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Does acquisition of mineral resources by firms in resource-importing countries reduce resource prices?☆

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ABSTRACT

This study theoretically and empirically examines how resource prices are affected when firms in resource-importing countries acquire mineral resources. The study's theoretical examination considers a simple, two-period model that demonstrates how firms acquiring mineral resources may raise either present or future resource prices. This finding implies that resource consumption in either period may decline. Strategic behavior of resource-mining firms, demand for final goods, and extraction costs play key roles in this examination. Using a dynamic panel model with oil price data, the study's empirical portion estimates how acquiring resources affects the price of oil. Results demonstrate that prices in the present period rise, and prices in future periods decline.

1. Introduction

In modern economies, energy resources such as petroleum and natural gas, common metals such as iron, copper, and aluminum, and minor metals such as nickel, chrome, titanium, and palladium are indispensable. Demand for resources has been constantly escalating in developing economies, and stable access to resources has become an important policy consideration for both governments and firms in resource-importing countries. Policy considerations are particularly acute because crucial major and minor resources are unevenly distributed across the globe. Current reserves of minor metals, in particular, are small, unevenly distributed, and costly to extract, making them more scarce than other resources. The Mideast held 48.1% of the world's 1.6527 trillion barrels of oil reserves at the end of 2011, Venezuela held 18.9%, Saudi Arabia held 16.1%, and Canada held 10.6% (Fig. 1).[1] In some oil-producing countries, such as Brazil and the U.S., consumption exceeds production (Fig. 2). The unevenness of minor metals' global production and distribution is even more remarkable.[2] For example, 77% of the world's production of beryllium, used in the aerospace and nuclear industries, is extracted in the U.S., and Brazil produces more than 90% of niobium, which is used to strengthen steel. South Africa holds more than 90% of the world's platinum reserves and produces 71% of its platinum, which is used as a catalyst for fuel cells and for jewelry.

Moreover, a small number of firms are the primary suppliers of these resources. The "resource majors" (suppliers) of petroleum include Exxon Mobil Corporation, British Petroleum, and Royal Dutch Shell. Some national oil companies (NOCs) such as Saudi Aramco, also play key roles. Principal suppliers of metals include BHP Billiton, Rio Tinto, and VALE. In 2011, seven producers, concentrated in Chile, supplied about 50% of the world's copper.

Even though most suppliers are large international companies, the number of intermediate and final goods producers that use resources as inputs far exceed the number of suppliers even though we take account the fact that most of the suppliers are large international companies. Because their small number grants suppliers bargaining power, it is crucial for intermediate and final goods producers to procure stable supplies of resources at low prices. Some producers accomplish this by acquiring interests in mines. In Japan, a resource-importing country, Nippon Steel Corporation and JFE Steel Corporation have acquired

Abbreviations: FOC, First-order condition; SOC, Second-order condition; OLS, Ordinary Least Squares; WTI, West Texas Intermediate

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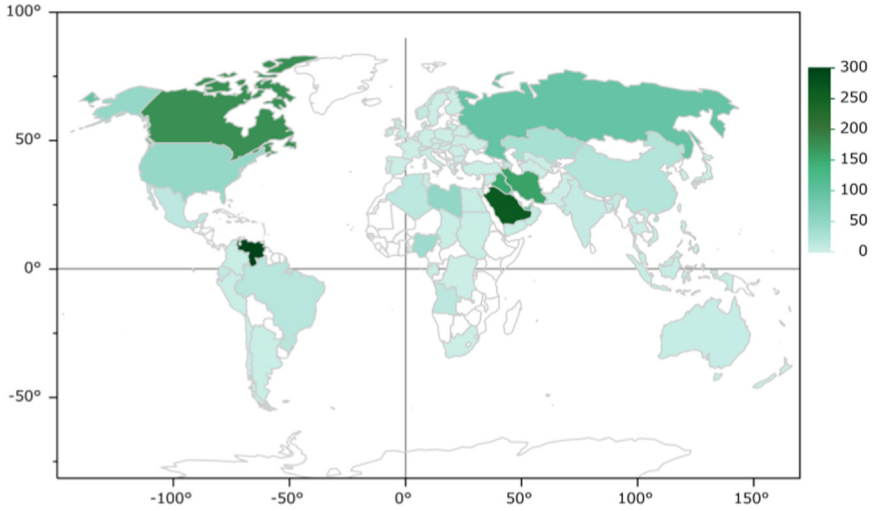

Fig. 1. 2013 Reserves of Petroleum (in billion barrels).
Source: BP Statistical Review of World Energy June 2014 (http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html, retrieved on February 20, 2015)

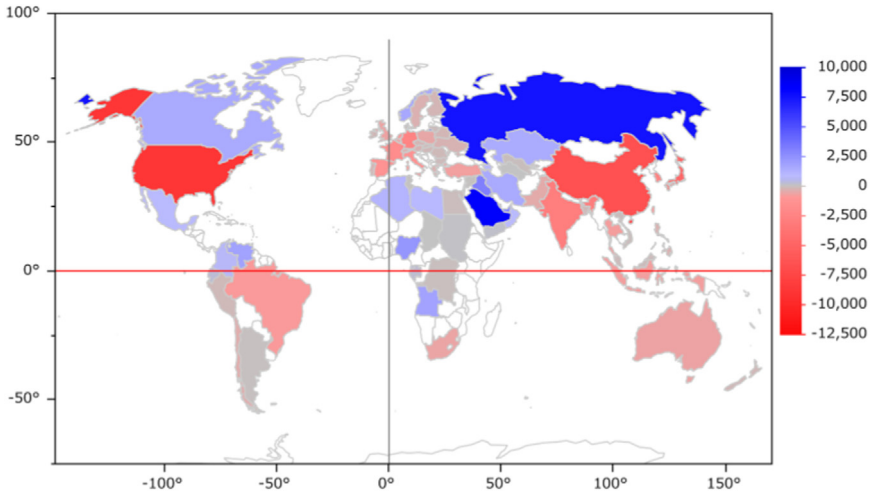

Fig. 2. 2013 Oil Production Minus Oil Consumption (in thousand barrels per day.
Source: BP Statistical Review of World Energy June 2014 (http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html, retrieved on February 20, 2015)

interests in foreign coal and minor metals mines, and other resource-extracting firms in the country are actively acquiring mining interests. For instance, Sumitomo Metal Mining Corporation announced that it will boost its investment in copper mines from 120,000 t in 2012 to 300,000 t in 2021.

Exploring and developing new mines requires time, and the amount of recoverable reserves is uncertain. Resource prices and long-term profits from exploration may vary drastically over short periods of time. Stable procurement of resources is vital for resource-importing countries as well as for firms that use resources as inputs. Thus, it may benefit society to share the exploration risk through governmental support policies. Notably, governments and governmental financial institutions have been providing support to domestic firms in their acquisitions of overseas mining interests. For example, the Ministry of Economy, Trade, and Industry supports the acquisition of foreign mining interests for the Japan Bank for International Cooperation, Japan Oil, Gas, and Metals National Corporation, and Nippon Export and Investment Insurance. This support incentivizes Japanese firms to acquire mining interests overseas.

Using a simple, two-period model, this study theoretically examines how the acquisition of mines by firms in resource-importing countries affects resource prices. Because government support in resource-importing countries encourages such acquisitions, we implicitly examine its influence on resource prices in present and future periods. To verify the analysis, we estimate the effects of resource acquisition policies on resource prices, using a dynamic-panel model. Different pricing mechanisms and markets exist for oil, gas, precious metals, and minor metals, and the bargaining power of both supplying and consuming countries is highly discrepant in these markets. What is prevalent in these markets is that concentration of the upstream industry is higher than that of the downstream industry.

Regarding the theoretical literature, one study calculated the effect of stockpiled material. Using a two-stage production model, Zhang and Kleit (2016) derived the value of stockpiled, intermediate ore between economic and breakeven cutoff grades and estimated its effect on optimal mining rates. They also extended their result to gold mines. Considering that stockpiled material impacts mining strategy, their results show that a stockpile contributes to a mine's value. Other studies evaluated the optimal price threshold of mining activation, using real options values instead of the more common discounted cash flow or net present value methods. Zhang et al. (2015) showed that flexibility, which has significant value, peaks when mining costs equal spot prices

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