OIL PRICE SHOCKS AND JAPANESE MACROECONOMIC DEVELOPMENTS

Rebeca Jiménez-Rodríguez
Department of Economics
University of Salamanca
E-37007 Salamanca (Spain)
Phone: +34 923 29 46 40 (ext. 35 14)
Fax: +34 923 29 46 86
e-mail: rebeca.jimenez@usal.es

Marcelo Sánchez
External Development Division
European Central Bank
D-60311 Frankfurt am Main (Germany)
Tel.: +49 69 1344 6531
Fax: +49 69 1344 6353
e-mail: marcelo.sanchez@ecb.int

OVERVIEW

A vast body of work has developed over the last three decades on how oil shocks affect macroeconomic developments. From a theoretical point of view, hikes in oil prices are seen to induce supply-side consequences including higher inflation and lower real output. Furthermore, terms-of-trade effects are expected to support aggregate demand in oil exporting countries, and lower it in oil importing countries. The empirical analyses have broadly corroborated these predictions (see Hamilton, 2008, and Jiménez-Rodríguez and Sánchez, 2005, as well as the references therein). After an early stage of studies involving linear models, the trend has in recent years shifted to the use of non-linear approaches which are better suited to capture the actual macroeconomic consequences of oil shocks. This trend goes back to the seminal work of Mork (1989), Lee et al. (1995), and Hamilton (1996 and 2003), who applied their models to the US economy. Japan is, however, a country for which the number of studies applying non-linear methods to investigate the effects of oil price shocks on economic activity remains scanty, with the exceptions of Mork et al. (1994) and, more recently, Lee et al. (2001), Cuñado and Pérez de Gracia (2005), and Zhang (2008). Among these more recent studies, Cuñado and Pérez de Gracia (2005) and Zhang (2008) considered bivariate models to analyze the link between oil prices and the macroeconomy, while Lee et al. (2001) used – like the present paper – multiequational specifications.

Attesting to the importance of studying Japan's macroeconomic developments in connection with oil prices, let us say that this country is the world's second largest economy as well as a major oil consumer and importer. More concretely, Japan is at present the third most important oil consuming country globally (behind the United States and China), representing some 6% of the world's total annual oil consumption. Considering the whole period 1975-2007 – which roughly corresponds to the estimation period used in this paper – Japan was comfortably the world's second largest oil consumer, accounting on average for about 8% of global oil consumption. In light of the country's limited domestic production, Japan currently imports over 4 million barrels a day of oil, which makes it the world's second largest oil importer (behind the United States) with a share of some 10% of this commodity's overall international trade. Finally, oil use covers approximately half of Japan's primary energy needs (see e.g. Zhang, 2008).

The present paper investigates the role of oil price shocks on both consumer prices and economic activity in Japan, constraining ourselves in the latter case to industrial output (in line with some recent studies). We extend the existing literature in two ways. First, considering data from 1970 we test for the presence of structural change in real interest rates, which can arise at least from two sources: i) the long time period involved (which could lead to a structural break in the earlier part of the sample); and ii) the emergence of a liquidity trap and associated financial problems during the 1990s. The information derived from structural break tests, as well as from those assessing nonstationarity, is used to decide the models

specifications attempted. Second, we identify periods of "high" oil prices, for which we compute the contribution of oil prices to macroeconomic developments by means of historical decompositions.

METHODOLOGY

The main results of this study are obtained by estimating and identifying a vector autoregression model of order p, or simply, VAR(p). To achieve this, we start by setting up a system of equations that can be written in its reduced form as $y_t = Ax_t + e_t$, where y_t is an (n×1) vector of endogenous variables, x_t is an (np×1) vector grouping all lagged terms of y_t up to order p, A is an (n×np) rectangular matrix of coefficients, and e_t is the (n×1) generalization of a white noise process with variance-covariance matrix Ω. The suitable lag length for the VAR is chosen on the basis of the Schwartz Bayesian information criterion (BIC).

The vector of endogenous variables used here includes the following set of variables: industrial production, real effective exchange rate (REER), real oil price, real wage, consumer prices, and real short- and long-term interest rates. Some variables (industrial production, consumer prices, REER, real oil price and real wage) are expressed in logs, while the remaining ones are simply defined in levels. Oil prices, industrial production and consumer prices are the main variables of interest of this paper. The remaining variables in the model are added in order to capture the most important transmission channels through which oil prices may affect economic activity indirectly, in part by inducing changes in economic policies. Those channels include a variety of demand- and supply-side effects of oil prices operating via exchange rates, financial variables, and the labor market.

We use the following data in the present study. Our measure of real oil prices is defined as the ratio of the price of the internationally traded variety of crude most relevant to Japan (Dubai) converted into yen and then deflated by the country's CPI (all underlying data from IMF's International Financial Statistics - henceforth IFS). Industrial production data come from IFS; CPI from OECD's Main Economic Indicators (henceforth MEI); interest rates from MEI; wages from IFS; and REER (based on CPI) from MEI.

Prior to setting up our VAR model, we look at the time series properties of the data employed. Then, we identify the VAR model by means of a Cholesky decomposition, which amounts to using exclusion restrictions on the contemporaneous impact of the structural shocks.

One difficulty tackled in this paper is that, in light of the long time period considered (spanning almost 4 decades, from 1970:1 to 2008:2), not only do we need to look at the order of integration of the time series but also the possible existence of structural changes. Our analysis of structural breaks focuses exclusively on interest rates variables, given the pre-eminence attached in the literature to the emergence of the so-called "liquidity trap" of late 1990s and early 2000s. Alongside the information derived from unit root tests, the detection of structural breaks is taken into consideration when setting the estimation sample for this study, as well as the relevant model specifications attempted.

VAR models are estimated for both a linear specification and the four leading non-linear approaches considered in the literature. The latter are the following: i) Mork's (1989) asymmetric model; ii) Lee et al.'s (1995) scaled model; iii) Hamilton's (1996) net model; and iv) Hamilton's (2003) net3 model.

MAIN RESULTS

The present study analyzes the role of oil price shocks in Japanese macroeconomic developments. The theory predicts that, in an oil importing economy like Japan, unexpected hikes in oil prices should lead to lower economic activity and higher inflation. The empirical

findings concerning the effects of oil shocks on industrial output growth and inflation confirm the expected pattern.

Our main econometric results provide evidence of non-linear macroeconomic impacts stemming from oil prices. More specifically, the scaled model – one of the leading non-linear approaches – is here found to dominate all of its alternatives. The scaled model, by controlling for the time-varying conditional variability of oil prices, highlights the importance of considering not only the magnitude and direction of actual oil price changes, but also the context in which the latter occur. The same oil price movement will normally entail a larger macroeconomic impact in an environment of stable as opposed to volatile prices for the commodity.

Historical decompositions are used to compute the contribution of oil price shocks across high oil price periods. Our analysis shows that the impact of oil prices on industrial activity and consumer prices is detectable only in the second half of the 1970s and early 1980s – an era in which OPEC had considerable influence on world oil markets. Industrial slowdowns and inflationary pressures are found to have since been largely unrelated to oil price hikes.

REFERENCES

1. Cuñado, J., Pérez de Gracia, F., 2005. Oil Prices, Economic Activity and Inflation: Evidence for Some Asian Countries. The Quarterly Review of Economics and Finance 45, 65-83.
2. Hamilton, J., 1996. This is What Happened to the Oil Price-Macroeconomy Relationship. Journal of Monetary Economics 38, 215-220.
3. Hamilton, J., 2003. What is an Oil Shock? Journal of Econometrics 113, 363-398.
4. Hamilton, J., 2008. Oil and the Macroeconomy. In: New Palgrave Dictionary of Economics and the Law, 2nd ed.
5. Jiménez-Rodríguez, R., Sánchez, M., 2005. Oil Price Shocks and Real GDP Growth: Empirical Evidence for Some OECD Countries. Applied Economics 37, 201-228.
6. Lee, K., Ni, S., Ratti, R., 1995. Oil Shocks and the Macroeconomy: the Role of Price Variability. The Energy Journal 16, 39-56.
7. Lee, K., Lee, B, Ratti, R., 2001. Monetary Policy, Oil Price Shocks, and the Japanese Economy. Japan and the World Economy 13, 321-349.
8. Mork, K., 1989. Oil Shocks and the Macroeconomy when Prices Go Up and Down: An Extension of Hamilton's Results. Journal of Political Economy 97, 740-744.
9. Mork, K., Olsen, O., Mysen, H., 1994. Macroeconomic Responses to Oil Price Increases and Decreases in Seven OECD Countries. Energy Journal 15, 19-35.
10. Zhang, D. (2008). Oil Shock and Economic Growth in Japan: A Nonlinear Approach. Energy Economics 30, 2374-2390.