The Value of Strategic Oil Stocks Under Reduced U.S. Oil Imports

Paul N. Leiby, Oak Ridge National Laboratory, leibypn@ornl.gov, 865-574-7720
David Bowman, Econotech, LLC, econotech@hotmail.com 865-574-8642
Gbadebo Oladosu, Oak Ridge National Laboratory, oladosuga@ornl.gov 865-576-2485
Rocio Uria Martinez, Oak Ridge National Laboratory, uriamartiner@ornl.gov, 865-574-5913
Kenneth Vincent, U.S. Department of Energy, kenneth.vincent@hq.doe.gov, 202-586-6244

Overview

This paper evaluates how major increases in U.S. oil production will change the benefits of strategic oil stocks. Historically, the economic benefits of oil stocks have been framed in terms of the economic losses avoided by stock releases. Oil price shocks adversely impact oil-consuming regions, and particularly net oil-importing regions by reducing GDP growth and increasing the wealth transfers to oil exporters. Strategic oil stockpiles provide benefits to the extent that they moderate price shocks in the global oil market and reduce these consequences. Beyond these quantifiable economic benefits in the event of global oil supply losses, oil stockpiles also provide protection against more-localized supply shocks as well as diplomatic and national security benefits.

The major increase in tight oil production in the United States, coupled with decreasing consumption is causing analysts to revisit the issue of energy security generally and the value of strategic oil stocks specifically. However, the exact impact of changes in the U.S. petroleum landscape on the value oil stocks represents a complex puzzle. This paper evaluates how projected trend in U.S. oil production will affect specific benefits associated with oil stocks, highlighting which benefits will decrease and which benefits will remain unchanged as U.S. oil imports decline. The conclusions seek to advance both the academic understanding of energy security and policy discussions about how to approach energy security in a changing global market.

Methods

To evaluate the quantifiable economic benefits of strategic oil stocks, this study uses the BenEStock Model, which was developed for the study of the costs and benefits of emergency oil stockpiling by the U.S. and other International Energy Agency nations. The model draws upon previous analytical tools used to assess the size and drawdown requirements of the U.S. Strategic Petroleum Reserve. It simulates the expected economic benefit of the current and planned IEA emergency stocks for a base case and various sensitivity conditions and scenarios. The model characterizes emergency stocks in terms of draw rate capabilities, stock sizes, fill rates and refill rates. It also produces estimates of the expected frequency of disruptions and use of emergency stocks, the probability of stock exhaustions, and a probability distribution of economic benefits generated using thousands of sample iterations.

BenEStock computes the benefits from using emergency stocks in cases of disruptions as well as stock level, stock use, net oil costs, and other relevant variables. Disruption impacts are modelled on a monthly basis, for disruptions of up to 18 months in length, over the period from 2013 to 2042 (30 years). Gross oil supply disruptions are directly offset by two exogenously specified sources: spare world oil production capacity and short-run demand switching (generally very small). If the net disruption (after these offsets) is greater than the specified drawdown threshold level, the emergency stocks will be used in a coordinated action. Drawdown rates for each stock type (i.e. public and obligated industry) are limited by the specified technical maximum drawdown rate for that year, the specified drawdown rule or strategy, and by the rate of exhaustion. After a drawdown, the emergency stocks can be refilled at exogenously specified refill rates.

Oil shortfall is calculated as the size of the remaining disruption after offsets and emergency stock draw. If the oil shortfall is greater than zero, the world oil price is affected. Under the central case assumptions, if the oil shortfall is zero, we consider the possibility that market dislocation, speculative behaviour, or a risk premium will prevent stocks from completely eliminating the price increase, even if the net disruption is fully offset by stocks. Oil price increases are then translated into economic costs to society. These costs are composed of Gross Domestic Product (GDP) losses, and net oil import costs. The model has the capability to vary numerous inputs to generate sensitivity cases for evaluation – this paper specifically focuses on how variations in the level of U.S. oil production and imports changes the expected cost of disruptions and level of benefits that accrue to the United States from emergency oil stocks.

Results

The results are calculated and presented in terms of average dollar benefits per barrel per year, with confidence intervals included. This includes a reference case as well as sensitivity cases with different potential levels of U.S. oil output, consumption and imports. We also discuss other benefits that are potentially important but more difficult to quantify.

Conclusions

The core conclusion is that while lower oil imports do reduce the costs of oil shocks and lessen one component of the benefits of emergency stocks, the U.S. is still exposed to significant economic losses and dislocation so long as it remains a large consumer of oil, and its energy sector is linked to global energy markets. We report quantitative estimates of the degree to which changes in the U.S. petroleum sector impact the value of strategic oil stocks. We also include a qualitative discussion of other benefits of strategic oil stocks that are more difficult to quantify, and how they may change in light of changing market conditions. Sensitivity to these changes will be compared to other variables that influence the value of strategic oil stocks, such as the level of global spare oil production capacity and the threshold at which drawdowns are initiated. While the paper does not advocate any particular policy course of action, it speaks to contemporary debates about oil stockpiling and energy security.

References

Brown, Stephen and Mine K. Yücel 2002. "Energy Prices and Aggregate Economic Activity: An Interpretative Survey," *Quarterly Review of Economics and Finance*, 42(2).

Brown, Stephen P A, and Hillard G Huntington (2010) "Reassessing the Oil Security Premium," *RFF Discussion Paper Series*, no. RFF DP 10-05, doi:RFF DP 10-05.

Cologni, Alessandro and Matteo Manera (2008). Oil Prices, Inflation and Interest Rates in a Structural Cointegrated VAR Model for the G-7 Countries. *Energy Economics* 30 (2008) 856–888.

Kilian, Lutz 2008. A Comparison of the effects of exogenous oil supply shocks on output and inflation in the G7 countries. Journal of the European Economic Association 6 (1): 78-121.

Cooper, John C.B. 2003. "Price Elasticity of Demand for Crude Oil: Estimates for 23 Countries," *OPEC Review*, March.

Energy Modeling Forum, Phillip C. Beccue and Hillard G. Huntington, 2005. *"An Assessment of Oil Market Disruption Risks,"* FINAL REPORT, EMF SR 8, Stanford University, October.

Hamilton, James D. 2005. "Oil and the Macroeconomy," *Palgrave Dictionary of Economics.*

Jones, Donald W., Paul N. Leiby and Inja K. Paik, 2004. "Oil Price Shocks and the Macroeconomy: What Has Been Learned Since 1996," *The Energy Journal*, 25(2)1-32.

Leiby, Paul N. and Bowman D. (2000). *The Value of Expanding the U.S. Strategic Petroleum Reserve*, Oak Ridge National Laboratory, ORNL/TM-2000/179

Leiby, Paul N. and David Bowman (2005). *Economic Benefits of Expanded Strategic Petroleum Reserve Size or Drawdown Capability*, December 31, Final Report Oak Ridge National Laboratory, ORNL/TM-2006/5.