

OIL AND THE DOLLAR: A TWO-WAY GAME

The rise in oil prices in the euro area has been moderated by the appreciation of the euro against the dollar, since 2002. The trends in both variables, however, are atypical compared to their long term relationship: according to estimates given here, a 10% rise in the real oil price leads, ceteris paribus, to a real depreciation of the euro against the dollar of 9.4%. In November 2004, the price of oil in euros should thus have been 37% above the actual price. It is possible that the evolution of other determinants of the bilateral exchange rate overshadowed the impact of the oil price. But this does not rule out the possibility that a change in the oil-dollar relationship itself has occurred. The cause for change does not seem to be the savings or import behaviours by OPEC countries, which traditionally explain this relationship. In contrast, the emergence of China and its exchange rate regime could lie at the heart of a new, negative causality, running from the dollar to the price of oil.

■ An Atypical Period

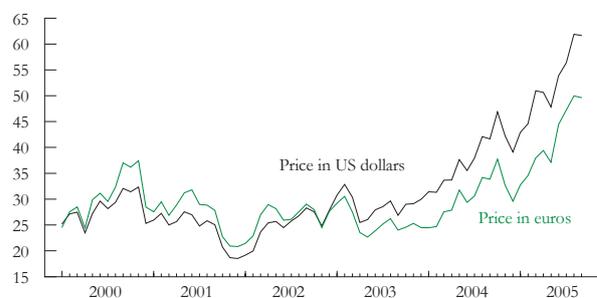
The rise in the world oil price is a major concern for all net importing countries, though it has been partly off-set in the euro area by the appreciation of the single currency. As a result, while the dollar price of oil rose by 233% between December 2001 and September 2005, the rise in euros was “only” 138% (see Graph 1). Within the euro area, it is of course this latter price which is significant for consumers (whose incomes are generally expressed in euros) and for companies (whose markets are mainly denominated in euros too).

The rise of the euro concomitant to the rise in oil prices has limited losses in consumer purchasing power and cost increases for companies. The euro has therefore contributed to limiting transmission of the oil price rise to euro area inflation. Nevertheless, the stronger euro also constitutes an unfavourable demand shock. Combined with the supply shock of higher oil prices, this has led to a slowing of activity (Box 1).

With hindsight, these developments over the last three years, which were interrupted at the end of 2005, are relatively

atypical. For the period running from 1974 to 2005, the correlation between the dollar oil price and the euro/dollar exchange rate was -0.42.¹ Consequently, the euro has tended to fall, on average, as the oil price has risen. Graph 2 shows that this scissor-movement was particularly strong for the reverse oil-shock in 1986, and during the first two years of stronger oil prices in 1999-2000.

Graph 1 - The price of crude oil per barrel - 2000-2005



Source: Datastream, crude oil, Global World International.

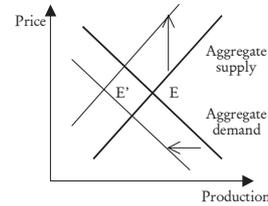
1. The exchange rate prior to 1999 is calculated using a synthetic euro.

BOX 1 — THE COMBINED IMPACT OF MORE EXPENSIVE OIL AND A STRONGER EURO ON THE EUROPEAN ECONOMY

The traditional neo-Keynesian framework of “aggregate supply - aggregate demand” is used here. Aggregate supply is the level of output sought by companies, for each general level of prices. Such supply rises with the price index, in the short term, as salaries are imperfectly indexed on prices (a price rise leads to a short term cut in real wages paid by companies, encouraging the latter to hire labour and raise production). Aggregate demand, in turn, is a diminishing function of the general level of prices, because a rise in prices reduces the real value of all household wealth which is not indexed on prices, and because price rises reduce net foreign demand, due to their impact on competitiveness.

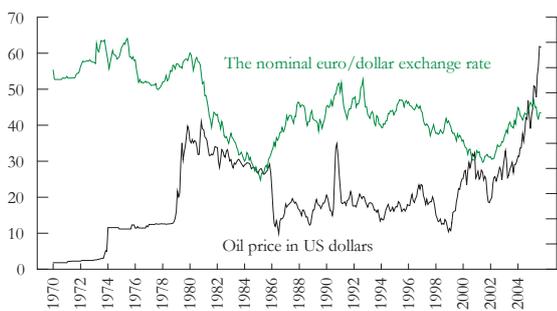
In this framework, a rise in the price of oil boosts producer prices for each level of supply: the supply curve shifts upwards. This movement is moderated by the appreciation of the euro, which influences the supply curve in the opposite direction, as the euro prices of imported raw

materials and intermediate goods are lower. Furthermore, the appreciation of the euro reduces demand for every price level, as net foreign demand is smaller (less exports, more imports). As a result, the aggregate demand curve shifts to the left, and the overall equilibrium moves to the left, in other words to a lower level of activity, but with little impact on prices.



Econometric tests carried out at the CEPII (Box 2) show that, over the long term (1974-2004), the real price of oil, defined as the oil price in dollars discounted by the US consumer price index, is positively linked to the real effective exchange rate of the dollar: i.e. the real exchange rate of the dollar against all US trade partners. Concerning the bilateral euro/dollar rate, estimates show clearly a negative relationship during the years 1980-2004, as shown in Graph 2. A 10% real increase in the price of oil coincides, in the long term, with a real depreciation of the euro against the dollar of 9.4%. Causality tests indicate that causality runs from the oil price to the exchange rate, and not *vice-versa*.

Graph 2 – The oil price and the (synthetic) euro/dollar exchange rate - 1970-2005



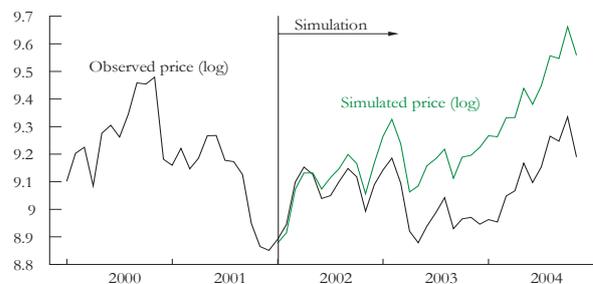
Source: Datastream.

Returning to the atypical period of 2002-2005, it is possible to simulate the effect of this long term causality on the evolution of the real euro/dollar exchange rate, on the basis of the observed trend of the real oil price in the United States. The corresponding evolution of the oil price in euros can then be deduced.² The result is plotted in Graph 3 in logarithms, so that the gap between the simulated series and the observed series may be read directly as a relative spread.

It may thus be observed that the relationship between the oil price and the euro/dollar exchange rate for 1980-2004 suggests an oil price in euros which is clearly higher in 2002-2004 than the actual price. In November 2004 (the last point in the simulation), the simulated, real price of oil in the euro area should have been 37% above the price actually observed. How is this gap to be interpreted?

The first, straightforward explanation is to say that the fall in the dollar between 2002 and 2005 was not mainly due to trends in oil prices. Indeed, the relationship which has been found in no way suggests that the oil price is the main determinant of the exchange rate. Interest rate spreads and external disequilibria substantially explain movements in the exchange rate over time.³ It may therefore be thought that the fall of the dollar between 2002 and 2005 follows on from US monetary policy, which led to lower interest rates in the US compared to the euro area, between mid-2001 and mid-2004. The fall has also been due to the worsening trade deficit, which reached 6% of GDP in 2005, while the euro area’s trade has been in balance. These major factors have overshadowed the link between the oil price and the dollar, so that ultimately both variables have moved in the same direction.

Graph 3 – Simulated and observed trends in the real price of oil for the euro area



Source: authors' calculations.

2. The real oil price in euros is calculated by multiplying the real price in the United States by the real euro/dollar exchange rate.
 3. The real oil price only explains 13% of the variance in the real exchange rate, in the model presented in Box 2.

The study conducted at the CEPII* examines the link between the real price of oil and the real effective exchange rate of the dollar. It covers the period from January 1974 to November 2004, or alternatively from January 1980 to November 2004, and uses monthly data. For the latter period (1980-2004), the analysis also looks at the real bilateral euro/dollar exchange rate, which is the variable studied here.

The existence of a long term relationship (a cointegration relationship) between the oil price and the euro/dollar exchange rate is confirmed at the 10% statistical threshold. This makes it possible to estimate an error correction model. Such a model describes the dynamic adjustment process of the exchange rate to its long term equilibrium, which is represented here by the past residuals (z_{t-1}) of the estimated cointegration relationship between the two variables. The equation relating to the logarithmic variations of the bilateral exchange rate is given by:

$$\Delta LRER_t = -0.0094 z_{t-1} + 0.3487 \Delta LRER_{t-1} - 0.1198 \Delta LRER_{t-2} - 0.0033 \Delta LOIL_{t-1} - 0.0204 \Delta LOIL_{t-2} - 0.0018$$

(-1.84)
(5.98)
(-1.95)
(-0.17)

(-1.04)
(-1.29)

where $LRER$ stands for the logarithm of the real euro/dollar exchange rate ($LRER$ rises when the dollar appreciates in real terms). $LOIL$ is the logarithm of the real price of oil (the dollar price adjusted for the US consumer price index). The figures in brackets are the Student's t values for the estimated coefficients. The speed of adjustment is very small, equal to 0.0094 per month, which means that approximately 11% of the adjustment in the equilibrium occurs every year (this is equivalent to about a 6-year half-life).

This relationship is then used to simulate what would have been the real price of oil in the euro area, had the relationship continued to function within the recent period. To do this, dynamic forecasts of the real euro/dollar exchange rate are made as of January 2002 using the preceding equation. The simulated value for $LRER$ (noted as $LRERS$) is then used to convert the price of oil into real terms, for the euro area (notes $LOILES$):

$$LOILES = LOIL + LRERS.$$

This price may then be compared to the observed evolution of the real price of oil for the euro area: $LOILE = LOIL + LRER$.

* A. Bénassy-Quéré, V. Mignon & A. Penot (2005), "China and the Relationship between the Oil Price and the Dollar", *CEPII Working Paper, No 2005-16*, October.

Without seeking to contradict the first explanation, it is also possible that the parallel movement observed since 2004⁴ between the oil price and the euro exchange rate (Graph 2) stems from a change in the oil-dollar relationship itself. What are the factors which could explain this?

The End of Parallelism

The positive link between the oil price and the dollar is usually explained by the savings behaviour of oil-exporting countries.⁵ A rise in the price of oil increases export earnings for these countries which are not fully re-spent. The resulting savings are invested in international capital markets, and oil exporters have a marked preference for dollar investments.⁶ Consequently, a rise in oil prices leads to an increase in world demand for assets denominated in dollars, in excess of the worsening in the US current account brought on by the bigger oil bill. As a result the dollar appreciates. Following this line of reasoning, a change in savings behaviour by oil exporting countries could explain a break or a weakening of the positive link between oil prices and the dollar. If these countries spend a larger share of their export earnings than previously, then their support for the dollar will lessen, and the dollar will not appreciate systematically when oil prices rise. Movements in the dollar will then be determined by the distribution of their imports

across countries and zones. If OPEC imports come more from Europe than from the United States, then the rise in OPEC imports resulting from an oil price hike will lead to an appreciation of the euro against the dollar.

According to the CEPII-CHELEM database, the share of the euro area as a supplier of OPEC (26%) is, in fact, higher than the area's share of world oil imports from OPEC (17%), and the gap is growing. The US, in turn, accounts for 24% of OPEC's oil purchases, but only supplies 8% of OPEC's imports. Again, this gap is growing.⁷ Were OPEC to spend all its export earnings on imports, then the trade balance in the euro area would rise and diminish in the United States.

However, this effect, likely to favour the euro, should not be substantial in the short term, as a major share of oil earnings are still saved. Indeed, OPEC's trade surplus doubled between 2001 and 2004, according to the IMF (Graph 4).

Overall, it is difficult to attribute the break in the positive link between oil prices and the dollar to changes in OPEC's savings behaviour or to structural shifts in OPEC imports.

In contrast, the break may be due to China's emergence as a key player both in the energy and foreign exchange markets. Even if its share of world imports is still limited at 4%, China was nevertheless responsible for a quarter of the increase in global oil demand between 1995 and 2004, and for a third of the rise in 2004.⁸ OPEC estimates that China's share in world oil imports will rise from 7% in

4. Despite a pause in the autumn of 2005.

5. See in particular P. Krugman (1980), "Oil and the Dollar", *NBER Working Paper*, No 554. We thank G. Horenstein for pointing out this reference.

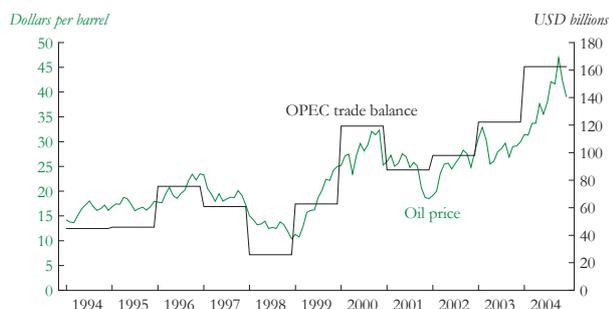
6. According to the Bank for International Settlements (*Quarterly Review*, December 2005), about 75% of OPEC bank deposits are in dollars.

7. In contrast, the United States and the euro area hold comparable positions *vis-à-vis* non-OPEC oil exporters. They import similar shares (respectively 31% and 37%) of these countries' oil exports and also provide comparable shares of imports (29% and 34% respectively).

8. World Bank, *Global Development Finance 2005*; OECD (2004), "Oil Price Developments: Drivers, Economic Consequences and Policy Responses", *OECD Economic Outlook* 76, December.

2005 to 12% in 2025. In comparison, Western Europe's share is expected to fall from 19% in 2005 to 15% in 2025.⁹ Turning to the forex markets, China holds the world's second largest official foreign exchange reserves (behind Japan), and the composition of this enormous portfolio is one of the prime uncertainties for the future of the euro/dollar exchange rate.

Graph 4 – Trends in oil price and OPEC's* trade balance - 1994-2004



* not including Algeria, Iran, Irak and Lybia.
Source: IMF-IFS and Datastream.

How could China's entry into both these markets have modified the link between the price of oil and the dollar? It could have done so because China operates a fixed exchange rate policy against the dollar.¹⁰ The fall in the dollar has impacted substantially on the Chinese economy in two ways. Firstly, it has raised the price-competitiveness of Chinese exports. Secondly, it has led to the central bank accumulating forex reserves to stop the yuan from appreciating against the dollar, which has boosted the Chinese money supply.

At the same time, China's growth voraciously consumes energy, and oil in particular. When measured in current dollars, the oil intensity of China's output (oil consumption/GDP) is twice as high as for the US and three times higher than in Europe: for each dollar of output, China consumes twice as much oil as the US and three times as much as Europe.

Consequently, the depreciation of the dollar, which favours growth in the United States and China at the expense of Europe, has strengthened world demand for oil: there has thus been some negative causality from the dollar to the oil price, which has perhaps outweighed the previous positive link.

Over the long term, it may be asked whether the emergence of China may durably mask the positive link between oil and the dollar. All depends on the future of China's *de facto* exchange rate regime. If, as seems likely, China moves more towards exchange rate flexibility, or towards a peg on a basket of foreign countries, then the negative link from the dollar to the oil price may disappear. In this case, the traditional relationship –under which the oil price affects the dollar in the short term through portfolio investments and in the long term *via* the distribution of oil-producers' imports– will reassert itself.

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9. OPEC, "Oil outlook to 2025", OPEC Review Paper, <www.opec.org/library/>.

10. In July 2005, the Chinese authorities announced a shift to a managed, floating regime referring to a basket of currencies. Since then, however, the yuan has *de facto* remained fixed against the dollar.

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