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Assessing the U.S. oil security premium

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ABSTRACT

World oil supply disruptions lead to U.S. economic losses. Increased oil consumption increases the vulnerability of the economy to oil supply disruptions, but it matters where the additional oil is produced. Increased production from stable producers can dampen future oil price shocks, whereas increased production from unstable producers can exacerbate future oil price shocks. Because oil is fungible, U.S. pricing and import policies can differentiate only between domestic and imported oil rather than between stable and unstable sources. The economic losses associated with oil supply disruptions—GDP losses and some transfers abroad—are externalities that can be quantified as oil security premiums. We estimate these premiums by taking into account projected world oil market conditions, probable oil supply disruptions, the market response to oil supply disruptions, and the resulting U.S. economic losses.

1. Introduction

High oil prices and unstable foreign oil production have renewed concerns about U.S. energy security. The United States draws its oil from an integrated world oil market that includes historically unstable suppliers. Past disruptions of world oil supply have led to episodes of sharply rising oil prices, which have resulted in reductions in U.S. gross domestic product (GDP) and large income transfers to foreign oil producers. In fact, 9 of the 11 U.S. recessions since World War II have been preceded by sharply rising oil prices (Hamilton, 2009).[1]

Bohi and Toman (1993) argue that increased oil consumption increases the vulnerability of the economy to oil supply disruptions, but we find that it also matters where the oil is produced. Oil security is greatly affected by the composition of world oil production. Increased production from stable producers, such the United States, Canada and Brazil, is likely to dampen future oil price shocks to the extent that more oil is being extracted in regions that are not particularly vulnerable to future disruptions. On the other hand, increased production from unstable producers, such as Venezuela, Libya and Nigeria, is likely to exacerbate future oil price shocks.

To the extent that the expected U.S. economic losses associated with future oil supply disruptions create externalities associated with oil consumption that are not taken into account in private actions, they are a concern for economic policy, as explained by Bohi and Toman (1993) and Toman (1993). Several recent studies—such as those by the Council on Foreign Relations (2006) and Leiby (2007)—examine the costs of U.S. dependence on imported oil, but take approaches that are not limited to security costs nor consider the potential security costs associated with the consumption of domestically produced oil. In contrast, Greene et al. (2007) and Greene (2010, 2011) take the perspective that U.S. oil independence could be achieved when U.S. oil consumption and imports are reduced sufficiently that the expected annual economic costs of oil dependence are less than 1% of U.S. GDP.

Taking a cue from the latter approach and recognizing that oil's fungibility means that U.S. policy can only distinguish between domestic and imported sources of oil, we measure oil security premiums for U.S. oil consumption from domestic and imported sources. Measured this way, an oil security premium is an attempt to quantify the externality portions of the economic losses associated with the potential disruptions in world oil supply that result from the increased consumption of either domestic or imported oil.

To estimate the oil security premiums associated with oil consumption, we use a welfare–analytic approach, taking into account projected world oil market conditions, probable oil supply disruptions, the market response to oil supply disruptions, and the U.S. economic losses resulting from disruptions to the extent that they should be considered externalities. To make these estimates, we use a simulation model of world oil markets and draw on an expert panel assessment of probable oil supply

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[1] In contrast with price increases, Hamilton (2011) argues that price decreases have relatively mild, if any, impacts on the economy. Concerns in the literature and in this paper focus on upward price shocks rather than on general oil price volatility.

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disruptions, recent studies of the elasticities of world oil supply and demand, and an extensive literature about the response of U.S. economic activity to world oil supply disruptions.

Although the mechanics of our approach are reminiscent of an older literature on the economic cost of imported oil, such as Bohi and Montgomery (1982), Broadman (1986) and Leiby (2007), we focus exclusively on the security externalities associated with the consumption of domestic and imported oil—disregarding the monopsony premium that can be earned by a large oil-importing nation during stable market conditions. Such a premium is typically the largest component in the estimated cost of imported oil, and it may be an important factor shaping such a country's policy decisions, but it bears no relationship to the security costs associated with oil consumption.

We also estimate three types of oil security premiums for the time period 2010–2035: one for increasing U.S. oil consumption with domestically produced oil, one for increasing U.S. oil consumption with imported oil, and one for displacing a barrel of imported oil with a barrel of domestically produced oil without a change in consumption. The previous literature focuses on the differences in costs between reliance on imported and domestic oil for a single set of oil market and economic conditions.

In the next section we examine the relevant features of the world oil market, including reasons for distinguishing between secure and insecure oil supplies. In Section 3, we examine the economic reasons for public policy to protect against oil insecurity by separating the private costs borne by each oil consumer from the external costs that could affect other consumers. In Section 4, we build on Section 3 to provide estimates of U.S. oil security premiums. The final section summarizes the findings and draws implications for U.S. oil security policy.

2. Oil security and the world oil market

Increased oil consumption of either domestic or imported supplies has security implications because increased oil consumption increases the economy's exposure to oil price shocks. Because oil is fungible and has relatively low transportation costs, an integrated world oil market has developed in which, as Nordhaus (2009) explains, prices move together. No source of oil confers price security.

Nonetheless, oil security can be greatly affected by the composition of world oil production. A given geopolitical event occurring in a region of the world is likely to remove a relatively constant proportion of the oil supplies produced in that region.[2] Under these conditions, the increased contribution of unstable oil supplies to world oil markets will lead to bigger oil supply disruptions and bigger oil price shocks. The increased production of stable supplies is unlikely to affect the absolute size of oil supply disruptions in total barrels, but will dampen the price shocks because a bigger share of the market comes from stable suppliers.

It follows that consumers and policymakers would like to distinguish and discriminate between stable and unstable sources of oil. Unfortunately, oil's fungibility means that individual consumers cannot distinguish between any sources of oil and U.S. policymakers cannot develop pricing or import policies that meaningfully distinguish between various foreign sources of oil. When it comes to oil security, what matters is the stability of the marginal source of world oil production, not the stability of the oil supplied to the United States.

Consequently, for purposes of developing oil security premiums, U.S. policy is limited to a much rougher approach of distinguishing between domestic and imported oil.[3] Domestic oil production is politically stable, whereas history shows that oil production in countries that Beccue and Huntington (2005) identify as unstable suppliers varies with non-U.S. oil production.[4] That means an increase in U.S. oil consumption met by increased oil imports reduces energy security; both by increasing the exposure of the economy to oil price shocks and by increasing the share of world oil supply that comes from unstable suppliers. In contrast, an increase in U.S. oil consumption met by domestically produced oil increases the exposure of the economy to oil price shocks, but this effect is partially offset by increases in the share of world oil supply that comes from stable suppliers.[5]

Our analysis specifically assumes that higher U.S. oil imports boosts *world* oil consumption and that this additional world consumption is met by unstable sources in proportion to their existing share of total oil production originating from outside the United States. For the calculations reported later in this paper, this assumption means that every additional barrel of oil consumed by the world due to higher U.S. imports calls for about 0.5 barrel originating from insecure supply sources. This assumption appears appropriate given that OPEC suppliers expand or contract their production capacity or rate of capacity utilization to exert some market power and maintain prices. It is quite consistent with EIA's *Annual Energy Outlook* estimates, which are widely used in policy circles and form the basis of our analysis.[6]

If one thinks that the additional world oil consumption created by an increase in U.S. oil imports is met entirely by increased production from secure sources like Brazil or Canada, there is no need for differentiating between domestic and imported oil. In such a case, one should simply use the security premium estimate for domestic production. Such an assumption, however, contrasts not only with our own view but also the perspective offered in published world oil market projections.

3. Oil security externalities

To the extent that the economic losses associated with oil supply disruptions are externalities that are not taken into account in private actions, they become a concern for economic policy. A number of costs arise from potential oil price shocks, but not all such costs are externalities. And of course, oil use creates other externalities—such as air pollution and greenhouse gas emissions—that are not associated with energy security.

If oil consumers can correctly anticipate the size, risks, and societal impacts of an oil disruption and take them into account in their oil purchases, there is little reason for government intervention. Consumers will internalize all of the social costs of oil consumption, including the risk of disruptions, by holding inventories, diversifying their energy consumption, and reducing their dependence on oil use. Some experts, however, believe that critical national security concerns restrict broadly available information about geopolitical conditions and oil market risks. If restricted information causes oil consumers to underestimate the risks, they are likely to underinvest in oil security protection.

Even if oil consumers have accurate information about oil market risks, government intervention may be justified for a second, more fundamental reason. Oil consumers will internalize any costs of oil use that they expect to bear, but they will typically ignore any external costs that their decisions impose on other consumers. The decision to purchase an

[2] The expert panel quantifying global oil disruption risks specifically assumed that any particular event occurring in a region removed a constant percentage of the region's oil production, regardless of how much oil was being produced in the region. See Beccue and Huntington (2005).

[3] The United States also could develop policies to subsidize stable foreign oil producers.

[4] Historical data on U.S. oil imports (Energy Information Administration, 2012a,b) and on petroleum production from OPEC members (BP, 2011) confirm a very strong correlation between the two series. The correlation coefficient is 0.855 for annual levels over the period 1965–2009 and 0.779 for annual changes over the same period.

[5] The same analysis may apply to any domestically produced liquid fuel—such as biofuels, coal-to-liquids, or gas-to-liquids—that is a close substitute for refined products. Prices for these liquid fuels will move with those of crude oil.

[6] A comparison of cases in EIA's *2012 Annual Energy Outlook* shows that changes in world consumption from the reference values are met almost exclusively by changes in OPEC production.