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Price Formation in Oil Markets: Some Lessons from 2009

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Introduction

The behaviour of oil prices during the 2002-2009 cycle has opened quite wide the debate on the main factors that influence oil price movements. While some analysts explain the sharp swings in oil prices in terms of changes in oil market fundamentals and expectations about these fundamentals, others attribute the recent oil price behaviour to speculative behaviour, irrational exuberance, the trading strategies of some financial players, such as index investors, and the large influx of funds into oil futures and over-the-counter markets. Both camps can draw on various pieces of empirical evidence to support their views. Due to methodological and data limitations, the diversity of players in the market, the high interrelation of factors influencing oil price movements, and the difficulty of identifying the motive behind trading decisions, the empirical literature has struggled to offer much in the way of firm conclusions, thus leaving the policy debate open into 2010 and perhaps beyond.

While the latest oil price cycle has many of the features of previous commodity cycles, it differs in some important aspects. One of the main shortcomings of the current debate on oil price behaviour is that both camps fail to recognise and appreciate some of the important changes in the functioning of the oil market. One such change relates to the process of oil price formation. This is reflected in the dominant role that expectations of future fundamentals play in determining the behaviour of both short-term and longer-term future prices and how the two prices interact with each other. In the recent past, uncertainty about future fundamentals appeared to destabilise long term expectations and rendered the oil price essentially indeterminate - with important consequences for the dynamics of oil prices.

To illustrate some aspects of this change, this paper focuses on the dynamics of oil prices in 2009. Rather than framing the analysis in terms of fundamentals versus speculation, or attempting to slice the oil price into fundamental and non-fundamental components, this paper offers an alternative framework which highlights the dual nature of crude oil as a physical commodity and a financial asset, the role of expectations, the relationship between short term and long term prices, the importance of public signals, and the interaction between various market participants. Whilst these factors have always been relevant to understanding oil price behaviour, they assumed much greater importance in the 2002-2009 price cycle, and presented real difficulties for explanations based on conventional frameworks.

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Oil Price Dynamics in 2009

The behaviour of oil prices in 2009 cannot be analysed in isolation of the preceding 2002-2008 price cycle. In that period, the annual average price rose year-on-year for seven consecutive years before collapsing to very low levels at the end of 2008.

Oil price behaviour in 2009 can be divided into two distinct phases. The first is the recovery phase which saw the WTI spot price rise from a very low base of $30.28 on 23 December 2008 to $79.39 on 31 December 2009, an increase of more than 160%. The second is the stabilisation phase which saw the oil price oscillate within a relatively narrow price band between $60 and $70 between the months of July and September and then between $70 and $80 between the months of October and December (Figure 1). In fact, 2009 represents a remarkable year in at least two respects. First, it witnessed the sharpest increase in spot oil prices in decades. Second, in the second half of 2009, it exhibited a high degree of relative stability despite a very uncertain and volatile global economic environment.

Figure 1: Cushing, OK WTI Spot Price FOB (Dollars per Barrel)

Source: EIA Website

The Recovery Phase

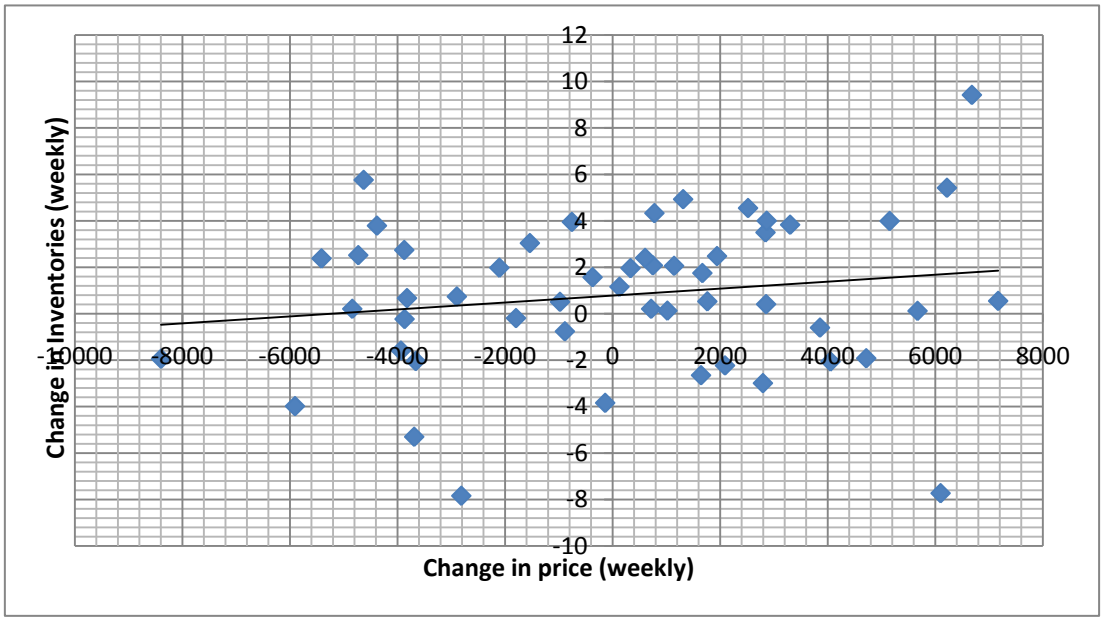
The negative dynamics unleashed by the financial crisis caused oil prices to undershoot in December 2008. As in other asset markets, oil prices were bound to recover to some extent as many investors realised that the fall in oil prices had gone too far by the end of 2008. Just as the move to the lows for prices had been accompanied by a rapid reduction in both GDP growth and oil demand expectations, the recovery in prices accompanied a period of improving growth expectations, and a particularly marked rebound in oil demand expectations following a flow of stronger than expected global demand data. In terms of GDP, consensus expectations for 2009 recovered from a low of a decline of nearly 2% to a more modest decline of 1%, whilst 2010 expectations went from a low of about 2.5% up to an expectation of growth of 4.2%.

In terms of oil demand, in July 2009, the IEA expected global oil demand in 2010 to rebound by 1.7% or 1.4 mb/d year on year. In its latest outlook in February 2010, the EIA expects global liquid fuels consumption to grow by 1.2 mb/d in 2010 and 1.6 mb/d in 2011. The move away from persistent fears of a multi-year economic recession dramatically improved overall sentiment and the willingness to assume risk. The partial recovery in economic expectations was associated with a strong recovery in asset values and prices across a wide range of financial and commodity markets. Indeed, until macroeconomic expectations began to stabilise, there was no recovery in oil prices – and probably could not have been.

In line with stabilisation of expectations about the global economy and oil demand, there were concerns at the height of the financial crisis that credit constraints, the high degree of uncertainty, and the low price environment would limit investment flows into the oil sector with negative consequences on future non-OPEC and OPEC supply growth. There was (and still is) a strong sentiment that the oil industry can no longer function in a relatively low price environment. Thus, to avert an oil crisis in the medium term, prices needed to adjust upward from their lows in December 2008. Concerns about long term fundamentals placed a limit on how much market players were willing to discount the price at the front end relative to the price at the back end of the futures curve. On the one hand, the oil price was relatively high given current market fundamentals. On the other hand, the oil price was relatively low compared to the long term prices. Thus, the oil market reached a point at which either the longer term future price had to adjust downward or the front end the curve had to adjust upwards. In the recovery phase, it was the front part of the curve that moved up.

The above analysis implies that in the first months of 2009 market expectations of future fundamentals became the dominant factor in the price formation process. While oil market fundamentals (as indicated by the demand supply balance) remained weak in 2009, participants attached little weight to these bearish signals and oil prices continued to rise. Rather than downsizing stocks in response to the recession in the aftermath of the financial crisis, expectations that oil prices would rise created an incentive structure for the accumulation of inventories. The oil price-inventory relationship completely broke down and even reversed as changes in inventories were positively correlated with changes in prices in 2009- as seen in Figure 2 below.

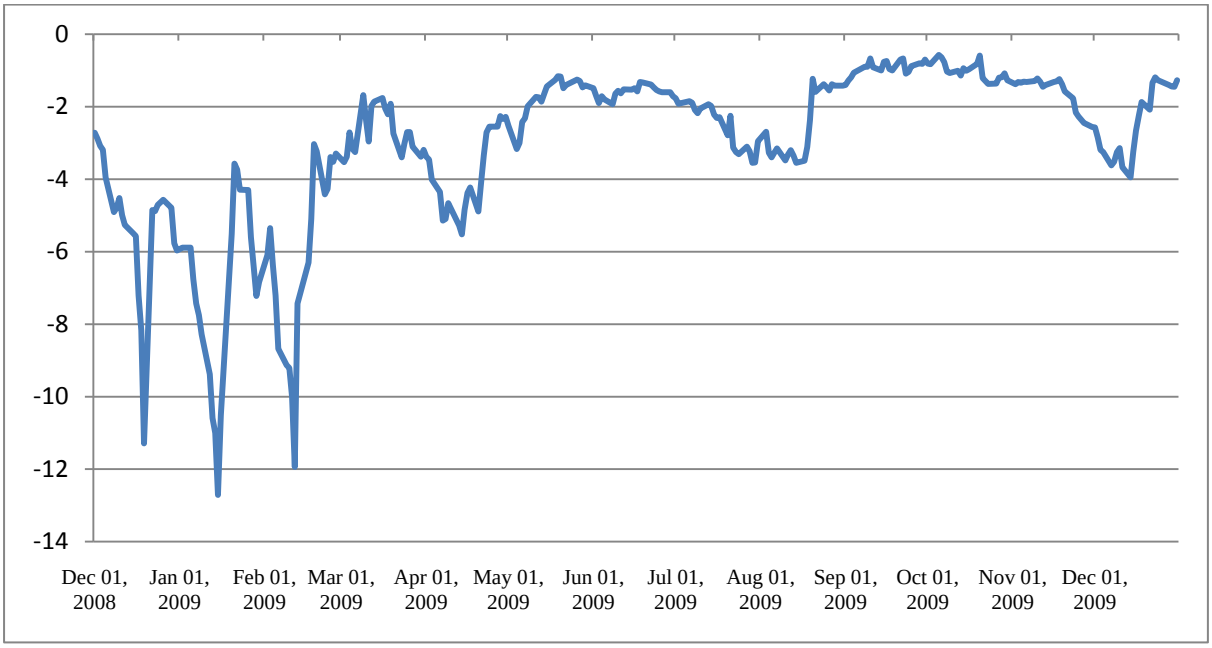
Figure 2: Change in Crude Oil Inventories vs Change in Oil Price in 2009 (US weekly data)



Source of Data: EIA

Time spreads widened considerably (see Figure 3) and inventories continued to rise in the first few months of 2009 indicating that some market participants were willing to pay for the cost of storage even when high levels of inventories were pushing the cost of storage up. In the US, crude oil stocks rose from a low of 290,000 thousand barrels in September 2008 to around 375,000 thousand barrels in April 2009 (see Figure 4). There was a surge in floating storage as storing oil had become a very profitable business. Some analysts attribute the contango structure and the desire to accumulate inventories to the large entry of index investors and their trading strategies. Verleger, for instance, argues that in the past "the lack of buyers of crude futures discouraged firms from holding extra inventories. These missing longs prevented the market from functioning as well as it could. The entry of index investors solved this problem. Index investors are the missing long. Their buying has prompted inventory accumulation" (p. 10).[1]

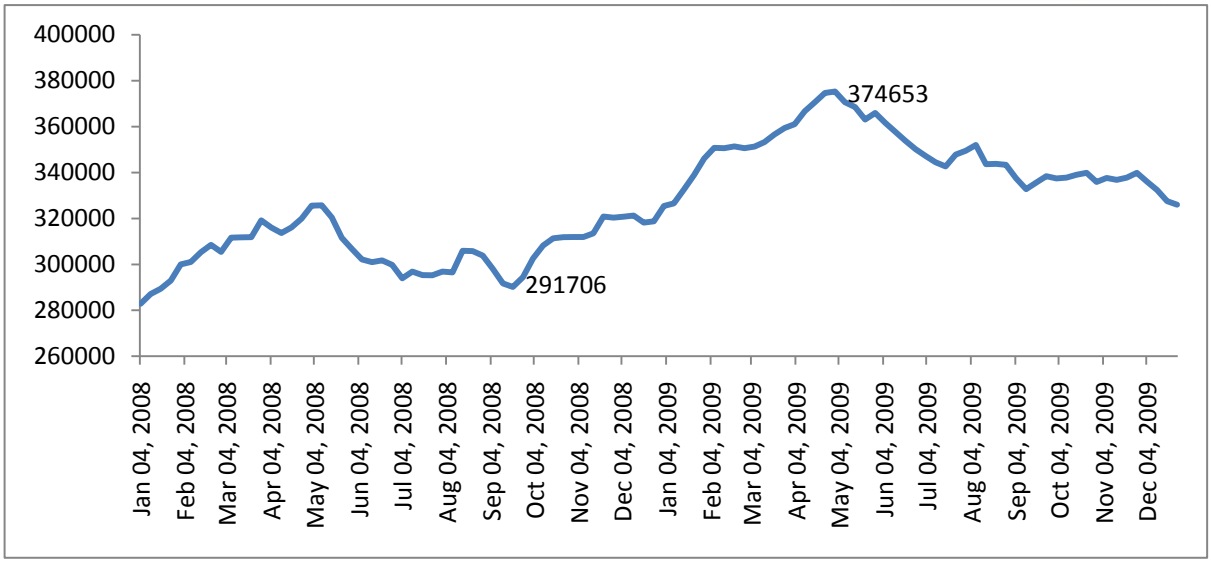
Figure3: Time Spreads for WTI: First Month Contract Minus Third Month Contract ($/barrel)



Source: EIA Website

Figure 4: Weekly U.S. Crude Oil Ending Stocks Excluding SPR (Thousand Barrels)

[1] Prepared Testimony of Philip K. Verleger, Jr. To U.S. Commodities Futures Trading Commission on The Role of Speculators in Setting the Price of Oil August 5, 2009



Source: EIA Website

A major difficulty with attaching great importance to 'medium-term' or 'long-term' oil market fundamentals in the price formation process is that the fundamentals themselves are highly uncertain. There are too many unknown variables that can play an important role in shaping anticipations of these future fundamentals, many of which originate from outside the oil market. These include the pace of global economic recovery, changes in consumer behaviour, fiscal and monetary policy responses, regulatory changes, geopolitical factors, technological innovations in the transport sector, technological developments in oil exploration and extraction, changes in key producers' behaviour, and the potential impact of energy security and climate change policies - just to mention a few.

This raises a key question: if market participants attach little weight to current market fundamentals and if future market fundamentals are highly uncertain and subject to continuous revisions, at which price or 'price range' should the oil market clear? In other words, when the oil price becomes detached from current fundamentals and there is large uncertainty about the price that would balance supply and demand in the long term, there is a wide range of prices at which the market can clear. The issue then is how does the market converge to one price and not another. This leads into discussion of the stabilisation phase.

The Stabilisation Phase

In the last few months of 2009, oil prices oscillated within the range of $60-$80 (although the upper end of the range has been broken few times). In effect, the oil market has operated within an *implicit* band. This is remarkable given the highly volatile expectations and the large uncertainty about market fundamentals at the time. This raises a key question: how did the market come to operate within the implicit band in the first place?

In a market characterised by indeterminacy of beliefs about the oil price that would clear the market, participants tend to form their own expectations of futures prices on the basis of other players' expectations. In other words, investment decisions will depend on 'higher order beliefs', i.e., players' beliefs about other players' beliefs; players' beliefs about other players' beliefs about other players' beliefs, and so on. This captures the intuition provided by Keynes's 'beauty contest' metaphor where traders are motivated to guess other traders' guesses to benefit from short-term movements in oil prices. [2]

[2] This idea has been formalised recently by Allen, F., S. Morris, and H.S. Shin (2006) 'Beauty Contests and Iterated Expectations in Asset Markets', *Review of Financial Studies* 19, 719.

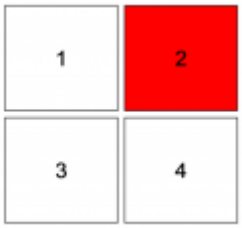
In such an environment, public information or signals take a leading role, even if these public signals do not necessarily reflect large changes in underlying fundamentals or provide new information to the market. Since public signals can affect a player's guess about other players' guesses, they could have a disproportionate impact on the oil price. [3] Participants closely monitor signals and other news about fundamentals as well as other market participants' reactions to these signals. What appears to matter in the formation of investors' expectations is what other investors think and how other investors are likely to respond to public signals and information.

But the oil market generates a large number of signals. So the next question is: why do the various market participants co-ordinate on one signal while ignoring others? The answer is that there are some signals that are more visible than others. To explain this point, we will use a very simple example[4].

Suppose two players A and B are playing a simple game. In this game, each of the players is shown a diagram of four boxes and each is asked to pick one. If both players pick the same box, then both will receive a reward (say $100). If they do not, then both will receive nothing. An important part of the game is that the two players are not allowed to communicate with each other. What box would the players pick?

In order to receive the $100, players need to adopt a simple strategy: For each box that player A picks player B will simply pick the same box. The difficulty of the game is figuring out what each of the players will guess about the other since the two cannot communicate with each other. There is no box that is "better" than another one; they are identical. In this game, both players would pick boxes (or numbers) randomly.

But what if we change the experiment slightly and instead of being faced with four identical boxes, the players are shown a diagram like the one below:



[3] See Morris, S. and H.S Shin (2003), 'Global Games: Theory and Applications', in M. Dewatripont, L. Hansen and S.Turnovsky (eds), *Advances in Economics and Econometrics (Proceedings of the Eighth World Congress of the Econometric Society)*, Cambridge Cambridge University Press.

[4] This example is based on "Focal Points (or Schelling Points): How We Naturally Organize in Games of Coordination", which applies this game to bike safety. http://mindyourdecisions.com/blog/2008/04/01/focal-points-or-schelling-points-how-we-naturally-organize-in-games-of-coordination/

Now, which box would the players choose? Since the red box stands out markedly, it is very likely that each of the players would realize that as the red box stands out, each would be inclined to choose it. Thus, the special marking does the trick - making both players pick box two "naturally." In other words, market players can coordinate on choosing a box without communicating with each other. Notice that there is nothing special about the red box other than the fact that it helps players coordinate their decisions. Such an equilibrium is known as the *focal point*.[5] The insights from this game can help explain the stabilisation of market participants' expectations around a specific price range.

While the market expected prices to adjust from the very low levels reached in December 2008, there was uncertainty as to the price or price range that would stabilise market expectations. The market needed a focal point that would enable market participants to coordinate their decisions. The oil market was ready to provide such a focal point. The severity of the previous price cycle helped the views of key players about a preferred oil price range converge. There was a realisation among various market players that too low (the low oil price in December 2008) or too high oil prices (the oil price in July 2008) served no one. On the one hand, low oil prices constrain the flow of investment required by the industry to ensure stable oil supplies. On the other hand, high and volatile oil prices can damage prospects for global growth, can result in oil demand destruction, and create worldwide imbalances with destabilising consequences.

These signals originated from various quarters. French President Nicolas Sarkozy and the UK Prime Minister Gordon Brown urged 'oil producers to agree a target price range, based on a clearer understanding of the long-term fundamentals... that are not so high as to destroy the prospects of economic growth but not so low as to lead to a slump in investment, as happened in the 1990s'.[6] The French President went even further, raising the question, 'why don't producer countries and consumers agree on general price guidelines to give to the market?'[7] Similar signals have also emerged from key oil exporters. In a rare precedent, King Abdullah of Saudi Arabia said in a newspaper interview that he considers $75 to be a 'fair' price for a barrel of crude oil. He reiterated his position in December 2009 arguing that "we [the Saudis] expected at the start of the year oil prices between $75 and $80 a barrel and this is a fair price...Oil prices are heading towards stability".[8] The Saudi Oil Minister, Ali Bin Ibrahim Al-Naimi, justified the target price as the 'price that marginal producers need to maintain investments sufficient to provide adequate supplies for future oil consumption needs'.[9] Indeed, in the OPEC meeting in September 2009, Mr Al-Naimi announced that the current price 'is good for everybody, consumers and producers'. He reiterated his position in December 2009 arguing that "the market is stable right now, volatility is at minimum, everybody is happy with the price, it is in the right range".[10] In its blueprint for oil price stabilisation,[11] ENI considers the optimal price to be somewhere in the region $60-$70 given current market conditions. This optimal price band is needed to ensure adequate return on investment to producers, encourage rational and efficient use of energy, safeguard food production, and encourage investment in new technologies. And that a price above $75, on the other hand, would hurt economic growth.

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[5] Schelling,T (1963), *The Strategy of Conflict*. Oxford University Press, New York, 1963.

[6] Gordon Brown and Nicolas Sarkozy, 'We Must Address Oil-Market Volatility', *The Wall Street Journal*, 8 July 2009

[7] *Emirates Business 24|7* daily newsletter, 'Sarkozy calls for regulated oil prices' 27 May 2009.

[8] Reuters, 'Oil price might rise "reasonably"-Saudi King in paper",26 December 2009.

[9] Reuters, 'Low oil prices mean less future supply – Saudi', 19 December 2008.

[10] Ayesha Daya and Maher Chmaytelli, 'Saudi Arabia's Al-Naimi Says Oil Price IS Perfect", Bloomberg, December 5, 2009.

[11] ENI, 'A Blueprint for Oil Price Stabilisation', Presented during the G8 Energy Minister Meeting, Rome, 25 May 2009

Further Issues

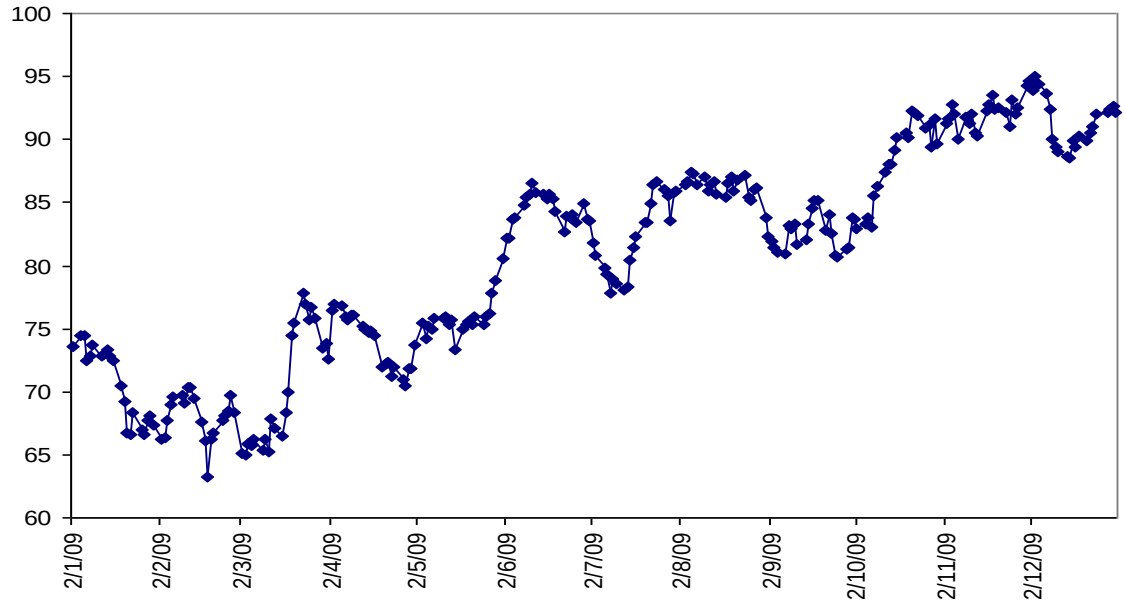
The above analysis raises a series of further issues. The first one is whether the market could coordinate on a different price range. The answer is yes. There is nothing special about the $70-$80 price range. The market could easily coordinate on a higher or a lower price range. Whether the market will move to a lower or higher price depends on the importance that market participants attach to the possibility that oil market fundamentals will tighten in the future. The wide uncertainty surrounding oil market dynamics in the aftermath of the financial crisis did not prevent many market analysts from making bold predictions that market fundamentals are likely to tighten in the future. These predictions are based on three main pillars: (1) very limited growth in non-OPEC supply due to peak oil and/or over-ground constraints such as geopolitical factors and hardening fiscal terms imposed on oil production; (2) a slowdown in investment in OPEC countries due to a variety of factors such as geopolitical risk, the incapability and/or unwillingness of OPEC countries to invest in their oil sectors in the presence of large spare capacity and amidst demand uncertainty; and (3) a rapid growth in global oil demand fuelled mainly by non-OECD economies. Based on these three pillars, some analysts claim that the world faces an energy crisis and argue that oil prices "did not remain high enough for long enough to generate a solution to the energy problem, which has not gone away". According to this view, there will be a "likely return to energy shortages as dwindling OPEC spare capacity is likely to be unable to meet rising demand as non-OPEC production growth is restricted by limited investment in oil production infrastructure".[12] Others claim that 'at least the day of cheap and easy oil is over' and that there is a "risk of a crunch in the oil supply after next year when demand picks up because not enough is being done to build up new supplies of oil to compensate for the rapid decline in existing fields.' [13]

It is important to note that while front prices have stabilised within a narrow range, the long term price has not yet stabilised within a band. As seen in Figure 5, the long term price has been moving upward reflecting optimism about the prospects of the world economy and expectations of tightened market fundamentals as high growth will be translated into higher oil demand while the supply response will continue to disappoint.

Figure 5: WTI 60-month Rolling Contract

[12] Kate Mackenzie, 'Goldman Sachs and the Unrecognised Energy Crisis', 4 June 2009, http://blogs.ft.com/energy-source/2009/06/04/goldman-sachs-and-the-unrecognised-energy-crisis/).

[13] An interview with Dr. Fatih Birol, 'Warning: Oil Supplies are Running Out Fast', The Independent, August 3, 2009(http://www.independent.co.uk/news/science/warning-oil-supplies-are-running-out-fast-1766585.html).



Source: Barclays Capital

The second issue is whether focal points are stable. In fact, they are not. Focal points can easily be broken. To be credible and prominent, it is important that the preferred price range be in line with market fundamentals. This implies that the preferred price range should adjust to changes in oil market fundamentals. Furthermore, if key players have different beliefs regarding oil market fundamentals, due to limited and imperfect information and uncertainty about the behaviour of key players in different market circumstances, then it would be difficult to sustain a convergence of views. Under these circumstances, the creation of a credible focal point in the market would be difficult.

Conclusion

The above analysis shows that the oil price formation process underwent a major transformation in which expectations about future fundamentals became dominant in determining oil price movements with far reaching effects on the behaviour of oil prices. This by no means suggests that the dynamics of oil prices in 2009 will necessarily be repeated. In fact, the year 2009 has been exceptional in many respects and once the oil market completes its adjustment, current fundamentals may come to play an increasingly important role in determining oil price movements. However, the events of 2009 indicate that the existing frameworks for the analysis of oil prices need to be modified to take into account new features of the market and the interaction among the various players. Furthermore, attempts to identify the relative importance of fundamentals versus speculation in explaining the last price cycle are of limited use. Instead, one should attempt to endogenise the role of financial players and understand the conditions under which these players behave in certain ways.

Finally, the above discussion also shows that the convergence of the interests of key players may under certain circumstances influence oil price behaviour. For consuming countries, the implicit band provided the price stability that they needed. For oil exporters, the price has converged towards their preferred range. For financial investors, it provided the necessary inter-day and intraday volatility on which these players thrive. For oil companies, it enabled them to maintain a fairly stable cash flow. In effect, no one has an interest to question the current price range. Will this convergence of interests be maintained for a long time? Most probably it will not. What market participants fail to appreciate is

that this represents a unique period in the history of the oil market and that they should make the most of it while it lasts.