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Oil Price, Output and Employment in Turkey: Evidence from Vector Error Correction Model

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ABSTRACT: This paper assesses the relationship among oil prices, real output growth and employment in Turkey over the period 2000:1-2012:4 by using vector error correction methodology. Empirical findings indicate a long-run relationship among the variables. Besides, short-run causality results based on vector error correction model provide an evidence of bi-directional causality linkage between oil prices and output, where uni-directional causality from oil prices and output to employment is established. The long-run causality analysis on the other hand shows that (i) the oil prices and real output do not cause employment, (ii) employment and real output do not cause oil prices, and however (iii) the oil price and employment cause output.

Keywords: Oil price; output; employment; Turkish economy
JEL Classifications: E24; Q43

1. Introduction

Oil has maintained its significance for many years as one of the world's major energy source and it seems that this remains raising over time. As emphasized by Basher et al. (2012), oil demand for emerging economies is increasing rapidly while it is growing very slowly or hardly at all in developed economies. In this context, the demand for oil is expected to increase considerably in Turkey as an oil importer emerging economy. Besides, this anticipation has been supported by the relatively substantive growth rates performed by Turkey in the recent years.

In general, the impacts of oil price shocks on macroeconomic variables could be addressed in two channels: the first one is supply-side appeared via high production costs and the second one is demand-side appeared via income effects and uncertainty. The classical supply-side effect is the best way to explain why rising oil prices slows GDP growth and diminishes employment. As among others Rasche and Tatom (1981), Barro (1984) and Brown and Yücel (1999) point out, fluctuant oil prices affect the cost of production, output and thus employment. In addition, there exists some other possible explanations how chancing oil prices influence real economy including income transfers from the oil-importer countries to the oil exporter countries, reel balance effect and monetary policy (see, for detailed discussions: Brown and Yücel, 2002: 194-198). Uncertainty about the oil prices, as suggested by Federer (1996), might affect real macroeconomic variables as well through investment demand.

The goal of this paper is to investigate the relationship among oil prices, output and employment in Turkey. Although a good number of papers, especially in the case of the USA, have been written in this issue following oil price shocks, the relevant literature on Turkish economy has expanded later than 2000s. Nonetheless, the literature on energy consumption-economic growth nexus is still larger than the literature on the nexus between oil prices and economic activity in Turkey. Moreover, to the best of our knowledge, there is no other published study in the case of Turkey covering the relationship between oil prices and employment. This paper therefore attempts to fulfill this gap and contributes to empirical literature.

Rest of the paper is structured as follows: section 2 provides a review of literature, section 3 describes model and data, section 4 presents empirical methods and findings. Finally, section 5 draws conclusion.

2. Literature Review

Since the oil shocks in 1970s, there has been a wide range of studies addressing the issue between oil prices and macroeconomic variables. Because the literature includes too many papers, this section focuses the papers in the case of Turkey soon after a review of empirical papers written in the recent years covering an extensive sampling from the rest of the world.

Benhmad (2013), by using wavelet analysis, investigates the relation between oil prices and GDP during 1947:I-2007:IV periods in the US economy. Findings indicate that while oil prices Granger cause GDP before 1984:I; GDP causes oil prices after 1984:I.

Behmiri and Manso (2012) examine the Granger causality among crude oil consumption, crude oil price, dollar exchange rate and economic growth in 27 OECD countries over the period 1976-2009. They concluded that GDP and oil price are cointegrated and oil prices Granger cause GDP.

Yazdan et al. (2012) investigate the causal relationship between oil prices and economic growth in Iran during 1980-2010 periods. The results of the paper do not support a causal running from oil prices to economic growth even though Iran is an oil-exporter country.

Ewing and Yang (2009) investigate relationship between US state-level manufacturing and non-manufacturing employment and real oil prices & real effective exchange rate over the period 1990:I-2005:IV. Both manufacturing and non-manufacturing employment are found to have a long-run equilibrium with the real oil prices in the vast majority of states.

Hanabusa (2009) examines the relationship between oil price and economic growth in Japan during the period from 2000:M7 to 2008:M3 by using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model. Findings reveal that economic growth Granger causes the change of oil price in mean and variance and the change of oil price Granger causes economic growth in mean and variance.

Jayaraman and Choong (2009) examine the long-run and causal relationship between oil price and economic growth in small Pacific Island countries. Both in the short and the long-run it is observed that there is a uni-directional relationship as causality nexus runs only from oil price to economic growth.

Lardic and Mignon (2008), study on the USA, G7, Europe and Euro Area economies and examine the long-run running between oil prices and economic activity. Analyses results, covering quarterly data from 1970:I-2004:III, does not provide long-run support for standard cointegration. However, asymmetric cointegration holds as well in this sample between the variables.

Lardic and Mignon (2006) investigate whether there exists a long-run relation between oil prices and GDP in 12 European countries using quarterly data ranging from 1970:I-2003:IV. The empirical results show that while standard cointegration is rejected, an asymmetric cointegration is detected between the variables in the majority of the questioned countries.

Abeysinghe (2001) measures direct and indirect effects of oil prices on GDP growth rate on 12 selected economies. Regardless of whether related countries are net oil exporters such as Indonesia and Malaysia, a negative correlation is found between the variables for all countries.

Papapetrou (2001) estimates the dynamic relationship among oil prices, real stock prices, interest rates, real economic activity and employment for Greece over the period 1989:M1-1996:M6. Multivariate VAR results suggest that oil price changes affect economic activity and employment.

Hoag and Wheeler (1996) estimate the impact of oil price shocks on employment in the case of Ohio coal mining. Empirical results which covers the period 1957:I-1982:IV indicate that oil price shocks have larger impacts on Ohio coal mining employment than do shocks to coal prices or coal wages.

Uri (1996) measures the effect of changes in crude oil prices on agricultural employment in the USA over the period 1947-1995. It is concluded in the paper that oil prices changes and agricultural employment is correlated with each other in terms of Granger causality.

In the case of Turkey, relevant literature has initially expanded over the relationship between energy consumption and economic growth (see for example: Özturk and Acaravcı, 2010; Özturk and Acaravcı, 2013; Balat, 2008; Lise and Montfort, 2007). Then, empirical papers examining the nexus between oil prices and some macroeconomic indicators have also become attractive in recent years (see for example: Ünlü and Topcu, 2012; Soytaş et al. 2009; Eryiğit, 2012). However, there are very limited papers looking into the relationship oil prices and real economic variables. Öksüzler and İpek (2011) investigate the relationship among oil prices, inflation and economic growth in Turkey during 1987:M1-2010:M9 periods using VAR. Their results show that oil prices cause economic growth in Turkey and a positive shock in oil prices increases economic growth. Using Toda-Yamamoto causality technique, Şengül and Tuncer (2006) examine the nexus among energy consumption, energy prices and GDP over the period 1960-2000. They find a bi-directional causal running between energy prices and GDP. Doğrul and Soytaş (2010) examine the relationship among oil prices, interest rate and unemployment in Turkey on monthly basis covering 2005:M1-2009:M8 periods. Using Toda-Yamamoto procedure, they find that real oil prices improve the forecasts of unemployment in the long-run.

3. Model and Data

As consistent with the most existing literature, we investigate the linkage among the variables in question by estimating a linear equation. For this purpose, following model is utilized:

$$e_t = \alpha_0 + \alpha_1 y_t + \alpha_2 op_t + u_t \tag{1}$$

In representative model above, the left-hand-side variable is employment which is measured using employed thousands of people. The variable is in logarithmic form and denoted by "e". Explanatory variables, on the other hand, are real output and oil prices. Real output represents GDP (thousands of Turkish Liras) as measured by expenditure approach at 1998 prices. As it seems a more appropriate proxy for Turkish economy, oil price variable is constructed using Brent oil prices per barrel in US dollars. The right-hand-side variables are also in logarithmic form and respectively denoted by "y" and "op".

Data of employment and real output are gathered from Turkish Statistical Institute Database and the data of oil prices is sourced from US Energy Information Administration Data Distribution System. Data used in the paper are quarterly[1] and ranging from 2000:I to 2012:IV. Descriptive statistics of the data can be found in Table 1.

Table 1. Descriptive statistics

	Obs.	Min.	Mean	Max.	Std. dev.
Employment	52	4.277	4.336	4.404	0.031
Real output	52	7.182	7.355	7.507	0.087
Oil price	52	1.305	1.716	2.090	0.234

Note: Values of related variables are presented in logarithmic form.

4. Methodology and Findings

Before presenting methods and findings, optimal lag length must be determined. Considering Schwarz Information Criterion (SIC), lag length used in empirical analyses is determined as five.

In this paper we follow traditional unit-root testing procedure in order to test whether series are stationary in the level, or not. In the case of the existence of a common stochastic trend among the variables, it is likely to infer that the variables in question are stationary in their first differences, and a long-run relationship should be examined. Phillips and Perron (PP, hereinafter) (1988), which has been generally chosen in empirical applications so far is employed for this investigation. PP equation that includes intercept and trend is given the equation below:

$$\Delta y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 trend + u_t \tag{2}$$

[1] Oil price variable is converted to quarterly data by obtaining averages of daily observations.

Two models indicating only intercept and intercept plus trend have been reported for all variables. Unit-root findings, presented in Table 2, produce mixed results. Findings for employment show that the variable is integrated of order zero, I(0), at 1% significance. Findings for output and oil price, however, prove that the variables are integrated of first order, I(1), at 1% significance.

Table 2. Unit root results

		Intercept	Intercept+trend
	Employment	-3.726***	-4.186***
I(0)	Output	-2.162	-5.203***
	Oil price	-0.736	-2.601
	Employment	-	-
I(1)	Output	-13.34***	-
	Oil price	-6.021***	-5.915***

Note: *** denotes significance at 1%.

Since the variables in the equation are not integrated of the same order, widely used cointegration methods such as Engle & Granger (1987), Johansen (1988) and Johansen & Jelius (1990) become no longer applicable. Pesaran (1997) suggested the utilization of bound test of cointegration, described in equation 3, once the variables in the model are of different order of integration. We therefore employ bound testing approach of cointegration, developed and extended by Pesaran (1997), Pesaran and Shin (1999) and Pesaran et al. (2001).

$$\Delta \ln e_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta \ln e_{t-i} + \sum_{i=0}^{m} \alpha_{2i} \Delta \ln y_{t-i} + \sum_{i=0}^{m} \alpha_{3i} \Delta \ln op_{t-i} + \alpha_4 e_{t-1} + \alpha_5 y_{t-1} + \alpha_6 op_{t-1} + u_t \quad (3)$$

Table 3 consists of two tables. While test results reported in table 3a indicate cointegration at 5% significance, results reported in table 3b indicate cointegration at 10% significance since the computed F-statistic is greater than the upper bound critical value. Thus, it can be inferred that a long-run nexus has been established among the variables.

Table 3a. Results of bound test of cointegration

		1% critical value		5% critical value		10% critical value	
k	F-stat	LB	UP	LB	UB	LB	UB
2	5.018	5.15	6.36	3.79	4.85	3.17	4.14

Table 3b. Results of bound test of cointegration

		1% critical value		5% critical value		10% critical value	
k	F-stat	LB	UP	LB	UB	LB	UB
2	5.018	5.707	6.977	3.987	5.090	3.280	4.273

Note: k is the number of regressors for dependent variables in the main model.
LB and UB represents lower bound and upper bound, respectively.
Critical values in table 3a are obtained from Pesaran et al. (2001), p. 300 (Table CI (iii)).
Critical values in table 3b are obtained from Narayan (2005), p. 1988 (case III).

Granger (1988) suggested the application of Vector Error Correction methodology (VECM, hereinafter) in the case where there the variables in the model are cointegrated in order to explore the short-run causal relationships. VECM enables to discriminate between long-run equilibrium and short-run dynamics and helps to identify short-run dynamics. In that sense, we employ following VECMs to estimate the causal linkages among the variables:

$$\Delta \ln e = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \Delta \ln e_{t-i} + \sum_{i=1}^{l} \alpha_2 \Delta \ln y_{t-i} + \sum_{i=1}^{m} \alpha_3 \Delta \ln op_{t-i} + \lambda ECT_{t-1} + v_t \quad (4)$$

$$\Delta \ln y = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta \ln y_{t-i} + \sum_{i=1}^{l} \beta_2 \Delta \ln e_{t-i} + \sum_{i=1}^{m} \beta_3 \Delta \ln op_{t-i} + \phi ECT_{t-1} + v_t \quad (5)$$

$$\Delta \ln op = \gamma_0 + \sum_{i=1}^{k} \gamma_1 \Delta \ln op_{t-i} + \sum_{i=1}^{l} \gamma_2 \Delta \ln e_{t-i} + \sum_{i=1}^{m} \gamma_3 \Delta \ln y_{t-i} + \delta ECT_{t-1} + v_t \quad (6)$$

Test results, reported in Table 4, show in the short-run that (i) output Granger causes employment, (ii) oil prices Granger cause employment, (iii) oil prices Granger cause output, (iv) output Granger causes oil prices. The long-run causality results, on the other hand, indicate that employment and oil prices Granger cause output.

Table 4. Causality results based on VECM

	Hypothesis Tested	F-stat.
Short-run causality	α_2 (y→e)	6.518***
	α_3 (op→e)	2.588*
	β_2 (e→y)	0.821
	β_3 (op→y)	2.737**
	γ_2 (e→op)	0.627
	γ_3 (y→op)	2.804**
Long-run causality	λ (y and op→e)	0.304
	φ (e and op→y)	0.081*
	δ (e and y→op)	0.150

Note: ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

5. Concluding Remarks

This paper aims to investigate the relationship among oil prices, output and employment in Turkey using quarterly observations from 2000:I to 2012:IV. Bound test of cointegration results indicate the existence of cointegration relationship among the variables in question. Causality results based on VECM provide strong evidence of the bi-directional causal running between oil prices and output in the short-run. This is consistent with the findings of Şengül and Tuncer (2006). In addition, uni-directional causality from oil prices and output to employment is also detected in the short-run. The evidences obtained from short-run analyses support the previous literature that generally finds a causal ordering from oil prices to real economic variables (see, for example: Behmiri and Manso, 2012; Jayaraman and Choong, 2009). When it comes to long-run, employment and oil prices are found to cause changes in output. Apart from the oil prices, long-run causality results provide strong support of the validity of Okun law in Turkey. While changes in output cause changes in employment in the short-run; changes in employment cause changes in output in the long-run.

As concluded by the bulk of the literature, findings of this paper point out the importance of oil prices on employment. However, investigating the impact of oil prices on sectorial employment might present more efficient results. Thus, following researchers should examine this issue in context of sectorial composition of employment in order to contribute to the existing literature.

References

Abeysinghe, T. (2001). Estimation of Direct and Indirect Impact of Oil Price on Growth, Economics Letters, 73, 147-153.

Balat, M. (2008). Energy Consumption and Economic Growth in Turkey during the Past two Decades, Energy Policy, 36(1), 118-127.

Barro, R.J. (1984). Macroeconomics, New York: John Wiley & Sons.

Basher, S.A., Haug, A.A., Sadorsky, P. (2012). Oil Prices, Exchange Rates and Emerging Stock Markets, Energy Economics, 34, 227-240.

Behmiri, N.B., Manso, C.R.P. (2012). Crude Oil Conservation Policy Hypothesis in OECD Countires: A Multivariate Panel Granger Causality Test, Energy, 43, 253-260.

Benhmad, F. (2013). Dynamic Cyclical Comovements between oil Price and US GDP: A Wavelet Perspective, Energy Policy, 57, 141-151.

Brown, S. P. A., Yücel, M. K. (1999). Oil Prices, and US Aggregate Economic Activity: A Question of Neutrality, Economic and Financial Policy Review, Federal Reserve Bank of Dallas, 2, 16-23.

Brown, S.P.A., Yücel, M.K. (2002). Energy Prices and Aggregate Economic Activity: An Interpretative Survey, The Quarterly Review of Economics and Finance, 42, 193-208.

Doğrul, H. G., Soytaş, U. (2010). Relationship between Oil Prices, Interest Rate, and Unemployment: Evidence from an Emerging Market, Energy Economics, 32, 1523-1528.

Engle, R., Granger, C. W. J. (1987). Cointegrstion and Error Correction: Representation Estimation and Testing. Econometrica, 55, 251-276.

Eryiğit, M. (2012). The Dynamical Relationship between Oil Price Shocks and Selected Macro Economic Variables in Turkey, Ekonomska istraživanja -Economic Research, 25(2), 263-276.

Ewing, B. T., Yang, B. (2009). Manufacturing and Nonmanufacturing Employment, Exchange Rate and Oil Price: A U.S. State-Level Time Series Analsis, The International Journal of Economic and Social Research, 5(1), 1-22.

Federer, J.P. (1996). Oil Price Volatility and the Macroeconomy, Journal of Macroeconomics, 18(1), 1-26.

Granger, C.W.J. (1988). Some Recent Development in a Concept of Causality, Journal of Econometrics, 39, 199-211.

Hanabusa, K. (2009). Causality Relationship between the Price of Oil and Economic Growth in Japan, Energy Policy, 37, 1953-1957.

Hoag, C. H., Wheeler, M. (1996). Oil Price Shocks and Employment: The Case of Ohio Coal Mining, Energy Economics, 18, 211-220.

Jayaraman, T. K., Choong, C-K. (2009). Growth and Oil Price: A Study of Causal Relationships in Small Pasific Island Countries, Energy Policy, 37, 2182-2189.

Johansen, S., Jelius, K. (1990). Maximum Likelihood Estimation and Inference on Cointegration-with Applications to the Demand for Money, Oxford Bulletin of Economics and Statistics, 52, 169-210.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors, Journal of Economic Dynamics and Control, 12(2-3), 231-254.

Lardic, S., Mignon, B. (2006). The Impact of Oil Prices on GDP in European Countries: An Emripical Investigation Based on Asymmetric Cointegration, Energy Policy, 34, 3910-3915.

Lardic, S., Mignon, B. (2008). Oil Prices and Economic Activity: An Asymmetric Cointegration Approach, Energy Economics, 30 847-855.

Lise, W., Montfort, K. V. (2007). Energy Consumption and GDP in Turkey: Is There a Cointegration Relationship, Energy Economics, 29(6), 1166-1178.

Narayan, P.K. (2005). The saving and Investment Nexus for China: Evidence from Cointegration Tests, Applied Economics, 37, 1979-1990.

Öksüzler, O., İpek, E. (2011). Dünya Petrol Fiyatlarındaki Değişimin Büyüme ve Enflasyon Üzerindeki Etkisi: Türkiye Örneği [The Effects of the World Oil Price Changes on Growth and Inflation: Example of Turkey]. ZKÜ Sosyal Bilimler Dergisi, 7(14), 15-34.

Özturk, İ., Acaravcı, A. (2010). CO2 Emissions, Energy Consumption and Economic Growth in Turkey, Renewable and Sustainable Energy Reviews, 14(9), 3220-3225.

Özturk, İ., Acaravcı, A. (2013). The Long-run and Causal Analysis of Energy, Growth, Openness and Financial Development on Carbon Emissions in Turkey, Energy Economics, 36, 262-267.

Papapetrou, E. (2001). Oil Price Shocks, Stock Market, Economic Activity and Employment in Greece, Energy Economics, 23, 511-532.

Pesaran, M.H., Pesaran, B. (1997). Working in Microfit 4.0, Interactive Econometric Analysis, Oxford: Oxford University Press.

Pesaran, M.H., Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis in: (Ed.) S. Storm, Econometrics and Economic Theory in the 20th Century, The Ragnar Frisch Centennial Symposium, Chapter: 11, Cambridge: Cambridge University Press.

Pesaran M.H., Shin, Y., Smith, R.J. (2001). Bound Testing Approaches to the Analysis of Long Run Relationships, Journal of Applied Econometrics, Special Issue, 16, 289-326.

Phillips, P.C.B., Peron, P. (1988). Testing for a Unit Root in Time Series Regression, Biometrika, 75(2), 336-346.

Rasche, R.H., Tatom, J.A. (1981). Energy Price Shocks, Aggregate Supply and Monetary Policy: The Theory and International Evidence, In K. Brunner and A. H. Meltzer, eds., Supply Shocks, Incentives, and National Wealth, Carnegie-Rochester Conference Series on Public Policy, 14, Amsterdam: North-Holland .

Soytaş, U., Sarı, R., Hammoudeh, S., Hacıhasanoğlu, E. (2009). World Oil Prices, Precious Metal Prices and Macroeconomy in Turkey, Energy Policy, 37(12), 5557-5566.

Şengül, S., Tuncer, İ. (2006). Türkiye'de Enerji Tüketimi ve Ekonomik Büyüme: 1960-2000 [Energy Consumption and Economic Growth in Turkey: 1960-2000], İktisat, İşletme ve Finans, 21(242), 69-80.

Turkish Statistical Institute Database, www.tuik.gov.tr

Uri, N.D. (1996). Changing Crude Oil Price Effects on US Agricultural Employemt, Energy Economics, 18, 185-202.

US Energy Information Administration Data Distribution System, www.eia.gov

Ünlü, M., Topcu, M. (2012). Do Oil Prices Directly Affect Stock Markets: Evidence from Istanbul Stock Exchange. İktisat İşletme ve Finans. 27(319), 75-88.

Yazdan, G.F., Ehsan, A.G., Hossein, S.S.M. (2012). Is Cointegration between Oil Price and Economic Growth? Case Study Iran, Procedia-Social and Behavioral Sciences, 62, 1215-1219.