Economics Bulletin

Volume 38, Issue 4

Macroeconomic Response of Disentangled Oil Price Shocks: Empirical Evidence from Japan

Mahmood -ur- Rahman
GSICS, Kobe University, Japan

Zakaria Zoundi
GSICS, Kobe University, Japan

Abstract

Deploying the extended version of the structural VAR framework of Killian (2009), this paper projects the dynamic effects of oil price shocks on some major macroeconomic aggregates of the 3rd largest energy consuming economy, Japan for the timespan 1996M1-2015M4. For this analysis the innovations are derived from both global oil and foreign exchange markets. Decomposing the oil price shocks into various components, this paper portrays a historical evolution of the structural shocks. The results convey that the macroeconomic components respond differently depending upon the nature of the oil price shock indicating significant variations in transmission mechanisms. Empirically, the non-existing impact of oil supply shocks on the components of Japanese national income identity along with the prominence of global demand and oil market specific speculative shocks have been discovered. Moreover, this research reestablishes the insulated nature of the Japanese economy. At the macro level, the exchange rate shocks are found to be insignificant to generate any response. Gradual reliance on international trade, which is susceptible to external shocks needs to be considered for macro stability.

We took time to contemplate on the attached referee report and tried our best to ensure that each point, mentioned by the honorable referee is meticulously addressed in the revised version of the paper.
Citation: Mahmood -ur- Rahman and Zakaria Zoundi, (2018) "Macroeconomic Response of Disentangled Oil Price Shocks: Empirical Evidence from Japan", *Economics Bulletin*, Volume 38, Issue 4, pages 2240-2253
Contact: Mahmood -ur- Rahman - mahmood_gsics_ku@yahoo.com, Zakaria Zoundi - zakariazoundi@yahoo.fr.
Submitted: March 11, 2018. **Published:** December 02, 2018.

1. Introduction

Despite the considerable surge in global oil demand since the oil shocks of the 1970s, global economies have become relatively less insulated to global oil shocks as a result of persistent innovations in energy-related technologies, expansion of energy resources, new discoveries, switching to energy substituting production technologies, reduction in energy intensity, development of energy commodity markets, strategic procurement and stock management policies, and publicly initiated energy efficiency doctrines. Following the seminal research by Hamilton (1983), quite a robust empirical literature (for example, Bruno and Sachs, 1985; Hamilton, 1996; Hutchinson, 1993; Davis and Haltiwanger, 2001; Brown and Yücel, 2002; Lee and Ni, 2002; Kilian, 2008; Hamilton, 2008; Kilian, 2009; Baumeister et al., 2010) has analyzed the relationship among oil prices and real economic activities, vividly elaborating the magnitude, transmission mechanism, and historical decomposition of effects of oil price movements on macroeconomic aggregates. Numerous empirical studies have detected diversified effects of oil market shocks, not only among the heterogenous economies but also for economies possessing homogenous features (Fukunaga et al., 2011). This notion of differentiated impacts has also been fortified by Kilian (2008) through constructing a structural VAR to address both the issues of reverse causality among oil price and macroeconomic aggregates as well as identification and breakdown of oil price shocks into distinct categories. This structural decomposition has provided a better understanding of both real oil price fluctuations as well as response of overall economy, associated with these fluctuations.

Both the significance of oil price shocks in economic downturns as well as the substantial volatility in the global oil market justifies the interest among researchers regarding the macroeconomic consequences of oil shocks to facilitate pragmatic policy formulation for efficient macro management. Challenging the common belief of oil supply disruptions through historical decomposition of fluctuations, Kilian (2008) has proven the oil price shocks to be driven primarily by a combination of global aggregate demand shocks and precautionary demand shocks. Fukunaga et al. (2011) have also stressed the growing prominence of rapid growth in emerging economies and integration of global supply chains in both oil price fluctuations and their transmission mechanisms.

Being one of the largest global energy consumers, the premier Asian developed economy, Japan has received considerable attention from researchers due to its uniqueness in transmission of oil market shocks on macroeconomic aggregates. Deploying a VAR model, Burbidge and Harrison (1984) noticed a subdued impact of oil price shocks on both price level and industrial production for Japan. Zhang (2008) has detected a non-linear association between oil price changes and economic growth. Using a quarterly dataset spanning between 1975 and 2002 for Japan along with five other Asian countries, Cunado and Gracia (2005) have found that oil price shocks significantly impact domestic price indexes as well as economic activity. However, the impact appears to be stronger for the short run and specifically when the shocks are expressed in local currencies. Additionally, for Japan and the other selected Asian economies, they have also confirmed the asymmetric responses of macroeconomic indicators to oil price shocks, detected as well in earlier studies (Mork, 1989; Hamilton, 1996; Lee et al., 1995; Edelstein and Kilian, 2007 and 2009; Davis, 1987; Elder and Serletis, 2012).

Fukunaga et al. (2011) have been the pioneers in applying Kilian's framework for Japan. They have investigated the underlying causes of oil price changes and their transmission mechanisms both to industry-level as well as aggregate data; the findings have reconfirmed the discovery of negligible or even positive effects of oil price shocks on the Japanese economy, significantly

deviating from the other major oil-importers. However, the recent study by Jimenez-Rodriguez and Sanchez (2012) has revealed negative consequences of oil price shocks on Japanese inflation and industrial production. Several research works have shed light on the response of some economic sectors such as residential, commercial, industrial, and transport to oil price fluctuations (Taghizadeh-Hesary et al., 2015). In numerous studies, (see, for example, Hutchison, 1993; Baumeister et al., 2010; Peersman and Van Robays, 2012) Japan has been simply clubbed with other developed economies to compare the divergence in dynamics of transmission.

Extensive exposure to international trade through heavy reliance on energy and other imports, and persuasion of export-led industrialization, and growth policies have made exchange rate fluctuations as one of the chief sources of external shocks to the Japanese economy as well.

Historically, external demand, exchange rate and oil price have exerted significant influence on the Japanese economy through affecting the domestic business cycle. A favorable depreciation of the yen, caused by economic expansion overseas, impacts the economy positively. Whereas, oil price shocks mostly have triggered unfavorable depreciation, resulting in adverse consequences. But the real scenario is truly complex due to the simultaneous presence of multiple factors. Subsequently, the macroeconomic consequences of both oil price shocks and exchange rate fluctuations have gathered substantial attention as a research topic from economists and policy makers.

This research is an endeavor to analyze the structural shocks, causing oil price and exchange rate movements for capturing the influence on Japanese macroeconomic aggregates. Specifically, deploying the extended version of Kilian's framework, this research investigates the response of some fundamental macroeconomic aggregates, principally derived from the national income identity (real output, consumption, investment, external trade volume) to exogenous shocks. Although this paper has borrowed from the research works of Kilian (2009), in terms of developing the model, it scrutinizes the responses of a broader array of macroeconomic aggregates to make a prominent contribution to the literature.

Decomposing the external structural shocks into various components, this paper portrays a historical evolution of the structural shocks. The results convey that the macroeconomic components respond differently depending upon the nature of the external shock, indicating significant variations in transmission mechanisms. Empirically, the non-existing impact of oil supply fluctuations on the components of Japanese national income identity has been discovered to augment the relatively insulated nature of the Japanese economy once again. The prominence of global demand shocks and oil market specific speculative shocks are detected as chief stimulants of dynamism in the macroeconomic aggregates. At the macro level, the exchange rate shocks are found to be insignificant in generating any response. Following the Introduction in Section 1, Section 2 presents the empirical framework for estimating the structural shocks. Discussions on the deployed empirical models, methodologies and the dataset are also featured in this section. Section 3 illustrates the empirical findings, capturing the impact of the identified structural shocks, which are external in nature for the Japanese macroeconomic aggregates. Section 4 wraps up with the concluding remarks.

2. Methodology and dataset

2.1 Framework for estimating structural shocks

Along with the basic market demand and supply side factors, temporary demand shocks emanating from projection-based precautionary or speculative motives also do induce fluctuations in global crude oil prices. Consequently, to scrutinize the quantitative impact of exogenous changes in crude oil prices on the macroeconomic aggregates, an underlying set of assumptions is essential for decomposing the fluctuations in prices. The SVAR framework, incorporating the desired assumptions, has been preferred by most researchers to scrutinize the impact of oil price shocks in previous studies; as it is also better suited to capture the dynamics of the global oil market (for example, Bernanke et al., 1997; Lee and Ni, 2002; Peersman, 2005; Kilian, 2009; Peersman and Van Robays, 2009), particularly, for categorizing the oil price innovations into distinct types (for example, Baumeister and Peersman, 2013; Kilian, 2009; Peersman and Van Robays, 2009). Following this line in the literature, three types of oil price shocks (i.e., oil supply shocks caused by exogenous disruptions in oil production, oil demand shocks driven by global economic activity, and oil-specific demand shocks, derived from market price which is closely associated with forecasts) have been considered to quantify the different impacts of each component on relevant macroeconomic aggregates. Through a series of well-articulated papers (Kilian 2009; Kilian and Park, 2009), Kilian has addressed the decomposition of oil price movements. He has also developed a new measure of global real economic activity to capture the global demand for crude oil. For analyzing the impact of exogenous shocks on the US economy, he has assumed that crude oil supply is unresponsive to oil demand shocks within the existing month. Precisely, Kilian (2009) has supposed that the aforementioned three types of structural shocks affect the oil price movements within the same month. Kilian has categorized the changes in the global crude oil supply capacity as the first type of exogenous shock to global oil supply and has been referred to as the 'supply shocks'. Coordinated OPEC production cuts and production decisions by the major non-OPEC exporters are the prime factors behind this type of shock. Kilian has related the second type of shock to global economic conditions, representing the demand for crude oil and terming it as the 'aggregate demand shocks'. Thirdly, he has classified the changes in current crude oil price as 'crude oil market specific demand shocks' as it captures the market demand based on future oil price expectations; where intensification of geopolitical risks in the Middle East or elsewhere, leading to possible supply disruptions or surge in speculative investments caused by prediction of persistent and robust global economic expansion in the future could be major catalysts. However, for this empirical work, these market specific shocks are considered not to be explained by oil supply shocks or aggregate demand shocks. The estimated residuals are exploited to represent these specific shocks leaving a wide array of options for interpretation. Kilian has estimated the following three-variable VAR system for oil production, global real economic activity (aggregate demand), and oil price:

$$X_t = \alpha + \beta X_{t-1} + u_t \qquad (1)$$

$$X_t \equiv \begin{pmatrix} oilprod_t \\ realeco_t \\ oilprice_t \end{pmatrix}, \qquad u_t \equiv \begin{pmatrix} u_t^{oilprod} \\ u_t^{realeco} \\ u_t^{oilprice} \end{pmatrix}, \qquad E[\, u_t u'_t] = V$$

The variables in the VAR system are growth rate of world crude oil production ($oilprod_t$), proxy for global real economic activity ($realeco_t$), developed by Killian and crude oil price

(*oilprice$_t$)*. Kilian imposed the following restrictions relating to the observed variables and structural shocks

$$u_t \equiv \begin{pmatrix} u_t^{oilprod} \\ u_t^{realeco} \\ u_t^{oilprice} \end{pmatrix} = A_0 \xi_t = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \xi_t^{SY} \\ \xi_t^{DY} \\ \xi_t^{OIL} \end{pmatrix} \qquad (2)$$

The structural shocks are defined as follows-
ξ_t^{SY} : oil supply shock;
ξ_t^{DY} : aggregate demand shock;
ξ_t^{OIL}: oil market specific demand shock

These postulations entailing the structural system leave a number of vital implications for the relationship between the observed data series for the current month and the structural shocks. (i) The coefficients in the first row of A_0, denoting the effects of structural shocks on observed oil supply, solely captures the influence exerted by the changes in the crude oil supply within a specific month (a_{11}), where the other types of shocks do not exert any effect. (ii) The coefficients, a_{21} and a_{22}, in the second row of A_0 embody the relationship between observed real economic activity and the structural shocks, which are nonzero. This suggests that global real economic activity within the current month is influenced by both the oil supply and demand shocks, where the crude oil price in the same month (a_{23}= 0) is unable to leave any impression. (iii) All the coefficients in the third row of A_0 are nonzero, indicating that the oil price within the existing month is affected by all three types of structural shocks. Based on these restrictions, Kilian (2009) estimated a monthly series for structural shocks, and then converted that to quarterly data. Subsequently, US GDP growth and CPI data were regressed on those quarterly structural shocks for examining the effects of different sources of oil price fluctuations.

In this study, Kilian's framework has been extended by adding exchange rate, (*fxrate$_t$*) as a fourth variable to the VAR system. The newly incorporated structural shock ξ^{FX}, represents the foreign exchange market specific shock and is not supposed to be contemporaneously correlated with any of the other three structural shocks. Assuming the influence of all types of structural shocks on the current movements in the foreign exchange rate, the following set of restrictions are imposed on the extended four-variable VAR system to identify the structural shocks:

$$u_t \equiv \begin{pmatrix} u_t^{oilprod} \\ u_t^{realeco} \\ u_t^{oilprice} \\ u_t^{fxrate} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{pmatrix} \xi_t^{SY} \\ \xi_t^{DY} \\ \xi_t^{OIL} \\ \xi_t^{FX} \end{pmatrix} \qquad (3)$$

The imposed restrictions in (3) suggest that along with the oil market demand and supply factors, oil market specific demand shocks affect the contemporaneous exchange rate, but various shocks pertaining to the foreign exchange market do not modify any of the other three structural shocks. Fluctuations in foreign exchange rate usually shift the purchasing power of nations, leaving the global oil demand unaffected; again, the subtle adjustments by the oil producers to prevent the revenue loss from depreciation of USD keeps the global oil supply unchanged – both of these could be put forward as the underlying rationale for this theoretical conceptualization. Moreover, empirical investigation through the impulse response functions

(IRFs) also validate the potency of this assumption, as swapping the ordering of the temporary oil price shocks and exchange rate shocks leave the IRFs almost unaltered.

2.2 Data sources

This research deploys a SVAR framework, incorporating four types of structural shocks pertaining to the oil and foreign exchange markets to investigate the response of some prominent macroeconomic aggregates for Japan, considering relatively a large timeframe of 20 years (1996.M01 – 2016.M12). For estimating the SVAR, the data on global real economic activity has been collected from Kilian (2009), in the form of an index constructed by Kilian, considering the shipping freight information of Drewry Shipping Consultants, Inc.; which is downloadable from his website. Data on global oil production as well as crude oil prices have been obtained from the US Energy Information Administration. The crude oil prices denote the average (dollar) price of three global benchmarks—North Sea Brent, West Texas Intermediate, and Dubai Fateh. The data on the real USD-JPY rate is derived from the IMF's International Financial Statistics. Data on Japanese macroeconomic aggregates (real GDP, consumption, investment and external trade volume) are collected from the Institute of Energy Economics, Japan.

3. Empirical discussion

3.1 Historical evolution of the structural shocks

Figure 1 captures the historical evolution (annual averages) of the structural shocks implied in the model, which also provides quite a reasonable match with the historical oil price shocks, summarized in Economou (2016). Figure 1 has reconfirmed the relatively stronger influence of the oil supply shocks on oil price prior to 2003, in which the Iraq War, Venezuelan crisis and several other supply cuts have played a major role. But since then, the supply shocks are overshadowed by the other types of shocks, where even the Arab Spring has rather exhibited a subdued and short-lived impact. It also depicts the subservient nature of global oil supply during the past decade or so, where supply cuts in some regions have been nullified by the production boosts in others to quell the impact of supply shocks. Positive shocks to the global demand caused by strong industrial expansion, coupled with robust precautionary demand have resulted in persistent surges in global oil price during 2003-2008. Other than the damper put on the global oil prices, by the Asian Financial Crisis of the late 1990s, the next substantial negative shock occurred in 2008, in the form of the Global Financial Crises, and subsequently, the post-2008 oil prices have remained quite volatile to the global demand shocks. The prevalence of the oil-specific demand shocks has been constant throughout the sample period where episodes like commodity super cycle, have significantly contributed to the global oil price surge. It is also quite apparent that the exchange rate shocks have subdued during the latter part of the 2000s as compared to the volatile 1980s and 1990s. The graph also signifies the links between oil market shocks and exchange rate shocks during the 2000s, in which aggregate global demand shocks and oil market specific demand shocks have been more prominent in affecting the real effective exchange rate over the exchange rate shocks.

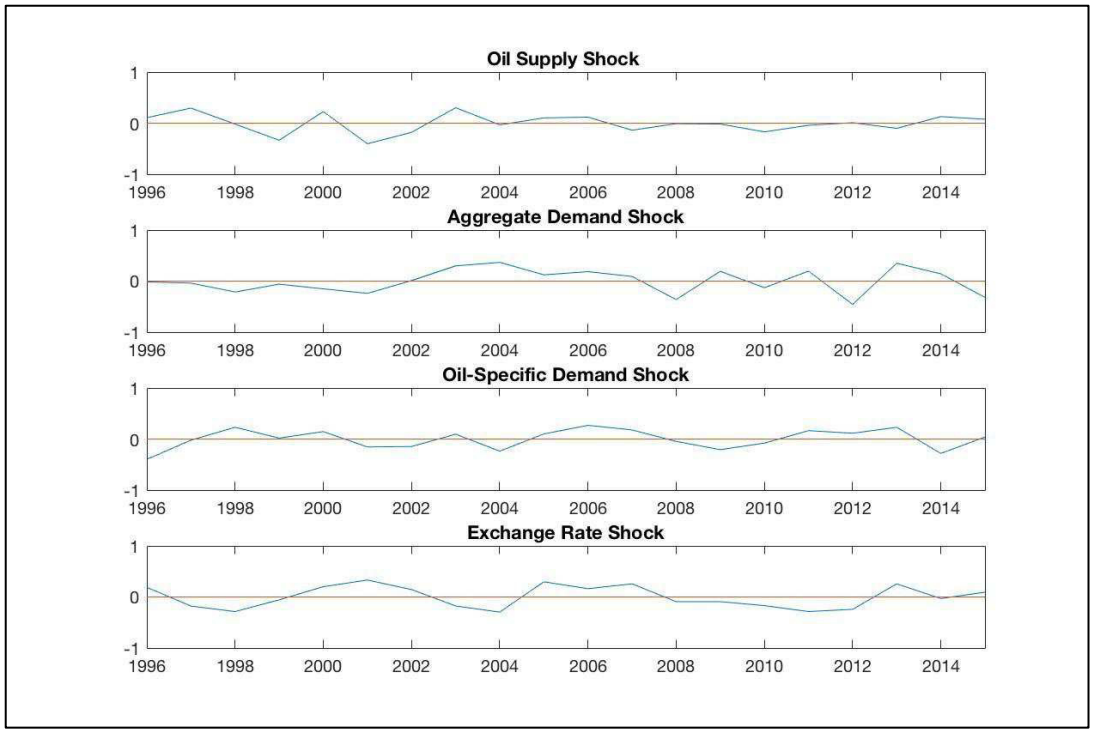


Figure 1: Historical evolution of the structural shocks

3.2 Cumulative responses in the global oil market block

The cumulative responses of the four variables in the global oil market block to one- standard-deviation structural shocks, identified earlier are shown in Figure 2. Other than the oil supply shock, which has been normalized to represent a negative shock to oil production, all the other shocks have been normalized to characterize positive shocks that raise the oil price. One-standard-error bands, computed from a bootstrap method are indicated by the dashed lines. The unanticipated oil supply disruptions have insignificant and negligible effect on the real price of oil as the supply shortfalls in specific regions are perfectly matched up by endogenous expansions in others. This indicates little systematic predictive power of oil supply shocks (Kilian 2008a). Although the global oil supply shocks are unable to exert significant impact on global real economic activity, global oil production is significantly and negatively affected by oil supply shocks instantly, which is also quite persistent in nature. It also has a short-lived negative impact on the dollar-yen exchange rate, which eventually turns insignificant; quite similarly, exchange rate shocks, such as appreciation of USD, do boost the global oil supply significantly with a lag of 4 months. Both unexpected disruptions in oil supply and exchange rate shocks exert statistically insignificant impacts on world industrial production; global economic activities have been significantly and positively influenced by oil demand shocks, as well as robust precautionary demand shocks significantly boosting the world industrial production. These oil market specific demand shocks do play a crucial role in raising precautionary demand for oil which tends to decline after 5 months. The impacts of these shocks also exert seemingly plausible feeble and lagged negative impacts on the foreign exchange market, but both the global supply shocks and fluctuations in the foreign exchange market leave the oil price unaffected. Apart from exerting significant and persistent positive effect on the foreign exchange market, as mentioned earlier, the exchange rate shocks neither influence global oil supply nor global economic expansion significantly; however, an unexpected oil-specific demand increase or oil price hike is associated with a slight decline in

the USD-JPY rate, indicating a shift in the investor sentiment. Moreover, disturbances in oil production could inflate the USD rate with a lag. The oil-specific demand shock has the most immediate effect on oil price, which is also quite persistent in nature. The global demand shock also has a large and persistent but lagged effect, as it causes a gradual increase in oil price followed by a decline. It is quite apparent that the effects of these shocks on oil price do differ in terms of both magnitude and persistence. The literature also bears the testimony. Cunado and Gracia (2015) in their study on oil price shocks in Asian economies have also suggested that indicators such as prices and economic activities respond differently, depending upon the type of oil shocks (whether supply or demand). While oil supply shocks have been detected to have limited impact on the economic activities of Japan, Korea, India and Indonesia, global demand shocks have been found to exert more prominent impact on these economies. Consequently, although the responses of macroeconomic aggregates to the types of oil shocks can have almost a common interpretation globally but for individual countries, findings can largely differ. This is due to the fact that oil shocks (whether supply or demand shocks) are only partially triggered by oil price shocks; whereas, country specific economic aggregates do differ in response to oil price shocks, where dependency on oil (net oil exporter or importer, see Cunado and Gracia, 2005) and consideration of business cycle (if the economy is in boom or recession) do play crucial roles. This is perhaps the reason why Zhang (2008), as well, demonstrated for Japan that oil prices and economic activity have a non-linear relationship. In his study on the USA and 10 Asian economies (Indonesia, Malaysia, Philippines, Thailand, Hong Kong, South Korea, Singapore, Taiwan, China, Japan), Abeysinghe (2001) has found that being a net exporter of oil fails to guarantee protection against the negative effects of high oil prices to countries like Indonesia or Malaysia, as high oil prices can only boost the economic activity in the short run, but in the long-run, however, the negative effect on trade partners jeopardizes future growth.

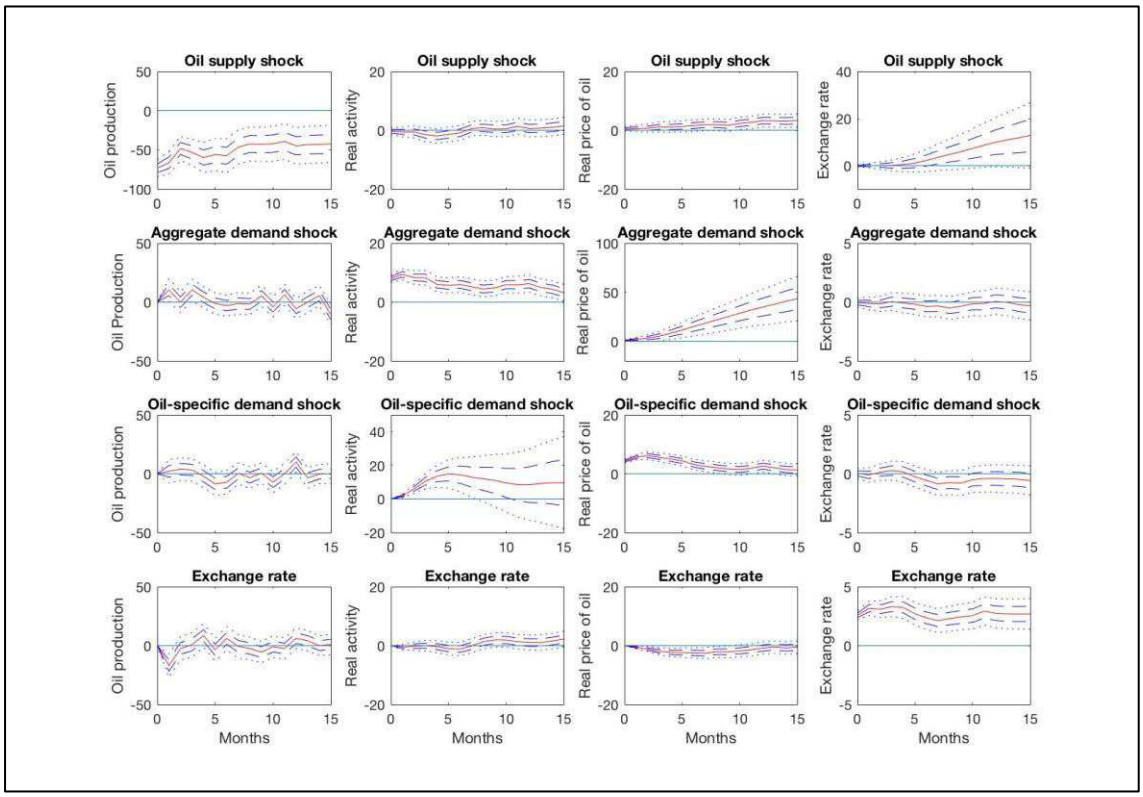


Figure 2: Cumulative responses in the global oil market block

3.3 Cumulative effect of structural shocks on the real price of oil

Figure 3 provides a historical decomposition of oil price into the contribution of the structural shocks. Through plotting the respective cumulative contribution of each structural shock to the real price of oil, it depicts the divergent impacts of structural shocks on oil price, which denotes significant differences in relative contribution depending on the nature of the shock. The first panel reconfirms the historical evidence regarding the gradually declining influence of oil supply shocks on the real price of oil. This matches the findings of Kilian (2009). To be precise, the aggregate demand shock and the oil-market specific demand shock have been discovered to leave the most prominent influence on the real oil prices historically. Oil-specific demand shocks have brought about the most changes in the oil price prior to 2000. Abrupt reduction in market specific demand, following the post-Asian Crisis (1997/98) or events like 9/11 signify the prominence of precautionary demand. Moreover, the figure establishes the principal contribution of the global economic boom around 2001, to elaborate the persistent surge in the oil price since 2002. However, likewise the supply shocks, fluctuations in the USD-JPY market have failed to significantly contribute to oil price variations. All these findings are fairly consistent with the previous studies of Kilian (2009) and Fukunaga et al. (2011).

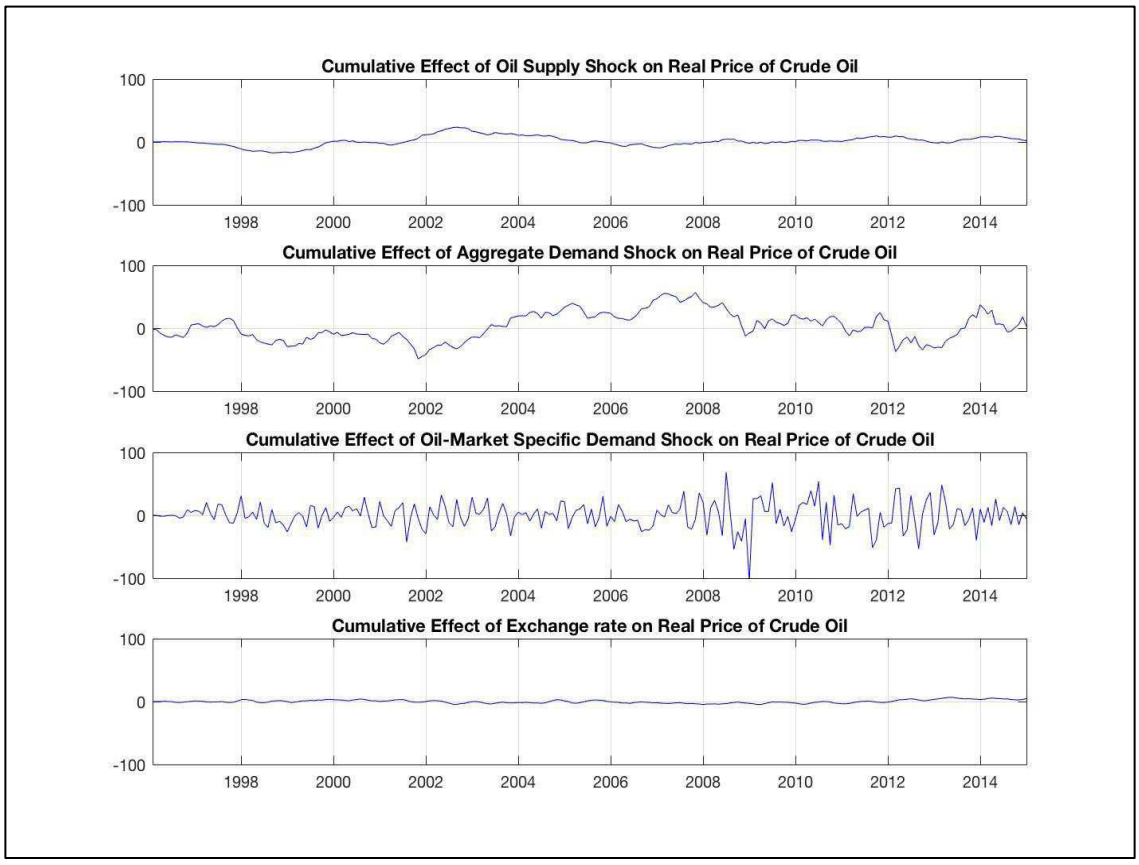


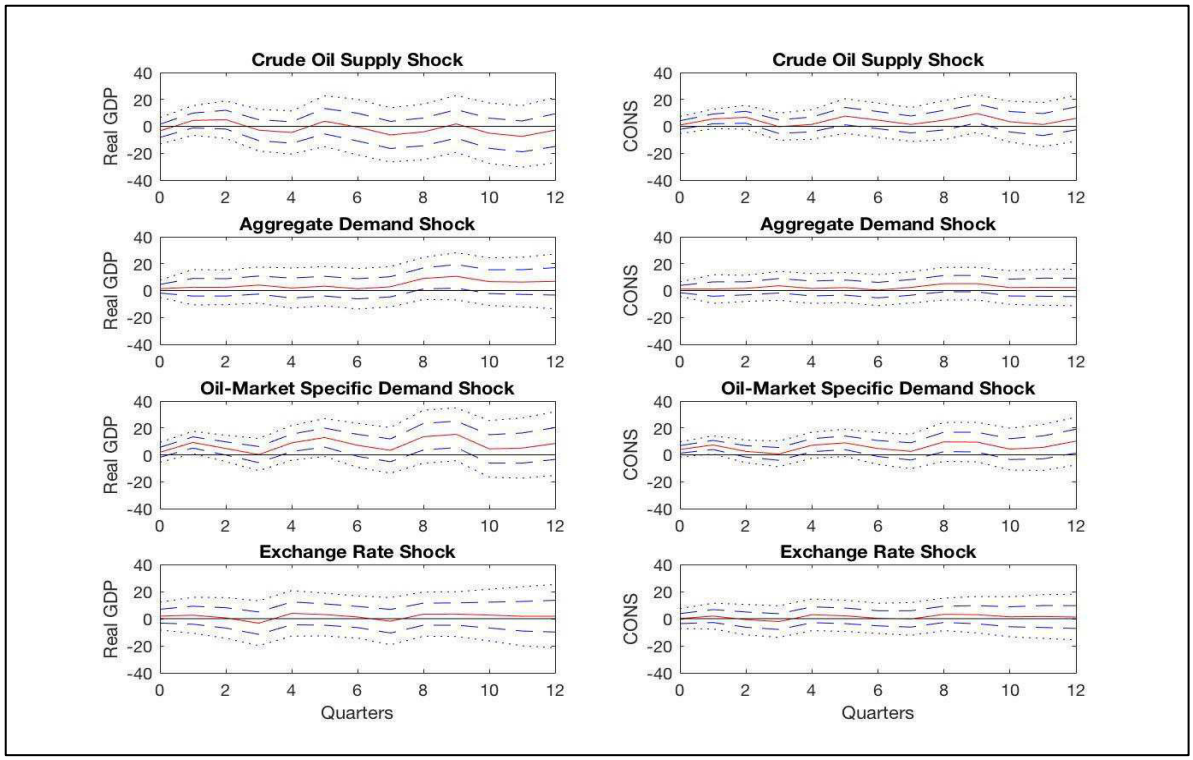
Figure 3: Cumulative effect of structural shocks on the real price of oil

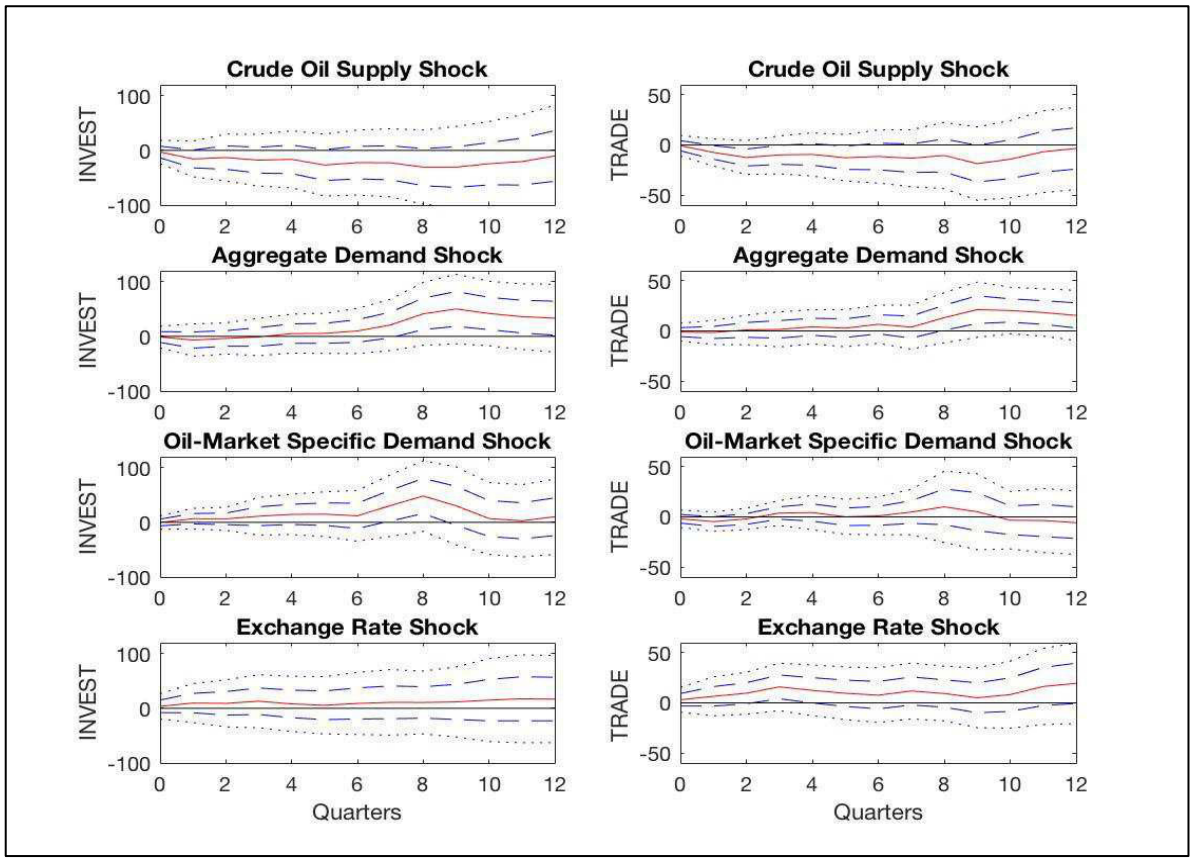
3.4 Response of Japanese macroeconomic aggregates

Figure 4 summarizes the responses of some Japanese macroeconomic aggregates, precisely, the chief components of the national income identity—level of real GDP, consumption, investment and external trade volume, to each of the four categories of shocks defined earlier. While estimating, the monthly structural shocks ξ^{SY}, ξ^{DY}, ξ^{OIL}, ξ^{FX}, derived from equation (3) are averaged for each quarter, as most macroeconomic aggregates are available quarterly. Under the assumption that the estimated structural shocks impact the Japanese macroeconomic aggregates but there is no feedback from the aggregates to shocks; the responses are computed using the block bootstrap method, which has been developed separately by Hall (1985), Carlstain (1986) and Künsch (1989). Block bootstrapping is particularly important when data or error terms can possibly be correlated in time, space or within groups (cluster data). In fact, when correlation exists for example in the residuals, a simple bootstrapping is not efficient as it fails to replicate the correlation in the data, which is not the case for block bootstrapping. Block bootstrapping replicates the correlation through several resampling (the higher the resampling the better the results) of the original time series, divided into blocks of estimated residuals. The estimations in this study have used 20,000 bootstrap replications and block size 4 (relaxing the size to 8 and switching the number of replications to 25,000 or 15,000 does not bring much difference in the estimated results).

The results illustrate important differences in how the oil demand and oil supply shocks, denoting the real price of oil as well as fluctuations in the USD-JPY rate, affect Japanese macroeconomic aggregates. Unanticipated oil supply disruptions insignificantly affect the real GDP, as the level of real GDP is absolutely unchanged by the oil supply disruptions. Unlike the other major oil consuming developed economies, this divergent response highlights the unique resilience of the Japanese economy and distinctly places it among the league of major oil-importing developed economies. Fluctuations in global demand and oil specific market demand exert meagre but positive influence on the level of real GDP, which is also significant in patches; more specifically, the positive effect of global demand stimulates the Japanese output with a lag of almost 2 years. However, exchange rate shocks have failed to transmit any type of significant influence on real GDP. All types of shocks fail to exert any substantial and significant influence on the consumption level, which again portrays the insulated nature of Japanese domestic consumption; the most, precautionary demand for oil, on impact, stimulates consumption level, and then it turns insignificant within the span of a year. But later on, it portrays phases, with significant but positive feeble impulses. Likewise, as real GDP and consumption, Japanese investments are insignificantly affected by oil supply shocks; although the initial impacts of both aggregate demand and speculative shocks on investments are insignificant, but within the span of almost 2 years these can generate significant positive responses. Exchange rate shocks don't impart any significant impetus on either investment or international trade. The non-responsiveness of investment perfectly justifies the perception of stability attached with the yen.

The Bank of Japan's prudent vigilance to protect the trade surplus has resulted in the non-sensitivity of trade volume. However, oil supply shocks can generate negative consequences for external trade, which is predominantly insignificant. Speculation in the oil market doesn't affect Japanese trade volume, although expansion in global real economic activities can positively and significantly contribute to trade with a lag of almost 2 years. All these matches the general findings of the previous studies regarding Japan.





Note: CONS stands for consumption; INVEST for investment; TRADE for trade volume.

Figure 4: Cumulative response of Japanese macroeconomic aggregates

4. Concluding remarks

Traditionally, the response of macroeconomic aggregates to oil price fluctuations has received a great deal of attention theoretically, empirically as well as among policy makers. Through sophisticated formulation of estimation strategy, this paper has given due consideration to issues such as existing reverse causality from macroeconomic aggregates to oil prices as well as direct and indirect impacts of structural demand and supply shocks on overall economy and oil prices. Deploying the extended version of the structural VAR framework of Kilian (2009), this paper has projected the dynamic effects of the oil price shocks on some major macroeconomic aggregates of Japan, where the innovations are derived from both oil and foreign exchange markets. Decomposing these oil price shocks into various components, this paper has portrayed a historical evolution of the oil price shocks where, gradually, the traditional oil supply shocks have been overshadowed by the significance of demand shocks. The results show that the macroeconomic components respond differently depending upon the nature of the oil price shock, indicating significant variations in transmission mechanisms. This has justified the notion of instability in regressing the macroeconomic aggregates on oil prices (Kilian, 2008). Empirically, the non-existent impact of oil supply fluctuations on the components of Japanese national income identity has been confirmed once again. This non-responsiveness to oil supply shock denotes the structural transformation of the Japanese economy. Accordingly, the prominence of global demand shocks and oil market specific speculative shocks are detected as the principal stimulants of the macroeconomic aggregates. Both real GDP and investments are significantly and positively influenced by these. Moreover, this research has reconfirmed the insulated nature of the Japanese economy as the consumptions have been left unresponsive to any category of external shock. Along with the domestic demand, global economic conditions have been discovered to be the chief determinants of Japanese external trade volume. At the macro level, the exchange rate shocks are found to be insignificant to generate any response. Considering a wider policy perspective, it could be asserted that the proper identification of the sources of oil price fluctuations bears significance for efficient management of the macroeconomy due to the differentiated impacts of the shocks on the various macroeconomic aggregates. Moreover, simultaneous influence of various structural shocks also complicates the real scenario, which is quite evident from the dramatic collapse in crude oil prices in 2014. This further justifies the necessity of the vigilance on the part of policy watchdogs in regard to both pragmatic formulation of policies as well as efficient implementation. Furthermore, Japan has already ensured competent execution of the newly formulated energy policy which is prudently drafted contemplating the long term.

Although this research has not explicitly dealt with narrower policy issues such as fine-tuning with respect to fiscal, monetary and exchange rate polices in elaboration to deal with the structural shocks, these are of crucial importance as well, as part of well-organized macro-management. The true contribution of this paper lies in reconfirming the diversified nature of the response of Japanese macroeconomic aggregates to oil price fluctuations, which reiterates the gravity of proper identification of the possible sources of oil price fluctuations with a view to ensure macroeconomic stability. However, installing open-economy dynamic stochastic general equilibrium models (suggested by Fukunaga et al., 2011) as well as coverage of more macroeconomic indicators could benefit policy makers to perceive the macroeconomic consequences of oil price fluctuations more comprehensively and plan accordingly.

References

Abeysinghe, T. (2001) "Estimation of direct and indirect impact of oil price on growth". *Econ. Lett*. 73, 147–153.

Baumeister, C., Peersman, G., Van Robays, I. (2010) "The economic consequences of oil shocks: differences across countries and time. Inflation in an era of relative price shocks". *In: Fry, R., Jones, C., Kent, C. (Eds.), Reserve Bank of Australia*, pp. 91–128.

Baumeister, Christiane, and Gert Peersman. (2013) "The Role of Time-Varying Price Elasticities in Accounting for Volatility Changes in the Crude Oil Market." *Journal of Applied Econometrics* 28(7): 1087–1109.

Bernanke, B.S., Gertler, M. andWatson, M. (1997) "Systematic monetary policy and the effects of oil price shocks". *Brookings Papers on Economic Activity* 1, 91–157.

Brown, S. P. A.,&Y¨ ucel, M. K. (2002) "Energy prices and aggregate economic activity and interpretative survey". *The Quarterly Review of Economic and Finance*, 42, 193–208.

Bruno, M. and Sachs, J. (1985) "Economics of Worldwide Stagflation". *Harvard University Press, Cambridge, MA.*

Burbidge, J.,&Harrison, A. (1984). "Testing for the effects of oil-price rises using vector autoregression". *International Economic Review,* 25, 459–484.

Carlstein, E. (1986). "The use of subseries values for estimating the variance of a general statistic from a stationary sequence". *The Annals of Statistics*, 14(3), 1171– 1179.

Cunado, J., Jo, S., & Perez de Gracia, F. (2015) "Macroeconomic impacts of oil price shocks in Asian economies". *Energy Policy*, 86, 867–879. http://doi.org/10.1016/j.enpol.2015.05.004

Cunado, J., Perez de Gracia, F. (2005) "Oil prices, economic activity and inflation: evidence for some Asian countries". *Q. Rev. Econ. Financ*. 45, 65–83.

Davis, Steven J. (1987) "Allocative Disturbances and Specific Capital in Real Business Cycle Theories." *American Economic Review Papers and Proceedings*, 77, 738–51.

Davis, S. J., &Haltiwanger, J. (2001) "Sectoral job creation and destruction responses to oil price changes". *Journal of Monetary Economics*, 48, 465–512.

Economou, A. (2016) "Oil Price Shocks: A Measure of the Exogenous and Endogenous Supply Shocks of Crude Oil". *OIES paper* WPM 68.

Edelstein, P., and Kilian., L. (2007) "The Response of Business Fixed Investment to Changes in Energy Prices: A Test of Some Hypotheses about the Transmission of Energy Price Shocks." *The B.E. Journal of Macroeconomics* (Contributions) 7, Article 35.

Edelstein, P., and Kilian., L. (2009) "How Sensitive Are Consumer Expenditures to Retail Energy Prices?" *Journal of Monetary Economics*, 56, 766–79.

Elder, J., & Serletis, A. (2010) “Oil price uncertainty”. *Journal of Money, Credit and Banking,* 42(October), 1137–1159. http://doi.org/10.2307/40784879

Fukunaga, I., Hirakata, N., & Sudo, N. (2003) “The Effects of Oil Price Changes on the Industry Production and Prices in the U.S. and Japan”. *Institute for Monetary and Economic Studies Bank of Japan* (Vol. 20).

Hamilton, J.D. (2008) “Oil and the macroeconomy”. *In: Steven, Durlauf, Lawrence, Blume (Eds.), The New Palgrave Dictionary of Economics, 2nd edition Palgrave McMillan Ltd., London.*

Hamilton, J.D. (1996) “This is what happened to the oil price–macroeconomy relationship”. *Journal of Monetary Economics* 38, 215–220.

Hamilton, J.D. (1983) “Oil and the macroeconomy since World War II”. J. *Polit. Econ*. 91, 228–248.

Hutchison, M. M. (1993) “Structural change and the macroeconomic effects of oil shocks: empirical evidence from the United States and Japan”. *Journal of International Money and Finance*, 12(6), 587–606. http://doi.org/10.1016/0261-5606(93)90027-9

Hall, P. (1985) “Resampling a coverage pattern”. *Stochastic Process and Their Applications*, 20(2), 231–246.

Iwaisako, T., & Nakata, H. (2015) “Oil Price, Exchange Rate Shock, and the Japanese Economy”, *Research Institute of Economy, Trade and Industry (RIETI).* Discussion papers 15028.

Jimenez-Rodriguez, R., Sanchez, M. (2012) “Oil price shocks and Japanese macroeconomic developments”. *Asian-Pac. Econ. Lit*. 26, 69–83.

Kilian, L. (2009) “Not all oil price shocks are alike: disentangling demand and supply shocks in the crude oil market”. *Am. Econ. Rev.* 99, 1053–1069.

Kilian, L. (2008) “The economic effects of energy price shocks”. *J. Econ. Lit*. 46, 871–909.

Kilian, L. (2008a) “Exogenous Oil Supply Shocks: How Big Are They and How Much Do They Matter for the U.S. Economy?” *Review of Economics and Statistics*, 90, 216- 240.

Kilian, L., & Park, C. (2009) “The impact of oil price shocks on the U.S. stock market”. *International Economic Review*, 50(4), 1267–1287. http://doi.org/10.1111/j.1468-2354.2009.00568.x

Künsch, H. (1989) “The jackknife and the bootstrap for general stationary observations”. *Annals of Statistics*, 17(3), 1217–1241.

Lee, K., Ni, S. (2002) “On the dynamic effects of oil price shocks: a study using industry level data”. *J. Monetary Econ*. 49 (4), 823–852.

Lee, K., Ni, S., and Ronald A. Ratti. (1995) “Oil Shocks and the Macroeconomy: The Role of Price Variability.” *The Energy Journal*, 16, 39–56.

Mork, Knut A. (1989) “Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton’s Results.” *Journal of Political Economy*, 91, 740–44.

Pagan, Peersman, G. (2005), “What Caused the Early Millennium Slowdown? Evidence Based on Autoregressions,” *Journal of Applied Econometrics*, 20, 185-207.

Peersman G., Van Robays,I. (2012). “Cross-country differences in the effects of oil shocks”. *EnergyEcon*. 34,1532–1547.

Peersman G, Van Robays I. (2009) “Oil and the Euro area economy”. *Economic Policy* 24(60): 603-651.

Taghizadeh-Hesary, F., E. Rasolinezhad, and Y. Kobayashi. (2015) “Oil Price Fluctuations and Oil Consuming Sectors: An Empirical Analysis of Japan”. *ADBI Working Paper* 539.

Zhang, D. (2008) “Oil shock and economic growth in Japan: a nonlinear approach”. *Energy Economics* 30, 2374–2390.