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TERMS OF TRADE AND EXCHANGE RATES: A RELATIONSHIP COMPLICATED BY ANCHOR POLICIES

The terms of trade of commodity-exporting countries are directly affected by the large-scale swings of worldwide prices. These terms of trade represent one of the key determinants of the real exchange rates of these economies. By estimating long-term equilibrium exchange rates we can gauge their impact for oil exporters and for exporters of other commodities. We then evaluate currency 'misalignments' as the discrepancies between the observed real exchange rates and their equilibrium values. Can these misalignments themselves be explained? In countries whose currencies are anchored to the dollar or to the euro, the misalignments are shown to depend on the behaviour of the anchor currency. When the anchor currency appreciates, the anchored currencies tend to be overvalued; when it depreciates, their undervaluation is likely.

From 1999 to 2007, global imbalances increased in line with world growth and became a major source of vulnerability. Oil exporters were among the countries accumulating the greatest current account surpluses over this period. Admittedly, the nature of their exports and the fact that the prices were fixed in dollars on world markets placed them in a very different position to some other countries, such as China, that were considered as having an undervalued currency, able to shore up their exports. However, the dollar peg of several of these oil currencies may have hindered the effective devaluation of the dollar by contributing to the euro/dollar face-to-face[1]. To what extent do the terms of trade explain the real exchange rates of theses countries? Has the dollar peg resulted in an undervaluation of their currencies? We will answer these questions by analysing the determinants of the real exchange rates for commodity and oil-exporting countries.

Terms of trade and equilibrium exchange rates

The terms of trade – defined as the export price relative to import price – are subject to wild fluctuations in commodity-exporting countries and these movements affect their real effective exchange rates (defined in box 1). Thus, the long-run decline in commodity-terms of trade over the 1980s and 1990s is reflected in a continued depreciation of the real exchange rates (Figure 1). Increasing terms of trade between 2000 and 2007 halted this depreciation, but did not reverse it completely. This leads us to further investigate the role of terms of trade in real exchange rates.

The terms of trade represent the export purchasing power of a country in terms of imports. From a theoretical perspective, they have an ambiguous impact on the real exchange rate, since

1. *See* A. Bénassy-Quéré, S. Béreau & V. Mignon (2008), "Euro-dollar : le face à face", *La Lettre du* CEPII, issue 279, June.

BOX 1 – THE REAL EFFECTIVE EXCHANGE RATE

The real exchange rate S is defined as follows:

$$S = E\frac{P}{P*}$$

where E is the nominal exchange rate expressed as the number of units of foreign currency per unit of domestic currency (when E increases, the exchange rate appreciates), P is the domestic consumer price index and $P*$ is the foreign consumer price index.

If we think not in bilateral terms but in terms of all partner countries, E becomes a weighted average of the bilateral exchange rates and is referred to as the nominal effective exchange rate. $P*$ thus becomes a weighted average of the consumer prices of the domestic country's trade partners. By using i to refer to the domestic country and supposing that country i has n trade partners ($j = 1,..., n$), we can express the nominal effective exchange rate of the country i as follows:

$$NEER_i = \prod_{j=1}^{n}\left(E_j\right)^{\alpha_j}$$

and $P*$ is thus expressed as: $P* = \prod_{j=1}^{n}\left(P_j\right)^{\alpha_j}$

where α_j represents the weight of country j in the trade of country i and E_j refers to the bilateral exchange rate between countries i and j.

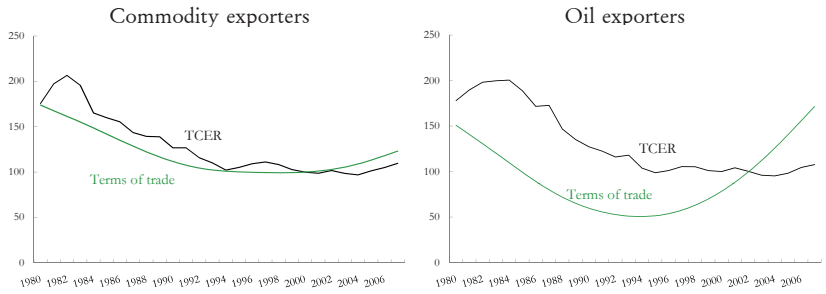
The real effective exchange rate $REER_i$ of country i can thus be expressed as follows: $REER_i = \prod_{j=1}^{n}\left(\frac{E_j}{P_j}\right)^{\alpha_j} P_i$

two effects operate in opposite directions: the income effect and the substitution effect. Let us consider an improvement in terms of trade. On the one hand, national income increases, which results in a rise in demand, particular for non-tradable goods (income effect); this in turn causes a rise in the general level of prices, which induces an appreciation of the real exchange rate. On the other hand, consumption of imported goods increases to the detriment of domestic goods (substitution effect); this causes a drop in demand for non-tradable goods, which results in a depreciation of the real exchange rate.

For commodity-producing countries, the income effect generally prevails over the substitution effect. The substitution effect is of little significance as the exported products – commodities – and imported products – manufactured products – are used in very different manners. It is difficult for households to substitute one type of products for the other in their consumption basket based on price variations. As a consequence, an improvement in the terms of trade results in an appreciation of the real exchange rate.

Fluctuations in the price of oil also have major effects on the wealth of nations and cause significant current account imbalances. Thus, in the wake of the spike in the price of crude in the mid-2000s, oil-exporting countries recorded all-time high current account surpluses and accumulated an external wealth per capita that was unrivalled throughout the world. The accumulation of surpluses or debts is however also a well known determinant for real exchange rates. To study the relationship between terms of trade, the accumulation of external wealth and exchange rates, we estimate the equilibrium exchange rates linking the real effective exchange rates to these determining factors. To do this, we use the behavioural approach[2], which consists in estimating a long-term econometric relationship between the real exchange rate and its economic fundamentals[3]. This type of model is not designed to forecast exchange rates but rather to calculate the real exchange rates compatible with balanced fundamentals, based on past behaviours. We estimate this relationship for two groups of countries: a panel composed of 52 commodity-exporting countries[4] and a panel of 16 oil-exporting countries[5].

Figure 1 – Real effective exchange rates (2000 = 100) and filtered terms of trade



Note: Exchange rates and terms of trade are averages calculated using samples from the countries listed above under footnotes 4 and 5. Filtered terms of trade (prices of commodities or oil compared with prices of manufacturing exports from the OECD) are long-term trends calculated using a Hodrick-Prescott filter.
Source: IMF and OECD, authors' calculations.

2. Referred to as the BEER (Behavioural Equilibrium Exchange Rate).
3. For more details, see V. Coudert, C. Couharde & V. Mignon (2008), "Do terms of trade drive real exchange rates? Comparing oil and commodity currencies", CEPII *working paper*, no. 2008-32.
4. Argentina, Australia, Bangladesh, Bolivia, Brazil, Burundi, Cameroon, Canada, Central African Republic, Chile, Colombia, Costa Rica, Côte d'Ivoire, Dominica, Ethiopia, Ghana, Guatemala, Honduras, Iceland, India, Kenya, Madagascar, Malaysia, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Myanmar, New Zealand, Niger, Pakistan, Papua New Guinea, Paraguay, Philippines, Peru, Senegal, South Africa, Sri Lanka, St. Vincent and Grenadines, Sudan, Surinam, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, Uruguay, Zambia and Zimbabwe.
5. Algeria, Angola, Bahrain, Indonesia, Iran, Kuwait, Libya, Mexico, Nigeria, Norway, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates and Venezuela.

Two models are considered. In model A, we retain three economic fundamentals: a proxy for relative productivity representing the Balassa-Samuelson effect, the net foreign asset position, and the terms of trade (box 2). In model B, only the terms of trade are included as explanatory variable.

The results obtained are in accordance with expectations: a rise in the terms of trade, the net foreign asset position or relative productivity leads to an appreciation in the real exchange rate for the two panels of countries. For commodity-exporting countries, the terms of trade are the most important factor for determining the exchange rates. Ceteris paribus, a 10% rise in their terms of trade results in a 4%-6.5% rise in their real effective exchange rate. In the case of oil-exporting countries, a rise in the oil price also results in a real appreciation in the exchange rate, albeit slightly lower – a 10% rise creates a real appreciation in the range of 2%-3%[5].

Misalignments and exchange rate regimes

Based on these estimations, we can calculate currency misalignments, defined as the difference between the real effective exchange rate and its equilibrium value as given by the estimation. For commodity-exporting countries, both model A and model B produce similar results, which is not surprising given that the terms of trade constitute the most significant variable with regard to explaining the exchange rate. In 2007, the end date for our sample, the results are not particularly decisive for commodity-exporting countries since half of the currencies are undervalued and the other half are overvalued. This latter group includes the Icelandic króna, which was to collapse in 2008, the New Zealand dollar and the countries in the CFA franc zone. Out of the 16 oil-exporting countries considered, 8 have undervalued currencies, 5 are close to the equilibrium value and 3 are overvalued. Undervaluation is more pronounced under model B owing to the importance of the coefficient applied to the terms of trade in this model (see box 2).

Are the exchange rate regimes able to explain part of these misalignments? On the one hand, floating exchange rates may diverge from fundamentals owing to speculation on the exchange market. On the other hand, a fixed exchange regime may prevent or slow the real effective exchange rate's adjustment to its equilibrium value, since this adjustment must take place via prices that are rigid in the short term, especially downwards. For this reason, pegged currencies are more prone to overvaluation[7]. On average, the results show that commodity currencies were undervalued in 2007 (Table 1). The undervaluation is much larger for floating currencies than for pegged currencies in both models. However, a closer look at the results across countries highlights a wide dispersion around the average results, which mitigates the link between the exchange regimes and the recent misalignments in this sample. A factor that does appear to play a crucial role, on the other hand, is the currency to which the currency of the exporting country is pegged. Thus, in 2007, currencies pegged to the dollar were undervalued by 4.2%-8.2%, depending on the model considered, whereas currencies fixed to the euro were overvalued by 7-7%-14.9%.

Box 2 – Estimation of the models of equilibrium exchange rates

In model A, the real effective exchange rate of country *i* (reer) (taken as a logarithm) is explained by its relative productivity (measured by the GDP per capita at purchasing power parity of country *i* compared with its trade partners and taken as a logarithm, referred to as *y*), its net foreign asset position as a percentage of the GDP (*nfa*) and its terms of trade (as a logarithm) (*tot*):

$$reer_{it} = \gamma_{0i}^{A} + \gamma_{1}^{A} y_{it} + \gamma_{2}^{A} nfa_{it} + \gamma_{3}^{A} tot_{it} + \eta_{it}^{A} \quad \textit{Model A}$$

In model B, only the terms of trade are considered, *i.e.*:

$$reer_{it} = \gamma_{0i}^{B} + \gamma_{3}^{B} tot_{it} + \eta_{it}^{B} \quad \textit{Model B}$$

The coefficients estimated for the period 1980-2007 using panel cointegration techniques for these two models are displayed in the table below.

	y	*nfa*	*tot*
Commodity-exporting countries			
Model A	0.0425	0.0028	0.4010
Model B			0.6484
Oil-exporting countries			
Model A	0.4746	0.0002	0.2237
Model B			0.2624

6. These results confirm those of other studies, which have shown that commodity and oil terms of trade have a significant impact on the exchange rates of producing countries. The order of size of these effects is also essentially the same as for the effects found in empirical studies. For a survey, see V. Coudert, C. Couharde & V. Mignon (2008), *op. cit.*.

7. See V. Coudert & C. Couharde (2009), "Currency misalignments and exchange rate regimes in emerging and developing countries", *Review of International Economics*, 17(1), or CEPII *working paper*, no. 2008-07.

Table 1 – Average misalignments in 2007 by exchange regime, in %

	Floating or Intermediary	Fixed	Anchor currency	
			USD	EUR
Model A	-10.2	-0.9	-4.2	7.7
Model B	-9.9	-1.8	-8.2	14.9
Number of countries	*39*	*29*	*21*	*8*

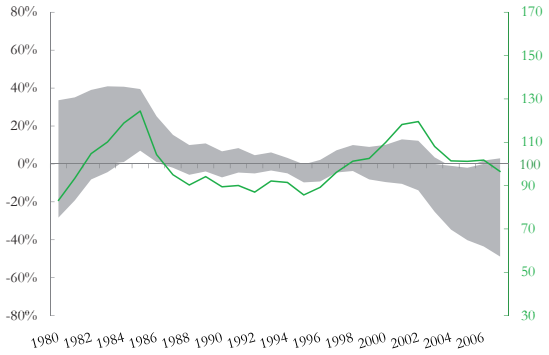
Note: Anchor currency: currency to which the nominal exchange rate of the domestic currency is pegged (the monthly variation of the bilateral nominal exchange rate stays in the (-1%, 1%) internal during more than ten months).
A negative (positive) sign represents an undervaluation (overvaluation) of the real effective exchange rate.
Source: authors' calculations.

The importance of the anchor currency

The fact that fluctuations in anchor currencies can explain recent trends in the real effective exchange rates of pegged currencies is not surprising given the size of the euro's movements against the dollar. The value of the euro doubled against the dollar between 2000 and 2007: the nominal exchange value of any currency pegged to the euro thus appreciated by 100% against the dollar over this period. Since the bulk of short-term movements in real exchange rates comes from the nominal value, being anchored to the dollar or to the euro largely determines the behaviour of the real exchange rate, at least in the short-run. The question then arises, more generally, of whether pegging to the dollar leads to currencies undervalued when the dollar is weak against all currencies, and, inversely, whether it leads to overvaluation in the periods when the dollar is strong. The same question can also be asked for currencies pegged to the euro.

To answer this question, we compare the misalignments of pegged currencies with the fluctuations in the anchor currencies, the euro and the dollar. The results listed in Figure 2 show that when the real effective exchange rate of the dollar appreciates, the currencies pegged to the dollar do tend to be overvalued, with the opposite being seen during periods when the dollar is weak. The same type of phenomenon is observed for countries whose currencies

Figure 2 – Misalignments of currencies pegged to the dollar* (%) and real effective exchange rate of the dollar (average for period = 100)



* Range of misalignments calculated using model B.
Note: The countries pegged to the dollar are: Bahrain, Dominica, Oman, Qatar, Saudi Arabia, St. Vincent and Grenadines, United Arab Emirates.
Source: authors' calculations and IMF for the real effective exchange rate of the dollar.

are pegged to the euro. The periods during which the euro depreciates are linked to an undervaluation of the currencies pegged to the euro, and vice versa.

Overall, pegging to the dollar or the euro is a key factor in explaining the real exchange movements for commodity and oil-exporting countries. The links between terms of trade and real exchange rates are altered by exchange rate regimes. Fluctuations in the key currencies, the euro and the dollar, have been so wild recently that they have affected the real exchange rates of pegged currencies more than the domestic fundamentals themselves. This raises the issue of the exchange rate regimes in these countries, and especially of the nominal anchor that could be adopted by the monetary union planned by the six countries of the Gulf Cooperation Council.

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