41)**	-0.1364 (-0.73)	0.0412 (0.37)
Hungary	1.56 (1.34, 1.87)	**1.9029** **(66.09)**	0.0083 (0.12)	-0.0351 (-0.91)
Latvia	1.79 (1.27, 2.51)	**2.6591** **(38.66)**	0.0043 (0.02)	-0.1639 (-1.74)
Lithuania	1.76 (1.37, 2.33)	**2.7210** **(50.75)**	-0.2042 (-1.69)	0.0105 (0.14)
Poland	1.50 (1.04, 1.92)	**2.7318** **(79.68)**	-0.0747 (-0.98)	-0.0114 (-0.25)
Slovakia	0.97 (0.56, 1.49)	**2.9185** **(66.07)**	-0.0365 (-0.58)	0.0461 (1.05)
Slovenia	0.88 (0.51, 1.34)	**1.9129** **(31.68)**	0.0535 (0.74)	-0.0275 (-0.48)

Note: In the second column the numbers in the first line are the differencing parameter and the estimated confidence interval appear in parentheses.In columns3, 4 and 5 we numbers in parentheses are t-statistics. We highlight in bold face the significant cases at the 5% level.

Table 4: Estimates of d and the 95% intervals, β-coefficient and t-values, based on white noise disturbances

Series	d	δ_0	δ_1	δ_2
Czech Rep.	0.67	-0.0312	-0.0426	-0.0663
	(0.47, 0.90)	(-0.83)	(-1.26)	(-1.86)
Estonia	0.41	-0.0157	-0.0176	-0.0317
	(0.25, 0.61)	(-0.26)	(-0.32)	(-0.46)
Hungary	0.45	-0.0125	-0.0112	-0.0126
	(0.32, 0.62)	(-0.55)	(-0.56)	(-0.50)
Latvia	0.37	-0.0081	-0.0036	-0.0062
	(0.23, 0.55)	(-0.16)	(-0.97)	(-0.10)
Lithuania	0.64	0.0252	0.0462	0.0579
	(0.48, 0.83)	(0.41)	(0.86)	(1.00)
Poland	0.49	0.0115	-0.0357	-0.0414
	(0.34, 0.68)	(0.40)	(-1.65)	(-1.69)
Slovakia	0.62	0.0121	**-0.0622**	**-0.0817**
	(0.42, 0.88)	(0.43)	**(-2.55)**	**(-3.04)**
Slovenia	0.20	-0.0086	-0.0178	-0.0327
	(0.00, 0.48)	(-0.37)	(-0.69)	(-0.94)

Note: In the second column the numbers in the first line are the differencing parameter and the estimated confidence interval appear in parentheses.In columns3, 4 and 5 we numbers in parentheses are t-statistics. We highlight in bold face the significant cases at the 5% level.

Table 5: Estimates of d and the 95% intervals, β-coefficient and t-values, based on Bloomfield errors

| Series	d	δ_0	δ_1	δ_2
Czech Rep.	0.45 (-0.14, 1.00)	-0.0233 (-0.83)	-0.0375 (-1.44)	-0.0536 (-1.76)
Estonia	0.41 (-0.01, 0.96)	-0.0157 (-0.26)	-0.0176 (-0.32)	-0.0317 (-0.46)
Hungary	0.56 (0.28, 0.88)	-0.2017 (-0.75)	-0.0130 (-0.56)	-0.0164 (-0.61)
Latvia	0.75 (0.26, 1.58)	0.0344 (-0.04)	0.0080 (0.09)	0.0217 (0.27)
Lithuania	0.76 (0.23, 1.39)	0.0366 (0.56)	0.0593 (0.91)	0.0613 (1.00)
Poland	0.52 (0.11, 0.86)	0.0132 (0.44)	-0.0348 (-1.36)	-0.0404 (-1.34)
Slovakia	0.47 (-0.27, 0.96)	-0.0026 (-0.11)	**-0.0581** **(-2.85)**	**-0.0762** **(-3.05)**
Slovenia	-0.18 (-0.71, 0.47)	-0.0116 (-1.30)	-0.0081 (-0.47)	-0.0240 (-0.95)

Note: In the second column the numbers in the first line are the differencing parameter and the estimated confidence interval appear in parentheses.In columns3, 4 and 5 we numbers in parentheses are t-statistics. We highlight in bold face the significant cases at the 5% level.

Table 6: Long-run effects based on unemployment trends

| Country	Long-run effect (+)			Long-run effect (-)		
	Coef.	F-stat	p-value	Coef.	F-stat	p-value
Czech Rep.	0.782	0.062	0.805	-1.330	0.082	0.778
Estonia	0.048	0.262	0.610	**-0.309**	**5.448**	**0.025**
Hungary	**0.207**	**3.571**	**0.066**	-0.214	1.036	0.315
Latvia	**0.145**	**2.904**	**0.096**	**-0.286**	**5.604**	**0.023**
Lithuania	**0.317**	**3.177**	**0.082**	**-0.526**	**5.557**	**0.023**
Poland	**-0.211**	**389.3**	**0.000**	**-0.030**	**3.750**	**0.060**
Slovakia	-0.398	2.087	0.156	0.228	0.883	0.353
Slovenia	-11.309	0.003	0.955	6.641	0.003	0.954

Note: We highlight in bold face the significant cases.

Figure 1: Unemployment rates in CEECs
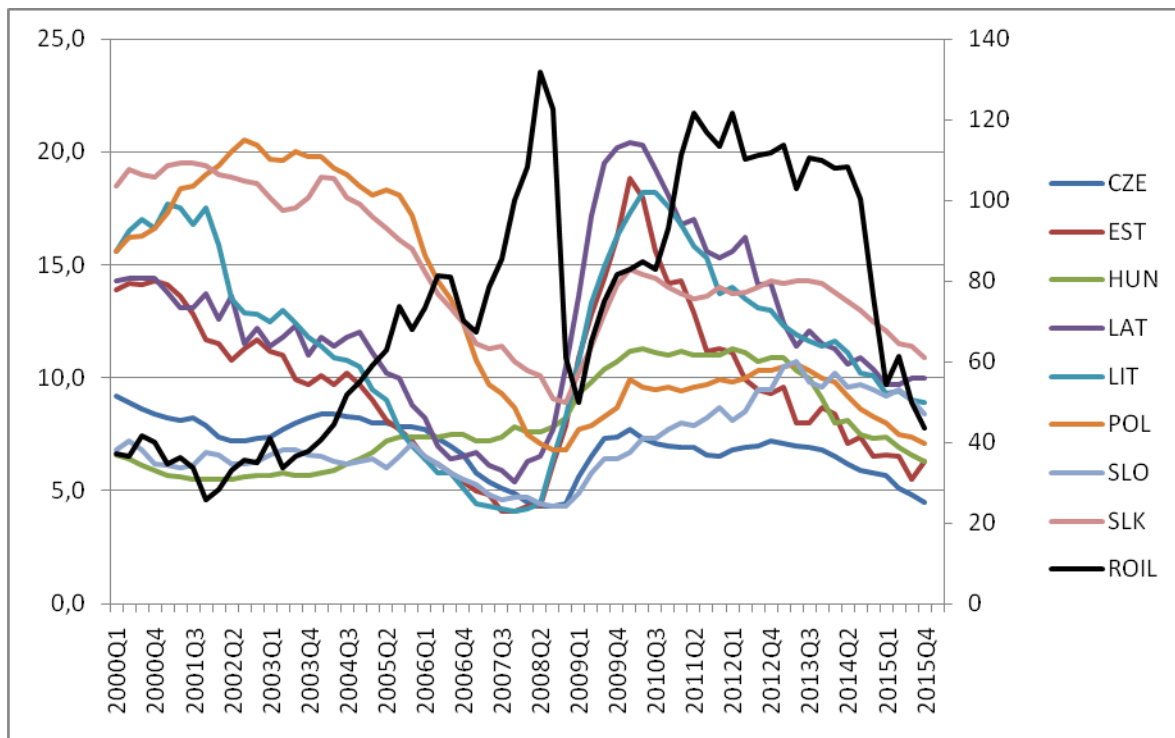
Note: The right axis indicates the oil price, the left axis the unemployment rate

Figure 2: oil prices
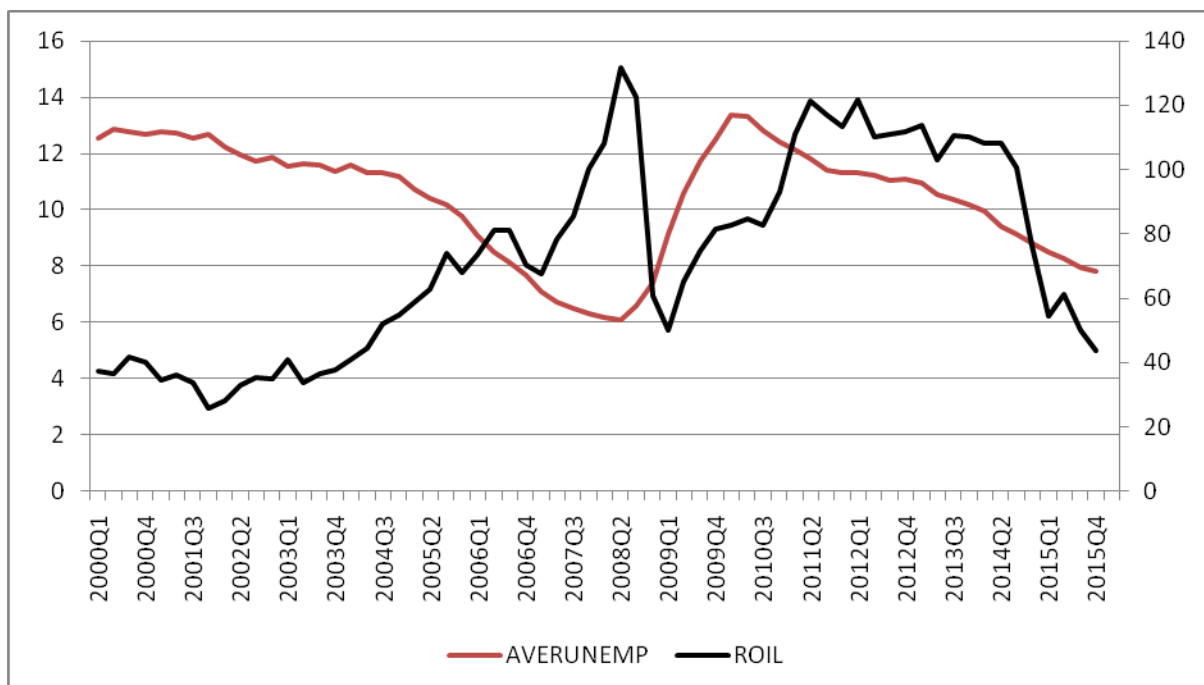
Note: The right axis indicates the oil price, the left axis the unemployment rate

Figure 3: Cumulative effects

Cumulative effect of LOILR on LCZE_T

Cumulative effect of LOILR on LEST_T

Cumulative effect of LOILR on LHUN_T

Cumulative effect of LOILR on LLAT_T

Cumulative effect of LOILR on LLIT_T

Cumulative effect of LOILR on LPOL_T

Cumulative effect of LOILR on LSLK_T

Cumulative effect of LOILR on LSLO_T