ESTIMATES OF OIL PRICE ELASTICITY IN INDIA

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Received October 05, 2012
Accepted March 05, 2013

ABSTRACT
The relationship between oil price fluctuations and soaring growth rates of various economies has always attracted growing global concern. In general, the empirical research has found that during the period starting after World War II and extending through the 1970s, oil price shifts had a very large impact on economic activities. When data from the 1980s was added to the sample period, estimates of the oil price elasticity fell sharply. In fact, during the mid-1980s the structural relationship appeared to change and researchers began to entertain the possibility that oil prices had an asymmetric impact on economic activities. Oil price increases continued to have a negative (though smaller) impact on economic activities, however, large oil price declines failed to produce an economic boom. Research conducted over the decade of 1990s notes that oil prices have become more volatile while the impact on the economy appears to have continued to diminish. These researchers have concluded that the central bank response to oil price shocks has fundamentally changed over the years and that this shift has mitigated much of the negative impacts on real GDP and contributed to the reduction in the oil price elasticity. In this study, we re-examine the co-movement and the causality relationship between international oil price fluctuations and growth rates in India. It also aims at examining the role of Reserve Bank of India in controlling the impact of oil price shocks on economic activities in India.

Key Words: Crude oil price fluctuations, Oil price elasticity, Central Bank response, Soaring growth rates, Economies

INTRODUCTION
Crude oil has become one of the very significant factors contributing to economic growth since the middle of 20th century due to its singular importance in the supply of world’s energy demands. The appearance of alternative forms of energy (such as wind, water and solar as well as nuclear power), due to their inadequate supply, absence of technology to tap their potential and high costs, have still not been successful in reducing the dominance of crude oil as the main source of energy. Thus, the view prevails that there is a strong relationship between growth rate of a country and crude oil availability and oil-price changes.

A number of research studies suggest that oil price fluctuations have a major impact on economic activities. Whereas an oil price increase should affect the oil exporting countries positively and oil importing countries negatively, the reverse should be expected when the oil price decreases. The transmission mechanisms through which oil prices have an impact on real economic activities include both supply and demand channels. The supply side effects are related to the fact that crude oil is a basic input to production, and consequently an increase in oil price leads to a rise in production costs that induces firms to lower output and reduce investments, too. Oil prices changes also entail demand-side effects on consumption and investment. Consumption is affected indirectly through its positive relation with disposable income. The magnitude of this effect is stronger, the more the shock is perceived to be long-lasting. Moreover, oil price changes influence foreign exchange markets and inflation, in turn, giving rise to indirect effects on real activities.

In general, the empirical research has generated an evolving impression about the magnitude of oil-price effects on aggregate economic activities. Researchers observed that during the period starting after World War II and extending through the 1970s, oil price shifts have had a very large impact on
economic activities. Point estimates of oil price elasticity were as high as -0.29 – indicating that a 10% increase in the price of oil would result into 2.9% decline in real GNP. When data from the 1980s was added to the sample period, estimates of the elasticity fell sharply. In fact, during the mid-1980s the relationship between oil prices and growth rate appeared to change and researchers began to explore into the possibility that oil prices had an asymmetric impact on economic activities. Oil price increases continued to have a negative (though smaller) impact on economic activities, however, large oil price declines failed to produce an economic boom.

It has been observed that oil prices have become more volatile while the impact on the economy appears to have continued to diminish. Point estimates of the elasticity based on macroeconomic model simulation where the impact of the shock can be isolated, produce results that are as low as -0.02 in year 1 and -0.05 in year 2 which means that a 10% increase in the price of oil would result in a decline in real GDP of just 0.2% in year 1 and a decline of 0.5% in year 2.

Several authors have tried to explain the economy’s reduced sensitivity to oil price spikes. One strand of this research emphasizes the response of monetary policy in determining the output and core inflation impacts of an oil price shock. These researchers found that Central Bank response to oil price shocks has fundamentally changed over the years and that this shift has mitigated much of the negative impacts on real GDP and contributed to the reduction in the oil price elasticity.

**AIMS AND OBJECTIVES**

To tries to study the impacts of oil price rise on the growth rate in India through 1970s to the decade of 2000. Furthermore, it also aims at examining the RBI (Reserve Bank of India) responses to oil price shocks and finding out whether the monetary policy responses have impacted these trends.

**METHODOLOGY**

The effective oil prices that a country faces are influenced by a number of factors such as price-controls, taxes on petroleum products, exchange rate fluctuations and variations in domestic price index. These factors make it difficult to measure the appropriate oil price variable. Most of the empirical literature uses the US$ world real price of oil as a common indicator of the world market disturbance to analyze the effects of oil price shocks on macroeconomic activities. The present study uses the data about world oil prices, Indian Wholesale Price Index (WPI) and Consumer Price Index (CPI) as well as India’s GDP at market prices to analyze the effect of oil shocks on Indian Economy. The study also takes into consideration changes in monetary policy by the RBI and uses the data on monetary aggregates, key policy ratios. It also traces the trends in domestic savings rates and domestic capital formation to analyse the impact of oil price hikes on inflation rates and growth rates in India and the impact of intervention by the RBI by way of monetary policy.

**RESULTS AND DISCUSSION**

The global oil price fluctuations have been a significant a result of supply disruptions, political turmoil in the Middle East and North Africa (MENA) region and the exercise of monopoly power by the Organisation of Petroleum Exporting Countries (OPEC). There have been a number of times over the last century that conflicts in the Middle East have led to significant disruptions in production of crude oil. These include closure of the Suez Canal following the conflict between Egypt, Israel, Britain and France in October 1956, the oil embargo implemented by the Arab members of OPEC following the Arab-Israeli War in October 1973, the Iranian revolution beginning in November 1978, the Iran-Iraq War beginning in September of 1980, and the first Persian Gulf war beginning in August 1990. In each episode, there were some offsetting increases in production elsewhere in the world. Each of these five episodes was followed by a decrease in world oil production of 4-9%. There have also been some other more minor supply disruptions over this period. These include the combined effects of the second
Persian Gulf war and strikes in Venezuela beginning in December 2002 and the Libyan revolution in February 2011. The disruption in supply associated with either of these episodes was about 2% of total global production at the time. There are other episodes since World War II when the price of oil rose abruptly in the absence of a significant physical disruption in the supply of oil. Most notable of these would be the broad upswing in the price of oil beginning in 2004, which accelerated sharply in 2007. The principal cause of this oil spike appears to have been strong demand for oil from the emerging economies confronting the stagnating global production.

Trading environment in the oil markets in 2011 remained uncertain with hedge funds liquidating and re-building positions causing volatility in prices. Event risks such as the political turmoil in the Middle East and North Africa (MENA) region, the Japanese quake shutting oil refineries and the sovereign default risks in the Euro zone reversed the otherwise firming oil prices on the back of global recovery broadly staying on track. The price of the Indian basket of crude rose from an average of US$ 69.8/barrel in 2009-10 to US$ 85.1/barrel in 2010-11 and further to US$ 118.5/barrel in April 2011, before declining to US$ 110.6/barrel in May 2011 on expectations of weaker global growth. Oil prices moderated temporarily in June 2011 on account of the decision of the International Energy Agency (IEA) members to release 60 million barrels of crude from their strategic reserves to offset supply disruptions, but edged up again, averaging US$ 112.4/barrel during July 2011. Following the US sovereign rating downgrade by S&P, oil prices fell again averaging US$ 106.6/barrel in the first fortnight of August 2011. Even with this, the August price of the Indian basket of crude is 25 per cent higher than its average during 2010-11.

In 2010-11, India was the world’s fifth largest net importer of oil, importing more than 2.2 million bbl/d, or about 87.3 percent of consumption. According to the International Energy Agency (IEA), oil constitutes 24% of the total energy consumption in India. The combination of rising oil consumption and relatively flat production has left India increasingly dependent on imports to meet its petroleum demand. A majority of India’s crude oil imports come from the Middle East, with Saudi Arabia and Iran supplying the largest shares.8

![Fig. 1: India’s oil imports by source, 2010](image)

India’s imports of crude oil during 2010-11\(^4\)\(^5\), in terms of quantity was 163.594 MMT valued at INR 4,55,909 crore. This marked an increase by 2.72% in quantity terms (159.259 MMT) and an increase by 21.45% (INR 3,75,378 crore) in value terms over the year of 2009-10. In terms of US$, the extent of increase in value of crude oil imports was
25.73%. It may be noted that the imports of crude oil doubled during this period as compared to imports in 2002-03. During this period, the average price of international crude oil (Indian basket) increased from US$ 26.59/bbl in 2002-03 to US$ 85.09/bbl in 2010-11 i.e. an increase of about 220%. The trends in growth of crude oil imports and crude oil International (Indian Basket) prices, over the last decade, are depicted in Table 1 and Fig 2.

Table 1: Imports of crude oil and average crude oil prices (2002-03 to 2010-11)

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports of crude oil (MMT)</th>
<th>% Growth</th>
<th>Average crude oil prices (US$/bbl.)</th>
<th>% Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>81.989</td>
<td>-</td>
<td>-26.59</td>
<td>-</td>
</tr>
<tr>
<td>2003-04</td>
<td>90.434</td>
<td>10.3</td>
<td>27.98</td>
<td>5.23</td>
</tr>
<tr>
<td>2004-05</td>
<td>95.861</td>
<td>6</td>
<td>39.21</td>
<td>40.14</td>
</tr>
<tr>
<td>2005-06</td>
<td>99.409</td>
<td>3.7</td>
<td>55.72</td>
<td>42.11</td>
</tr>
<tr>
<td>2006-07</td>
<td>111.502</td>
<td>12.16</td>
<td>62.46</td>
<td>12.1</td>
</tr>
<tr>
<td>2007-08</td>
<td>121.672</td>
<td>9.12</td>
<td>79.25</td>
<td>26.88</td>
</tr>
<tr>
<td>2008-09</td>
<td>132.775</td>
<td>9.13</td>
<td>83.57</td>
<td>5.45</td>
</tr>
<tr>
<td>2009-10</td>
<td>159.259</td>
<td>19.95</td>
<td>69.76</td>
<td>-15.77</td>
</tr>
<tr>
<td>2010-11</td>
<td>163.594</td>
<td>2.72</td>
<td>85.09</td>
<td>21.97</td>
</tr>
</tbody>
</table>

Source: Indian Petroleum and Natural Gas Statistics 2010-11, Government of India, Ministry of Petroleum and Natural Gas Economic Division

The data reflects that the growth tendency of crude oil imports in India has followed an upward trend; but has also been affected by the swings in the global economy. The pattern does not differ in case of the oil price growth trend except for the fact that the variations are too large in case of the later. It must be noted that the same period has also produced remarkably steady upward trend in India’s GDP growth rate as can be seen in Fig 3.
In India, the possible impact of petroleum price hikes, which are administered, have always generated debate. The postponement of adjustments in administered prices may delay the building up of inflationary pressures in the short run, but subsequently gets translated into an invariably bigger shock. IMF indicates that a sustained US $5 per barrel increase in the price of oil leads to 1.3 percentage point increase in inflation after a year in India and reduces the annual GDP growth by 0.1 percentage point. However, the magnitude of such an impact crucially depends on the degree of monetary tightening and the extent to which consumers seek to offset the decline in the real income through higher wage increases and producers seek to restore profit margins. It may be noted that during the same time period the inflation rate in India has been continuously rising, substantiating the perceived relationship between oil price hike and domestic inflation through the demand as well as supply route. The trend can be clearly seen from Table 2 and Fig. 4.

**Fig. 3 : GDP at market prices (2002-03 to 2011-12)**

**Table 2 : Wholesale Price Index (Base- 2004-05=100) and Consumer Price Index (Base- 2001-02= 100)- annual average**

<table>
<thead>
<tr>
<th>Year</th>
<th>WPI- all commodities</th>
<th>CPI- all commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>100.0</td>
<td>340</td>
</tr>
<tr>
<td>2005-06</td>
<td>104.5</td>
<td>353</td>
</tr>
<tr>
<td>2006-07</td>
<td>111.4</td>
<td>380</td>
</tr>
<tr>
<td>2007-08</td>
<td>116.6</td>
<td>409</td>
</tr>
<tr>
<td>2008-09</td>
<td>126.0</td>
<td>450</td>
</tr>
<tr>
<td>2009-10</td>
<td>130.8</td>
<td>513</td>
</tr>
<tr>
<td>2010-11</td>
<td>143.3</td>
<td>564</td>
</tr>
<tr>
<td>2011-12</td>
<td>156.1</td>
<td>611</td>
</tr>
</tbody>
</table>

**Source:** Reserve Bank of INDIA, Database on Indian economy, (2011)
The data reveals that the crude oil prices grew at an annual average of 40.14% (2004-05), 42.11% (2005-06) and then at 12.1% (2006-07), 26.88% (2007-08). Their growth rate fell at 5.45% in 2008-09 and growth rate turned negative to -15.77% in 2009-10. For reasons enumerated earlier the oil price growth has picked up again in 2010-11 to 21.97%.

In the same time period India’s GDP (at constant prices) growth rate has increased from 7.85% in 2004-05 to 9.28% in 2005-06 and remained above 9% p.a. till 2007-08. It slowed down after that and has reached 6.86% in 2011-12. Both the WPI and CPI have shown a continuous rise during the same period but the growth in the price level w. r. t. CPI has been much faster and larger. This may be indicative of the fact that the oil price hike has left a lagged impact translated in CPI. Domestic supply bottlenecks could also be one of the major reasons for the rising CPI. Poor performance of the agriculture, reducing contribution of the industrial production could also have contributed to the consumer inflation reflected in the movements in the CPI.  

The rising inflation rate does not seem to have affected the growth rate of the Indian economy with the prudent policy changes by RBI and improved Fiscal- Monetary policy interface which have imparted greater flexibility to the Reserve Bank in its monetary management since the mid-1990s, even though it had to contend with large capital flows. Equipped with abundant food stocks and foreign exchange reserves, the Reserve Bank has been able to contain inflation. Significant success in reining in inflation has helped to lower inflation expectations. Also the net domestic savings growth rate which was wavering between 0.24% in 1991 to 40.89% in 1994-95 and -1.86% in 2001-02, has stabilized to an average of 25%. This, coupled with the increasing net domestic capital formation also contributes to the growth potential of Indian economy. This has been possible also due to consistent rise in the broad money ratio as well as continuous monitoring of key policy rates like repo rate and reverse repo rate along with CRR by the RBI.

**CONCLUSION**

Oil price hike has a direct impact on the growth of the Indian economy through the supply as well as demand route. Matching with the global trends, the oil price elasticity in case of India, too was higher in the decade of 1970s with the initial oil price shocks. Research studies have proven that as the data for 1980s and 1990s gets added, the elasticity seems to be reducing, indicating an insignificant impact of oil price hikes on the GDP.
growth rates. In contrast to this trend, the decade of 2000 in case of India has been remarkably different. Within 2002 to 2012, the global economy has experienced huge variations in the oil price growth rates which have left a mixed impact on Indian economy. Apparently, these variations do not seem to have affected the growth rates in India, but have definitely impacted the domestic inflation rates. The RBI has played a very prudent role in applying accommodating credit policy till 2008-09 while the global economy was in recession. But when the WPI started showing a rise in the later part of 2009, RBI started tightening the monetary policy. This only leaves one with an impression that the oil price elasticity in India has not shown much of a deviation from the global trend as the prudent policy measures of the RBI have succeeded in nullifying the impact of oil price rises on growth in India.

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