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Asymmetric impacts of international energy shocks on macroeconomic activities

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ABSTRACT

While limited by its scarcity of natural resources, the impacts of energy price changes on Taiwan's economic activities have been an important issue for social public and government authorities. This study applies the multivariate threshold model to investigate the effects of various international energy price shocks on Taiwan's macroeconomic activity. By separating energy price changes into the so-called decrease and increase regimes, we can realize different impacts of energy price changes and their shocks on economic output. The results confirm that there is an asymmetric threshold effect for the energy-output nexus. The optimal threshold levels are exactly where the oil price change is at 2.48%, the natural gas price change is at 0.66%, and the coal price change is at 0.25%. The impulse response analysis suggests that oil price and natural gas shocks have a delayed negative impact on macroeconomic activities.

1. Introduction

Energy is essential to all economic activities, pushing developed and developing economies to pursue long-term stable energy prices and energy supply. These targets are very beneficial to economic development. However, greater energy consumption may increase the possibilities of global warming and climate change. According to the International Energy Outlook of Energy Information Administration (EIA) (2010), the global consumption of marketed energy from all fuel sources will persistently rise over the projection period of 2007–2035. Fig. 1 shows fossil fuels are expected to continue supplying much of the energy used worldwide. Although conventional fuels remain the largest source of energy, the global share of marketed liquids and natural gas consumption will correspondingly fall from 35% in 2007 to 30% in 2035 and from 22% in 2007 to 21% in 2035. On the contrary, the global share of marketed coal, nuclear, and renewable consumption will rise in the same periods. In particular, the global share of renewable consumption will rise from 9% in 2007 to 13% in 2035. It can be seen that clean energy still cannot replace the conventional type of energy use. In the reference case of International Energy Outlook of EIA, the use of liquids grows modestly or declines in all end-use sectors (except for the transportation sector), where in the absence of significant technological advances liquids will continue to provide much of the energy consumed.

Energy price shocks are generally acknowledged to have important effects on both the economic activity and macroeconomic policy of industrial countries. Huge and sudden rises in energy prices increase inflation and reduce real money balances with negative effects on consumption and economic output. The most acute supply shocks hitting the world economies since World War II have been the sharp increase of oil and other energy products' prices. Since the 1970s, oil prices in the world market have experienced fluctuations, including rather sharp increases during the first and second oil crises. During the two periods of 1973–1974 and 1978–1979, when the Organization of Petroleum Exporting Countries (OPEC) first imposed an oil embargo and the Iranian revolution disrupted oil supplies, respectively, the prices of a barrel of oil increased from $3.4 to $30.

Fig. 2 depicts the time series of international energy prices from 1983 to 2009, showing energy prices rapidly rising from $16 to $26 after the Gulf War in 1990. Due to a decline in 1999 following the Asian financial crisis, energy prices fell from $20.28 to $11.13. Since 2000, oil prices have been on an upward trend with repeated fluctuations. In particular, oil price volatility in the crude oil market rose spectacularly during 2004–2008. By March 13, 2008, the West Texas Intermediate (WTI) spot crude oil price had spiked to a historical high of $110.21 per barrel. EIA (2009) estimated that the January 2010 WTI futures contract under volatility at that time would be $61 per barrel at the lower limit and $104 per barrel at the upper limit under a 95% confidence

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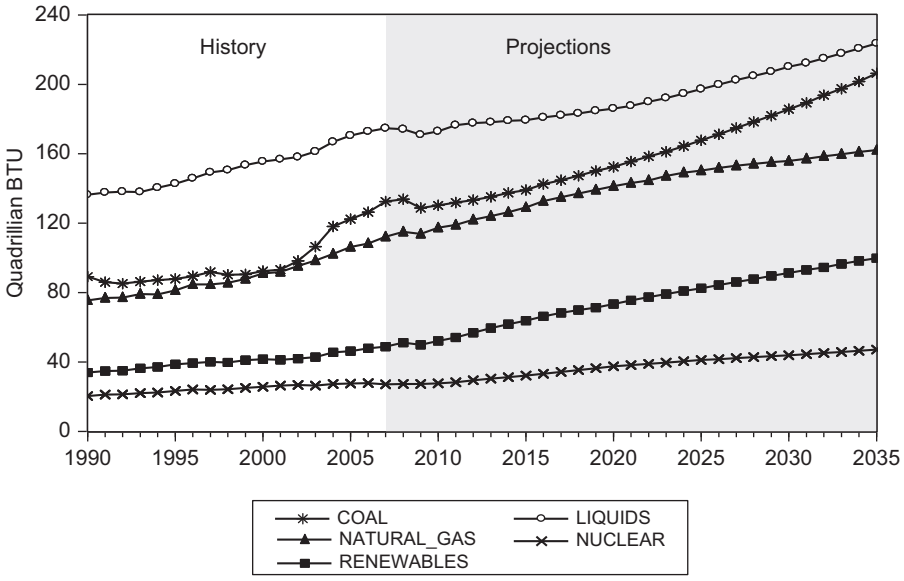

Fig. 1. Global marketed energy use by fuel type, 1990–2035.
Source: Energy Information Administration (2010).

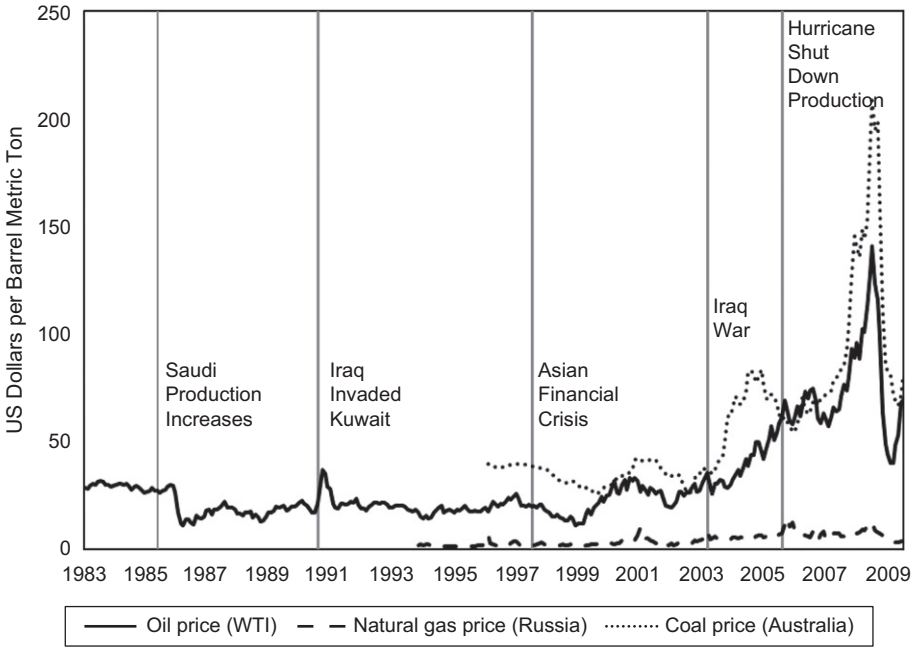

Fig. 2. Global marketed energy prices, 1983–2009.

interval. As a whole, oil prices are more volatile than prices of natural gas and coal. Although the volatility and historical event turning points of international energy prices are rather different, their long-term trends are quite similar.

As energy prices play a critical role in influencing economic growth and economic activities, we want to analyze the linkage of international energy prices and macroeconomic variables in Taiwan with linear and asymmetric frameworks. This study is motivated by two reasons. First, several studies have indicated that oil price shocks have a significantly negative impact on industrial production (e.g., Mork, 1989; Hooker, 1996; Hamilton, 1996; Bernanke et al., 1997; Hamilton, 2003; Hamilton and Herrera, 2004), yet little is known about the relationship between other energy prices and economic activities. Second, some studies already consider the asymmetric relation in terms of the impact of an oil price change or its volatility on industrial production and stock returns (e.g., Mork, 1989; Mork et al., 1994; Sadorsky, 1999; Papapetrou, 2001). However, these studies use zero as a cutoff point for distinguishing oil price changes into up (increase) and down (decrease) segments.

The aforementioned studies may encounter some problems. First, using a predetermined value as a trigger point lacks any statistical verification. Second, they neglect the asymmetric association to accurately gage varying degrees of the impacts of energy price changes on the macroeconomy. Third, the two-regime model based on the value of a variable (greater than zero or less than zero) is somewhat arbitrary. Is it true that a very small increase in energy prices changes would have a significant negative effect on economic activities? Although oil price changes certainly affect economic activities, they will also affect the production sector when the oil price increase exceeds a certain