

AN INVESTIGATION INTO THE NEXUS BETWEEN OF OIL CONSUMPTION AND ECONOMIC GROWTH IN CHINA

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Overview

A proper understanding of the nexus between oil consumption and economic growth is vital if energy conservation policies are to be implemented without detrimental consequences for an economy. Depending on whether there is evidence to support the growth, conservation, feedback or neutrality hypothesis, has significant impacts for energy conservation policies. There is a vast body of literature that examines the nature of the relationship between energy consumption and economic growth (see, for example, Ozturk, 2010; Payne, 2010). However, most of this research focuses on developed countries and the findings are mixed (see, for example, Zheng and Dongkun, 2013; Fang, 2011; Yildirim and Aslan, 2012; Yalta and Cakar, 2012).

China is the world's second largest oil consuming country in the world and is forecast to become the largest oil consuming country in the world by early 2030s (Nguyen, 2014). Therefore, Chinese oil consumption is becoming an increasingly important topic attracting attention from industry, environmental regulators, central banks, policy makers and academics. While much attention is being placed on finding solutions to meeting the enormous growth in China's energy demand and to reduce China's energy consumption, a better understanding of what drives trends in oil consumption – including the peaks and troughs experienced during the business cycle – and what are the potential economic implications of energy conservation policies, is vital for any solution to work.

The purpose of this study is to investigate the nexus between oil consumption and the real business cycle in China. Specifically, what is the direction of the causal relationship? Is the relationship characterised by short and long run dynamics? Does the business cycle impact oil consumption asymmetrically? There are three innovations in this study that make a valuable contribution to the literature. First, unlike previous studies that rely on annual data, we use quarterly data and can therefore examine the relationship between the business cycle and oil consumption. Second, by applying an asymmetric error correction model, we are able to examine whether oil consumption responds asymmetrically to the real business cycle. Third, in the final stages of the project, we incorporate dynamics and asymmetries to assess the out-of-sample forecasting accuracy of the model.

The paper is organised as follows. After the introduction, a review of the extant literature examining the relationship between oil consumption and economic growth is provided. In section three, we describe the methodology and data employed in this study. Section four provides an analysis of the results. This is followed by a discussion of the results and conclusion.

Methods

This study uses a range of established techniques to investigate the nexus between oil consumption and economic growth in China. Long and short run dynamics are captured within the structure of an error correction model (ECM) and asymmetries are captured in two ways. First, using asymmetric cyclical variables. Second, using asymmetric error correction terms.

The first stage in this project is to use the Hodrick–Prescott filter to decompose seasonally adjusted GDP into trend and cycle. Second, granger causality testing is performed to determine the direction of any causal relationship between economic growth (decomposed into trend and cycle) and oil consumption. Third, unit root testing is performed on the dependant and independent variables, as well as the residuals from an OLS regression, to identify the suitability of fitting an ECM. Based on these findings, an ARDL model is run to identify the appropriate number of lags in modelling the relationship.

To determine whether there is evidence of dynamics and asymmetry, we run several alternative model specifications and compare the results for robustness. These are: model specified in first differences with no asymmetric variables, a symmetric ECM, an ECM with asymmetric error correction terms, an ECM with asymmetric business cycle variables, and an ECM with asymmetry captured in the business cycle variable as well as the error correction term.

Conventional testing of the significance and magnitude of the coefficients will determine whether there is evidence of dynamics and asymmetry. Follow this, the ECMs are estimated and out-of-sample forecasts generated from 2009 to 2013. Forecasting accuracy is assessed by both conventional (such as RMSE) and alternative (such as direction accuracy) measures.

Results

Consistent with the feedback hypothesis, we find bi-directional causality between oil consumption and output over the long run. We also find strong evidence of asymmetric impacts arising from the long run dynamic relationship, but find no evidence of short run or asymmetric business cycle impacts. The findings demonstrate the importance of incorporating asymmetry in order to uncover the true long run dynamic relationship between GDP and oil consumption. By comparing the results of symmetric and asymmetric error correction models, we find that failure to incorporate asymmetry may lead to erroneous conclusions about the nature and significance of the long run dynamic relationship between oil consumption and economic growth. We use several alternative model specifications to demonstrate this proposition.

The forecasting accuracy results show that GDP is a leading indicator of oil consumption and is particularly useful for predicting turning points in the level of China's oil consumption. Similarly, the level of China's oil consumption is a leading indicator of China's future economic growth. All model forecasts outperform the random walk in terms of the magnitude of error, and consistently generate direction accuracy of 75 per cent. Despite overwhelming evidence in support of an asymmetric long run dynamic relationship, forecasting diagnostics show that incorporating asymmetries brings about no improvement in out-of-sample forecasting accuracy. These results are particularly pertinent for supply chain management across a range of industries.

Conclusions

The results clearly demonstrate the existence of a long run dynamic and asymmetric relationship between oil consumption and economic growth in China. There is no evidence of a short run dynamic relationship between oil consumption and either economic growth or the business cycle. Therefore, domestic energy conservation policies will only be consequential for China's economic growth over the long run and this will, in turn, impact China's demand for oil. We conclude that there is a bi-directional relationship between oil consumption and economic growth in China, consistent with the feedback hypothesis.

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