

Mr. Nordhaus: The United States and other high-income countries face several long-term challenges relating to energy. The headline issue, which is engaging a small army of scientists and international negotiators, is the carbon question. The key economic policy requires placing a price on carbon fuels that reflects the social costs of their emissions. Over the longer run, nations will need to find an economical way to make the transition from today's technologies – so dependent upon fossil fuels – to that are essentially carbon-free.

Another set of questions involves oil. The oil question involve a highly complex and controversial set of issues. These include among other things the rising share of imports for the U.S., local and regional pollution, the interaction with national security, particularly visible in our Iraq strategy, the rising dollar burden of imports, recycling oil revenues, price volatility, unacceptably high profits of U.S. oil companies, tradeoffs between drilling and environmental values, and oil's contribution to global warming.

The Integrated Oil Market

My remarks today will encompass all of these, but in a roundabout way. My major point is that much thinking about oil is misguided because analysts often have misunderstood how the oil market works (no one in this room, to be sure, but many people outside this room)

I suggest that it is fruitful to think of the oil as a single integrated world market. That market will be the outcome of a multitude of individual supplies and demands, but the overall price and quantity are determined only by the *sum* of the demands and the *sum* of the supplies. The composition of the supplies and demands is irrelevant. If you look at the world through these spectacles, the world looks very different. That is the point of my talk today.¹

In this integrated-market view, we can envision the oil market as a giant bathtub (as this Figure shows). The bathtub contains the world inventory of oil. There are spigots from Saudi Arabia, Russia, the U.S., and producers that introduce oil into the inventory; and there are drains as the U.S., Japan, Denmark, and consumers that draw oil from the inventory. But the price and quantity dynamics are determined by the sum of the demands and supplies and inventories, and are independent of whether the faucets and drains are labeled “U.S.,” “Russia,” or “Denmark.”

You might naturally ask, How do we know it is an integrated world market? The best test for market integration is to examine prices, in this case, the price of oil in different markets. This figure shows a graph of weekly oil prices over the period 1997 to 2009 for 15 different crude oil markets. The picture shows in a striking fashion how oil prices move together. Taking 33 prices with long historical records, the median correlation coefficient of prices over this period was 0.994.

This figure shows one further measure, which is a scatter plot of the log price of Iranian and Libyan crude. These are particularly revealing because these two countries have been subject to sanctions and embargoes, but none of these shows up in the prices of their crude oil.

This correlation here is markedly higher than virtually any other traded good or service. We show in this figure, as a more typical example, the prices of standardized saw logs (#2 sawmill Douglas fir logs in the Pacific northwest of the U.S.). These show substantial variation of the prices, and the median correlation coefficient is 0.75. Similar empirical findings on the failure of the law of one price have been seen for virtually all products, even very homogeneous ones.

¹ Some technical details: In this discussion, I will consider the polar case of a 100 percent integrated world market and recognize that it is oversimplified and

only 99.8 percent accurate. But 99.8 is pretty close to 100, so the analysis of the pure case is very close to the more complete truth. I emphasize that this discussion applies to oil but not to most other energy sources such as natural gas or coal. Also, for this discussion, I will abstract from national security implications, such as the military costs of protecting oil supplies, or the cost of going to war to protect oil producing countries from predation or chaos. These are important questions but involve issues far beyond the scope of this talk. Finally, note that these are pre-tax prices from EIA and are FOB prices. They will differ from wellhead prices and definitely will differ from consumer prices of retail petroleum products.

Implications

Few of you will find the discussion up to this point surprising. I spend some time on it primarily to lay the empirical foundation for the substantive discussion. My plan now is to examine several common themes about oil policy and analyze them in the context of an integrated world oil market.

Let's begin with one of the most common fallacies in oil policy – the need for oil independence. A hardy perennial is the idea that we should limit our consumption to countries that are “secure sources.” We might concentrate on the Western Hemisphere, or perhaps our neighbors Canada and Mexico, or perhaps rely only on the United States, or we might even exclude Alaska lest it decide to secede.

These policies make no sense in an integrated world oil market. They have zero value. Suppose that we were to concentrate our imports on completely reliable sources – ones that would never, never cut off supplies to the United States. But a “cutoff” from unreliable country A to the U.S. would lead country A to send its oil to

other countries. In the integrated world market, this would simply lead to a reallocation of global production from other countries to the U.S. to make up the difference. Unless a country actually reduces its flow into the world bathtub, there would be no impact on the U.S. of sourcing imports from secure regions.

A corollary of this point concerns U.S. embargoes on foreign oil producers, such as Libya or Iran. To a first approximation, these have no effect on world prices or production; no impact upon the countries whose oil is embargoed; and no impact on the United States. They are purely symbolic measures.

We should not conclude from this discussion that we should relax our concerns about security of supply and price volatility. Rather, the point is that these are global problems that arise from the balance of global supply and demand. The world oil market is vulnerable if global supply is tightly constrained, say because there is no excess capacity. Even if the U.S. has limited its purchases to secure sources, a crisis anywhere is a crisis everywhere.

A related fallacy is the security concern about the “competition for resources.” We might worry about who will control oil production in distant lands? As an example, national security specialists sometimes fret about whether Russia is gaining oil-production concessions in neighboring countries; or whether China will dominate drilling in the South China Sea; or whether India will have concessions in the Sudan. These concerns are more appropriate to the 19th century than to the 21st. In fact, the major U.S. interests are that the world’s oil resources be fully and quickly developed, not who develops these rights. If India can find and develop Sudan’s oil resources quickly and efficiently, that will add to

the flow into the oil bathtub, will reduce world oil prices, will diversify world supply, and will benefit the U.S.

Turn next to the broader question, what is the value of “oil independence” in the context of an integrated world oil market? This requires considering the question of the “oil premium.” This concept refers to the “externality” generated by oil consumption. In other words, what is the difference between the social cost and the private cost of oil consumption?

Literature on the oil premium has identified three sources: first are the technological externalities (such as air pollution and congestion); second is the price effect – the fact that higher consumption drives up the world price and therefore raises total costs; third are macroeconomic externalities – the finding that an increase in oil price tends to produce or worsen recessions.

Energy independence would be valuable to the extent that it reduces these three external costs of oil consumption. The important point is that none of these costs involves oil independence or the share of imports; rather, each of them involves total consumption of oil along with the elasticities of supply and demand for oil in the world oil market.

Begin with the price externality. If the U.S. consumes an additional unit of oil, this adds to world demand. The impact on the oil price is determined solely by the *world* price elasticities of supply and demand and is independent of domestic demand and of the share of imports in domestic consumption. Take the simple example where the world elasticities of demand and supply are minus and plus one-half, respectively. Then the oil price externality is exactly equal to the initial oil price. The share of imports does not enter into this calculation.

This reasoning indicates why oil independence will also have no effect upon the macroeconomic externality. Most analyses of the recessionary impact of oil prices find that the impact goes through two mechanisms. The first is the “tax increase effect,” through which consumers find their real incomes decline as rising oil prices rise. A second effect is the monetary-policy effect. As oil prices rise, this increases the rate of inflation. To the extent that central banks target inflation and do not completely remove oil price shocks from their target inflation rate, oil price increases will lead to higher interest rates. The contractionary impact of the interest rate effect reinforces the tax increase effect.

However, note that both of these impacts are affected by the total domestic expenditures on oil, not by imports of oil. The fraction of oil consumption that is imported has to a first approximation no effect on either the tax increase effect or on the monetary-policy effect. Therefore, here again, the key focus of policy should be on the world market, the U.S. contribution to total consumption, and not on oil imports.

This discussion has ignored up to now the implications of our oil consumption on the balance of payments, foreign indebtedness, and the external accounts. For many people, this is a central concern. We are, it might be thought, impoverishing ourselves because of our addiction to oil. This figure shows the trend over the last four decades. The dollar value of oil imports peaked at about 28 percent of total imports in 1979-80, fell to around 5 percent in the late 1990s, and then rose to between 15 and 20 percent in the last few years. People might naturally be concerned that oil imports are a serious issue for our external accounts.

Two points are important here. The first relates to the microeconomic principle of comparative advantage. We import oil because the cost of domestic oil is higher than the cost of foreign oil. It is more economical to grow and export wheat and use the proceeds to import oil than to drill for high-cost oil or to grow oil from corn. Comparative advantage applies just as much to oil as to textiles, to bananas, and ... dare we mention it ... to automobiles. There is no reason to engage in uneconomic import substitution for oil for balance-of-payments reasons than to engage in import substitution for tennis shoes, paper boxes, or automobiles.

The second point is a deeper one. Macroeconomists have gradually changed their view of the reasons for countries' trade deficits and surpluses. We can best understand our trade deficit and China's trade surplus as the result of national and world savings and investment patterns, not as the result of the microeconomics of oil drilling, free trade, or cheap foreign labor. The large U.S. current account deficit is primarily a result of low U.S. saving and high foreign saving, not of our addiction to Saudi oil and Chinese toys.

Reducing the value of oil imports would take place through the same mechanism by which our overall trade deficit would be reduced. Higher governmental and private saving would lead to higher national saving. The full-employment equilibrium would come at lower domestic interest rates and a depreciated dollar. This would raise import prices, including dollar oil prices, and raise export prices. The net effect would be to reduce domestic consumption of oil as the world oil price in dollar terms rises. So here again, as in the other issues, the key variable to keep your eye on is total domestic oil consumption, not imports of oil.

Enough of fallacies. If we look at the world through the lens of an integrated world oil market, how should we think about oil policy? What are appropriate measures to deal with our oil problem? What exactly is our oil problem?

A full discussion will need another talk, but I will sketch a few points. Beginning with the basics, we have two major but closely related objectives. The first is that oil prices should be low, stable, and sustainable. Second, however – and this is a big however! – low oil prices must be in the context of the proper pricing of carbon. Low oil prices are beneficial to the economy as long as they do not drive us into dangerous climatic waters. Hence, it is critical for sensible oil policy to get climate-change policy right. Until countries put an appropriate price on carbon emissions, energy policy will be incoherent, and energy and environmental policies will be working at cross-purposes.

Once we have corrected the price of carbon, the major objective is to take policies that will ensure low, stable, and sustainable oil prices. Within this framework, we need to consider oil policy in terms of world demand and world supply, rather than domestic demand and supply. In terms of supply, we should encourage development and production by all producers, independent of whether or not they will benefit American consumers or producers. The world oil price will be lowered equally by increased production by Chinese, Indian, or American companies in any part of the globe. This also implies that we should not subsidize domestic production. There are around \$2 billion of U.S. tax expenditures for oil and gas production today. Many of these are rationalized as encouraging domestic production to reduce dependence on imported oil and are wasteful in the context of an integrated world oil market.

The second point is to encourage policies that lower the demand for oil everywhere, not just in the United States. There are many examples, but a particularly important one is to work to reduce subsidies to oil consumption wherever they occur. According to the International Energy Agency, there are around \$100 billion of subsidies on oil, with the biggest subsidies in Iran, Indonesia, Saudi Arabia, Egypt, and China. These are not only inefficient policies and costly to these countries, but they have spillover effects and drive up oil prices in the world market.

The lesson here is that we need to broaden our horizons when thinking about oil policy. We are all in this tub together.