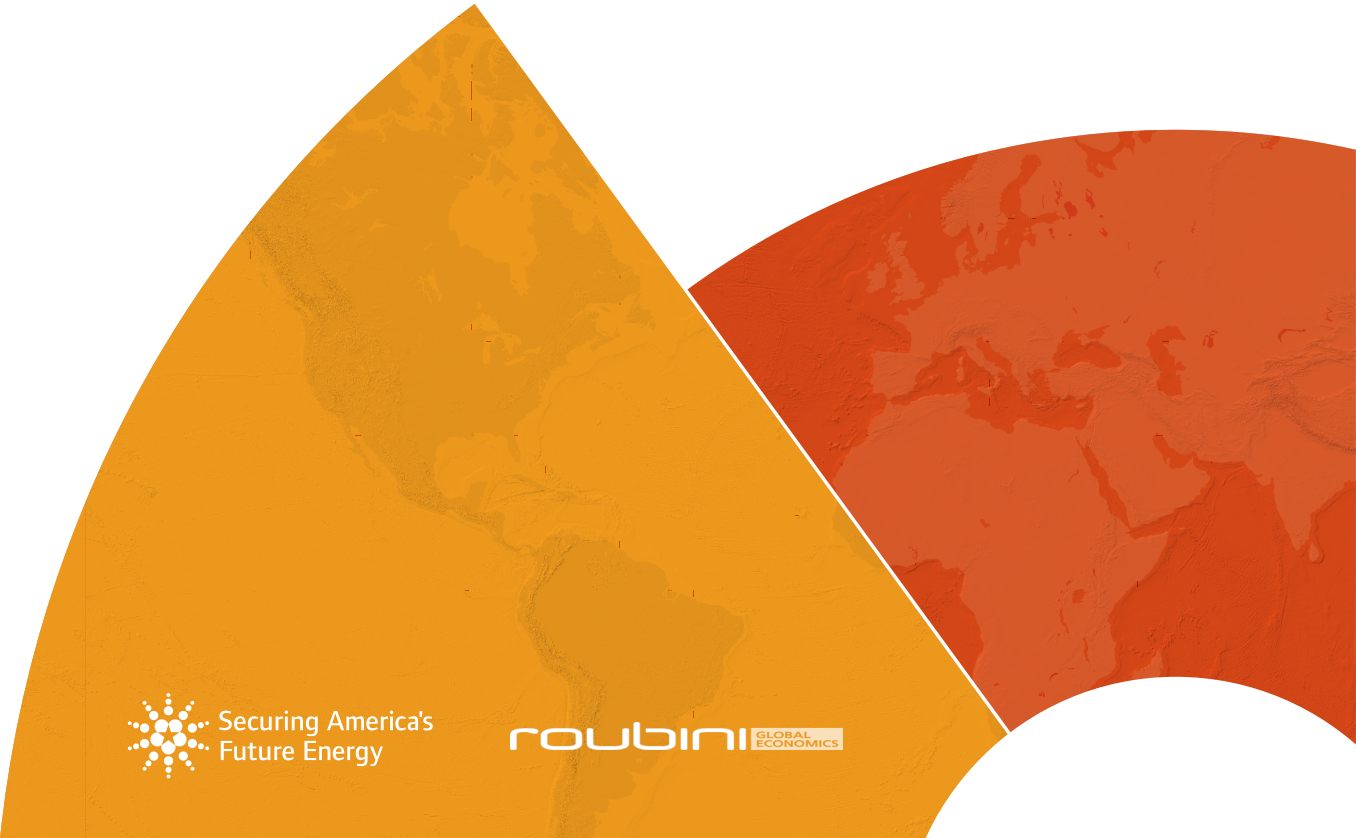


Oil Security Index

Quarterly Update



April 2014



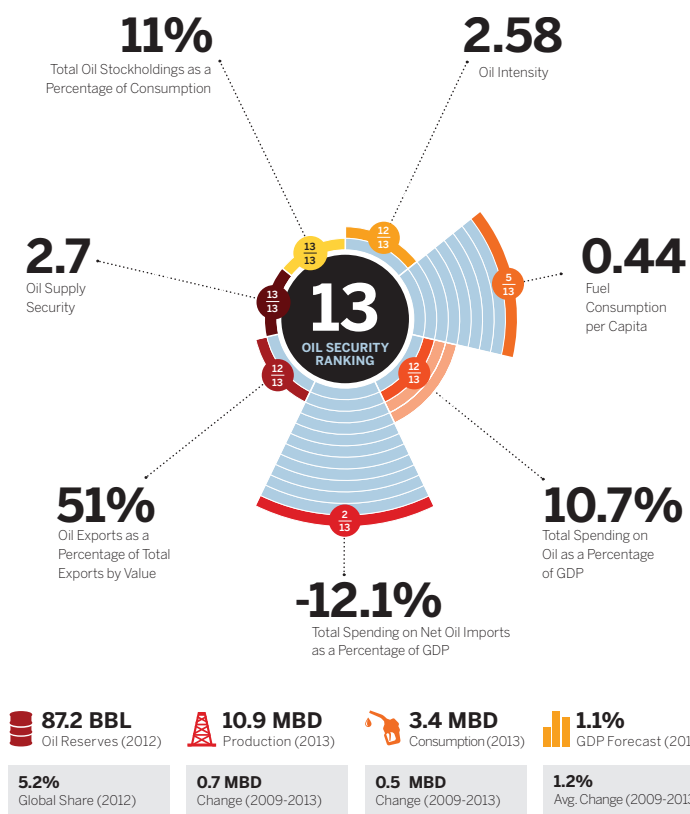
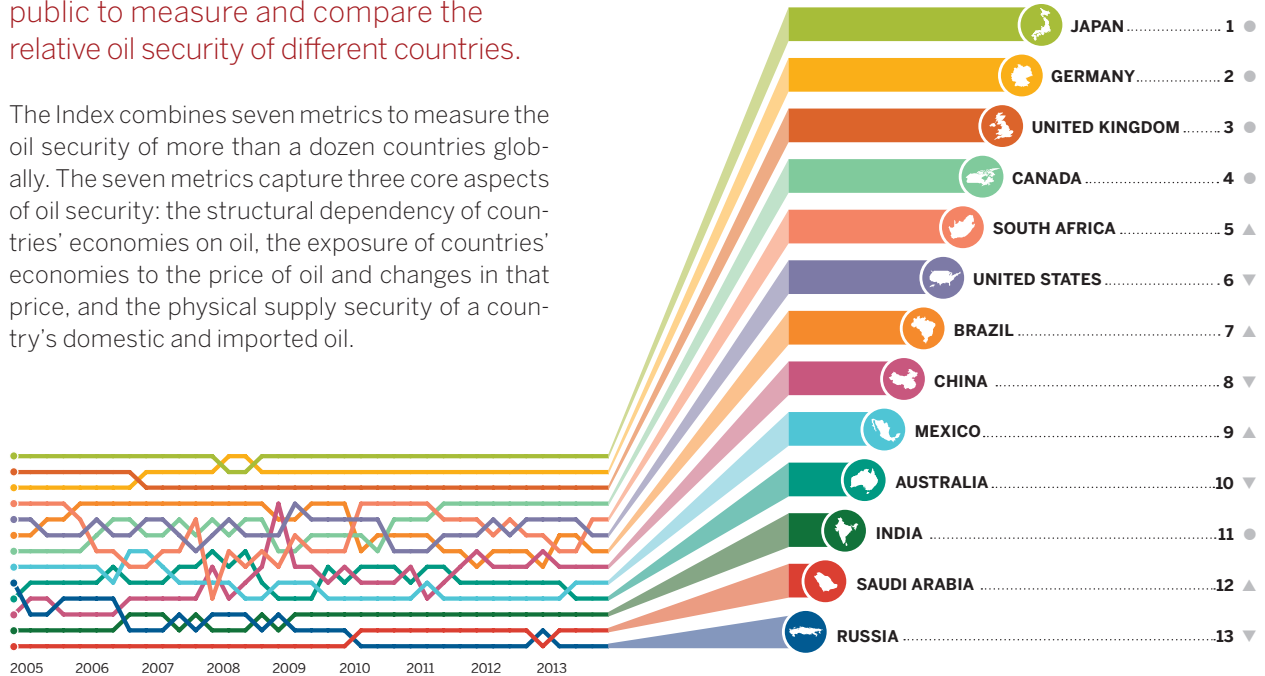
 Securing America's
Future Energy

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Oil Security Index Rankings

The Oil Security Index is designed to enable policymakers and the general public to measure and compare the relative oil security of different countries.

The Index combines seven metrics to measure the oil security of more than a dozen countries globally. The seven metrics capture three core aspects of oil security: the structural dependency of countries' economies on oil, the exposure of countries' economies to the price of oil and changes in that price, and the physical supply security of a country's domestic and imported oil.



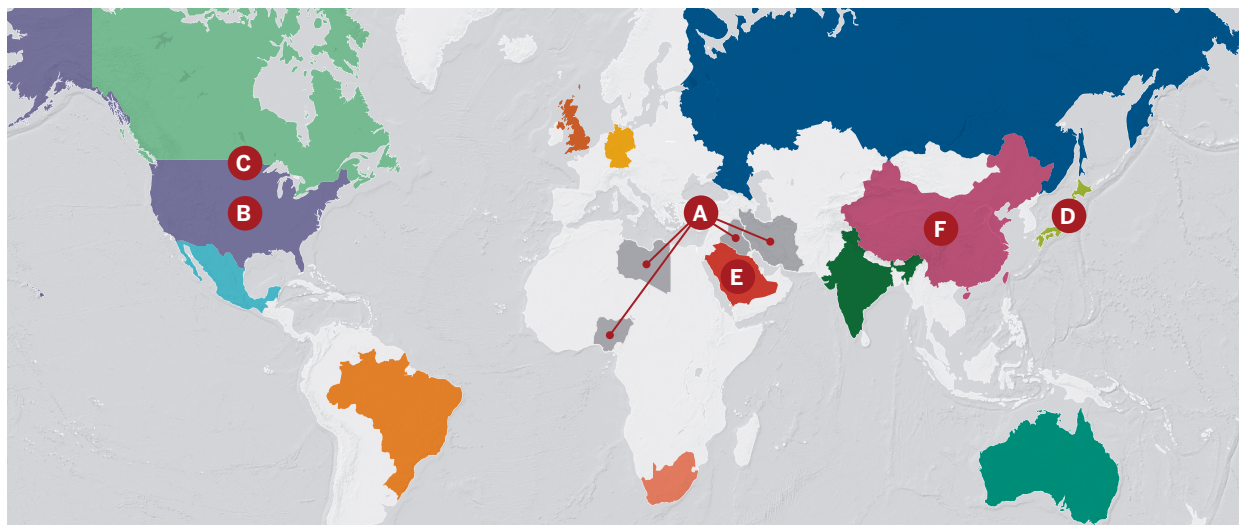
Spotlight on Russia

With Saudi Arabia and the United States, Russia is one of the three largest oil-producing countries in the world, and also a major oil exporter to Europe and Asia.

Recent attention on Russia's energy sector has focused on the country's leverage over Europe due to natural gas exports. Some European countries rely on Russia for as much as 100 percent of their natural gas supplies and the continent as a whole relies on Russia for 30 percent of total supplies. Russia's economy is heavily dependent on the revenues generated from oil and natural gas production and export, and sensitive to the price changes in both commodities. Today, oil export revenues account for more than 50 percent of Russia's total export revenues. The reliance, plus the Russian economy's relatively high oil intensity and rising oil consumption result in its position at the bottom of the Index rankings.

Q4 2013 Global Highlights

Changes in oil demand and supply in different countries around the world impact both those countries' oil security and the global oil market.



- A Unexpected oil supply outages were substantial.** In the second half of 2013, outages exceeded 3 mbd due to disruptions from Iran, Iraq, Libya, and Nigeria. Venezuela, a major source of U.S. crude oil imports, looms as a possible source of oil supply disruption in 2014 given ongoing political instability.
- B U.S. oil demand grew substantially in late-2013.** Oil consumption in the United States grew by approximately 0.8 mbd between Q4 2012 and Q4 2013—its largest year-over-year increase since 2004.¹ The country's Total Oil Spending as a Percentage of GDP metric reacted accordingly, rising from 3.2 to 3.3 percent over the period in a relatively stable price environment.
- C Growth in non-OPEC oil production was strong, driven primarily by the United States and Canada.** Non-OPEC production grew by 1.4 mbd year-over-year in Q4, outpacing global demand growth of 1 mbd. North America accounted for 84 percent of non-OPEC supply growth. Meanwhile, Russia continues to increase its use of horizontal drilling to help offset declining productivity at mature fields and maintain oil production growth of approximately 0.16 mbd year-over-year (1.5 percent).² Several countries, however, including Australia, Brazil, China, India, Mexico, and the United Kingdom, observed effectively flat or gradually declining production.
- D Japan's oil demand declined approximately 3 percent year-over-year.** Between 2011 and 2012, Japan's oil demand increased by more than 0.25 mbd (6 percent) as alternatives to nuclear power generation were sought in the wake of the Fukushima disaster.³ Through 2013, Japan increasingly displaced this oil with coal-fired power generation.
- E Saudi Arabia adjusted production levels in response to market developments.** Despite rising non-OPEC oil production, global supply disruptions and domestic summer power generation needs prompted Saudi Arabia to actually increase oil production in Q3 and Q4 by approximately 0.25 mbd year-over-year.
- F China's oil demand growth slowed in 2013 and actually fell year-over-year in Q4.** This was due to a combination of factors, including sluggish manufacturing activity, gains in efficiency, and reduced heavy-duty transportation demand. The overall deceleration masked an emerging and important trend: the rise of passenger vehicle demand as the core driver of overall Chinese oil demand. While diesel demand fell approximately 1.5 percent in 2013, gasoline demand surged by 6.6 percent year-over-year.

1 SAFE analysis based on data from: IEA, OMR, Archives

2 SAFE analysis based on data from: IEA, OMR, February 2014, Tables 2 and 3 (February 13, 2014)

3 Id., Table 2

U.S. Oil Security a Function of Production and Consumption

Rising domestic oil production continues to strengthen U.S. oil security, but heavy oil use leaves the economy vulnerable to high and volatile oil prices.

SUMMARY

Rising U.S. oil production has been the most visible trend in the global oil market over the past several years. Since 2008, U.S. crude oil production has increased by approximately 3 mbd, or 60 percent.⁴ With consumption slow to recover post-recession, this has resulted in net U.S. oil imports declining by more than 6 mbd since their historical peak in 2005.⁵

This increase in domestic production has helped facilitate a gradual—but increasingly substantial—strengthening in the Oil Supply Security metric from 5.8 in 2008 to 6.5 since Q2 2013. This comes through substituting oil imports from countries like Angola and Nigeria, which are more at risk of disruption, with more secure oil produced in the United States. By lowering the quantity of oil imports required, increasing domestic production has also helped reduce the Total Spending on Net Oil Imports as a Percentage of GDP metric to 1.5 percent in Q4 2013 (from a maximum of 2.7 percent in Q4 2008 and more recent high of 2.0 percent in Q2 2012).

The United States consumes more oil each day than China, Japan, and Russia combined.

Although the effects of rising domestic oil production are unquestionably positive for the country's relative and absolute oil security, the United States is also the world's largest oil consumer, accounting for approximately 20 percent of total global oil demand—a share greater than China, Japan, and Russia combined.⁶ The country's Fuel Consumption Per Capita metric is the second highest in the Index (1.72 gallons per person per day in Q4 2013, up from 1.70 in Q1 2013) and its Oil Intensity metric (0.56) remains higher than many of its developed country peers including Japan (0.33), Germany

(0.40), and the United Kingdom (0.30). Such high levels of economy-wide oil consumption—which in Q4 2013 increased by approximately 800,000 barrels per day versus Q4 2012⁷—leave the United States far from being truly insulated from high and volatile oil prices. This was reflected by an increase in the Total Spending on Oil as a Percentage of GDP metric from 3.0 percent in Q1 2013 to 3.3 percent in Q4 2013.

U.S. OIL SECURITY INDEX SCORE IN THE 21ST CENTURY

In addition to a relative ranking, the Index also provides a numerical score of U.S. oil security that allows for tracking and comparing over time. This score is calculated by normalizing the results for each of the seven metrics over the entire time series. The combined score is the sum of the indexed metrics—indexed at 100 in Q1 2000, the first quarter of data of the Index.

The combined score for the United States has shown only moderate improvement since Q1 2000 as a result of several factors, including an increase in global oil prices (imported crude oil prices averaged less than \$30 per barrel on an annual basis between 2000 and 2003, for example, compared to \$98 per barrel in 2013).⁸ The score has, however, also experienced upward and downward shifts, fluctuating between a low of 98.9 in Q3 2008 and a high of 100.8 since Q2 2013 (see Figure 1). The score's low point was a result of record-high global oil prices and consumption and imports that reached historic highs in 2005 and remained elevated through the first half of 2008. As prices subsequently receded, and consumption declined, oil security improved somewhat. However, the improvement in the combined score was short-lived, as both prices and consumption rebounded in 2010.

Since 2012, the combined score has been rising steadily, reaching its highest levels yet in 2013. This improvement comes as a result of ongoing economy-wide improvements in efficiency, gradually moderating fuel consumption per capita (see Figure 2), increasing domestic oil production, and relative price

4 U.S. EIA, STEO, March 2014, U.S. Crude Oil Production (March 11, 2014)

5 Id., Total Petroleum Net Imports

6 SAFE analysis based on data from: IEA, OMR, February 2014, Table 2

7 Id.

8 U.S. EIA, STEO, March 2014, Imported Crude Oil Price

Structural Dependency

Definition: A country's structural dependence on oil due to capital stock and other economic factors. The structural dependency metrics typically change slowly over time, providing relatively consistent measures of vulnerability regardless of prevailing price conditions.

Oil Intensity captures the volume of oil consumed per unit of GDP (in this case, per \$1,000 of GDP). As such, oil intensity is a direct measure of the structural importance of oil in a country's economy and is perhaps the most meaningful measure of "oil dependence." Oil intensity changes little over short time periods and is almost entirely determined by oil-use efficiency levels, fuel diversity, and economic growth.

Fuel Consumption per Capita uses the size of a country's population, as opposed to the size of its economy, to contextualize oil consumption. This measure can be useful in comparing the different levels of oil consumption of countries with vastly different population sizes or GDPs. Fuel consumption per capita can give insight into a country's level of oil efficiency or its future demand growth potential.

Economic Exposure

Definition: A country's direct economic exposure to oil price volatility. Economic exposure is a function of structural dependency, but it is also more heavily driven by exogenous changes in global oil prices, and therefore variable over time. Economic exposure is measured by spending on oil across typical indicators like GDP and the current account.

Total Spending on Oil as a Percentage of GDP is the most straightforward measurement of a country's economic exposure to oil. Changes in oil prices have direct effects on the ability of governments, businesses, and consumers to effectively plan, budget, and make expenditures. Transportation can be particularly sensitive to changes in oil prices, as oil is the predominant fuel in the sector and there are few substitutes (demand is therefore highly inelastic).

Total Spending on Net Oil Imports as a Percentage of GDP shows the extent to which countries rely on imported oil. This indicator provides a measurement of revenue either earned or spent through the oil trade and, therefore, oil's effect on a country's current account balance.

Oil Exports as a Percentage of Total Exports by Value highlights the degree to which the economies of oil-producing countries are dependent on oil revenues for economic growth. In other words, "oil dependence" should be evaluated not only in terms of an economy's consumption requirements, but also its production and export requirements. Just as oil price spikes are devastating for many consumers, oil price collapses are highly problematic for non-diversified producers.

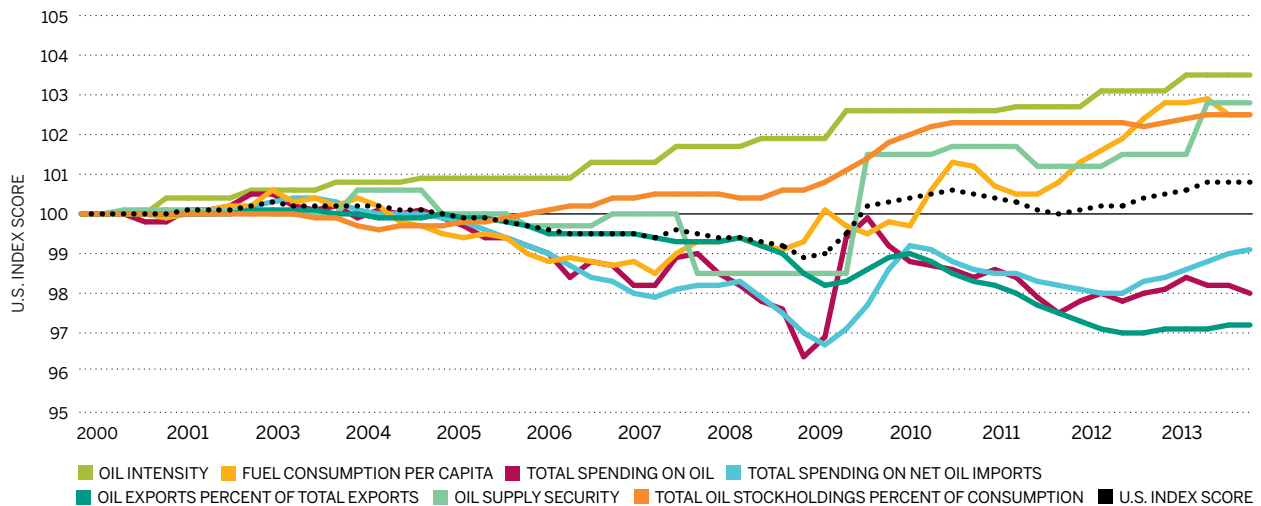
Supply Security

Definition: A country's vulnerability to physical supply disruptions and its response capabilities. While supply disruptions are typically addressed by price changes, the adjustment period can be highly damaging for import-dependent countries, especially if adequate and appropriate emergency inventories are unavailable.

Oil Supply Security is a proxy for the risk of disruption to a country's oil supply in both the short term (e.g. political instability and terrorism) and long term (e.g. tax and regulatory schemes). This metric accounts for the differences in risk between the sources of supply that a country relies upon to meet its needs (in some instances, both domestic production and imports from a selection of other countries).

Total Oil Stockholdings as a Percentage of Consumption indicates how prepared a country is to meet its own short-term needs in the event of a physical disruption to oil supplies. Total stockholdings include commercial inventories (held by companies) and public reserves (held by governments).

FIGURE 1
U.S. Index Score and All Metric Scores,
Q1 2000 to Q4 2013



Source: SAFE/RGE analysis

stability. Further, U.S. oil production has effectively offset disruptions to output in other countries, including Libya, Iraq, Iran, and Nigeria. These dynamics have seen the United States move from a low of seventh in the Index rankings (most recently in Q2 2007) to a rank of sixth in Q4 2013.

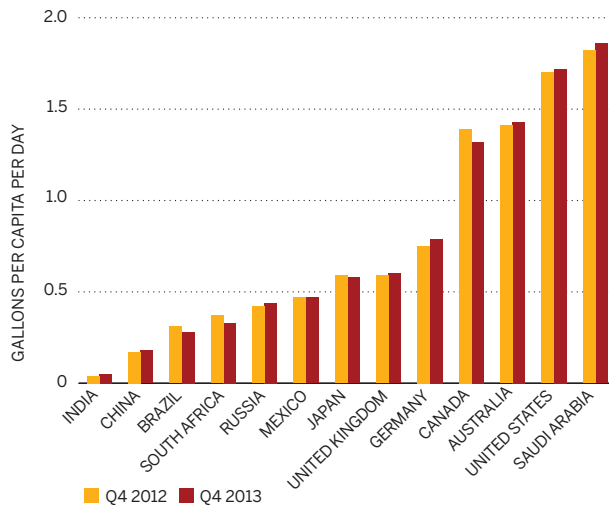
Both Structural Dependency metrics have improved as the U.S. economy has gradually become more oil efficient and American consumers have decreased their fuel use since the mid-2000s. Oil Intensity has steadily improved, falling by nearly one third, from 0.75 barrels per \$1,000 of GDP in 2000 to 0.56 in Q4 2013. This trend corresponds to a normalized metric score of 103.5, the highest of any individual score over the time period (see Figure 1). This improvement is predominantly due to the efficiency of oil use rising at a faster average rate than GDP since 2000. Consumers have also decreased consumption in response to higher oil prices since 2007. In part this shift has resulted from improved vehicle fuel efficiency (the average fuel efficiency of the light-duty vehicle fleet increased by more than 15 percent between 2007 and 2012, from 26.6 to 30.8 miles per gallon).⁹ However, a decline in vehicle miles traveled due to high unemployment and reduced economic activity during the recession was a much larger contributor. Over the long term, as economic growth recovers, rising vehicle efficiency will play a greater role in moderating total U.S. oil consumption.

Changes in the Economic Exposure metrics have largely followed upward and downward movements in global oil prices. This is particularly obvious in the Total Spending on Oil as a Percentage of GDP metric. Specifically, record-high prices that reached \$147 per barrel in July 2008 resulted in this metric reaching 4.7 percent in Q3 2008, corresponding to a normalized score of 96.4, the lowest of any metric since 2000. The Total Spending on Net Oil Imports as a Percentage of GDP metric has also tracked price movements to a certain extent. However, the impact of declining net oil imports (due to rising domestic oil production and generally lower levels of consumption) is noticeable in more recent years as the evolution of the two metrics has begun to diverge (see Figure 1). Although the Oil Exports as a Percentage of Total Exports by Value metric score has decreased, the U.S. economy remains highly diversified, limiting its exposure to any decreases in oil revenue that could result from a sharp decline in global oil prices. Moreover, U.S. oil exports are almost exclusively of refined petroleum products, which are of higher economic value than crude oil and require a refining infrastructure that complements domestic exploration and production activities.

The Oil Supply Security metric has experienced substantial shifts as a result of changes in consumption and production since 2000. The most obvious is the decline from 6.1 in the early 2000s to 5.8 in 2007 as imports rose to exceed 12 mbd from 2005 to 2007 and oil had to be sought from additional (and on average less politically stable) locations. However, a concurrent

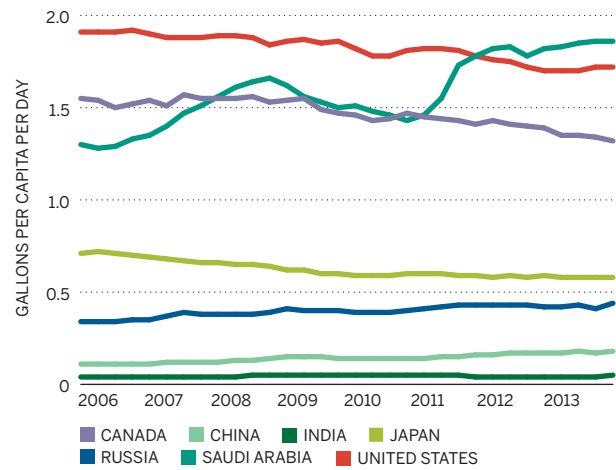
⁹ U.S. Department of Transportation, Summary of Fuel Economy Performance (April 25, 2013)

FIGURE 2
Fuel Consumption per Capita,
Q4 2012 and Q4 2013



Source: SAFE/RGE analysis

FIGURE 3
Fuel Consumption per Capita,
Select Index Countries, Q1 2006 to Q4 2013



DATA TRENDS
FUEL CONSUMPTION
PER CAPITA

Fuel consumption per capita in less developed countries is substantially lower than in the United States, but growing, driven in part by increased vehicle ownership. For example, per capita fuel consumption in China has more than doubled from 0.08 in Q4 2003 to 0.18 in Q4 2013.

decline in consumption accelerated into 2008 as prices hit historical highs. This decline was then intensified by the onset of recession, which coincided with the emergence of meaningful increases in domestic oil production. As a combined result of declining consumption and surging production, the rising import trend began to reverse. Net crude oil imports fell from 9.8 mbd in 2008 to 7.6 mbd in 2013,¹⁰ strengthening the Oil Supply Security metric substantially and propelling it to new highs in recent quarters (the metric result reached 6.5 and the score 102.8 in Q2 2013). With stockholdings experiencing very little overall change during the time period, declining consumption has had a similarly positive effect on the Total Oil Stockholdings as a Percentage of Consumption metric (see Figure 1).

SHORT-TERM OUTLOOK FOR THE U.S. OIL SECURITY INDEX SCORE

While many of the country’s individual metric scores have improved in recent years, a return of high and volatile prices remains a serious and unpredictable threat

to U.S. oil security. A recent example is supply outages in Libya in early 2011 that caused global oil prices to spike and contributed to a decline in U.S. oil security as measured by the Index. This decline occurred despite positive trends of rising efficiency and falling oil imports (and even though U.S. imports of crude oil from Libya averaged less than 1 percent of total imports in late 2010 and early 2011).¹¹

Today, the market once again appears susceptible to price volatility given supply outages in Iran, Iraq, Nigeria, and Libya (again), that have resulted in global spare oil production capacity falling to just 1.7 mbd and 2.0 mbd in Q3 and Q4 2013 respectively¹²—a level that provides a very limited amount of flexibility in the event of further outages. Perhaps the most immediate threat to global oil supplies (beyond worsening violence in Iraq) is the prospect of political upheaval in Venezuela. Venezuela not only contributes 2.2 million barrels of crude oil to the global oil market each day, but also, unlike Libya, is a major exporter to the United States (approximately

10 U.S. EIA, STEO, March 2014, Crude Oil Net Imports

11 SAFE analysis based on data from: U.S. EIA, U.S. Imports by Country of Origin

12 U.S. EIA, STEO, March 2014, Table 3c

800,000 barrels per day in 2013).¹³ Any disruption to oil supplies from Venezuela, therefore, would likely have implications for the United States beyond price volatility.

The 0.8 point increase in the combined score since Q3 2011 is evidence that the trends of increasing domestic oil production and improving efficiency are strengthening U.S. oil security even in a historically high-price (although less price-volatile) environment. Stronger insulation of the U.S. economy from the effects of high

and volatile prices will be achieved by further reducing oil intensity and fuel consumption per capita in particular. Continued increases in the Economic Exposure metric scores (assuming that they are not caused by temporary declines in oil prices or U.S. economic activity) will be indicative of growing resilience. Increasing domestic oil production will also have a positive effect on the Total Spending on Net Oil Imports as a Percentage of GDP and Oil Supply Security metric scores, both of which either remain below—or have been below—100 for most of the time period, dragging down the combined score.

13 Id.; and U.S. EIA, U.S. Imports by Country of Origin

UPDATES TO THE OIL SECURITY INDEX METHODOLOGY

In this quarterly update, two minor adjustments were made to the methodology. The first adjustment relates to how the country results are normalized into relative rankings. Rather than being normalized by the mean and standard deviation, the results are now normalized on a zero to ten scale (weakest to strongest relative oil security). The zero to ten scoring scale is established by calculating the bottom and top 10 percentiles across the entire data set (from Q1 2000 to Q4 2013). The second adjustment was made to the Oil Supply Security metric. This metric now uses a modified, more targeted version of Roubini Global Economics' (RGE) Social, Institutional and Regulatory Risk (SIRR) Index. It focuses on political risk (one of the three components of SIRR) and a simple average of RGE's terrorism risk and political institutions scores.



The Oil Security Index is an analytical tool developed by Securing America's Future Energy in partnership with Roubini Global Economics. The Index is designed to enable policymakers and the general public to measure and compare the relative oil security of more than a dozen countries around the world.

Learn more at OilSecurityIndex.org



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