Marina Lolić Čipčić
University of Split, Split, Croatia
Department of Professional Studies
E-mail: mlolic@oss.unist.hr

THE IMPACT OF OIL PRICES ON INVESTMENT IN CROATIA

Preliminary communication
UDK: 665.6:330.322(497.5)
JEL classification: E22, Q43
DOI: 10.17818/DIEM/2021/1.11
Accepted for publishing: July 8, 2021

Abstract

If we look at economic growth as a function of labour and capital then, aside from the labour force, investment is a key determinant of capital accumulation and, accordingly, a prerequisite for economic growth and prosperity. During the analysed period (1996:Q1-2015:Q4) investment in Croatia demonstrated pro-cyclically behaviour but showed a higher level of fluctuation then personal consumption or GDP. The aim of the paper is to examine the influence of oil prices on investment during the analysed period using Vector Autoregression (VAR) analysis and to determine the nature of their relationship by permuting four different oil price indicators. The results indicate that investment initially react positively to the growth of oil prices after which their reaction to oil price growth becomes negative (and more pronounced than the initial positive reaction). Contribution of oil price changes to investment fluctuations were also found.

Keywords: investment, oil prices

1. INTRODUCTION

Investment is a key component of aggregate demand due to its contribution to capital accumulation and, consequently, economic growth (Mankiw, 2006). Despite the academic consensus on the undoubted importance of investment to the economy, the understanding of the determinants of investment (as well as the empirical evidence) is still quite limited. The movement of variables traditionally associated with investment (such as interest rates) are in fact insufficient to clarify the majority of investment variations (Dixit & Pindyk, 1994; Chirinko, 1993). This has recently encouraged scientists to test the impact of hitherto neglected factors on investment (Lim, 2013) including oil prices, among others.

In order to test the hypothesis of a possible impact of oil prices on investment in Croatia, four VAR models (1995:Q1-2015:Q4) were constructed using four different oil price indicators as to capture the possible differences in the nature of the relationship between oil prices and aggregate investment in Croatia.

The research contributes to a rather limited body of research exploring the nexus between oil prices and investment at the aggregate level, and focusing on oil import dependent small open economies such as Croatia in particular. As for Croatia, to the best of the authors' knowledge, no earlier attempts were made in order to test the impact of oil prices on investment at the aggregate (or the company) level. The research is also aimed at detecting possible contribution of oil price volatility to investment volatility in Croatia, for investment were found to be the most variable component of Croatian GDP throughout the analysed period.

2. LITERATURE REVIEW

Pindyck & Solimano (1993), as well as Carruth et al. (2000), state the growing focus of scientists on the impact of risk (uncertainty) on investment. McDonald & Siegel (1986) also indicate that conditions of high uncertainty have an extremely high impact on the decision to undertake an investment. On the other hand, some researchers (Goldberg, 1993; Leahy & Whiteed, 1996; Driver et al., 1996) state that the relationship between uncertainty and investment is dubious.

The impact of oil prices on investments is primarily a consequence of their possible impact on the uncertainty of the business environment. Bernanke (1983) explains how companies seek to delay planned investments due to uncertainty about future oil price movements. Uri (1980) argues that oil prices are important determinants of investment at the industry level as well as at the aggregate level. The latter was also confirmed by Glass & Cahn (1987). At the aggregate level, investment is expected to decrease as a result of oil prices increase (and an associated production cost increase), especially if an oil price shock was preceded by a long period of stable prices. As it seems, oil prices have emerged as an important factor in contributing to an uncertain business environment with the potential for even more significant impact in the future (Henriques & Sadorsky, 2011).

Rising oil prices make oil a less desirable production input as well as less represented in the energy-labour-capital production input ratio, where the degree of input substitution depends on both technical capabilities and the cost of substitution. In their review of 375 different studies on substitution possibilities between production inputs, Broadstock et al. (2007) state that energy and capital generally behave as complements or weak substitutes. If oil and capital are weak substitutes, reducing the use of oil would require a significant increase in the use of capital in order to maintain the same level of production. If, on the other hand, energy and capital are complementary, rising oil prices should result in a reduction in both oil (energy) and capital use, thus increasing the negative impact of rising oil prices on the economy.

Although oil is most often viewed as a production input, Henriques & Sadorsky (2011) estimate that about 98% of all consumed goods come into contact with oil in at least one segment of the value chain from production to consumption. This is why companies also perceive oil price shocks as demand shocks for their products. Ferderer (1996) also considers uncertainty about future oil prices by arguing that rising oil prices affect the economy through declining investment, among other. Uncertainty defines not only the value of an individual investment, but also the value of the company undertaking it (Miller, 1998). Additionally, uncertainty about future oil prices is positively correlated with oil price volatility, regardless of whether oil prices rise or fall (Elder & Serletis; 2009, Elder & Serletis; 2010).

Existing literature suggests that oil prices have a strong influence on investment decisions in the real economy, but mostly at the micro level (Henriques & Sadorsky, 2011; Yoon & Ratti, 2011; Ratti et al., 2011; Mohn & Misund, 2009; Wang et al., 2017). Focusing on developed economies, Henriques & Sadorsky (2011), Yoon & Ratti (2011) and Ratti et al. (2011) offer empirical evidence that uncertainty about global oil prices has a statistically significant negative impact on company investment. In a recent study on nonfinancial firms in China (2004:Q3-2014:Q4), Wang et al. (2017) show that uncertainty regarding global oil prices negatively affects investments at the company level, with the negative effect being more pronounced in private companies as oppose to state-owned ones.

However, accounting for the national specifics of the industrial structure, energy intensity, import dependence on oil as well as the way prices of petroleum products are formed at the national level, may lead to results that could be significantly different in less developed economies

(Crompton & Wu, 2005). Elder & Serletis (2010) conclude that rising oil price volatility reduces investment as well as real growth at the aggregate level in the US. Similar results were obtained for Canada (Elder & Serletis, 2009), Turkey (Başkaya et al., 2013), China (Tang et al., 2009; Cheng et al. 2019). This research also contributes to the latter limited body of literature aimed at exploring the effects of oil prices on aggregate investment.

3. MODEL AND DATA

In order to identify the nature of the response of investment to oil prices four different oil price indicators were used.

The first and the only linear oil price indicator is the 1) real oil price, UK Brent spot (a benchmark for Europe) in US dollars deflated by US Producer Price Index. This definition of oil price implies a common global oil price shock enabling international comparison of research results (this oil price indicator was used in, for instance: Mork, 1989; Lee et al., 1995; Carruth et al., 1998; and Hooker, 1996; 1999). Brent benchmark is commonly used as an indicator of world oil prices (for Europe and Africa in particular; Speight, 2017), especially after the period from 2010 to 2014 when West Texas Intermediate (benchmark for North America) had significantly lower prices and as such was not a representative indicator of world oil prices. Therefore, Brent oil price is commonly used as a reference global oil price indicator (Baumeister & Kilian, 2016).

Additionally, three non-linear transformations of oil prices were used: 2) an asymmetric specification of oil prices as in Mork (1989), a 3) scaled specification as proposed by Lee et al. (1995) and a 4) net specification as in Hamilton (1996). The scaled and the net specification were created in order to account for the surprise effect, indicating that an unexpected oil price shock should induce larger macroeconomic (investment) reactions then the expected one. Morks (1989) oil price indicator differentiates positive and negative oil price changes as follows:

$$\text{MORK+:}\quad o_t^+ = o_t; o_t > 0 \qquad o_t^+ = 0; o_t \le 0 \tag{1}$$

$$\text{MORK-:}\quad o_t^- = o_t; o_t < 0 \qquad o_t^- = 0; o_t \ge 0 \tag{2}$$

where o_t is the percent change of the real price of oil (Q_t/Q_{t-1}).

Lee et al. (1995) proposed the following AR (4) – GARCH (1,1) model of oil prices:

$$o_t = \alpha_0 + \alpha_1 o_{t-1} + \alpha_2 o_{t-2} + \alpha_3 o_{t-3} + \alpha_4 o_{t-4} + e_t \tag{3}$$

$$e_t | I_{t-1} \quad N(0, h_t) \tag{4}$$

$$h_t = \gamma_0 + \gamma_1 e_{t-1}^2 + \gamma_2 h_{t-1} \tag{5}$$

$$SOPI = \max(0, \hat{e}_t | \sqrt{\hat{h}_t}) \tag{6}$$

$$SOPD = \min(0, \hat{e}_t | \sqrt{\hat{h}_t}) \tag{7}$$

where o_t is the percent change of real oil price, SOPI is the Scaled Oil Price Increase and a SOPD is a Scaled Oil Price Decrease.

Lastly, Hamiltons (1996) Net Oil Price Increase (NOPI4) indicates oil prices increases that exceed the maximum oil price of the previous four quarters, completely neglecting oil price decreases and implying asymmetric macroeconomic responses. The NOPI4 indicator is calculated as follows:

$$NOPI4 = 100 \cdot \log\left(\frac{p_t}{\max(p_{t-1},...., p_{t-4})}\right)^+ \tag{8}$$

Throughout the last decade, vector autoregressive (VAR) models of the global oil market have become the standard tool for understanding the evolution of the real price of oil and its effect on the macro economy (Killian & Zhou, 2020). A linear specification of the Vector Autoregression (VAR) model of order p is defined as follows:

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-1} + \varepsilon_t \qquad (9)$$

where y_t is the vector of endogenous variables, c is the intercept vector, A is the autoregressive coefficients matrix and ε_t is the generalization of the white noise.

The VAR model used in this research includes quarterly variables (1996:Q1-2015:Q4) of the y_t vector; namely: LINV - natural logarithm of real investments (gross fixed capital formation in constant 2010 prices in HRK), LBDP - natural logarithm of real gross domestic product (in constant 2010 prices in HRK), IRr - real interest rate (%), oil price indicator (LOIL - natural logarithm of real oil price in USD, i.e. the corresponding oil price indicator; MORK+/MORK-, SOPI/SOPD and NOPI4) and a dichotomous dummy variable - CRISIS. Brent oil prices were obtained from US Energy Information Administration, GDP and investment data from Croatian Bureau of Statistics, and interest rate data from Croatian National Bank (all data is freely available on official web sites). Calculations were made using Eviews 8 statistical package.

4. EMPIRICAL FINDINGS

After applying unit root tests (Augmented Dickey Fuller, Phillips-Perron and the KPSS test) our analysis proceeded with the stationary variables (DLINV, DLBDP, IRr, DLOIL, MORK+, MORK-, SOPI, SOPD and NOPI4). Investment, GDP and real oil price are expressed in log form and differentiated in order to achieve variable stationarity.

Testing for the optimal lag length (k) of the VAR models, information criteria (SC, AIC and HQ) indicated k=6 to be the optimal lag length for the VAR model with SOPI/SOPD oil price indicators and k=7 for the rest of the analysed models. Diagnostic tests were also performed in order to test for the VAR model stability as well as for the existence of autocorrelation and heteroscedasticity.

Furthermore, using stationary time series Granger Causality/Block Exogeneity Wald tests were performed. The results (reported in Table 1) indicate that only DLOIL and SOPD oil price indicators Granger cause real investment at 5% and 10% significance level, respectively.

It should be noted that all the VAR models indicated; a bidirectional Granger causality between GDP and investment (at 1% level), a unidirectional Granger causality running from real interest rate to investment (at 1% level) as well as to GDP (at 1% level) and a unidirectional Granger causality running from oil price indicators (DLOIL, MORK-, MORK+, SOPD and NOPI4) to GDP. These results imply a certain result consistency among VAR models with different oil price indicators. Granger causality running from oil price indicators to GDP, and a bidirectional Granger causality between investment and GDP may imply an indirect effect of oil prices on investment through their influence on GDP.

Table 1 Granger Causality/Block Exogeneity Wald test

VAR model with oil price indicator:	Granger causality from X to Y
DLOIL	DLBDP => DLINV***
	IRr => DLINV***
	DLOIL => DLINV**
	DLINV => DLBDP**
	IRr => DLBDP***
	DLOIL => DLBDP***
	DLOIL => IRr**
MORK+/MORK-	DLBDP => DLINV***
	IRr => DLINV***
	DLINV => DLBDP***
	IRr => DLBDP***
	MORK- => DLBDP***
	MORK+ => DLBDP***
SOPI/SOPD	DLBDP => DLINV***
	IRr => DLINV***
	SOPD => DLINV*
	DLINV => DLBDP***
	IRr => DLBDP***
	SOPD => DLBDP*
	DLINV => IRr**
	SOPI => IRr***
	SOPD => IRr**
NOPI4	DLBDP => DLINV***
	IRr => DLINV***
	IRr => DLBDP***
	NOPI4 => DLBDP*

*, **, *** indicate a statistically significant result at 10%, 5% and 1% level, respectively
Source: Author's calculations

Next, Wald tests were performed in order to test if oil prices affect investment directly or, precisely, to test if oil price indicator coefficients in the investment equations of the VAR systems are statistically different from zero (0). Test results (reported in Table 2) indicate the rejection of the null hypothesis solely for the real oil price indicator (DLOIL) implying a statistically significant direct influence of the real oil prices on investment.

Accounting for the possibility of oil prices affecting real investment indirectly, through the remaining variables in the VAR model, Wald tests were performed to test if oil price coefficients in the GDP and the real interest rate equations were statistically different from zero.

Table 2 Wald test results (chi-square p values)[1]

DLOIL	MORK+	MORK-	SOPI	SOPD	NOPI4
0,0407**	0,2322	0,1824	0,3361	0,1620	0,1233

*, **, *** indicate a statistically significant result at 10%, 5% and 1% level, respectively
Source: Author's calculations

The results of the Wald test (reported in Table 3) indicate a statistically significant effect of oil prices on GDP and real interest rate (jointly) at the 1% significance level with the exception of NOPI4 where the result is significant at the 10% level. This result is somewhat expected considering we have found a unidirectional Granger causality running from oil prices to real GDP as well as a unidirectional Granger causality running from oil prices to interest rates.

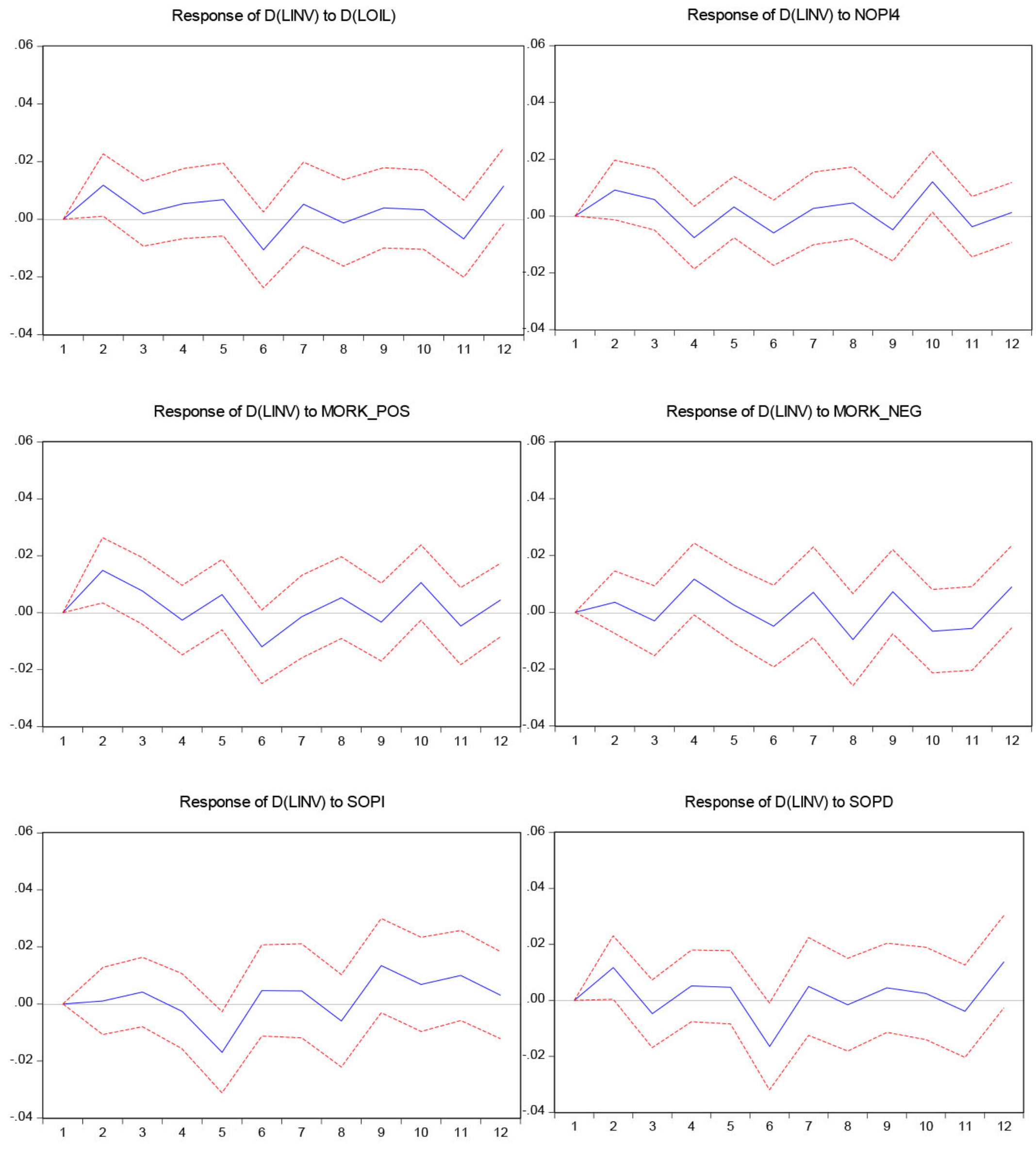
[1] H_0: oil price indicator coefficients in the investment equation of the VAR system = 0, H_1: oil price indicator coefficients in the investment equation $\neq 0$

Table 3 Wald test results (chi-square p values)[2]

DLOIL	MORK+	MORK-	SOPI	SOPD	NOPI4
0,0000****	0,0030***	0,0001***	0,0190**	0,0093***	0,0708*

*, **, *** indicate a statistically significant result at 10%, 5% and 1% level, respectively
Source: Author's calculations

Figure 1 reports the orthogonalised Impulse Response Functions (IRFs) of real investment growth to a one-standard-deviation (1 SD) oil price innovation for the oil price indicators DLOIL, MORK +, MORK-, SOPI, SOPD and NOPI4, with their corresponding two standard error bands (+/- 2 S.E.).



Notes: Y axis – dependant variable reaction, X axis - time in quarters, Cholesky ordering: DLINV DLBDP IRr (DLOIL, MORK+/MORK-, SOPI; SOPD, NOPI4)
Source: Author's calculation

Figure 1 Orthogonalised Impulse Response Functions (IRFs) of real investment growth to a one-standard-deviation (1 SD) oil price innovation for the oil price indicators DLOIL, MORK +, MORK-, SOPI, SOPD and NOPI4 (solid blue lines), with their corresponding two standard error bands (+/- 2 S.E. – dashed red lines)

[2] H_0: oil price indicator coefficients in the GDP and real interest rate equation of the VAR system = 0, H_1: oil price indicator coefficients in the GDP and real interest rate equation ≠ 0

In the VAR model with the real oil price (DLOIL), the IRF shows a positive impact of the DLOIL variable on real investment in the first two quarters after the initial shock (+ 1% on the shock of 1 S.D.). An almost identical reaction of real investments (DLINV) to oil price indicators can be seen with NOPI4, MORK+ and SOPD oil price indicators. Similarly, in the 5th and 6th quarters after the oil price shock, there was a statistically significant negative impact of DLOIL, MORK+, SOPI and SOPD on investments (approximately 2% on average per shock of 1 SD). The reaction of real investment to SOPI and SOPD is particularly interesting, for it is negative in both cases. This supports the thesis that the growth of uncertainty (volatility of oil prices) reduces investment regardless if oil prices have fallen or risen.

Variance decomposition (VDs, available upon request) indicates the amount of information each variable contributes to the other variables in the VAR or how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. The variance of the variable of real investment for the 12 quarter horizon, is mostly influenced by the real GDP variable, which in some models explains up to 30% of the variability of real investment, followed by oil price indicator variable whose movement can explain a significant 15% to 20% variance of the prognostic error of the real investment variable.

As for the dichotomous dummy variable CRISIS, Wald test results indicate that the impact of crisis on both investment and GDP is negative, while its impact on real interest rate is positive with all results being statistically significant at the 5% significance level.

Lastly, the estimated models were compared in order to identify the most appropriate oil price indicator. To do so the adjusted coefficients of determination (adjusted R^2) as well as the Akaike (AIC) and Schwarz (SBC) information criteria of the real investment equations of the estimated VAR models were compared. The aim was to identify the highest R^2 and the lowest AIC and SBC values. The results of all three tests (presented in Table 4) point to the real oil price (DLOIL) as the optimal oil price indicator for Croatia, also indicating a linear relationship between oil prices and investment.

Table 4 Adjusted R^2, the Akaike (AIC) and Schwarz (SBC) information criteria of the real investment equations of the estimated VAR models

VAR model with oil price indicator:	$\bar{R}^2$	AIC	SBC
DLOIL	0,580836	-3,525068	-2,583784
MORK+/MORK-	0,574891	-3,496887	-2,335969
SOPI/SOPD	0,568337	-3,488521	-2,484484
NOPI4	0,554512	-3,464162	-2,522877

Source: Author's calculation

Empirical findings indicate that a rise in real oil prices (DLOIL) has a positive initial impact on real investment in the first two quarters (in the short run) after the oil price change, which then ceases to be statistically significant until the sixth quarter in which it becomes negative (in the long run; thus neutralizing the positive impact from the beginning of the period after the initial shock).

5. CONCLUDING REMARKS

It seems that real investments, at least initially, react positively to an oil price increase while the negative effect, in line with previous research (Crompton & Wu, 2005; Tang et al., 2009; Elder & Serletis, 2009; Elder & Serletis, 2010; Başkaya et al., 2013), occurs round $5^{th}/6^{th}$ quarter. The latter also supports Bernanke's (1983) theoretical explanation of investments that are postponed due to expected oil price volatility and uncertainty associated with oil price uncertainty.

Granger causality analysis revealed a strong bidirectional causality between real GDP and real investment in all estimated VAR models, with Granger causality also running from real GDP to real interest rates, as well as to real investments. Given the above, the effect of oil prices changes may affect real investment directly as well as indirectly, through their effect on real GDP. A statistically significant relationship between real GDP and real investment was detected in all estimated VAR systems, which is in line with the theoretically expected pro-cyclical character of aggregate investment. It is also important to note that the impact of real interest rate on real investment was not found to be statistically significant in any of the VAR models. This might be explained by the fact that foreign exchange interventions (EUR-HRK) are the main monetary policy instrument of the CNB (not the interest rate as in developed economies).

In contrast to a rather modest body of research on the impact of oil prices on real investment at the aggregate level, this research suggests their initial positive relationship, with a subsequent negative reaction of investment to an oil price increase. This result can be explained by the relatively strong real growth of the Croatian economy in the third millennia, until 2008, despite the rise in oil prices. Given a tight co-movement of real GDP and real investment, the result can be explained by the fact that oil prices rose till 2008 as a result of strong global economic activity. According to Kilian (2009) and Cashin et al. (2014), oil-demand shocks driven by global economic activity have a positive impact on real growth of oil importing countries in the short run. It is also evident that in case of Croatia, the impact of oil prices on real investments indirectly contributes to the impact of oil prices on real GDP.

Starting from the assumption that not all sectors react to changes in oil prices in the same way (Elder & Serletis, 2010) individual segments of investment spending would be worth exploring. If certain categories move in opposite directions (eg. investments in the oil industry sector follow the growth of oil prices, which is not the case in other sectors) then the effects of the impact of oil prices on real investments at the aggregate level would be significantly different. Furthermore, it would be advisable to use retail prices of petroleum products on the domestic market as an input price. Wang et al. (2017) point out that in China the reactions of private companies (investments) are stronger than the reactions of public companies (investments) to changes in oil prices, and in Croatia, compared to the EU28, there is a higher share of public than private investments (Eurostat, Investment share of GDP by institutional sectors, % of GDP, 2018).

As a suggestion for further research, it would certainly be interesting to examine the impact of oil prices on investment decisions at the micro level, as is the case in a growing number of comparable studies. In this way, one can also distinguish possible differences in the way public and private investments react, as well as differences in the reactions of investments between various sectors of the economy. Given that many of the findings in the existing literature indicate the importance of oil price volatility, as oppose to oil price changes that seem less significant, it would also be advisable to generate an alternative oil price volatility measure and test its influence on real investment.

REFERENCES

Baumeister, C., Kilian, L. (2016). Forty Years of Oil Price Fluctuations: Why the Price of Oil May Still Surprise Us, Journal of Economic Perspectives, Vol. 30 (1), pp. 139-160. https://doi.org/10.1257/jep.30.1.139

Bernanke, B.S. (1983). Irreversibility, Uncertainty and Cyclical Investment, Quarterly Journal of Economics, Vol. 98 (1), pp. 85-106. https://doi.org/10.2307/1885568

Broadstock, D., Hunt, L., Sorrell, S. (2007). UKERC Review of Evidence for the Rebound Effect, Technical Report 3: Elasticity of substitution studies, Available at: https://www.euro-ciss.eu/fileadmin/user_upload/Redaktion/Seco@home/nach haltiger_Energiekonsum/Literatur/rebound_effekt/WP3_Elasticity_of_Substitution_Studies.doc

Carruth, A., Dickerson, A., Henley, A. (2000). What Do We Know About Investment Under Uncertainty?, Journal of Economic Surveys, Vol. 14(2), pp. 119 - 154. https://doi.org/10.1111/1467-6419.00107

Carruth, A.A., Hooker M.A., Oswald, A.J. (1998). Unemployment equilibria and input prices: Theory and evidence from the United States, Review of Economics and Statistics, Vol. 80, pp. 621-628. https://doi.org/10.1162/003465398557708

Cashin, P., Mohaddes, K., Raissi, M., Raissi, M. (2014). The Differential Effects of Oil Demand and Supply Shocks on the Global Economy, Energy Economics, Vol. 44, pp. 113-134. https://doi.org/10.1016/j.eneco.2014.03.014

Cheng, D., Shi, X., Yu, J., & Zhang, D. (2019). How does the Chinese economy react to uncertainty in international crude oil prices? International Review of Economics & Finance, Vol. 64, pp. 147-164.https://doi.org/10.1016/j.iref.2019.05.008

Chirinko, R.S. (1993). Business Fixed Investment Spending: Modeling Strategies, Empirical Results, and Policy Implications, Journal of Economic Literature, Vol. 31 (4), pp. 1875-1911.

Crompton, P., Wu, Y. (2005). Energy consumption in China: past trends and future directions, Energy Economics, Vol. 27 (1), pp. 195-208. https://doi.org/10.1016/j.eneco.2004.10.006

Dixit, A.K., Pindyk, R.S. (1994). Investment under uncertainity, Princeton University Press, Princeton, New Jeresy

Driver, C., Yip, P., Dahkil, N. (1996). Large company capital formation and effects of market share turbulence: micro-data evidence from the PIMS database, Applied Economics, Vol. 28, pp. 641-651. https://doi.org/10.1080/000368496328380

Elder, J., Serletis A. (2009). Oil price uncertainty in Canada, Energy Economics, Vol. 31, pp. 852-856. https://doi.org/10.1016/j.eneco.2009.05.014

Elder, J., Serletis A. (2010). Oil price uncertainty, Journal of Money, Credit and Banking, Vol. 42 (6), pp. 1137-1159. https://doi.org/10.1111/j.1538-4616.2010.00323.x

Ferderer, J.P. (1996). Oil Price Volatility and the Macroeconomy: A Solution to the Asymmetry Puzzle, Journal of Macroeconomics, Vol. 18, pp. 1-16. https://doi.org/10.1016/S0164-0704(96)80001-2

Glass, V., Cahn, E. S. (1987). Energy price uncertainty over the business cycle, Energy Economics, Vol. 9, pp. 257-264. https://doi.org/10.1016/0140-9883(87)90033-8

Goldberg, L. (1993). Exchange rates and investment in United States industry, The Review of Economics and Statistics, Vol. 75, pp. 575-589. https://doi.org/10.2307/2110011

Hamilton, J.D. (1996). This Is What Happened to the Oil Price-Macroeconomy Relationship, Journal of Monetary Economics, Vol. 38, pp. 15-220. https://doi.org/10.1016/S0304-3932(96)01282-2

Henriques, I., Sadorsky, P. (2011). The effect of oil price volatility on strategic investment, Energy Economics, Vol. 33, pp. 79-87. https://doi.org/10.1016/j.eneco.2010.09.001

Hooker, M. (1999a). Are oil shocks inflationary? Asymetric and nonlinear specifications versus change in regime, Journal of Money, Credit and Banking, Vol. 34 (2), pp. 540-561. https://doi.org/ 10.1353/mcb.2002.0041

Hooker, M. A. (1996), What happened to the oil price-macroeconomy relationship?, Journal of Monetary Economics, Vol. 38, pp. 195-213. https://doi.org/10.1016/S0304-3932(96)01281-0

Kilian, L. (2009). Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market, American Economic Review, Vol. 99 (3), pp. 1053-1069. https://doi.org/10.1257/aer.99.3.1053

Leahy, J.V., Whited, T.M. (1996). The effect of uncertainty on investment: some stylized facts, Journal of Money, Credit and Banking, Vol. 28 (1), pp. 64-83. https://doi.org/10.2307/2077967

Lee, K., Ni, S., Ratti, R.A., (1995). Oil Shocks and the Macroeconomy: The Role of Price Variability, Energy Journal, Vol. 16, pp. 39-56. https://doi.org/10.5547/ISSN0195-6574-EJ-Vol16-No4-2

Lim, J.J. (2013). Institutional and Structural Determinants of Investment Worldwide, The World Bank, Development Economics Prospects Group, Policy Research Working Paper 6591 https://doi.org/ 10.1596/1813-9450-6591

Mankiw, N.G. (2006), Osnove ekonomije, III. Izdanje, Mate d.o.o., Zagreb

McDonald, R., Siegel, D.R. (1986). The value of waiting to invest, Quarterly Journal of Economics, Vol. 101, pp. 707-728. https://doi.org/10.2307/1884175

Miller, K.D. (1998). Economic exposure and inegrated risk management, Strategic Management Journal, Vol. 19, pp. 497-514. https://doi.org/10.1002/(SICI)1097-0266(199805)19:5<497::AID-SMJ958>3.0.CO;2-M

Mork, K.A. (1989). Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton's Results, Journal of Political Economy, Vol. 97, pp. 740-744. https://doi.org/10.1086/261625

Pindyck, R.S., Solimano, A. (1993). Economic Instability and Aggregate Investment, NBER Working Paper No. 4380. https://doi.org/10.3386/w4380

Ratti, R.A., Seol. J., Yoon, K.H. (2011). Relative energy price and investment by European firms, Energy Economics, Vol. 33, pp. 721-731. https://doi.org/10.1016/j.eneco.2010.12.010

Speight, J.G. (2017). Rules of Thumb for Petroleum Engineers, Scrivener Publishing LLC., John Wiley & Sons, Inc. https://doi.org/10.1002/9781119403647

Uri, N.D. (1980). Energy as a determinant of investment behavior, Energy Economics, Vol. 2, pp. 179-183. https://doi.org/10.1016/0140-9883(80)90031-6

Wang, Y., Xiang, E., Cheung, A., Ruan, W., Hu, W. (2017). International oil price uncertainty and corporate investment: Evidence from China's emerging and transition economy, Energy Economics, Vol. 61 (C), pp. 330-339. https://doi.org/10.1016/j.eneco.2016.11.024

Yoon, K.H., Ratti, R.A. (2011). Energy price uncertainty, energy intensity and firm investment, Energy Economics, Vol. 33, pp. 67-78. https://doi.org/10.1016/j.eneco.2010.04.011

Kilian, L., Zhou, X. (2020). The Econometrics of Oil Market VAR Models, Federal Reserve Bank of Dallas, Working Paper 2006. https://doi.org/10.24149/wp2006

Tang, W., Wu, L., Zhang, Z. (2009). Oil Price Shocks and Their Short-and Long-Term Effects on the Chinese Economy, East-West Center Working Papers, Economics Series, No. 102, April 2009. https://doi.org/10.2139/ssrn.1396943

Başkaya, Y., Hülagü, T., Küçük, H. (2013). Oil Price Uncertainty in a Small Open Economy, IMF Economic Review, Vol. 61, pp. 168-198. https://doi.org/10.1057/imfer.2013.5