Economics Bulletin

Volume 29, Issue 3

The role of oil prices in monetary policy rules: evidence from 4 major central banks

Guillaume L`oeillet
University of Rennes 1, CREM, IFP

Julien Licheron
University of Rennes 1, CREM

Abstract

Recent movements in oil prices on international markets have generated many comments on the role that oil prices may play for Central Banks of oil-importing countries, oil price shocks being interpreted as supply shocks leading to higher inflation rates and lower economic growth. In this paper, we examine the role played by oil prices in the monetary policy strategy of 4 major Central Banks: the U.S. Federal Reserve, the ECB, the Bank of Canada and the Bank of England. Using an Ordered Probit model, we assess the reaction of each Central Bank to oil price changes and investigate a potential asymmetric response to oil price increases and decreases. Our results suggest that the role of oil price for Central Bankers may be very different depending on the objectives and the strategy of each Central Bank regarding inflation and output stabilization.

This letter has benefited from discussions with Christophe Tavéra, Isabelle Cadoret and Frédéric Lantz. The authors are also grateful to Jan-Egbert Sturm, Alper Cenesiz and Christian Pierdzioch for comments on a related paper presented at the Macroeconomic Research Meeting MAREM (Bonn, 9-10 May 2008) and the 25th Symposium on Money, Banking and Finance (Luxembourg, 18-20 June 2008). The usual disclaimer applies.

Citation: Guillaume L`oeillet and Julien Licheron, (2009) "The role of oil prices in monetary policy rules: evidence from 4 major central banks", *Economics Bulletin*, Vol. 29 no.3 pp. 2361-2371.

Submitted: Feb 11 2009. **Published:** September 18, 2009.

1 Introduction

Recent movements in oil prices on international markets have generated many comments on the role that oil prices may play for Central Banks of oil-importing countries. The dollar price of oil indeed rose sharply between 1999 and 2007, going from \$12.5/barrel in January 1999 to \$145/barrel in July 2008, before falling dramatically during the second half of 2008 to the \$30-\$50/barrel range[1]. This new and long-lasting oil shock received important consideration for its presumed effect on macroeconomic variables: an oil shock is expected to generate inflation, since oil prices are included in the Consumer Price Index (CPI) and increase production costs. Inflationary pressures in turn reduce margins and the purchasing power of consumers, leading to a lower economic growth. Many empirical papers indeed suggest that the big oil price shocks of the 1970s strongly affected output and inflation (Hamilton, 1983). However, recent researches suggest that oil shocks have had much smaller macroeconomic effects since the early 1980s (Hooker, 1996, 2002; LeBlanc and Chinn, 2004).

Several papers claim that this breakdown in the relationship between oil and macroeconomic indicators is partly related to a change in monetary policy (Blanchard and Galí, 2007). To some extent, monetary policy can indeed influence the impact of an oil shock on the inflation rate and GDP growth. On the one hand, inflationary pressures may lead the Central Bank to raise its short-term interest rate following an increase in oil prices, with the risk of amplifying the economic slowdown. On the other hand, monetary authorities may choose to cut their interest rate to prevent a recession after an oil shock, with the risk of letting inflationary pressures increase. The solution of this trade-off between inflation and output stabilization would therefore depend on the preferences of policymakers: preserving price stability or maintaining output and employment near their potential level.

Bernanke *et al.* (1997) investigate the influence of the systematic reaction of the Fed monetary policy in the U.S. economy (using a VAR modelling) and conclude that the upward movements of the Fed Funds rates explain to a large extent the low economic growth observed after oil shocks. They claim that a counter-inflation monetary policy is systematically harmful, and that a "neutral monetary policy" could avert the contractionary response to oil shocks[2]. Hamilton and Herrera (2004) refute the conclusions of Bernanke *et al.* (1997) and alleviate the responsibility of monetary policy in the transmission of oil shocks to activity. According to them, the direct impact of rising oil prices on output is underestimated because of a bad specification of the model and a misleading perception of the monetary policy driven by the Federal Reserve. However, Leduc and Sill (2004) demonstrate, in a calibrated general equilibrium model, that monetary policy may contribute to nearly 40 percent to the drop in output following a rise in oil prices. The Central Bank can not fully insulate real output from an oil price shock, and the real effects thus vary depending on the priority assigned by the monetary authority.

The asymmetry of the relationship between oil prices and macroeconomic indicators is also examined as a specific feature in the literature. Mork (1989), Mory (1993) and Mork *et al.* (1994) find that the relationship between oil prices and activity is nonlinear since an increase in energy prices diminishes the output to a larger extent than falling prices improve the economic situation. This asymmetry can be justified by many reasons developed by Huntington (1998) and Balke *et al.* (2002). One of them is that Central Banks potentially adjust their monetary

[1]Those figures relate to WTI (West Texas Intermediate) oil prices.

[2]The issue of "neutral monetary policies" is discussed in Brown and Yücel (1999).

policy when oil prices increase, whereas interest rates are unchanged when prices fall (see Leduc and Sill, 2004). Asymmetric preferences of the authorities *and/or* the expectation of a nonlinear transmission from crude oil prices to output and overall inflation may explain an asymmetric response from Central Banks.

Our goal is to examine the role played by oil prices in the monetary policy strategy of 4 major Central Banks: the U.S. Federal Reserve, the ECB, the Bank of Canada and the Bank of England. A comparison of the practices of those Central Banks regarding oil prices seem to be very appealing, since they have different objectives and display different monetary policy strategies. Even if each of them is concerned with fighting inflation, the U.S. authorities also seek to maintain employment near the full employment level. The main objective of the others is price stability. The Bank of Canada and the Bank of England even adopted an inflation targeting regime[3], while the ECB does not have a true inflation target but a primary objective of containing the inflation rate "below but close to 2%". Differences in the objectives, strategies and inflation rate targets of those 4 major Central Banks are summarized in Table 1.

Table 1: **Monetary policy frameworks**

	Objective(s)	**Strategy**	**Inflation "target"**
U.S. Federal Reserve (Fed)	Twofold objective : stable prices and maximum employment	Mixed policy ("*fine tuning*")	No explicit inflation target
European Central Bank (ECB)	Main objective : price stability	A "two-pillar strategy" : economic analysis + monetary analysis	Below, but close, to 2% - CPI inflation
Bank of Canada	Single objective : low inflation	Inflation targeting	2% (midpoint of the target range 1-3%) - CPI inflation
Bank of England	Single objective : low inflation	Inflation targeting	3% (within the range 2-4%) - CPI inflation

In this paper, we assess the reaction of each Central Bank to oil price changes and investigate a potential asymmetric response to oil price increases and decreases. We assess these two questions by estimating a reaction function based on a Taylor rule extended with oil prices, using an Ordered Probit model, as in Gerlach (2007).

The remainder of the paper is organized as follows: Section 2 presents the methodology while the results are developed in Section 3. Finally, Section 4 concludes and provides some insights.

[3]Inflation targeting is a monetary policy regime in which a Central Bank attempts to keep inflation in a declared target range, usually using the short-term interest rate as the instrument. Inflation targeting was pioneered in New Zealand in 1990, and then introduced by the Bank of Canada in 1991 and by the Bank of England in 1997.

2 Methodology

The specification of our model follows the works of Gerlach (2007). We assume that the Central Bank proceeds to a gradual adjustment of the actual interest rate, as in Judd and Rudebusch (1998):

$$i_t^* - i_t = \gamma_1 i_{t-1} + \gamma_2 \Delta i_{t-1} + \gamma_3(\pi_t - \pi^*) + \gamma_4 y_t + \gamma_5 \Delta o_t + \varepsilon_t \tag{1}$$

where i_t is the actual short-term nominal interest rate, i_t^* the desired interest rate, π_t the inflation rate and y_t the output gap. π^* is the target for the inflation rate, which is supposed constant over time. Δo_t is the 12-month annualized change rate of oil prices expressed in domestic currency. We also distinguish between positive (Δo_t^+) and negative (Δo_t^-) oil price growth rates to investigate a potential asymmetric behaviour.

The decision of the Central Bank is therefore defined as a choice among three possibilities: a cut in the interest rate (-1), no change (0) and an increase of the interest rate (+1)[4]:

$$\begin{cases} \Delta i_t = & -1 & \text{if} \quad i_t^* - i_{t-1} \leq \mu_1 \\ \Delta i_t = & 0 & \text{if} \quad \mu_1 < i_t^* - i_{t-1} \leq \mu_2 \\ \Delta i_t = & +1 & \text{if} \quad \mu_2 < i_t^* - i_{t-1} \end{cases} \tag{2}$$

where i_t^* would be the optimal interest rate if it could be set on a continuous scale. This is the latent (unobserved) variable of our model. The effective change in the observed interest rate depends on where the latent variable is relative to threshold values μ_1 and μ_2.

We work on monthly data. Interest rates are extracted from the IMF International Financial Statistics (IFS) database. The monetary instrument is represented by the Federal Funds rate for the U.S., the Marginal Refinancing Operations (MRO) rate for the ECB, the overnight rate for the Bank of Canada, and the Bank Rate for the Bank of England. For oil prices, we use spot prices of WTI (West Texas Intermediate) from the EIA (Energy Information Administration) database[5]. Oil prices are expressed in domestic currency using a bilateral exchange rate (National currency units per U.S. dollar). The inflation rate is the 12-month growth rate of the CPI. The output gap is constructed using the Industrial Production Index (IPI) adjusted for seasonal variations, and defined as the monthly deviation of the IPI from a trend calculated using the Hodrick-Prescott filter with a smoothing parameter set to 14400 (standard value for monthly data). We also explore the robustness of our results using an alternative measure of activity: the unemployment gap, also calculated as the monthly deviation of the unemployment rate (adjusted for seasonal variations) from a trend obtained with the Hodrick-Prescott filter. All the series (except interest rates and oil prices) are extracted from the OECD Main Economic Indicators.

We use an Ordered Probit model to estimate this discrete choice model. Since the seminal paper from Eichengreen *et al.* (1985), the estimation of monetary policy reaction function by

[4]We do not discriminate interest rates changes regarding the scope of these changes. The size of our sample entails very few observations of 50-basis-point increases or decreases. That's why we match them with 25-basis-point variations.

[5]The Brent price would perhaps have been more appropriate for the Euro Area and the United-Kingdom, but this price is also highly correlated with the WTI (with a correlation coefficient of 0.998 between the two prices).

means of Ordered Probit models has become increasingly popular. Examples of their diffusion include Galí *et al.* (2004), Carstensen (2006) and Gerlach (2007). Since the levels of the estimated coefficients can not be directly interpreted, we also analyse the marginal effects relative to oil prices coefficients[6].

3 The results

The sample of our estimates goes from 1999:1 to the end of 2007[7]. We decide to begin the sample in 1999 in order to describe the true ECB policy and compare it with the practice of the other Central Banks. Table 2 reports the results of our estimates of Equation (1) including the standard oil price indicator.

Oil prices play an important role in the monetary policy decisions, except for the Bank of England which seems rather insensitive oil price changes. Interestingly, the reaction of the U.S. Fed to a change in oil prices is very different from those of the ECB and the Bank of Canada. On the one hand, rising oil prices increase the probability of a reduction of the Fed's key interest rate. This conclusion is consistent with the results from Hess (2000) that during Chairman Greenspan's tenure the Fed has acted to make monetary policy looser in response to an oil price increase[8]. It may reflects the U.S. specific concern for output stabilization, conducting the Fed to act in order to fight output contractions and unemployment rises. On the other hand, the ECB and the Bank of Canada react to oil price increases by leading a tighter monetary policy. They thus seem to fear inflationary pressures associated to rising oil prices rather than a possible downturn of the economy. This result is in line with their main objective of price stability. The adoption of a true inflation targeting regime does not seem to make a major difference, since the ECB doesn't have a true inflation target. The results reached using an unemployment gap (instead of the benchmark output gap), reported in Appendix A, are rather in line with our key conclusions. The only difference is that the Bank of England also react to oil prices (in the same way as the ECB and the Bank of Canada) in this specification. However, this result is not very robust.

The next step in our analysis deals with the potential asymmetric reaction of policymakers regarding oil prices. Table 3 report the results reached when distinguishing between oil price increases and decreases. Those regressions corroborate the previous results: the Bank of England does not seem to react to oil price increases nor decreases, the U.S. Fed seems to prefer a looser monetary policy when oil prices increase, while the ECB and the Bank of Canada have higher probabilities to increase their interest rates after an oil shock. Very interestingly, the Fed does not demonstrate any asymmetric response and also adjust its key interest rate when oil prices decrease (by tightening its monetary policy). On the contrary, the ECB and the Bank of Canada only adjust their interest rates when oil prices increase. It suggests that they fear inflationary pressures associated to an oil shock, but not the risk of a deflation or a strong disinflation when energy prices decrease. Two potential explanations may be put forward such a behaviour. The

[6]The marginal effects are the change in the probability of each modality (-1, 0 and +1, *i.e.* respectively decrease, no change and increase in the MRO rate) for a one-unit change (a one-percentage-point change in our case) in the explanatory variable (calculated for mean values of explanatory variables). The computation of marginal effects thus allows us to interpret and compare the impact of small changes of each variable on the Central Bank decision.

[7]2007:7 for Canada, 2007:8 for the U.K., 2007:9 for the euro area and 2007:10 for the U.S.

[8]Hess (2000) shows that during the 1970s, prior to Paul Volcker's chairmanship, the Fed used to have the opposite reaction and tightened monetary policy in response to an oil price increase.

first one is related to asymmetric preferences of the ECB and the Bank of Canada, while the second one is related to their expectations that some downward price rigidities would stop a downward adjustment from crude oil prices to CPI inflation. All in all, such an asymmetric reaction of the ECB and the Bank of Canada may be involved in the asymmetric relationship between crude oil prices and output found by Mork (1989).

Finally, to assess the magnitude of the Central Banks reaction to oil price changes, we report in Tables 4 and 5 the marginal effects of oil price changes on the probabilities of monetary policy changes, *i.e* a decrease (-1) and an increase ($+1$) of interest rates[9]. Those marginal effects suggest that a ten-percentage-point increase in crude oil prices rises the probability that the Fed cut its interest rates by 0.021 and decreases the probability of a tighter monetary policy in the U.S. by 0.03. For both the Bank of Canada and the ECB, we observe the opposite behaviour: a ten-percentage-point increase in crude oil prices decreases the probability of lower interest rates by 0.020 and 0.013 respectively, while increasing the probability of a tighter monetary policy by 0.023 and 0.027 respectively. Moreover, oil price decreases only affect the behaviour of the Fed, whereas they have no effect on the probability of adjusting interest rates for the ECB and the Bank of Canada[10].

Table 2: **Ordered Probit estimates with oil price changes**[a]

	U.S.	CANADA	U.K.	EURO AREA
i_{t-1}	0.0794	**-0.3141**	**-0.4464**	**-0.3275**
	(0.0827)	(0.1170)***	(0.1742)**	(0.1866)*
Δi_{t-1}	**3.0270**	**2.4375**	**-1.8080**	0.2660
	(0.5400)***	(0.8162)***	(0.4219)***	(0.8954)
$\pi_t - \pi^*$	0.2529	-0.0121	**0.7520**	-0.518491
	(0.1849)	(0.1643)	(0.2809)***	(0.3555)
y_t	-0.0355	0.1103	**0.5275**	**0.5055**
	(0.1328)	(0.0895)	(0.1910)***	(0.1778)***
Δo_t	**-0.0138**	**0.0112**	0.0098	**0.0084**
	(0.0048)***	(0.005)***	(0.0061)	(0.0048)*
Number of observations	106	103	104	103
Pseudo R^{2b}	0.2419	0.1954	0.2375	0.1420
log(L)	-80.5901	-73.6624	-72.1770	-59.6783

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.

[b] The pseudo-R^2 is the Mac Fadden R^2. It is calculated as $1 - log(L)/log(L_0)$ where $log(L_0)$ is the log-likelihood of a model computed with only a constant term.

[9] We should note that oil prices do not have a significant effect in the more frequent decision: the *status quo*.

[10] Marginal effects computed on regressions using the unemployment gap instead of the output gap provide very similar results.

Table 3: **Ordered Probit estimates with asymmetric oil prices**[a]

	U.S.	CANADA	U.K.	EURO AREA
i_{t-1}	0.0252	**-0.3141**	**-0.4748**	**-0.4319**
	(0.0885)	(0.1173)***	(0.1885)**	(0.1990)**
Δi_{t-1}	**2.9841**	**2.4372**	**-1.7828**	0.2583
	(0.5433)***	(0.8437)***	(0.4238)***	(0.9152)
$\pi_t - \pi^*$	0.2465	-0.0121	**0.7628**	-0.4988
	(0.1864)	(0.1713)	(0.2816)***	(0.3598)
y_t	0.0592	0.1103	**0.5394**	**0.6021**
	(0.1441)	(0.0910)	(0.1930)***	(0.1901)***
Δo_t^+	**-0.0112**	**0.0112**	0.0126	**0.0153**
	(0.0050)**	(0.0053)**	(0.0092)	(0.0063)**
Δo_t^-	**-0.0465**	0.0112	0.0021	-0.0162
	(0.0193)**	(0.0214)	(0.0198)	(0.0149)
Number of observations	106	103	104	103
Pseudo R^{2}[b]	0.2566	0.1954	0.2384	0.1637
log(L)	-79.0264	-73.6624	-72.0942	-58.1691

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.

[b] The pseudo-R^2 is the Mac Fadden R^2. It is calculated as $1 - log(L)/log(L_0)$ where $log(L_0)$ is the log-likelihood of a model computed with only a constant term.

4 Conclusion

In this paper, we have examined the role played by oil prices in the monetary policy strategy of 4 major Central Banks: the U.S. Federal Reserve, the ECB, the Bank of Canada and the Bank of England. Using an Ordered Probit model, we assess the reaction of each Central Bank to oil price changes and investigate a potential asymmetric response to oil price increases and decreases. Our results yield three kinds of behaviour. On the one hand, the U.S. Fed seems to accommodate oil price shocks by conducting a loose monetary policy when oil prices increase. On the other hand, the ECB and the Bank of Canada display a restrictive reaction to oil price changes in order to fight inflationary pressures induced by oil price increases. As for the Bank of England, it does not react at all to oil price changes. Our results thus suggest that the role of oil prices for Central Bankers may be very different depending on the objectives and the strategy of each Central Bank regarding inflation and output stabilization.

Finally, the ECB and the Bank of Canada display an asymmetric response to oil price changes, fighting inflationary pressures related to oil price increases, but not reacting at all to oil price decreases. Such an asymmetric reaction may provide an additional explanation to the asymmetric relationship between crude oil prices and output emphasized in the literature. It does not mean that those two Central Banks create the asymmetry in the relationship, but only contribute to it. The optimality of this asymmetric behaviour of Central Bankers will be investigated in a upcoming paper.

Table 4: **Marginal effects of oil prices on the probability of a more accommodative policy** [a]

	U.S.	CANADA	U.K.	EURO AREA
Δo_t	**0.0027**	**-0.0020**	-0.0039	-0.0077
	(0.0010)***	(0.0010)**	(0.0024)	(0.0005)
Δo_t^+	**0.0021**	**-0.0020**	-0.0050	**-0.0013**
	(0.0010)**	(0.0010)**	(0.0037)	(0.0007)*
Δo_t^-	**0.0088**	-0.002	-0.0008	0.0014
	(0.0039)***	(0.0039)	(0.0079)	(0.0014)

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.

Table 5: **Marginal effects of oil prices on the probability of a tighter policy** [a]

	U.S.	CANADA	U.K.	EURO AREA
Δo_t	**-0.0038**	**0.0023**	0.0038	**0.0016**
	(0.0013)***	(0.0011)**	(0.0024)	(0.0009)*
Δo_t^+	**-0.0030**	**0.0023**	0.0049	**0.0027**
	(0.0014)**	(0.0011)**	(0.0036)	(0.0012)**
Δo_t^-	**-0.0126**	0.0023	0.0008	-0.0029
	(0.0054)***	(0.0043)	(0.0078)	(0.0027)

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.

Appendix A. Robustness checks with the unemployment gap

Table 6: **Ordered Probit estimates with oil price changes**[a]

	U.S.	CANADA	U.K.	EURO AREA
i_{t-1}	0.0720	**-0.3171**	**-0.3994**	**-0.8329**
	(0.0810)	(0.1281)**	(0.1661)**	(0.2813)***
Δi_{t-1}	**3.0246**	**2.6626**	**-1.4852**	0.3517
	(0.5424)***	(0.7904)***	(0.3617)***	(0.9137)
$\pi_t - \pi^*$	0.1850	-0.0237	**0.4912**	**-0.648863**
	(0.2061)	(0.1654)	(0.2461)**	(0.3673)*
$u_t - u^*$	-0.2861	-0.5688	-1.1083	**-5.4429**
	(0.5844)	(0.7469)	(0.8219)	(1.5591)***
Δo_t	**-0.0146**	**0.0113**	**0.0101**	**0.0201**
	(0.0042)**	(0.0055)**	(0.0055)*	(0.0052)***
Number of observations	106	103	104	103
Pseudo R^{2}[b]	0.2427	0.1902	0.2039	0.1761
log(L)	-80.5068	-74.1383	-75.3601	-57.3097

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.
[b] The pseudo-R^2 is the Mac Fadden R^2. It is calculated as $1 - log(L)/log(L_0)$ where $log(L_0)$ is the log-likelihood of a model computed with only a constant term.

Table 7: **Ordered Probit estimates with asymmetric oil prices**[a]

	U.S.	CANADA	U.K.	EURO AREA
i_{t-1}	0.0309	**-0.3159**	**-0.3974**	**-0.8413**
	(0.0843)	(0.1283)**	(0.1777)**	(0.2848)***
Δi_{t-1}	**2.9851**	**2.6226**	**-1.4875**	0.3445
	(0.5461)***	(0.8310)***	(0.3690)***	(0.9142)
$\pi_t - \pi^*$	0.1923	-0.0310	**0.4907**	**-0.6690**
	(0.2070)	(0.1717)	(0.2468)**	(0.3809)*
$u_t - u^*$	-0.4321	-0.5578	-1.1071	**-5.5404**
	(0.5931)	(0.7507)	(0.8228)	(1.6357)***
Δo_t^+	**-0.0106**	**0.0110**	0.0099	**0.0194**
	(0.0048)**	(0.0058)**	(0.0087)	(0.0064)***
Δo_t^-	**-0.0446**	0.0145	0.0107	0.0231
	(0.0173)***	(0.0211)	(0.0184)	(0.0155)
Number of observations	106	103	104	103
Pseudo R^{2}[b]	0.2583	0.1904	0.2039	0.1764
log(L)	-78.8449	-74.1257	-75.3603	-57.2885

[a] Standard errors are in brackets. ***, ** and * denote significance at the 1%, 5%, and 10% respectively.
[b] The pseudo-R^2 is the Mac Fadden R^2. It is calculated as $1 - log(L)/log(L_0)$ where $log(L_0)$ is the log-likelihood of a model computed with only a constant term.

References

Balke, N. S., S. P. Brown, and M. K. Yücel (2002) "Oil Prices Shocks and the U.S Economy: Where Does the Asymmetry Originate?" *The Energy Journal* **23**, 27–52.

Bernanke, B. S., M. Gertler, and M. Watson (1997) "Systematic Monetary Policy and the Effects of Oil Price Shocks" *Brookings Papers on Economic Activity* **1997 (1)**, 91–157.

Blanchard, O. J., and J. Galí (2007) "The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s So Different from the 1970s?" NBER Working Paper 13368.

Brown, S. P., and M. K. Yücel (1999) "Oil Prices and U.S. Aggregate Economic Activity: A Question of Neutrality" *Federal Reserve Bank of Dallas Economic and Financial Review* **1999 (Second Quarter)**, 16–23.

Carstensen, K. (2006) "Estimating the ECB Policy Reaction Function" *German Economic Review* **7**, 1–34.

Eichengreen, B., M. Watson, and R. Grossman (1985) "Bank Rate Policy under the Interwar Gold Standard: A Dynamic Probit Model" *The Economic Journal* **95**, 725–745.

Galí, J., S. Gerlach, J. Rotemberg, H. Uhlig, and M. Woodford (2004) *The Monetary Policy of the ECB Reconsidered: Monitoring the European Central Bank 5* London: Centre for Economic Policy Research (CEPR).

Gerlach, S. (2007) "Interest Rate Setting by the ECB, 1999-2006: Words and Deeds" *International Journal of Central Banking* **3**, 1–45.

Hamilton, J. D. (1983) "Oil and the Macroeconomy since World War II" *Journal of Political Economy* **91**, 228–248.

Hamilton, J. D., and A. M. Herrera (2004) "Oil Shocks and Aggregate Macroeconomic Behavior: The Role of Monetary Policy" *Journal of Money, Credit and Banking* **36**, 265–286.

Hess, G. (2000) "Oil and the Macroeconomy" Prepared for the Shadow Open Market Commitee Meeting, November 13th, 2000.

Hooker, M. A. (1996) "What Happened to the Oil Price-Macroeconomy Relationship?" *Journal of Monetary Economics* **38**, 195–213.

Hooker, M. A. (2002) "Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regime" *Journal of Money, Credit and Banking* **34**, 540–561.

Huntington, H. G. (1998) "Crude Oil Prices and U.S. Economic Performance: Where Does the Asymmetry Reside?" *The Energy Journal* **19**, 107–132.

Judd, J. P., and G. D. Rudebusch (1998) "Taylor's Rule and the Fed: 1970-1997" *Federal Reserve Bank of San Francisco Economic Review* **1998**, 3–16.

LeBlanc, M., and M. Chinn (2004) "Do High Oil Prices Presage Inflation? The Evidence from G-5 Countries" *Business Economics* **39**, 38–48.

Leduc, S., and K. Sill (2004) "A Quantitative Analysis of Oil-Price Shocks, Systematic Monetary Policy, and Economic Downturns" *Journal of Monetary Economics* **51**, 781–808.

Mork, K. A. (1989) “Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton’s Results” *Journal of Political Economy* **97**, 740–744.

Mork, K. A., O. Olsen, and H. T. Mysen (1994) “Macroeconomic Responses to Oil Price Increases and Decreases in Seven OECD Countries” *The Energy Journal* **15**, 15–37.

Mory, J. F. (1993) “Oil Prices and Economic Activity: Is the Relationship Symmetric?” *The Energy Journal* **14**, 151–161.