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THE NEW OIL PARADIGM: CAN THE DEVELOPING WORLD LIVE WITH $100 PLUS OIL?

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SIEMS MONTHLY BRIEFING

SKOLKOVO Institute for Emerging Market Studies
Moscow School of Management
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"Cycles of shortage and surplus characterize the entire history of oil."
Daniel Yergin

I. INTRODUCTION

The US Department of Energy calls oil "the lifeblood of modern civilization." Approximately 85 million barrels are consumed each day. Oil currently supplies 37 percent of the world's energy demand. It powers nearly all of the world's transportation, without which production and trade would grind to a halt.

Since oil was first successfully drilled in Titusville, Pennsylvania in 1859, demand for it has been strongly linked to the rate of global economic growth. Conversely, this relationship has gone the other direction. It is no coincidence that 10 of the past 11 U.S. recessions in the post World War II period were preceded by significant oil price increases. Energy price shocks may not be the sole reason for economic contractions but the evidence is strong they have played a significant role.

Despite a tepid global economic recovery, oil prices have since recovered handsomely, having roughly doubled from their recent low

Last decade witness a protracted bull market in oil prices that culminated in a price peak of almost $150 a barrel by June 2008[1]. What distinguished this five year price appreciation was not a supply shock as in previous cycles, but exceptionally strong global economic activity, particularly from the emerging market economies. The sharpest global contraction in world output since the Great Depression quickly brought energy prices spiraling downward, hitting a recent low of $39 per barrel in February 2009. Despite a tepid global economic recovery, oil prices have since recovered handsomely, having roughly doubled from their recent low as of this writing. If the global economy returns to growth rates similar to those experienced during the 2003-2008 period, we are likely to see significantly higher energy prices over the short and medium horizon. This raises a critical question. What is the likely impact of significantly higher oil prices on economic activity, particularly in the dynamic and fast moving emerging market economies?

This paper will attempt to estimate the likely vulnerabilities of the largest emerging market economies (including some developed ones) to a price rise similar to what the world experience in the latter half of last decade. In contrast to the large-scale modeling "black box" approach favored by large institutions such as the International Energy Agency (IEA) or the IMF, our approach to estimating the impact of higher oil prices will utilize a simple but accurate algebraic model with clear assumptions. This methodology will provide policymakers with a much more transparent model in estimating the impact of energy price movements on economic growth.

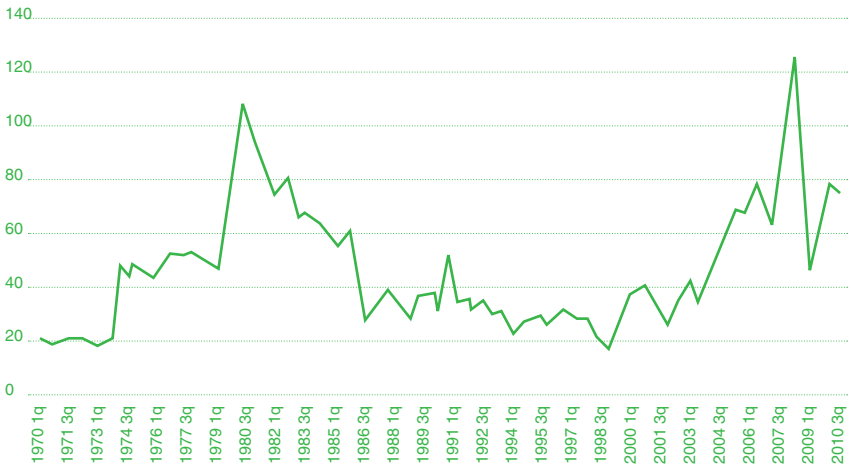
[1] Unless otherwise stated, oil prices quoted are West Texas Intermediate (WTI).

II.
THE NEW ENERGY PARADIGM

A distinctly new paradigm in the global crude oil markets has been unfolding in recent years. Stagnant demand among the rich, developed economies, who historically have been the largest consumers of crude oil, is being more than offset by increased demand from the emerging market economies (EMEs). Oil use in the developing world has been rising robustly, even during the most recent global recession. This is the first time oil prices have rallied while the developed economies have been growing so sluggishly.

The EMEs share of the world's oil market has been increasing even faster than their share of global GDP

FIGURE 1/ Real Price of Crude Petroleum (in 3rd Quarter 2010 dollars per barrel)



Source: EIA, BLS
Note: Quarterly average of West Texas Intermediate divided by the ratio of the consumer price index (1970 Q1 through 2010 Q2).

The EMEs share of the world's oil market has been increasing even faster than their share of global GDP. Growth in oil demand in the developing countries has averaged 5% a year since 1970, compared with only 1% per year growth in the developed world. EMEs consumed approximately one-quarter of the world's supply of crude oil during the 1970s. This share hit 40% in 1997and then in 2007 – for the first time – energy use among non-OECD nations exceeded that among the affluent OECD nations.

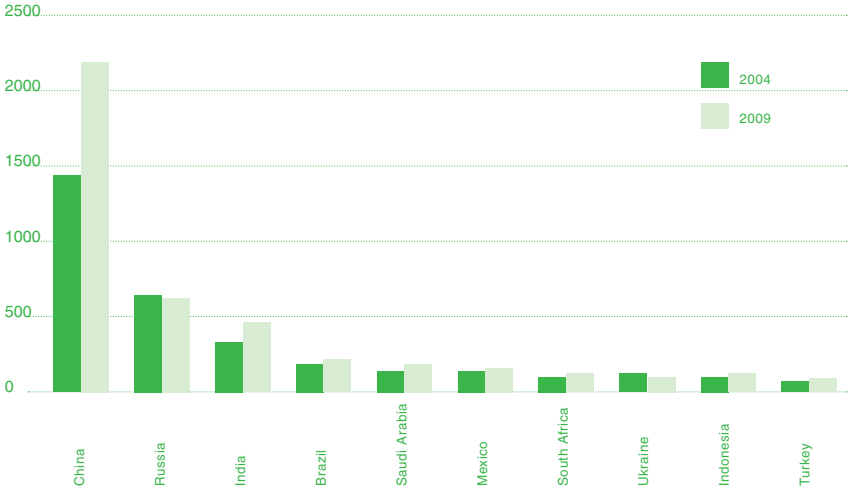
Unlike the big oil supply shocks of the 1970s and early 1990s (Iraq's invasion of Kuwait), the price shock last decade was primarily driven by

brisk demand from the EMEs.[2] For example, world GDP clocked in a 4.9% average rate of growth during 2003-2007 compared with a 2.9% average pace over the robust 1990s. Despite the more than tripling in crude oil prices between 2004 and 2009, primary consumption of energy in the EMEs increased by 30% during the same period, reaching 5,149 million tons of oil equivalents in 2009. China alone accounted for 62% of the increase between 2004 and 2009 (section IV provides more detail of the growth in Chinese demand). Real oil prices (after adjusting for inflation), even surpassed their peak reached during the late 1970s (i.e. – the Iranian revolution), illustrating how income growth dominates price increases in determining growth in oil demand over the short and medium term.

Unlike the big oil supply shocks of the 1970s and early 1990s (Iraq's invasion of Kuwait), the price shock last decade was primarily driven by brisk demand from the EMEs

Emerging market Asia is by far the region most dependent on oil imports. Most countries import almost all of their petroleum consumption and only Malaysia is a net exporter. Indonesia was a long time OPEC member but became a net importer in 2004. Africa only consumes approximately 4% of the world's crude oil. Five EMEs countries dominate the continent's

FIGURE 2. Top 10 largest consumers in emerging market economies: 2004 and 2009 (Million tons of oil equivalent)



Source: BP Statistical Review of Energy

[2] The supply of oil failed to rise adequately during this period to meet rising demand, contributing to the sharp rise in energy prices.

upstream oil production. They are, in decreasing order of output, Angola, Nigeria, Libya, Algeria and Egypt.

In emerging Latin America, Mexico and Brazil had the highest oil production in 2009. The discovery of huge oil reserves in Brazil's Tupi field will make Brazil a significant net exporter by the end of this decade. Revenues from oil production are a critical factor driving economic growth in Mexico. However, oil production is dropping and proven reserves are also decreasing rapidly. As a result, many analysts believe that the country could become a net importer with a few years.

China, Russia and India were the largest consumers of energy for EMEs in 2009. However, while China and India have limited domestic energy resources and are net importers of petroleum fuels, Russia was the second largest oil producer and net oil exporter in the world in 2009, and possesses the world's largest natural gas reserves. In Russia, GDP contracted by 7.9% in 2009 as the value of mineral fuels exports fell by 35%.

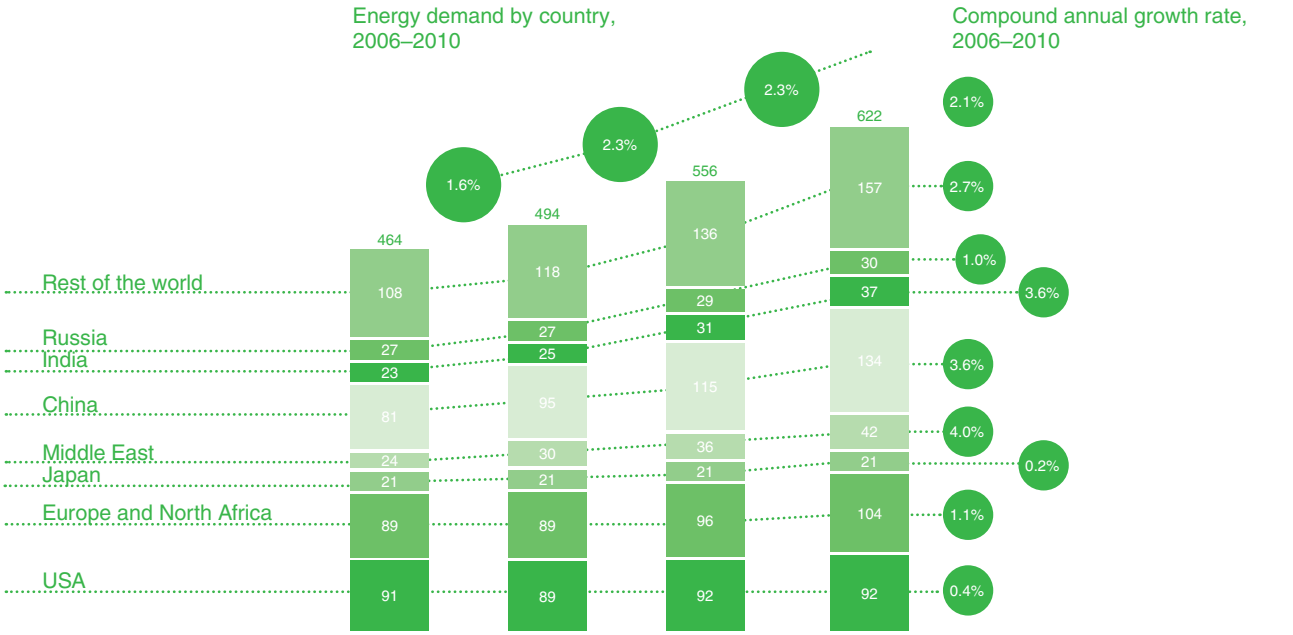
III. WORLD ENERGY DEMAND WILL BE DRIVEN BY THE DEVELOPING ECONOMIES

After declining for two consecutive years due to the global economic downturn, oil demand is expected to rise again in 2010, driven by demand growth in the EMEs. While energy efficiency is improving throughout much of the developing world, the income elasticity of petroleum demand in many of the EMEs exceeds unity[3] (in the developed economies like the United States, the figure is approximately 0.5). As a consequence, as a higher share of global economic growth emanates from the EMEs, growth in oil demand should remain robust. This is the primary reason why oil prices rose so rapidly late last decade.

Once global GDP growth rebounds to its long-term trend (4–5%), it follows that energy-demand growth will also strengthen. According to McKinsey, energy demand growth is projected to recover and grow 2.3% annually over the next

As a higher share of global economic growth emanates from the EMEs, growth in oil demand should remain robust. This is the primary reason why oil prices rose so rapidly late last decade

FIGURE 3/ Compound energy-demand growth by countries and regions (2006-2020)



Source: McKinsey Global Institute – Global Energy Demand Model 2009

[3] The income elasticity of petroleum demand tells us the relationship between growth in income and oil demand. An elasticity of 1.5 for example, implies that for every 1% increase in real GDP, oil demand increases by 1.5%.

decade (2010–2020), nearly a percentage point faster than from 2006 to 2010. If this comes to bear, the tight demand-supply balance seen at the end of 2007 that led to $100 plus per barrel prices could easily return.

More than 90 percent of this demand expansion in energy is expected to come from the EMEs. Energy use in non-OECD Asia is expected to show the most robust growth of all the non-OECD regions, rising by 118 percent from 2007 to 2035.[4] However, strong growth in energy use also is projected for much of the rest of the non-OECD regions. According to McKinsey, the Middle East will have the fastest-growing energy demand of any major region, growing 4% annually from 2010-2020, driven by the expansion of industrial capacity to take advantage of the Middle East's oil and gas supplies, as well as continuing growth in the region's vehicle stock and ongoing energy subsidies to businesses and consumers. China and India come in a close second, with annual demand expected to rise 3.6% over the same period.

In Central and South America and Africa, energy consumption is expected to rise by about 2% annually over the next decade. The slowest projected growth among non-OECD regions is for non-OECD Europe and Eurasia, which includes Russia and the other former Soviet Republics. Growth in energy use for the region totals 17 percent from 2007 to 2035, as its population declines and substantial gains in energy efficiency are achieved through the replacement of inefficient Soviet-era capital equipment. Energy demand growth is expected to be almost flat in the United States (0.4%) and Japan (0.2%) over the next decade while Europe will see energy demand growing at a rate of some 1%, reflecting the inclusion in this region of many developing economies. According to the IEA, by 2020, non-OECD economies are expected to be consuming 32% more energy than the OECD economies.

Unless economic growth unexpectedly tumbles from current levels, China and India will have the greatest impact on demand growth. Since 1990, energy consumption as a share of total world energy use has increased significantly in both countries, and together they accounted for about 10 percent of the world's total energy consumption in 1990 and approximately 20 percent in 2008. Energy use is projected to more than double and account for 30 percent of total world energy consumption by 2035. In contrast, the US share of world energy consumption is expected to fall from 21 percent in 2007 to about 16 percent in 2035.

According to the IEA World Energy Outlook 2009, China is expected to overtake the US around 2025 to become the world's largest spender on imported oil and gas, while India is likely to overtake Japan soon after 2020 to become the world's third largest importer.

[4] According to the IEA.

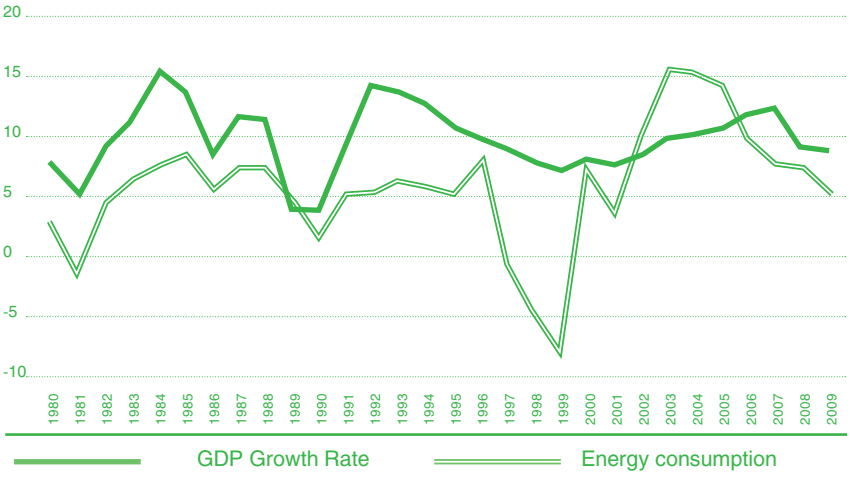
IV. SPOTLIGHT – ENERGY HUNGRY CHINA

China's impact on the energy markets the past few years has been so awesome it warrants additional analysis and commentary. According to the IEA, China surpassed the US as the largest consumer of energy in 2009, a position the US has held since at least the beginning of last century.[5] Unlike most of the developed nations, however, China's major source of energy is coal, accounting for approximately 70% of consumption. Crude oil accounts for a relatively small share in China's energy mix. But while the relative importance of crude oil in primary energy consumption is fairly stable, (it made up about 20% of energy consumption in both 1980 and in 2007), domestic production has not kept pace. The share of crude oil in total energy production fell from 24% in 1980 to just 10% by 2008 as oil production in China became more challenging and costly.

While China's energy consumption has expanded briskly since the start of economic reforms, its growth rate (in real terms) remained well below its growth rate of real GDP until 2002. Between 1980 and the late 1990s, GDP quadrupled but energy consumption only doubled thanks to a massive shift of Chinese industry from heavy to light industries (e.g. textiles, leather, electronics)[6] and to gains in energy efficiency.[7]

Then in the middle of last decade, China's energy demand literally exploded, growing between 10–15% annually for five consecutive years.

FIGURE 4/ Chinese GDP Growth Rates and Energy Consumption 1980–2009



Source: China Statistical Yearbook

[5] China's National Energy Administration denies this finding by the IEA, and claims the US is still the largest consumer of energy worldwide.

[6] From FIW Research Reports 2009/10. "China's foreign oil policy: genesis, deployment and selected effects.

[7] The amount of energy used to generate one unit of GDP fell significantly from 3.4 tons of coal equivalently per 10,000 Yuan GDP in 1980 to 1.2 in 2007.

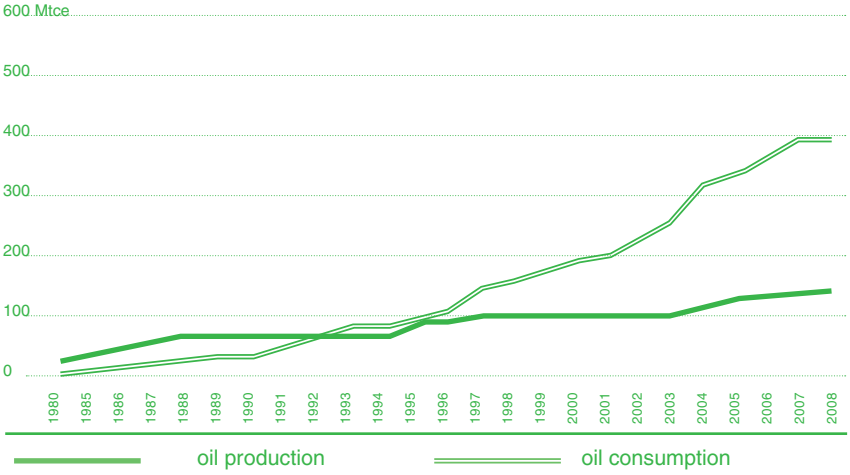
China's rising demand for crude oil during this period was caused by the ever-increasing consumption of petroleum products for transportation and to a smaller extent for construction activities. Driving this has been China's rapid urbanization, higher per capita incomes and the surge in motor vehicles sales (motor vehicles sales rose from 3 million units in 2005 to 13 million in 2009). This spike in energy demand was an important determinant for the rise in oil prices during this period.[8]

China was a net exporter of petroleum until 1992, and its imports as recently as 1998 were only about 750,000 barrels per day (b/d).[9] But by 2009, China's net imports had reached a staggering 5 million b/d, second only to the US. While coal may still be king in China, the Middle Kingdom is now the world's second largest consumer of crude after the US, and by far the largest source of new demand.

> While China has a credible program to reduce energy intensity throughout its economy, rising per capita consumption will easily swamp incremental improvements in energy efficiency

Are the recent trends in oil consumption and net imports likely to persist in China? The short answer is an unqualified affirmative. While China has a credible program to reduce energy intensity throughout its economy,

FIGURE 5/ Crude oil production and consumption in China (1980–2008)



Source: China Statistical Yearbook

[8] Chinese energy consumption rose four times faster than predicted by the IEA over this period.

[9] According to the Chinese Statistical Yearbook, China became a net importer in 1992, but according to the IEA, this first occurred in 1996.

rising per capita consumption will easily swamp incremental improvements in energy efficiency.[10] China's oil consumption doubled over the past decade, and economic growth remains highly energy intensive. The current energy consumption per $1,000 of GDP in China is 0.57 tons of oil equivalent (toe), significantly higher than those of Germany (0.09), Japan (0.12) and the US (0.17). During 2009, China used about 2.25 barrels of oil per person. For comparison, Mexico, another EME, used 6.7. Chinese per capita oil consumption would have to triple to even match Mexico's levels.

The consensus forecast by many analysts have China consuming approximately 20 million b/d by 2020 (about as much as the US is currently consuming), and then having consumption double again to 40 million b/d by 2030.

The IEA projects a slow decline in China's oil production over 2015-2030. Correspondingly, China's import dependency ratio (share of oil consumption that is imported) is expected to rise from 53% in 2009 to ranges of 61%–72% in 2020 and 76%–79% by 2030.

[10] Energy intensity measures the amount of energy used to produce a unit of economic output.

V.
OIL'S ECONOMIC IMPACT

How might $100 plus oil per barrel impact the global economy? If the higher petroleum prices are largely a consequence of faster global economic activity (i.e. – a demand shock), as they were last decade, then higher prices are unlikely to significantly dampen the level of quantity demanded, particularly over the short-run. First, studies have shown that the short-run (less than one year) price elasticity of demand for oil is somewhere around -0.1%. That means, holding everything else constant, a 10% increase in price would only reduce quantity demanded by 1%. Secondly, the income elasticity effect (the increase in demand for oil as a result of faster income growth) would more than offset any demand destruction resulting from higher prices over the short-run.

Energy price increases, very simply, cause a transfer of income from oil importing to oil exporting countries

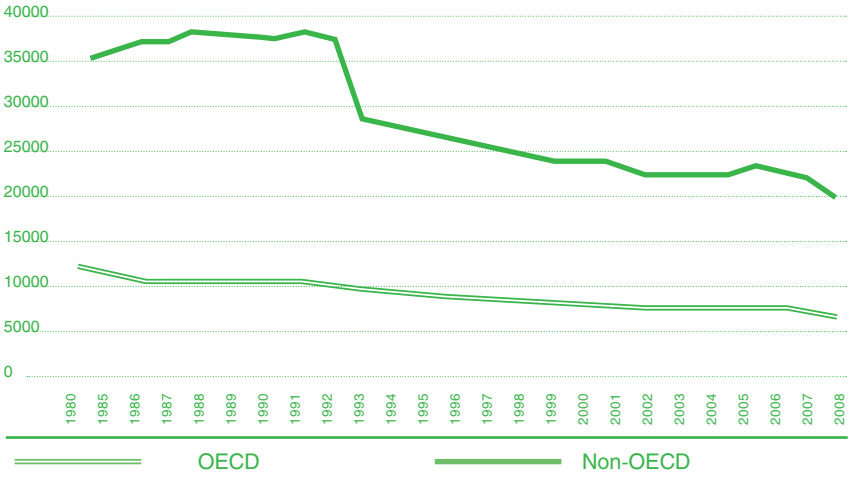
Energy price increases, very simply, cause a transfer of income from oil importing to oil exporting countries. Oil price increases act as a tax for net oil importing economies.[11] The main determinant of the size of the initial net loss of global GDP is how OPEC and other oil-exporters spend their windfall oil revenues. In many oil exporting countries, a significant proportion of higher oil revenues accrue to the government. The reaction of these governments is likely to depend on the underlying financial conditions in each of these countries.[12]

The boost to economic growth in the oil-exporting countries provided by higher oil prices in the past has always been significantly less than the loss of economic growth in the importing countries, such that the net effect has always been distinctly negative for global economic growth. This is largely because the marginal propensity to consume of the net oil importing countries that lose from higher prices is generally higher than those of the exporting countries.[13]

While the EMEs seem better prepared to handle higher energy prices than the developed economies because their public, corporate and household sectors are significantly less leveraged than they were a decade ago, they also consume three times more energy for a given level of output (2007 figures). While energy intensity has been falling for the EMEs as a group, it is still increasing in many developing countries as modern commercial fuels

[11] Actually they are worse than tax increases for oil importing nations because the central government derives no revenue gain.
[12] Both the IMF and OECD simulations assume that oil exporters would spend around 75% of their additional revenues on imported goods and services within three years.
[13] An oil price increase also changes the balance of trade and exchange rates between countries. Net oil importing countries normally experience deterioration in their balance of payments and a worsening in the terms of trade, putting downward pressure on their exchange rates.

FIGURE 6/ Energy Intensity. Total Primary Energy Consumption per Dollar of GDP (Btu per Year 2005 U.S. Dollars)



Source: International Energy Agency

replaces traditional fuels in the household sector and industrialization, motorization and urbanization take root. The vulnerability of oil importing EMEs to higher prices is also exacerbated by their limited ability to switch quickly to alternative fuels, the prices of which may be increasing more slowly than those of oil products.

That said, the western economies are highly leveraged right now, with record levels of debt in both their private and public sectors. Given their anemic recoveries and necessity to reduce debt levels in the coming years, the developed economies are in a much more precarious condition than they were during the run up in oil prices last decade.

Section VI provides a simple and transparent model for estimating the impact of higher oil prices on economic growth by region and by country.

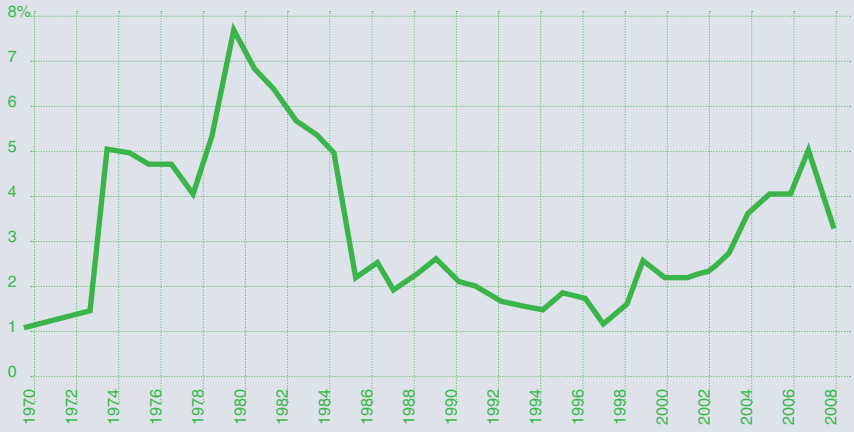
CAN OIL PRICES BE TOO HIGH OR TOO LOW?

Figure 7 plots global petroleum consumption as a share of GDP since 1970. Despite the huge fluctuations in the relative price of oil over this period, petroleum consumption tracked income growth remarkably steadily. The two oil price shocks of the 1970s caused a big spike in petroleum's share of world GDP, hitting 5% during the first shock (1973) and then a record 7.5% of GDP during the second shock in 1979. There was a significant downward adjustment in oil use at the end of the 1970s, though achieving that 20% drop in petroleum consumption required an 80% increase in the relative price and a very deep recession over 1980-82.

Thereafter, for two full decades, petroleum's share remained historically low and fluctuated little. This is in part attributed to delayed conservation consequences of the 1970s oil shocks. The flatter slope persisted, however, long after the price had fallen quite dramatically and seems more likely to be due to the fact that the income elasticity of demand for oil was declining rapidly in the developed countries. The long bull market in oil prices last decade pushed oil's share of world GDP from a recent historic low of 1% in 1998 (during the emerging market crisis) to of peak of 5% of GDP by 2008. The deep global 2008-09 recession pushed average annual oil prices down from an annual average of $97 in 2008 to $62 in 2009, reducing oil's share of global GDP to 3.3%.

The volatility in oil prices and their share of world income begs the following question: "Is there a sweet spot for oil prices?" Oil prices at $75 a barrel would put petroleum's current share of world GDP at approximately 4%. When oil expenditures account for more than 5-6% of global GDP, it is absorbing too much of global income. It also, however, provides many incentives for substitutes. At 1-2% of global GDP, conversely, prices are too low because end user demand grows very rapidly and upstream investment does not. There is a growing consensus that the "sweet spot" appears to be somewhere near 3-4% of global expenditures. That translates into a current oil price near $60-$75 a barrel. At $100 and $120 per barrel, oil expenditures account for 5.1% and 6.2% of GDP, respectively.

FIGURE 7/ Where is the Sweet Spot? Oil expenditure as a share of World GDP



Source: International Energy Agency

VI.
THE MODEL

For policymakers and economists, it has been very difficult to find a consistent, transparent and easy to understand methodology that can be used when analyzing the relationship between oil prices and the economy. Traditionally there has been little choice but to recite the results of studies conducted by large institutions like the IMF or the IEA who typically utilize complex large scale models which can best be described as a "black box". If it were possible to calculate an index expressing the relationship between changes in oil prices and economic growth in a format that even nonmodeling experts could understand, such a methodology would be of considerable use in policy discussions.

Fortunately there exists such a model, although perplexingly it seems to have received little attention or use in policy circles. We borrow this model from Akira Maeda's work (2008) on the oil price-GDP relationship. Maeda's model is based on simple algebra and clear assumptions, providing a more transparent and intuitive understanding of the impact of changes in oil prices.

Using a static general equilibrium model, we can show that the sensitivity of GDP to movements in oil prices, or the oil price-real gross domestic product (GDP) elasticity, can be estimated with only four variables: current oil prices, GDP, and oil imports and exports.[14]

$$\eta = (dY/Y)/(dp/p) = -p(M-X)/Y \qquad (1)$$

where:

Y – real GDP
P – price of oil
M – volume of oil imports
X – volume of oil exports

The price of oil is a simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh. Export and import oil volumes are denominated in barrels.

Equation (1) is self-evident and easy to understand. The sensitivity of real GDP to fluctuating oil prices (η) is equal to the current ratio of net oil imports to GDP. Intuitively, countries with larger net imports relative to output would be more adversely impacted by higher oil prices. Conversely, net oil exporting nations would benefit proportionally from higher oil prices.

Equation (1) can be modified to show the percent change in real GDP as a direct function of the percent change in crude oil prices:

$$\Delta Y/Y = -p(M-X)/Y * (\Delta p/p) \qquad (2)$$

In other words, equation (2) shows the percent change in real GDP equals the percent change in oil prices times oil expenditures' share of real GDP.

[14] The derivation for equation (1) is taken directly from Maeda (2008), pp. 101 – 106.

Note that this simple model captures the vulnerability of a country that is a net importer regardless of whether a nation subsidizes wholesale or retail energy prices. For example, many EMEs heavily subsidize their retail energy prices. If a country were to keep retail prices constant in the event of a significant rise in crude oil prices, then the entire cost would be initially borne by the government sector. In this case the present value of the future tax increase would equal the incrementally higher cost of imported oil. In other words, regardless of whether prices are controlled or not, equation (2) captures the net cost.

This model also captures any changes in a nation's oil intensity over time. As a country becomes more energy efficient, its ratio of net oil imports to its GDP will fall (holding energy prices constant).

VII. OIL SHOCK ESTIMATES

In this section we estimate the impact of higher oil prices on real GDP growth rates using equation (2). We use $75 as our benchmark price for a barrel of crude oil for two reasons. First, it has roughly hovered around this level since the modest rebound of the global economy in 2010. Secondly, many analysts estimate that that this is currently the marginal cost of production for oil.[15] From this benchmark price we estimate the impact on real GDP growth rates when crude oil prices are averaging $100 and $120 per barrel over a full year. These represent price increases of 33% and 60%, respectively.

At the current volume of trade in crude oil, a 33% and 60% rise would collectively cost importing nations $775 billion and $1.4 trillion, respectively, over the course of a full year

At the current volume of trade in crude oil, a 33% and 60% rise would collectively cost importing nations $775 billion and $1.4 trillion, respectively, over the course of a full year. With a $60 trillion global economy, this amounts to 1.3% and 2.3%, respectively, of world GDP. How much of this transfer would be spent by the net exporting countries in the same year is difficult to estimate and would vary greatly based on underlying economic conditions. As a consequence, these figures are a maximum estimate of the cost to the global economy. Moreover, many consumers from the oil importing countries would reduce current savings to help offset the impact of lower real wages. Nevertheless, the reduction in any savings is a real loss whether it reduces spending today or in later years.

The OECD countries are a lot less vulnerable to an oil shock (holding the size of the price shock constant) compared to the late 1970s and early 1980s. Oil expenditures were at least 3% of GDP until the mid-1980s. Leaps in energy conservation and efficiency over the past three decades have significantly reduced their exposure. At our benchmark price of $75 per barrel, OECD oil expenditures amount to about 1.6% of their collective GDPs. Oil prices that averaged $100 and $120 per barrel for the entire year would clip the rich

The OECD countries are a lot less vulnerable to an oil shock (holding the size of the price shock constant) compared to the late 1970s and early 1980s

[15] In theory the price of oil should eventually return to its marginal cost of production but new sources of demand (from the EMEs) can outstrip supply (which is price inelastic) over the short and medium-term, keeping prices significantly above marginal cost.

club's economic growth rate by an estimated 0.5% and 1%, respectively.[16]

Falling production and rising import volumes (until the recent recession) had made the 16 member Euro-zone a little more vulnerable than the OECD as a whole despite gains in energy efficiency. Oil expenditures (at $75 per barrel) currently accounts for 2% of GDP so a similar price shock would shave a maximum of about 0.7% and 1.2% from annualized economic growth. For a region now averaging only 2% growth in an average year, however, this pullback could be quite significant. The U.S., easily the world's largest importer of oil, could see economic growth cut by as much as .6% and 1.1%.

TABLE 1. OIL PRICE-GDP ELASTICITIES AND ESTIMATES OF DECLINES IN REAL GDP AT $100 AND $120 PER BARREL OIL (ALL FIGURES IN PERCENT)

	Hη	$100	$120
US	-1.85	-0.6	-1.1
Japan	-2.4	-0.8	-1.4
China	-2.76	-0.9	-1.7
India	-4.5	-1.5	-2.7
OECD	-1.6	-0.5	-1.0
Eurozone	-2	-0.7	-1.2
Asia	-3	-1.0	-1.8
Turkey	-1.9	-0.6	-1.1
Brazil	-0.1	0.0	-0.1
Indonesia	-1	-0.3	-0.6
Russia	14	4.6	8.4

Source: IEA, SIEMS' calculations

Asia is clearly the region that is the most vulnerable to higher oil prices. Malaysia is the only country on the continent that is a net exporter of crude. At our benchmark price oil consumes a full 3% of GDP and $100/barrel oil cuts regional growth by 1% (1.8% for $120/barrel). Strong economic growth has increased the regions' appetite for energy enormously in recent years, more than offsetting recent gains in efficiency.

Asia is clearly the region that is the most vulnerable to higher oil prices

Indonesia, Asia's sole OPEC member, left the organization in 2008 because of falling production and the inability to find new reserves. With oil

[16] Unless otherwise noted, estimates are for the maximum economic impact to real GDP growth rates in the current year. Dissavings and spending by net oil exporters of their higher dollar surpluses would reduce the estimates.

only absorbing 1% of GDP, however, it would take a sizeable price increase to dent Indonesia's recently vibrant economy.

With coal still the prominent fuel source in China (see section IV), it seems at first glance higher oil prices might do little damage to China's growth prospects. But the huge surge in net oil imports in recent years has increased China's vulnerability. While hovered around 1% as recently as the beginning of last decade, its value has almost tripled since then. From 2005 to 2009, oil imports more than doubled. Oil at $100 per barrel would reduce China's annual growth rate by almost 1% while the 60% rise would shave off at most 1.7%.

Fortunately for China, energy inputs have helped the country produce growth rates of approximately 10%, so at second glance, they are less disruptive than for many of the much slow growing developed nations

Are these estimates potentially "large" setbacks for China? Fortunately for China, these energy inputs have helped the country produce growth rates of approximately 10%, so at second glance, proportionally speaking, they are less disruptive than for many of the much slow growing developed nations. An important caveat, however, concerning China, should be noted here. Its oil dependency is set to grow very rapidly over the next decade as production remains stagnate and consumption continues growing rapidly.

Among the big EMEs, India has become the most vulnerable in recent years

Among the big EMEs, India has become the most vulnerable in recent years. Oil production, which has been flat now for a decade, averages just 750,000 b/d. Consumption, however, has risen from 2.5 million b/d a day in 2005 to 3.2 million b/d in 2009. Oil consumes approximately 4.5% of India's GDP at $75 per barrel, and $100 oil would reduce economic growth by a maximum of 1.5% (a hefty 2.7% for $120 oil). For a nation critically trying to raise its growth rate north of 8%, these are not inconsequential energy drains.

Averaging approximately 8% growth from 2003-2009, it would seem that higher oil prices did not adversely impact India's top line growth. But India's oil dependency was much weaker early last decade, although it did rise in dramatic fashion late in the decade. India also heavily subsidizes retail fuels prices so the rise in India's structural budget deficit last decade, despite a widening tax base and revenues, probably assumed the lion's share of the energy cost shock. Again, this is a cost that will ultimately have to be borne in some manner in due time (higher taxes, lower spending, etc).

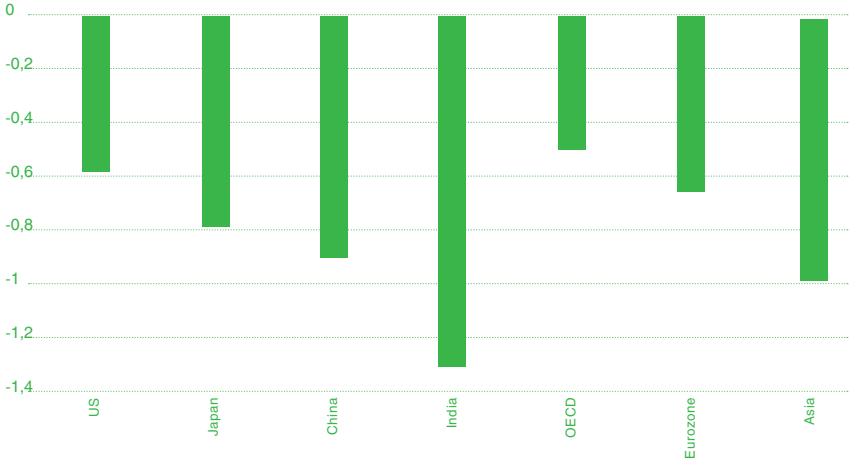
The impact of the price increase on Brazil is completely neutral (it will take toward the end of this decade for oil production to ramp up significantly from its newly discovered fields). In 2009, Brazil's daily average production and consumption of crude oil was approximately 2.5 million b/d.

As was illustrated last decade, the economic consequences of higher energy prices were awesome for Russia's economy

What about for a large net exporter like Russia? As was illustrated last decade, the economic consequences of higher energy prices were awesome for Russia's economy. The world's second largest producer and net exporter, Russia produced and consumed 9.9 and 2.8 million b/d, respectively, in 2009. Its oil price real GDP elasticity is a whopping 14%, implying a 33% average annual price shock alone would amount 4.6% of Russia's GDP (8.4% of GDP at $120 per barrel).

If these figures are accurate, why was Russia's real GDP growth rate not even faster last decade?[17] Recall that much of the oil revenue from Russia's state owned oil sector accrues to state coffers. Russia's Reserve Fund accumulates proceeds from the export of non-renewable natural resources. This is the primary reason Russian foreign exchange reserves exploded from $48 billion in 2003 to $456 billion by 2008. The 75% decline in oil prices (from peak to trough) also explains the almost 8% collapse in Russia's GDP in 2009.

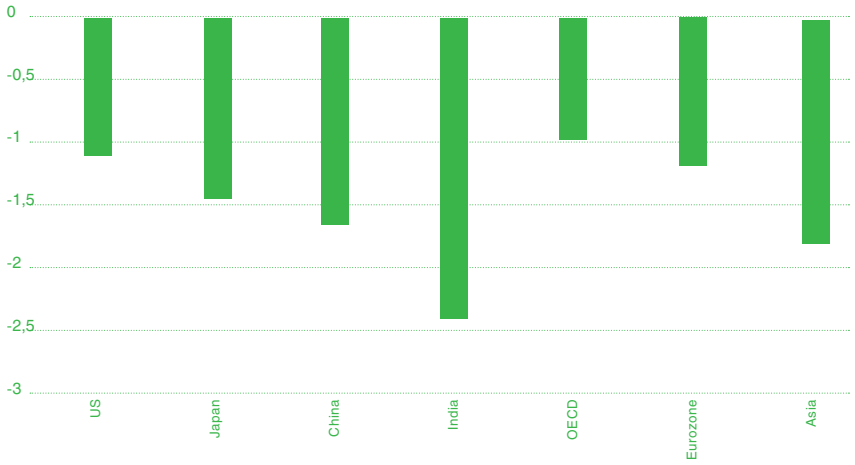
FIGURE 8/ Change in Real GDP Due to the price of oil rising from $75 to $100 per barrel (33% rise)



Source: IEA, SIEMS' calculations.

17 The Russian economy averaged real GDP growth of approximately 7% from 2000-2008.

FIGURE 9/ Change in Real GDP Due to the price of oil rising from $75 to $120 per barrel (60% rise)



Source: IEA, SIEMS' calculations.

VIII. CONCLUSIONS

At $60 - $80 per barrel, oil prices are probably somewhere in their "sweet spot". That is, at a level that is neither too high to depress global economic activity but neither too low in discouraging the movement toward alternative energy resources. Cycles of shortage and surplus, however, have characterized most of the industry's history, and oil prices can deviate from this sweet spot for protracted periods. Unfortunately for large net importers of oil, a new paradigm has been unfolding in recent years which could easily return us to $100 plus prices as the global economy gains traction from the deepest recession since the Great Depression.

The estimated declines to the OECD economies from higher energy prices were not particularly draconian because they have become more energy efficient over the past several decades. Unfortunately, their post-recession rebalancing woes has reduced their short-term growth potential and they are now actually much more vulnerable to higher energy prices today than they were last decade. Perhaps the worst aspect about the new oil paradigm for the developed world is the following: normally the developed economies received enormous energy price relief when their growth rates slowed markedly. Those days are long gone for now.

Of the two big net importing EMEs, India appears the most vulnerable over the short-run. Significantly higher oil prices will not trigger recessionary conditions there but it will worsen their structural budget deficit and jeopardize their chances of achieving their 10% growth potential. Despite the massive surge in Chinese oil imports in recent years, China remains relatively resilient to higher oil prices. But this resiliency to higher prices is quickly eroding.

Among the big EMEs, Russia will be the greatest beneficiary of higher prices. Unfortunately higher prices will probably kill any structural reform momentum Russia so desperately now needs.

Oil supply, beyond the scope of this paper, will obviously be a critical factor in moderating price increases as the global economy eventually returns to trend growth. Supply failed to keep pace with demand growth last decade and that pattern could easily be replicated if growth in the EMEs continues to surprise on the upside. Then there is always geopolitical risk, but we save that topic for another day.

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