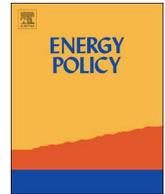




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What determines China's crude oil importing trade patterns? Empirical evidences from 55 countries between 1992 and 2015[☆]

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ABSTRACT

This study develops a conceptual framework that synthesizes the supply, demand, price, and openness of crude oil trade, along with a list of traditional economic, political, and geographical factors to investigate the determinants of crude oil imports in emerging markets. We test the framework using China's crude oil imports from 55 countries for the period from 1992 to 2015. Using both static and dynamic panel data models, we find that China's crude oil import is associated with exporting country's supply, demand, and price as well as its bilateral trade relationships. These factors were found to affect China's import of crude oil from the Middle East. However, only bilateral trade relationships affect its imports of crude oil from the Asia-Pacific. Furthermore, we do not find substantial evidence in this research to indicate that China's direct investment increases crude oil imports from those countries.

1. Introduction

With industrialization and urbanization, China's oil consumption has increased more than three times in the period from 1990 to 2015, driven primarily by the development of transportation, industries, and power plants as well as the expansion of foreign trade (NBSC, 2016). Although China has published many policies focusing on energy efficiency improvement in various sectors and has encouraged investment in renewable energy, this increasing trend is expected to continue. China's share of global oil consumption has risen from 3.57% in 1990 to 12.92% in 2015 (BP, 2016). At the same time, China has shifted from crude oil self-sufficiency, with a small amount of exports, to a net importer of crude oil, with a widening gap between crude oil supply and demand. Its annual crude oil imports were only about 11.36 million tons in 1992, which had risen to more than 100 million tons by 2004, reaching about 335.49 million tons in 2015 (UN Comtrade, 2016). Although China's rapid economic development has created the need for more crude oil, its domestic crude oil production has increased slowly in recent years, implying that its need has been mainly met through imports. Its crude oil imports are anticipated to double in the coming 20 years, gradually increasing to account for around 80% of its total oil consumption in 2035 (Odgaard and Delman, 2014). The country's growing dependence on imported crude oil since the early 1990s is of

great concern to the government as well as scholars in related fields.

With the increase in China's demand for crude oil, the source country structure for crude oil imports has also changed significantly. Its source of crude oil imports has shifted from the Asia-Pacific to the Middle East, which has abundant resources and plays an important role in China's demand for crude oil. This underscores the fact that the regional pattern of China's crude oil imports has significantly changed. On one hand, several countries, such as Saudi Arabia, the Russian Federation, Angola, Iraq, and Oman, have been vital sources of its crude oil imports. On the other hand, the relative importance of each country has changed over time. Such changes have necessitated a study of the driving factors of China's crude oil import and the associated trends. Therefore, identifying the principal factors affecting China's oil security from the supply-side perspective can help secure its crude oil supply, improve the strategy around its crude oil trade, and lead to the optimization and regulation of its trade patterns (Zhao and Chen, 2014).

Our study makes several contributions to the literature on energy. First, we propose a unified framework that integrates the supply, demand, and trade openness of crude oil exporters with the traditional bilateral trade factors, which is worthy of extensive research to help ensure a stable supply of energy in the future. The formation of a commodity trade pattern is not only influenced by the supply and demand in trading countries, but also largely restricted by the

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economic development of trading countries, structural adjustments in energy, political situations, and so on (Zhang et al., 2015). We demonstrate that, besides exporters' supply and demand for crude oil, the bilateral relationship between the exporter and the importer affects China's regional crude oil imports. This represents an important extension of the traditional trade theory in the context of commodity trade.

Second, factors that influence the trade of crude oil from emerging countries are studied for the first time. Previous studies have examined the features of international and regional crude oil trade relationships (An et al., 2014; Du et al., 2017; Guan et al., 2016; Zhang et al., 2014, 2015). It was worth mentioning that Zhang et al. (2015) found that both the supply and demand factors significantly influenced worldwide oil trade patterns. However, empirical knowledge about whether and how those factors influence crude oil imports of emerging economies in different periods is still overlooked. In particular, China is a good test case for the general theory of commodity trade as it is exposed to many special conditions that are negligible in one country. Thus, we focus on China's crude oil imports from 55 countries across different periods. Specifically, we use the dynamic panel approach to incorporate all available information in the cross section and time series dimensions (Carstensen and Toubal, 2004).

Third, the empirical findings confirm that the factors have different effects on China's crude oil imports in different regions. Its imports from the Middle East and Africa are both positively associated with the regions' crude oil supply and its bilateral trade relationship with exporting countries, while those from the Asia-Pacific only have a significant and positive relationship with the region's openness in crude oil trade. This allows us to identify the regional trade determinants with different trading partners and test the sensitivity of these factors toward the trading partners. The findings can be employed to optimize the regional strategy of China's crude oil trade immediately.

The remainder of this paper is organized as follows. Section 2 describes the regional pattern of China's crude oil imports. Section 3 presents the influencing factors and hypotheses regarding China's crude oil imports. Section 4 reveals the data and methodology used in the study. Section 5 discusses the empirical results, and Section 6 provides the conclusions and suggestions.

2. Influencing factors and hypotheses

What are the characteristics of the countries that export crude oil to China? The trade of crude oil is not only affected by the exporter's resource endowments, demand, prices, transportation, and trade policies, but also by geographical location, risk, and bilateral trade relationships. In this section, we attempt to explore the factors affecting China's crude oil imports.

2.1. Crude oil supply

Due to the unbalanced distribution of global crude oil resources, the supply of crude oil shows distinctive characteristics. According to related estimates, more than 80% of the world's proven crude oil reserves are located in OPEC member countries, with the bulk of OPEC oil reserves found in the Middle East, amounting to 65% of OPEC's total production (OPEC, 2015). Specifically, since the crude oil supply in the Middle East is extremely vast, despite the fact that these regions have complex geopolitics and turbulent social environments, many countries, including the United States and countries in the Asia-Pacific region, are dependent on oil imports from these regions (Salameh, 2003). Therefore, our first hypothesis is as follows:

Hypothesis 1. China's crude oil imports are positively associated with the exporter's crude oil output.

2.2. Crude oil demand

Economic growth, population increasing and urbanization development all drive a country's energy demand (Asafu-Adjaye, 2000; Chedid et al., 2007). The rule of the relationship between energy demand and economic development also exists in oil exporting countries (Mehrrara, 2007; Sadorsky, 2011). The exporter's demand is also an important factor influencing its oil exports, as it will affect the amount of crude oil available for export (Asif and Muneer, 2007). An example of this is Indonesia, a country which exported the greatest quantity of crude oil to China in the early 1990s, yet, due to the rapid development of its economy, its exports to China later decreased dramatically (Li and Leung, 2011). We thus derive the following hypothesis:

Hypothesis 2. Chinese crude oil imports are negatively associated with the oil exporter's demand.

2.3. Crude oil price

Oil price shocks have both direct and indirect economic impacts on both oil-importing and oil-exporting economies (Le and Chang, 2013). With the development of China's crude oil market, the co-movement of China's crude oil market with the international crude oil markets has been strengthened and the main international oil markets are the Granger causes of the Chinese oil market (Song et al., 2016). The crude oil price also plays an important role in the cyclical and secular evolution of the terms of trade, and the rising price may undermine the related import demand of oil-importing countries (Backus and Crucini, 2000). Our third hypothesis is as follows:

Hypothesis 3. Chinese crude oil imports are negatively associated with crude oil price.

2.4. Crude oil trade openness

An economy is considered more open when there are fewer barriers hindering its trade with the rest of the world (Esfahani and Squire, 2007). Some countries may adopt a tariff structure or other macroeconomic policies to achieve greater numbers of imports and exports of all goods and services, thus leading to greater trade openness (Huntington, 2015). As one of the most important crude oil exporters, OPEC resolved to be practically involved in the trade of its members' crude oil through existing sales contracts and OPEC quotas (Gault et al., 1999). Therefore, a country's crude oil export is also affected by its crude oil export policy and openness. This leads to our fourth hypothesis:

Hypothesis 4. China's crude oil imports are positively associated with the exporter's crude oil trade openness.

2.5. Bilateral trade relationship

Countries lacking in oil resources tend to expand their crude oil trade relationships with both oil-rich and oil-poor countries, in order to satisfy their oil requirements and safeguard their energy security. The trade patterns and interactions between each pair of countries form links, which may encourage them to trade crude oil in the future (Du et al., 2017; Guan et al., 2016). For example, China's growing cooperation with energy exporting countries and the establishment of friendly relations with OPEC countries have promoted an increase in the amount of crude oil imports from those areas (Guan et al., 2016). This is the basis for our fifth hypothesis:

Hypothesis 5. China's crude oil imports are positively associated with bilateral trade relations between the oil exporter and China.

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