The forward market for oil

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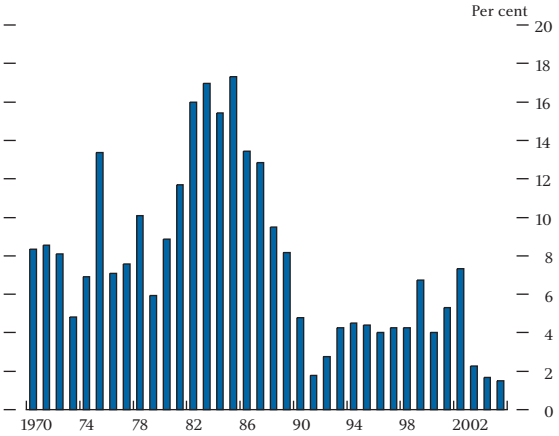
As the spot price of oil has risen in recent years, so has the price of oil for delivery in the future. This article examines the workings of the forward market for oil and considers why producers have not been hedging more of their future oil production following these unusual forward price moves.

Introduction

The price of oil is an important macroeconomic variable. It reflects demand pressures in the global economy, and potentially impacts directly on the inflation rate, at least in the short run. This article looks at how a particular section of the market for oil operates: the forward market.

In February 2006, the price of oil for delivery within the next month was around $60 per barrel, roughly double the price of two years earlier. The rise largely reflects strong growth in global demand for oil at a time when estimated short-term spare production capacity was at historical lows (Chart 1). The rise in the price of oil for near-term delivery has been accompanied by an unusual increase in the price of oil for delivery further in the future, suggesting that higher prices are expected to be a relatively long-lasting phenomenon. But a higher future price of oil ought to allow producers to hedge future production, thus bringing about higher future supply by increasing expected returns on investments in oil production. Unless demand growth continues to exceed supply growth, this process ought eventually to reduce the price of oil for immediate and future delivery.

Chart 1
World spare oil production capacity as a percentage of world oil production(a)



Sources: Bank of England and US Energy Information Administration.

(a) Spare capacity is defined as extra production that can be brought on-line within 30 days and that can be sustained for at least 90 days.

In this article we explore the question of whether the forward market for oil may be less than fully efficient in allowing market participants to hedge future production. We consider first how the forward market for oil operates, both on and off exchange. We then go on to discuss why there is not more hedging activity. It is argued that the lack of hedging may reflect failures in forward markets for other goods and services rather than in the forward market for oil. In addressing these issues, we have consulted a range of market participants and interested parties. These include oil producers, futures exchanges, investment banks, hedge funds, academics and representatives from official institutions.

How the forward market for oil operates

Oil is traded 'forward', for future delivery, both on recognised futures exchanges and directly between market participants (known as 'over-the-counter' or OTC trades). This section examines how exchange trading and the OTC market operate in practice. We then draw out the key features of the forward market: the range of market participants; the available set of contracts; and alternatives to trading in the market.

The exchanges

Exchanges usually allow for trade in both futures and options contracts. The standard futures contract on the

two major exchanges — the New York Mercantile Exchange (NYMEX) and ICE Futures[1] in London — is for 1,000 barrels of oil for delivery on a future date.[2] These exchanges offer contracts for delivery up to and including 2012. Options can be written in many ways, but a common example would allow an oil consumer to pay a premium for the right to buy oil at a fixed price in the future. Only if the price goes above that level will the option be 'exercised'. The two exchanges are dealing rivals but each dominates trading in particular types of oil. The most traded (or 'benchmark') contracts on NYMEX are for the delivery of US light, sweet crude oil[3] such as West Texas Intermediate (WTI). The benchmark for ICE Futures is for another light, sweet crude oil: namely Brent.

There are other exchanges that trade oil-related contracts, notably the Tokyo Commodity Exchange (TOCOM). The Dubai Mercantile Exchange is scheduled to open for oil futures trading in the fourth quarter of 2006, but it is not yet clear which benchmark contract will be offered. NYMEX and ICE Futures are the clear world leaders by volume. In 2005, 59.7 million light, sweet contracts traded on NYMEX[4] while 30.4 million Brent contracts traded on ICE Futures. Both were record volumes.

The exchanges are supported by 'central clearing counterparty' services which are also made available for some OTC trades. The central counterparty (CCP) matches buyers and sellers of contracts (the 'counterparties') and then arranges for payment and settlement. This means that counterparties take no direct credit exposure to each other. If a trader defaults, other market participants are protected by the CCP. The CCP offsets its credit risk by collecting so-called 'margin payments'. These payments reflect both the initial contract position (that is, whether the trader is a seller or a buyer of the futures contract) and changes in the value of the contract as market prices vary.

The over-the-counter (OTC) market

In OTC oil markets, investment banks act as the intermediaries or market-makers, matching buyers and sellers. The most common OTC contracts are swaps and options. Swaps allow, for example, an oil producer to receive a fixed price at agreed future points in time and in return pay the 'floating' spot price — an easy way to hedge future income streams. Conversely, an oil consumer could agree to pay the fixed price and receive the floating spot price, thereby increasing its certainty as to future oil expenditure.

Although the most actively traded contracts expire between the spot date and five years hence, the major intermediaries are prepared to make markets in OTC swaps and options as far out as their customers demand. But the price charged by a market-maker will usually increase to reflect the reduced liquidity available beyond the five-year horizon and, consequently, the time they will have to hold, or 'warehouse', the risk incurred before they can find a counterparty interested in taking that risk off the bank's books.

The swaps/options markets in oil are mostly conducted over-the-counter rather than on-exchange (our contacts suggest up to 90% is OTC). This is because swaps/options are usually used to hedge entity-specific risks rather than to speculate. Contracts are therefore highly individually tailored, or 'bespoke', and, unlike standardised futures contracts which are easily tradable, are usually held to maturity (which underlines their predominantly non-speculative usage).

As noted above, some exchanges provide facilities for OTC trades to be cleared through a CCP and so be protected against credit risk. As in other financial markets, there are alternatives to central clearing to insulate against counterparty credit risk in long-term contracts. Counterparties can agree standard rules calling for the deposit of collateral against the net market value ('marking-to-market') of any long-term contract. These deposits are similar to margin payments and work to minimise the degree of unsecured exposures. It is usually possible also to negotiate the sale back of OTC contracts (at a market-determined price). In our discussions, no current market participants mentioned credit risk or the long-term nature of contracts as an issue constraining the market.

Given that exchanges trade contracts only for up to some six years ahead, all longer-term contracts are made

(1) ICE Futures changed its name from the International Petroleum Exchange (IPE) on 26 October 2005.
(2) NYMEX also offers trading in contracts for the delivery of 500 barrels of light, sweet crude oil.
(3) Crude oils can have different physical characteristics. For example, the density and sulphur content may differ. Less dense, or light, oils are easier to refine than heavy oils to produce valuable light products, such as petrol — rather than less valuable heavy products, such as residual fuel oil. Oils that have a high sulphur content are said to be sour, whereas those with a low sulphur content are sweet. Sulphur has to be removed from oil when it is refined, so sweet oils are generally cheaper to refine.
(4) These include only contracts for the delivery of 1,000 barrels of oil.

over-the-counter. In common with other OTC commodity markets there is only limited information available about the size of the OTC market for oil. But the range of market participants we surveyed were unanimous in reporting that the OTC oil derivatives market is significantly larger than the exchange-traded oil futures market.

Market participants

Oil market participants are a diverse group, trading at different maturities and with different objectives. Major commercial oil producers are involved in the market to varying degrees, with the more active producers involved as both buyers and sellers. Oil producers have expert knowledge about oil production and the different oil-related products which gives them an informational advantage in many trades. Sometimes oil companies will trade around their own oil delivery schedules, to manage cash flows, but generally they do not hedge future production. We explore reasons for this later.

Discussions with oil producers indicate that they do not base investment decisions on one particular forecast of future oil prices, even if such forecasts have to be made for accounting purposes. Producers stress test their production against a range of possible prices to make sure that an investment decision makes a minimum return.

In contrast to the major oil companies, smaller independent oil producers or exploration companies are more likely to be dependent on bank financing rather than equity financing and are thus more likely to be involved in hedging activity.

National oil companies of some Middle Eastern and South American countries participate in the forward OTC oil market, but only to a limited extent. So it is not apparent that oil-producing countries hedge much of their future production (although their foreign exchange reserves managers are likely to invest accumulated oil profits in financial markets more generally). Some oil-consuming countries hold strategic oil stocks. But in discussions with contacts, few, if any, countries were said to be involved in significant hedging of oil consumption needs.

The major investment banks are dealers and also take proprietary risk themselves — including where they take on risk from a counterparty, but cannot immediately find a second counterparty willing to take it off them.

Hedge funds have been increasingly active in the oil market in the past couple of years. They typically concentrate their positions in the most liquid segments of the market, so that positions can be closed out quickly if need be. In general, the entry of hedge funds to a financial market will bring about an increase in arbitrage-type activity, such as speculation on the re-establishment of previously observed historical relationships. An example would be for a hedge fund to buy contracts for the future delivery of oil and coal on the one hand (a 'short' position — betting the price will go down) and the future receipt of petrol and electricity on the other (a 'long' position — betting the price will go up), aimed at exploiting occasional disruptions in refining and power generation. The oil market affords numerous opportunities for hedge funds and other traders to take such views on the price spreads between different petroleum products (such as petrol and heating oil) or types of crude oil.

Other market participants include specialist oil trading firms, pension funds and asset managers. The former are likely to be a more significant factor in the market.

Some of the major global oil consumers (eg airlines) trade oil futures, options and swaps. But they are small players relative to the major investment banks and oil companies. And they reportedly do not make significant use of these markets to hedge their longer-term exposure to the forward price of oil.

Incomplete forward markets for oil

The oil market is clearly not characterised by a complete set of contracts. For example, there are no major benchmark futures contracts for the heavier, sour crude oils that make up much of Middle Eastern output. There is also no specific global oil index that is easily tradable such as a contract based on a basket of major world crude oils (OPEC constructs and monitors, but does not trade, a basket of its members' oils). In the view of most market participants we spoke to, more contracts and longer-term contracts would follow on from an increase in trading volumes, rather than being something that could be introduced in anticipation. Introducing contracts too early could, in the opinion of some market participants, reduce liquidity rather than generate more.

Alternatives to trading directly in oil markets

If someone wants to take a position on the oil price (either outright or as a hedge), they do not have to use a direct oil market contract. The alternatives include:

- buying or selling shares in companies with an exposure to the oil price;
- trading oil-related physical assets such as oil fields, refineries, etc;
- investing in commodity indices such as the Goldman Sachs Commodity Index (GSCI) and structured notes linked to these. Pension and hedge funds in particular appear to buy into commodity markets through these indices; and
- investing in exchange-traded funds (ETFs). These are similar to mutual funds, and their value is backed by the underlying commodity (in this case oil). ETFs are relatively new to the oil market.

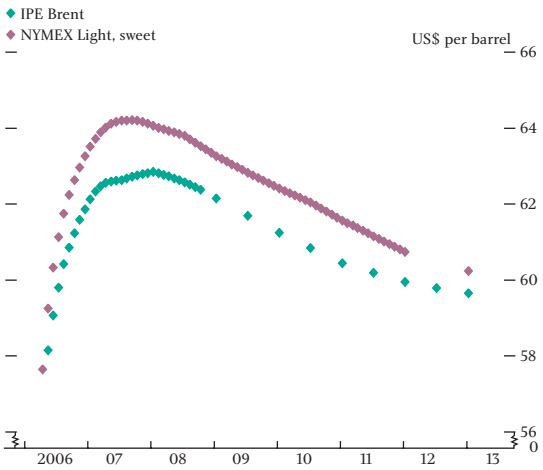
Use of the forward market

A risk that oil companies face when investing in production capacity is that the oil price might fall and that the investment may, in turn, become unprofitable. This may limit the extent to which companies are prepared to expand their productive capacity. Similar issues arise for all business investment. But the problem is more acute for oil given the long time-lags involved before production comes onstream, the relatively high proportion of production cost which is investment related, the absence of alternative uses for that investment, and the potential volatility of the oil price.

As discussed earlier, oil is traded forward, so an oil company should, in principle, be able to reduce, or hedge, an investment project's price risk. Specifically, it could sell a futures contract to lock in the price at which it can sell oil in the future.

Given the current shape of the oil futures curve, an oil company should be able to guarantee itself a high price (Chart 2), and hence a possibly profitable investment, by entering into a contract with a commitment to supply oil in the future from a new project's output. But it seems that relatively little such production hedging takes place via the forward market for oil. For example, at end-2005 the combined volume of oil for future delivery as indicated by outstanding futures contracts on NYMEX and ICE Futures was only 4% of that year's estimated world crude oil production. Most contracts were also for delivery within a year (Chart 3) — too short a time horizon for oil companies to cover investment costs.

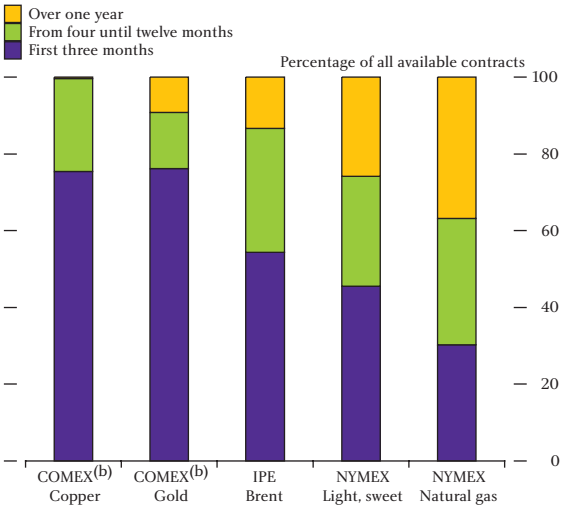
Chart 2
Futures prices and contract maturities for crude oil, 15 February 2006(a)



Source: Bloomberg.

(a) On ICE Futures, trading of an oil futures contract normally ends on the business day immediately preceding the 15th day prior to the first day of the contract's delivery month.

Chart 3
Outstanding futures contracts by expiry date(a)



Source: Bloomberg.

(a) Daily average during January 2006.
(b) COMEX, previously the New York Commodities Exchange, is a division of NYMEX.

Table A
Reported stocks and market turnover of selected commodities, 2004

	Reported stocks(a) (in weeks of production)	Turnover on futures exchanges (in US$ billions)(b)	Turnover on futures exchanges/annual production (per cent)(b)
Aluminium	4.8	1,259	24.5
Copper	1.5	1,406	30.8
Gold(c)	691.4	842 (2,250)	26.2 (70)
Silver	9.5	186	45.3
Oil	6.9	3,171	2.6

Sources: Commodities Research Unit for aluminium, copper, gold and silver. International Energy Agency Monthly Oil Market Report January 2006 for oil production and stocks, and Bloomberg for oil futures turnover.

(a) Consists of both (reported) non-exchange and exchange stock holdings. Exchange holdings are London Metal Exchange (LME), Comex, TOCOM and Shanghai for aluminium; LME, Comex and Shanghai for copper; and Comex and TOCOM for gold and silver. For oil, stocks are those of the OECD (including government stocks).
(b) Turnover figures for aluminium and copper are on the LME and Comex, for gold and silver on Comex and TOCOM, and for oil on NYMEX and ICE Futures. Valued at 2004 average spot prices.
(c) Figures in brackets include activity on the London Bullion Market.

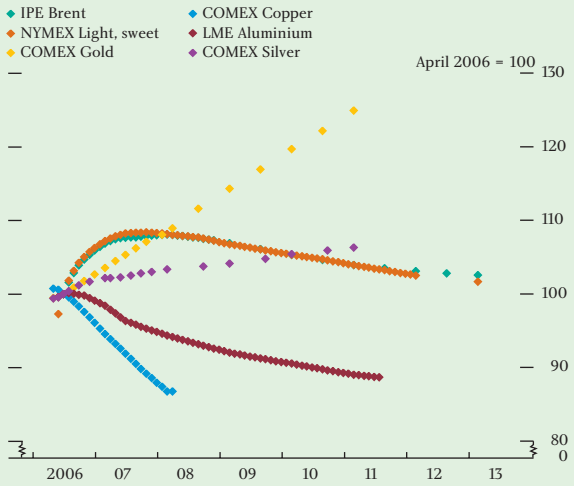
What explains the shape of commodity futures curves?

Perhaps one of the biggest differences between the futures market for oil and those for other commodities is the shape of the futures curve. The simplest theory of the futures curve is by Hotelling (1931)(1) which considers the optimal extraction of an exhaustible resource, such as oil, under perfect competition and no uncertainty about future prices. This suggests that the price of oil (net of extraction costs) should be expected to rise in line with the (risk-free) rate of interest so that a producer is indifferent between extracting and selling an extra barrel of oil today, and keeping it in the ground and selling it in the future.

A similar result emerges from the theory governing the optimal (above ground) storage of non-perishable commodities such as oil.(2) This suggests that the expected price of oil needs to rise by the rate of interest plus the storage cost, so that holders of crude oil stocks are indifferent between selling an extra barrel from their inventory today and holding on to it for future sale.

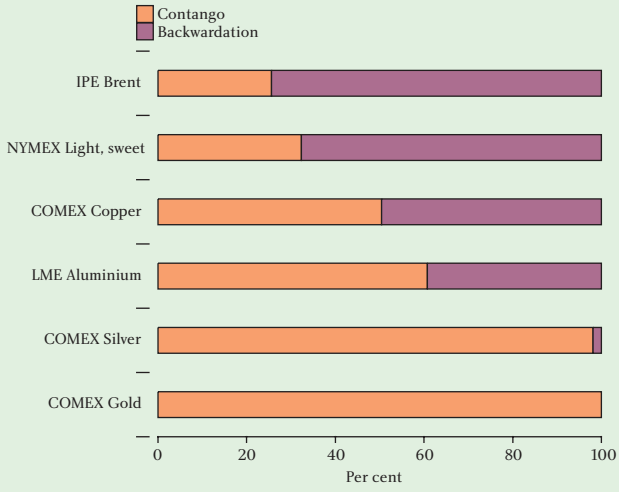
These theories are relevant for the oil futures curve given that the participants in this market both produce and hold positive inventories of crude oil (although the inventory theory may be more relevant for the near-term futures curve given the lags involved in producing and transporting oil). Both theories imply that crude oil prices should be expected to rise over time (a situation known as 'contango'), subject to certain conditions. However, in practice, the oil futures curve is more often than not downward sloping (known as 'backwardation') so that futures prices are lower than the current spot price.(3) Other commodities show backwardation from time to time, including recently industrial metals (Chart A), but are normally in contango (Chart B). The recent backwardation across a number of (non-precious metals) commodity futures markets might suggest that spot prices are indeed expected to fall in the future. But as we mention below, futures contract prices are not necessarily equal to expected future spot prices.

Chart A
Futures prices (April 2006 = 100) and contract maturities for crude oil and other physical commodities, 15 February 2006



Source: Bloomberg.

Chart B
Percentage of time in contango or backwardation(a) in selected commodity markets(b)



Source: Bloomberg.

(a) Contango and backwardation imply up and downward sloping futures curves.
(b) Based on the price difference between one and twelve-month futures contracts, January 1991 to 15 February 2006. LME Aluminium from July 1997 and IPE Brent from April 1994.

(1) Hotelling, H (1931), 'The economics of exhaustible resources', *Journal of Political Economy*, Vol. 39.
(2) Hull, J C (2005), *Options, futures, and other derivatives*, Chapter 5.
(3) Recently, the futures curve has been slightly upward sloping for the first year or so of the curve, but has been downward sloping after that. See Chart 2 in the main text.

Why does the futures curve usually slope downwards?

One possible reason for a persistently downward sloping oil futures curve would be uncertainty about future demand and supply. Given that one has the choice to delay extraction, in the hope of benefiting from a higher price later, the decision to produce oil when there is uncertainty takes on the characteristic of exercising a financial option — there is an option value in holding reserves below ground rather than 'disinvesting'.(4) Because the total return of holding oil reserves in the ground includes this option value, the current price must be higher than the price predicted by Hotelling's theory to make a producer indifferent between extracting oil and leaving it in the ground. And if the uncertainty is large enough this can result in backwardation.

There is also a similar value to the holder of above-ground oil stocks. This value is typically referred to as the 'convenience yield' of having immediate access to oil stocks and is likely to be a more important factor when stock levels are low. For example, oil consumers may be uncertain about future oil supply — especially given the concentration of production and reserves in a few countries, some of which are vulnerable to political factors. The uncertainty about future supply means that consumers of oil may be willing to pay more now to ensure they have stocks of oil than they would be willing to pay in the future. This could lead to the spot price being higher than the futures price.

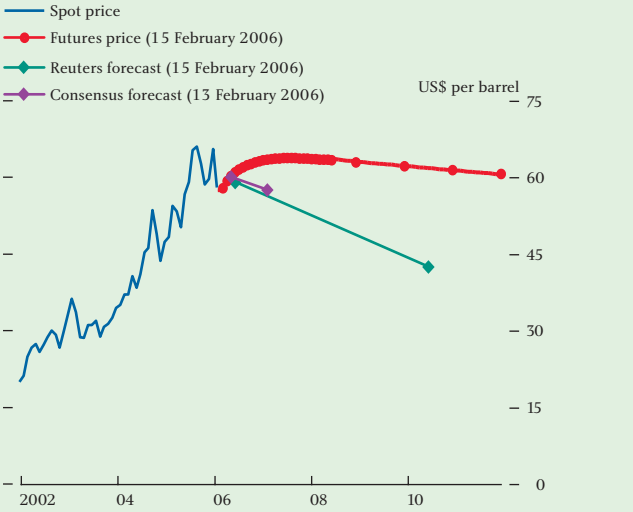
The futures market for gold, however, works quite differently. Gold inventories above ground are very high — equivalent to more than 13 years of production (Table A in the main text) — suggesting that the convenience yield is negligible. This might explain why the gold futures curve is usually upward sloping as predicted by Hotelling's theory (also Chart B).

A further issue arising from the physical nature of oil is that it is cheaper to arrange delivery at some future point than to do so at very short notice. Thus the producer may demand a higher price for near-term delivery and this could add to the backwardation in the market at the very short-end of the curve.

Why does the forecast price of oil lie below the futures curve?

Economists' forecasts of the oil price currently lie, on average, well below the futures curve (Chart C). A factor that could create a wedge between the futures price and the expected spot price is the existence of risk premia. Theory(5) suggests that investors would typically require a different rate of return — including a risk premium — to compensate them for the price risk associated with holding stocks of oil. This would be reflected in the expected future spot price being different from the futures price and could be positive or negative. In the current oil market, if the price of oil is perceived to be negatively correlated with investors' consumption or wealth, then holding physical oil — rather than buying the futures contract — would help investors diversify their risks. As a result, they would be willing to accept a lower rate of return from holding physical oil than otherwise (so the expected spot price would be lower than the futures price).

Chart C
Surveys(a) and market beliefs(b) about future oil prices(c)

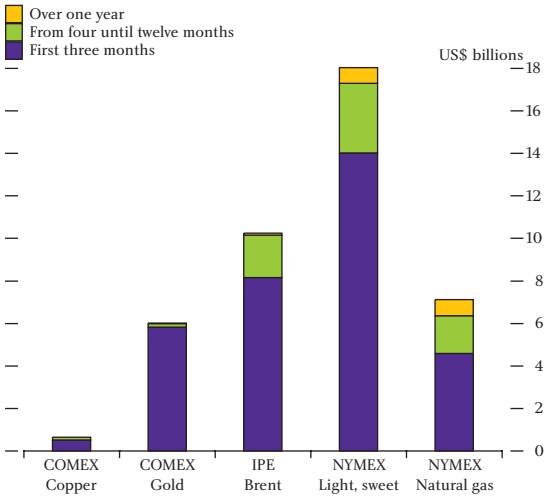


Sources: Bloomberg, Consensus Economics, Reuters and Thomson Financial Datastream.

(a) Diamonds indicate mean survey responses. Consensus forecasts are for the end of May 2006 and the end of February 2007. Reuters forecasts are year averages for 2006 and 2010.
(b) Monthly data.
(c) West Texas Intermediate crude oil.

(4) Litzenberger, R H and Rabinowitz, N (1995), 'Backwardation in oil futures markets: theory and empirical evidence', *The Journal of Finance*, Vol. 50, No. 5.
(5) Keynes, J M (1930), 'A treatise on money', *The Applied Theory of Money*, Macmillan, Vol. 2.

Chart 4
Trading volumes by expiry date(a)



Source: Bloomberg.

(a) Daily average trading volumes during January 2006, valued at daily average spot prices during the same period.

The small scale of outstanding contracts in the exchange-traded market for oil futures may give rise to a relative lack of liquidity. Although the dollar volume of market turnover is higher than in any other commodity futures market, the oil futures market looks distinctly less liquid when measured by turnover relative to production (Table A). This holds even more so for contracts with long delivery dates (Chart 4).

Why the forward market for oil is not used more for hedging

The payback period from investing in oil production depends on the difficulty of extraction from the particular source. Our contacts cited periods from three to ten years or even longer before costs are recovered. The oil field could then be producing oil for the next 20 years or more. The problem for the producer who wants to hedge over such a timescale is whether it can, in fact, sell its oil forward. If not, this may be a barrier to entry for producers.

There are two obvious financial market counterparts to a producer's hedge: financial investors or oil consumers. If the exchange-traded futures market does not go out far enough, then there will be an incentive to hedge over-the-counter. For example, press reports have suggested that Canadian tar sands producers are seeking long-term agreements with refiners and power stations in the United States.

Several market intermediaries we spoke with reported rapid growth in investors' longer-term oil forward positions since the oil price started to rise, but the absence of precise quantitative OTC data makes it difficult to confirm this. The greatest barrier to a more liquid long-run market, in their view, is the lack of hedging by producers and consumers of future oil production and consumption.

Oil consumers

One reason oil consumers do not hedge is the lack of forward contracts for other products. Consider the following example. An airline company hedges its purchase of jet fuel for the next ten years by buying oil forward. But there is no comparative forward market for airline tickets, and the price of airline tickets in the future is likely to vary with the spot price of oil. If competitors' costs reflect the spot oil price and this price fell sufficiently below the hedged price, then the airline could, in the extreme case, be put out of business by an unhedged competitor able to undercut ticket prices by buying cheaper oil in the spot market. So, although the hedge would reduce the volatility of the company's costs, the volatility of its profits is more likely to rise unless, in addition to buying oil forward, it can sell its own output forward at similar time horizons.

Oil producers

We can extend this example to cover oil producers. As discussed earlier, countries do not generally hedge (production or consumption) to any significant degree. Indeed, there is not yet a benchmark contract for Middle East crude oil (partly because of the possibility of price manipulation by monopoly suppliers). The Tokyo Commodity Exchange does offer contracts which are an average of Dubai and Omani oils. But these are only available up to six months ahead, the contracts are priced in yen, and the volumes traded are small. However, the Dubai Mercantile Exchange may trade a new futures contract based on an underlying Middle East crude oil.

A motivation for not hedging oil production could be the inability of oil-producing countries to hedge, say, the prices of their imports. More generally it appears that state-owned producers want to obtain the benefits of any upward movements in prices and are less concerned about downward movements. In fact, for state oil company management, it is likely that there is considerable negative utility attached to the possibility of being seen, after the fact, to have under-priced the sale of a national asset.

Similarly, major commercial oil producers do not routinely hedge their production. The most common explanation offered for this is that their shareholders pressure them to keep their profits, and hence equity prices, exposed to the oil price because shareholders may themselves want to hold oil price exposure as a hedge, as an outright speculative position or as part of a diversified investment portfolio. In fact, if hedging an exposure to the oil price directly is not an easily available strategy, then other hedging strategies may be a rational second-best alternative. For example, it might then be a better hedge for retail investors and investment funds to hold oil company equities (or equity derivatives) or oil-based exchange-traded funds — the prices of which may move closely with the oil price. The investors and funds are likely to have established systems for, and more experience of, these types of investments, rather than taking direct positions in markets like oil, where specialist traders have an informational advantage.

Smaller independent oil companies, dependent to a greater extent on bank loans rather than equity finance, are more likely to hedge some of their production — perhaps because of interest payment obligations. Since their businesses are more specialised, their dependence on the oil price is also likely to be higher and hence the hedge has greater effect. As an example, one smaller UK-based company(1) stated in their 2004 annual report that they hedged about 20% of their forecast total group production over 2005–07.

Data

The availability of relevant data can be crucial in developing confidence and hence liquidity in any financial market. Just as macroeconomic data are important for exchange or interest rate markets, so data on oil reserves, oil consumption, trading, etc are important for the oil market.

Although the quality of data from futures exchanges is good, other data on the oil market appear incomplete. Contacts reported that oil reserve statistics are widely susceptible to inaccuracies as countries and oil companies may have an incentive to overestimate reserves (eg to increase production quotas or share prices). Similarly, while data on OECD countries' oil production published by the International Energy Agency (IEA) are regarded as good quality, non-OECD production data are not viewed by market participants as reliable. One project aimed at remedying this deficiency is the Joint Oil Data Initiative (JODI) which began in 2001 and is now under the direction of the International Energy Forum (IEF). JODI launched a new database in November 2005.

The influence of fiscal authorities on the incentive to invest and hedge

Commercial oil exploration and production companies face uncertainties about their returns not just from the oil price, but also because fiscal authorities can change the tax regime after a commercial investment decision has been made. This has been cited to us as a strong disincentive to invest that cannot easily be hedged against in the market.

Sometimes tax changes are pre-programmed under a production sharing agreement. The government of an oil-producing state might insist that any extra revenue from selling oil above a certain price goes to the state, in return for promises of a lower tax burden if oil prices go below a specified minimum. This effectively imposes a hedging regime on the commercial producer. Indeed, the producer will have no incentive to increase investment significantly, once the forward price of oil goes past the agreed threshold price. Some sources estimated that up to 20% of major oil companies' production was subject to this type of arrangement.

Summary and conclusions

The recent rise in the spot price of oil has been accompanied by an unusual increase in its forward price. There are indications from our discussions with market contacts and from market data of an increase in forward trading volumes and increased hedging activity. But most expected future oil production still remains unhedged. Low levels of hedging activity could be contributing to the high forward oil price and restricting the future supply of oil.

Our discussions with a range of contacts have not suggested any significant market failure regarding the functioning of the existing forward oil market (exchange-traded or OTC) for current market participants. Compared with other commodity markets,

(1) Paladin Resources plc, 2004 *Annual Accounts*.

the oil market is relatively liquid, credit risks can be mitigated, and barriers to entry for potential buyers and sellers do not appear to be significant. On the other hand, the low level of hedging relative to production indicates the potential for more activity. We have identified four main factors which may be acting as restraints on the level of hedging in the forward market for oil:

1. The absence of complete forward markets for goods and services for which oil is a key input (such as air travel and power supplies) means that the second-best solution for consumers may be not to hedge their consumption at all.

2. Many countries with state-owned oil producers also do not hedge forward production. As above, in the absence of complete forward markets for their imports, this could be rational for these states.

3. Shareholders of major commercial oil producers put pressure on those companies not to hedge. This may be a rational way for investors to hedge their own oil exposure or to take a speculative view.

4. The quality and coverage of data on oil reserves, production and consumption, and on the OTC market is widely regarded as being poor. The uncertainty this generates may limit hedging activity.