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Abstract We investigate in this paper the skirmishes that the US dollar and the euro had from 2007 to 2011 and, in particular, the two distinct sharp falls that the single currency had in 2008 and 2010. We basically consider how impulses coming from domestic money markets impact on the USD/EUR exchange rate through the Eurocurrency market. Our findings show that the cycles in the spreads in the LIBOR rates have a bearing on the direction of change in the spot exchange rate in a way which is different from that predicted by the interest rate parity. The exposure of the value of reserve currencies to the vagaries of the outside circulation in the Eurocurrency and FX markets is only one of the many different policy implications of the current arrangement of the international monetary system. In the final part of the paper we also discuss some of those tied to the very existence of the international money market and to competition among old and emerging global currencies and financial centres.

Keywords Exchange rates, LIBOR rates, reserve currencies, financial centres.

JEL Codes F31, F33, F36

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1. Introduction

The volatility of the USD/EUR exchange rates during and after the great crisis of 2007-2009 and the concurrent swings of interest rates in the domestic and international money markets seem to offer an interesting case study for investigating the relation between interest rates and exchange rates. At best, the findings of our simple analysis could help to clarify the vexed question regarding whether and how exchange rates respond to interest rates. The relation is for the short term or the long term depending on whether nominal or real magnitudes, respectively, are taken into consideration. We will concentrate on nominal magnitudes and, in particular, on LIBOR¹ rates, which at least since Frenkel and Levitch (1975) have been the preferred benchmark for tests regarding interest rate parities. During the crisis LIBOR rates were under investigation², but they remain key rates in the international money market.

Exchange rates obviously reflect many other variables other than interest rates and prices. The current account, the net position in foreign assets, economic growth and merger and acquisition activities are only some of features of the macroeconomic scenario in which exchange rates move. Many efforts have been made in analysing exchange rates behaviour within comprehensive macroeconomic frameworks, but these frameworks have famously failed to give convincing explanations and reliable predictions about exchange rates (e.g. Frankel-Rose, 1994). Indeed, exchange rates are said to represent countries, their currencies and policies rather than companies and thus they also inevitably have meta-economic significance, particularly in the long run. Although exchange

¹ LIBOR (London Inter-bank Offered Rate) is the average of the rates set for ten currencies and fifteen maturities, i.e. of 150 rates each business day. LIBOR rates are published daily by the British Bankers' Association (<http://www.bbalibor.com/>) for loans ranging in maturity from overnight to a year. They are defined as the arithmetic mean of the middle eight rates declared by senior bankers in prime banks. While such rates are the banks' offered rates on their own loans, EURIBOR rates (the euro equivalent for LIBOR rates), instead, are estimated as averages of the rates at which prime banks other than the ones surveyed have to borrow. LIBOR and EURIBOR rates are extremely important since they represent the daily benchmarks for extending credit in the international and the national credit markets.

² The Financial Times (Oakley, 2010) reported on investigation of the banks involved in setting the LIBOR before and during the 2007-2008 crisis, i.e. when worries about counterpart risks made strain and spreads among offered rates in the interbank market soar. Since banks are asked to state the offered rate, i.e. the rate at which they could borrow, at the height of a liquidity crisis such as the last one a weaker bank has an incentive to underestimate the rate at which it can borrow to appear less weak.

rates are influenced by political and economic news, economists like to believe that they are endowed with a sufficient degree of capacity to revert to fundamental equilibrium, or at least to the mean. In this paper we deliberately focus on interest rates; and in looking at LIBOR rates we find that the USD/EUR exchange rate is clearly driven by the cycle in spreads, which, in turn, are supposed to reflect existing competition between offshore and onshore credit and deposit markets in any currency.

Section 1 focuses on the 2008 and 2010 episodes of weakness in the euro and on their different nature. Section 2 briefly summarizes the theory regarding exchange crises. Obvious differences exist between reserve and non-reserve currency crises. A crisis in a non-reserve currency is an all but infrequent event and the two episodes cited have been perceived as manifestations of intrinsic weakness, if not as fully-fledged crises³. A real crisis in a reserve currency after the complete demonetization of gold would be a novelty that existing theories fail to capture; however, substitution and skirmishes between currencies in the evolving multi-polar system of flexible exchange rates may become a pretty recurrent event. Indeed, the current arrangement is bound to change in order to allow space for a new reserve currency from the emerging economies, or for a true supranational currency⁴. This transition has been advocated not only by China and other emerging economies, but also by the United Nations. As far as China is concerned, the efforts that the country is making to turn Hong Kong into a offshore renminbi centre are noteworthy (He and McCauley, 2010). In Section 3, we compare the USD/EUR exchange rate and US dollar and euro LIBOR rates to ascertain whether and how they matched during the turbulent period extending from 2007 to early 2011. The main finding is that LIBOR spreads follow a cycle which is able to guide the trend in the USD/EUR exchange rate. Section 4 presents an overview of some policy implications of the enlarging offshore currency markets and excessive exchange rate fluctuations of reserve currencies. The final section briefly concludes.

³ In what follows, they will be called crises not only for simplicity's sake, but also because speculation combined with self-fulfilling expectations and with doubts on the long-term viability of the European monetary union concurred to yield a sharp fall in the single currency.

⁴ See the 2009 Report of the UN Commission of Experts on the problems of the current international monetary and financial system and their call for a truly global reserve currency based on a broadened SDR arrangement (http://www.un.org/ga/econcrisissummit/docs/FinalReport_CoE.pdf). The idea of a truly global reserve currency is far from new, but the rapid growth of emerging economies and the ensuing rebalancing of economic weights obviously gives a new perspective to the evolution of the international monetary system.

2. The EUR-USD exchange rate

Europeans certainly took into consideration the problems arising when a national currency is used as an international one when they had to design the European Monetary System in 1979. Instead of the Deutsch-mark, they preferred the European Currency Unit (ECU), a basket currency which was merely used as a benchmark for regulating bilateral exchange rates within the exchange rate mechanism of the European monetary system (EMS-ERM). The mechanism did not work well and after a decade its difficulties were maximal. The EU then launched the project of monetary union and replaced the EMS-ERM with the euro in January 1999, i.e. twenty years after the ECU. The new currency started circulating as the single currency in 2002 to foster integration not only in the EMU, but also to stabilize exchange rates in the rest of the European Union and Europe itself. While believing that the single market needed a single currency and that the latter needed a central bank, the EU thought that neither a political union with a federal budget nor an integrated bond market and effective macroeconomic policy coordination were necessary in order to back the single currency. The Growth and Stability Pact, which was intended to replace fiscal federalism, has proved to be quite ineffective in providing short-term flexibility and fiscal sustainability in the medium term. The latter needs a more efficient mechanism of internal adjustment than that provided by relative prices. The sluggishness of prices in combination with the price stability mandate of the central bank translate into permanent deflationary pressure in the laggard countries. As the common monetary policy is obviously unsuitable for reducing real divergence, large structural imbalances (i.e. deficits and surpluses in the current account) increased during the first ten years of the monetary union. What triggered the crisis in 2010 was actually the foreign debt⁵ in some countries – primarily in Greece⁶, Portugal, Spain and Ireland⁷ – resulting from structural

⁵ The foreign debt results from the accumulation of liabilities, i.e. a structural deficit in a country's current account.

⁶ In the case of Greece, the misreporting on the actual level of the budget deficit had a distinct triggering effect.

⁷ An excessive foreign debt is a threat to national and foreign banks. The crisis erupts in the capital market as the value of sovereign and corporate bonds and the value of bank stocks falls. In a single country the crisis is immediately passed on to the national currency, but in the European Monetary Union the crisis of any one of its members is transmitted to the common currency because adjustment mechanisms and governance are ineffective. Even

imbalances in the public and/or private sector and notably bank crises and public debt. Notwithstanding, the euro had gained a role as the second key currency in official exchange reserves⁸.

The 2007-2009 crisis was a turning point since it triggered heightened instability in the exchange rate between the two main reserve currencies. The single currency basically had two plunges of 21% each (Figure 1). The first was on 15 July 2008, when it toppled from the maximum of US\$ 1.599 to reach US\$ 1.246 on 10 October 2008 (-21%). The second was on 3 December 2009, when it fell from US\$ 1.512 to reach US\$ 1.194 on 8 June 2010 (-21%). Although the two episodes produced a nominal depreciation of an almost identical size, they were not manifestations of the same mechanism.

The 2008 fall has been ascribed to the flight-to-safety or, more exactly, to the effect of the abnormal demand for dollars generated by the unwinding of foreign asset positions held by US investors. The event started with a surge of the US dollar vis-à-vis the euro reflecting a large conversion of euros into dollars through FX swaps and an increase in the LIBOR spreads in favour of the euro, all signalling an acute dollar shortage. In this sense, it can be said that the event had its start in the US rather than in the EU. This could have made surprising the fall in the single currency instead of the dollar if, in the same event, the US Federal Reserve had not used its Term Auction Facility to grant loans in dollars to a few

the governance reforms introduced with the Lisbon Reform Treaty and the rescue plans launched in 2010 and 2011 appear unable to fix the problem.

⁸ According to the International Monetary Fund (IMF, 2010) after that of the US dollar (62%), the euro had the largest share (27%) in global exchange reserves at the end of 2009.

European banks. Indeed, the auctions which started in December 2007 to provide funds to banks which were facing difficulties in obtaining term funds in the domestic inter-bank market (McAndrews et al., 2008). The Federal Reserve was then able to maintain the effective federal funds overnight rate close to its target, but was unable to do the same for term loans since banks were reluctant to lend to each other at longer terms. The European Central Bank experienced the same problem a little later. The crisis was obviously global and, as was disclosed in late 2010, Barclays was a large borrower to buy the US operations of Lehman Bros. and a few other big European banks benefited from the emergency credit provided by the Federal Reserve (Harding et al., 2010).

The December 2009 – June 2010 fall in the single currency was -21% (Figure 1), i.e. practically of the same extent as in the July-October 2008 crisis, but intrinsically different. It was originated by concerns over government finances and banks' solvability. While the 2008 crisis occurred in a period in which risk appetite and funding liquidity were very low, the 2009-2010 crisis took hold when all financial systems were awash in liquidity poured in by central banks. Indeed, stock markets had recovered from their lows of early 2009 and commodity prices were sloping upwards. In May 2010, i.e. after six months of decline, the possibility of a further steep fall in the single currency made the possibility of a coordinated currency intervention surface⁹. The last time that the ECB had intervened in the exchange market was in September 2000. Then, shortly after the introduction of the euro, the single currency was very weak. The ECB bought a few billion euro, but it was not alone since the US Federal Reserve and the central banks of Japan, Canada and Britain joined to help the ECB and the single currency, which then was slightly above \$ 0.8, i.e. almost half of the peak reached in July 2008 (Figure 1). The 2010 crisis can be seen more correctly as the result of a market perception of fragility stemming from internal imbalances and concerns over the sustainability of the EMU after the crisis and of a favourable environment for speculation rides¹⁰. Indeed, a structural divergence seems to exist between the core and the peripheral countries in terms of unit labour costs and prices which the existing real adjustment mechanism does not seem able to curb effectively. Since integration inside the EMU is still imperfect,

⁹ At a Reuters Newsmaker event of mid September 2010, the well-known financier George Soros said that buying the euro and the debt of weaker states under attack helped the single currency to recover (<http://about.reuters.com/events/newsmaker>).

¹⁰ Liquidity was plentiful and interest rates were low.

real adjustment requires a considerable degree of flexibility in the real exchange rate which, given the single currency, implies an identical degree of flexibility in nominal prices and wages. The problem is that such a degree of flexibility does not exist. The first ten years or so have been spent in muddling through without adequate progress in the working of the real adjustment mechanism. Current account imbalances across the monetary union were increasing. They reflect increasing differences in competitiveness and thus a biased allocation of the expenditure between domestic and foreign goods. At the same time, the persistently low level of interest rates distorted the choices between saving and investment (i.e. the imbalances just mentioned) led to divergent asset positions in the private sectors across member countries. This could not have taken hold without the bank intermediation and without an underestimation of the risks involved. For a long while the capital market did not notice the whole scenario or – and it amounts to the same thing – it thought that the euro zone might grow in a reasonably uniform way and thrive or, at least, provide a de facto guarantee. The 2008-2009 crisis and the ensuing divergences in growth have led the market to make drastic changes in the relative prices of risks in sovereign and private debts and thus in banks' solvency. When the crisis erupted, banks faced illiquidity and saw their assets depreciating; credit dried up and the governments made their debt increase rapidly after they took an active role in the economy. This eventually triggered the crisis in the single currency starting in December 2009. In early May 2010, the euro was plunging; EMU was close to disintegration and a first rescue plan was hurriedly settled by the EU, the ECB and the IMF¹¹. This was only the first in a series of decisions aimed at strengthening vigilance and increasing liquidity in the peripheral countries. According to Bini Smaghi (2010), a Member of the Executive Board of the ECB, the design of EMU is flawless, although in June 2010, i.e. after the single currency had plunged to \$ 1.194 and the emergency plan was already in action, it appeared that the EMU was in need of some correction of its institutional weaknesses (Bini Smaghi,

¹¹ The European Financial Stability Facility (EFSF) is a vehicle company created in early May 2010 to issue bonds for up to €440bn from the member states. Considering the €60bn provided by the Commission and the €250bn provided by the International Monetary Fund, the rescue package makes the total of €750bn. EFSF has been assigned the best possible credit rating by Standard & Poor's and Fitch Ratings, Aaa by Moody's and its first two issuances were successfully made in 2011. They provided limited help to Greece and Ireland, tough???. In mid-2013, the company will be replaced by the European Stability Mechanism (ESM) a permanent crisis management institution. On March 2011, EU leaders endorsed the creation of the ESM and the Euro Plus Pact, a package which aims at removing the deep causes of the crisis. <http://www.efsf.europa.eu/about/index.htm>

2010). In his view, financial markets failed to exert vigilance on the rise of excessive sovereign debts. Furthermore, the Stability and Growth Pact had been totally ineffective and, third, the Lisbon process, which had started in 2000, failed to increase competitiveness adequately in the peripheral countries. The emergency plan that was then devised for Greece and which consisted in fiscal retrenchment, was hoped to be the right solution, but the subsequent bail-outs of Ireland and Portugal proved that such an approach is not able to bring interest rate spreads down and allow those countries to return to the capital market. The alternatives appeared unpalatable. The exit from the EMU implies a wild depreciation of the national currency and a real debt shock. Euro bonds and fiscal transfers across member countries trigger political difficulties. Debt restructuring is dangerous for the European banks. The real problem seems to be that of the sustainability of structural imbalances and net liability positions in the private and public sectors inside a monetary union. The changed balance between assets and liabilities had obvious effects in the capital and the foreign exchange markets. The lesson that can be drawn from the European experience is that the degree of sustainability of imbalances inside a monetary union like the European one is not higher than that existing outside. When the real adjustment mechanisms are not sufficiently effective, the non-existence of the exchange rate inevitably makes countries forget the problem of debt sustainability. In other words, by giving up the exchange rate, countries lose an useful warning device or indicator, if not an efficient adjustment mechanism. The existing literature has focused more on the adjustment potential of exchange rates than on their signalling capability. The fall in interest rates at global level has worsened the forgiveness problem. Persistent low interest rates have increased the appetite for credit in the private and public sectors and the ensuing excessive debt-building has driven some countries into a debt trap just when one of the available indicators was being lost and has driven some others to miss the opportunity to exit the trap when it was easier to do so.

3. Hints from the literature on currency crises

Currency crises are events which are mainly for fixed or pegged currencies. These crises have been so frequent since the demise of Bretton Woods that there are interesting and different explanations (Pesenti, Tille, 2000). The so-called first-generation model of currency crises indicates inconsistency between the policy stance and a structural imbalance in the exchange regime as the triggering factor for

the crisis. The second-generation models emphasise the role of expectations in that, at a certain point in time, a shift in expectations occurs making the exchange rate peg unsustainable. In the third-generation models it is the reduction in interest rates that makes firms and banks let domestic low-return, but risky, investments rise to unsustainable levels.

The first or oldest theory is far from being useless. In the case of the EMU, some countries have unsustainable internal imbalances in the current account. Excessive borrowing in the private and public sectors also made the third-generation theories relevant. Furthermore, the sudden surge in spreads in government debt that materialized in 2010 and the ensuing contagion are clearly fitted by the second-generation models. The basic point to be borne in mind is that EMU member countries are obviously bound by an internal fixed exchange rate regime, but they no longer have their own domestic currency. Thus theories classified in the three generations do not immediately fit the euro crisis because the EMU does not have, per se, all the symptoms of the canonical domestic currency crisis.

The two episodes should actually be seen as crises in a floating currency as the euro is allowed to free float vis-à-vis all other major currencies. One possibility is a crash following a sudden exchange rate movement caused by carry-trade unwinding (Brunnermeier et al., 2009). A carry trade is a market situation whereby the currency paying the higher return or the investment currency slowly appreciates over the funding currency. As such, a carry trade violates the UIP, i.e. the condition whereby the currency paying the higher return suddenly appreciates while being expected to depreciate by the same extent as the spread. Yet the euro is not an obvious funding currency as official interest rates, short term money market rates, EURIBOR and LIBOR interest rates and Treasury bill rate of returns are all quite high, on average, vis-à-vis the same rates in other typical funding currencies. It is therefore arguable that the single currency lacks the basic features of any true funding currency and that carry-trade unwinding was certainly not the case of the euro in 2008 and 2010. Neither can the 2008-2009 crisis be adequately paralleled to the 7-8 October 1998 flash-crash of the US dollar against the yen (one-day 7% loss). The role of algorithm trading in that sharp, flashy and unexpected fall has not yet been carefully investigated.

A different paradigm is the crisis of a reserve currency

losing its reserve currency status. This event could come in at least two forms. The first is a large and prolonged depreciation of a fiat currency vis-à-vis other instruments. This was typically the case of the years 1971-1974. At that time the US dollar depreciated against gold, but it was actually gold – not the US dollar – that was losing its status in the international monetary system as the dollar survived as the key reserve instrument. As regards the second possibility, a vast literature developed regarding the crisis in a reserve currency deriving from intrinsic weaknesses of the domestic economy. This literature led to the ongoing debate on the reform of the international monetary system. The debate about the likelihood of a future dollar crisis developed during the last twenty years or so (e.g. Obstfeld-Rogoff, 2004; Krugman, 2007) and addressed the issue of US current account deficit sustainability, which is obviously entirely different from the lost link with gold. More recently, the introduction of the euro and its expanding role in global exchange reserves fuelled the debate about the alleged flaws in the design of the European monetary union and the ensuing intrinsic weaknesses of the single currency (Galati and Wooldridge, 2006; Pisani-Ferry and Posen, 2009). The steep falls in 2008 and 2010 obviously rekindled the discussion about the role of the single currency as reserve instrument and even about its sustainability (Alcidi et al., 2010). The weaknesses of the historical reserve currencies and the surge of emerging economies are obviously forerunners of significant changes in the current international reserve system and in exchange rates as well. This issue cannot be dealt adequately without considering that exchange rates have a role to play in the complex process needed to rebalance saving and investment in the different economies. The dislocation of the rates at which the dollar, the euro and all other currencies –the renminbi included— could be substantial. Although it is commonplace to argue about unsustainable imbalances, a real global rebalancing is more an analytic expedient than a warranted and observable outcome in the real world. The existing pattern of surpluses, deficits and monetary privileges, indeed, will probably evolve into a different distribution of imbalances and privileges. The dislocation, never the less, could assume the features of a real exchange rate crisis in some cases. The US currently has a gigantic outside circulation of dollars and a large and unsustainable deficit to reduce; China has a small outside circulation while having a large and unsustainable surplus to trim. Its large stock of reserves offers a potential contribution to global liquidity with which China, at least in part, already feeds the international money and bond market. The EU has a significant outside circulation without any special imbalance to correct, in

the aggregate. Exchange rates and other economic variables, such as interest rates, prices, saving and investment, have a role to play in the evolution/rebalance process of the existing pattern, but – ultimately – an outside circulation is indispensable, if the international monetary system is to remain in place to do the job. The present article modestly aims at focusing the interdependencies between interest rates in the international monetary market and the USD/EUR exchange rate and it is to this issue that we are turning.

4. Cyclic LIBOR spreads and exchange rates

Soaring trade in financial assets and innovation has made people increasingly look at a currency as the price of an asset, yet the foreign exchange market still quotes the relative price of a pair of media of exchange. Thus the size of the foreign exchange market can be gauged by the daily turnover only, rather than by capitalization. The foreign exchange market peculiarly neither goes up nor down since each day half of the currencies appreciate and half depreciate. In terms of daily turnover, the foreign exchange market is the largest market of all (BIS 2010b). Innovation is making it also one of the fastest markets. According to the last survey of the Bank of International Settlements (BIS, 2010b) daily turnover averaged 4000 billion US dollars in April 2010. The turnover has been growing substantially as it was only 1934 billion in April 2004 and 3 324 billion in April 2007 and the flood of liquidity that started in 2008 certainly did not fail to reinforce the latest trend, which is predicted to continue until quantitative easing ends in the United States. The exchange market is bank dominated in that the daily turnover in the interbank market was about 1.4 trillion (38.8%) in April 2010, while the trading activity in which at least one counterpart is a hedge fund, pension fund, mutual fund or insurance company increased to 47.7% of turnover. While the foreign exchange market is dominated by banks, the offshore or euro currency market is really dominated by the major currencies¹² The US dollar is still the most traded currency since in almost 85% of the trades in April 2010 it represented one side of the deal. The euro is second (39% of the trades). The yen is third (19%). While the US dollar and the yen were then in slow retreat from their peak shares reached in 2001, the euro was then still gaining market share. In April 2010 the US dollar–euro currency pairs accounted for 1.1 trillion of daily turnover.

¹² At the London inter-bank market the currencies are ten.

Investors who use the exchange market as a vehicle for purely speculative investment coexist with those who use it because they literally need to buy or sell a particular currency to trade in goods and services or move capital; and those who simply turn to it for liquidity. The first dominant instrument amounted to 56.3% of turnover in April 2010 and is formed by outright forwards and foreign exchange swaps. FX swaps are transactions involving the exchange of two currencies on a specific date at a rate agreed at the time of the conclusion of the contract and a reverse exchange at a date further in the future at a different or equal rate, depending on the circumstances, also agreed at the time of the contract. In April 2010 spot transactions generated about 37,4% of turnover and represented the second dominant instrument.

USD/EUR FX swaps are typically used to raise liquidity across the international US and euro money markets. These markets are linked to the domestic money markets since euro banks compete with domestic banks by bidding higher rates on deposits and asking lower rates on loans. The rate spread in an FX swap is implicit in the forward premium/discount $F/S - 1$ where S and F are the spot and forward¹³ price of the euro in terms of the US dollar. The forward premium/discount represents the cost of covering and is the alternative to the cost borne in the cash market where the spread is $i_{US} - i_{EU}$. If the latter equals the forward premium/discount, the covered interest parity or CIP is said to hold as a no-arbitrage condition: $S(1 + i_{US}) = F(1 + i_{EU})$. Covered interest arbitrage is expected to align the LIBOR spread to the premium/discount quickly by increasing the interest rate in the funding currency and depressing it in the investment currency. With the exclusion of periods of turbulence, such as those experienced recently, the CIP condition holds approximately since the premium/discount stays inside a tolerance or neutral band $(i_{US} - i_{EU}) \pm \alpha \approx F/S - 1$ ¹⁴, yet as a matter of fact the analysis that follows shows a forward puzzle, i.e. that the euro, which actually is high yielding vis-à-vis the US dollar, keeps appreciating when its LIBOR rate spread is increasing.

This view of the forward markets assumes that expectations do not have an explicit role to play since the forward premium/discount is basically equal to the interest spread, a feature that long ago Tsiang (1959) recognized as a limit. Indeed, in the FX forward market, risk-averse

¹³ Transaction costs and the different types of risks are priced in forward rates.

¹⁴ Frenkel and Levitch (1975) have estimated the tolerance margin ε .

speculators obviously buy the euro only when they expect to be able to sell it in the spot market at a higher price in the future, i.e. when $F < S^e$, but they will buy the US dollar when they expect to be able to sell it at a higher price, i.e. when the reverse condition $F > S^e$ holds. The equilibrium forward exchange rate then results from the interaction between speculators and hedgers each with their own degree of risk aversion thus, according to the theory of the forward exchange rate market advanced by Tsiang (1959), the equilibrium forward exchange rate results not only from the interest rate parity i.e. $S^* = S(1+i_{US})/(1+i_{EU})$, but also from expectations about the future spot rate S^e and risk aversion of speculators and hedgers. According to Tsiang, the forward exchange rate may be quite far from the parity and close to its own expected future spot rate S^e if speculators are more risk averse than hedgers. A second limit is that the condition $(i_{US} - i_{EU}) \approx F/S - 1$ offers a premium/discount in the exchange and no information on the spot rate independent from the forward rate, which is a problem given that the forward premium is not a useful prediction on the future direction of change in the spot rate (see, e.g. Taylor, 1995, on the forward bias). Given that LIBOR spreads are cyclic, we want to understand whether cyclicity in the spread can provide any information on the future direction of change in the spot rate which, arguably, could be the basis on which expectations are formed.

Among the various factors that affect a currency's value, the differences in interest rates across countries certainly count for more than other factors such as trade, growth and politics particularly if they are high as was the case in 2007-2008. Interest rates vary continuously and information on them comes in with major frequency. Expectations of capital appreciation/depreciation on currency holdings, therefore, are naturally driven by information and expectations on interest spreads, at least in the short period. As the interest rate in a given currency rises, the currency's value often increases¹⁵. The effects on the capital flow depend on what happens to expectations about the currency. If the appreciation is coupled with an expected depreciation equal to the interest rate spread, $i_{US} - i_{EU} = S^e/S - 1$, the market settles in the UIP, or no-arbitrage, condition which halts capital movement. Yet, if the same appreciation (depreciation) triggers an expectation of further appreciation, a capital inflow (capital outflow) will pave the way for a further currency appreciation

¹⁵ Depending on how the market evaluates the nature of the rise, the currency's value could actually go up or down.

(depreciation), a phenomenon which usually emerges under carry trade. Thus what matters most in the short run are interest rate spreads since they bear upon expectations on exchange rates.

In analysing LIBOR dollar and euro rates, we found that spreads in LIBOR rates have clear effects on exchange rates and expectations¹⁶. Usually the LIBOR dollar rates are lower than the LIBOR euro counterparts although LIBOR spreads widen and narrow in a cyclic fashion. The pattern that emerges from data can be defined as one according to which the narrowing (broadening) of the spread $i_{EU} - i_{US} > 0$ weakens (strengthens) the euro. The narrowing of the reverse spread $i_{EU} - i_{US} < 0$ strengthens the euro thus we argue that LIBOR spreads matter more for guessing the USD/EUR current and expected exchange rate than for the premium/discount on the exchange rate.

Spreads follow cycles and their swings unambiguously suggest the direction of spot exchange. As an example, let's consider the 2007-2008 period. At that time, LIBOR rates were particularly high as they ranged in the 3-6% interval since risk perception and illiquidity were making interest rates rise dramatically. In early 2007, the euro was appreciating even though the spread $i_{US} - i_{UE}$ was positive and the progressive reduction of the spread advantage of the dollar was seemingly pushing up the single currency. During the last quarter of 2007, the spread turned in favour of the euro $i_{US} - i_{UE} < 0$ and the single currency rose. During the second half of 2008, the spread was in favour of the euro, but the advantage was faltering and the euro weakened because the LIBOR dollar spiked. This is clearly shown in [Figure 2](#) which reports the spot rate and the value of the parity $S^* = S(1 + i_{US}) / (1 + i_{EU})$ for three different maturities during the first and the fourth quarter in 2007. The same is done for the period ranging from end July to October 2008. [Figure 3](#) shows data on the 1-m and 3-m spreads. A strong positive relation seems to exist between the spread $i_{EU} - i_{US}$ and the spot rate in all the three periods just mentioned.

¹⁶ We are not short of theories and empirical models on exchange rates. Frenkel and Levitch (1975), Frankel and Rose (1994), Taylor (1995), Pesenti and Tille (2000), Krugman (2007) and Eichengreen and Rua (2011) provide a comprehensive view of the literature.

Figure 4 reports data ranging from November 2009 to May 2010 and from February to May 2011. It basically

confirms the findings above. Then the climate in the national and international money markets was quite different from that of 2007-8 period in that the unprecedented monetary expansion had quelled markets and LIBOR rates were back inside the normal 0-2% range. During the first time interval, the single currency had a limited and slowly narrowing positive spread $i_{EU} - i_{US} > 0$. The euro continued easing vis-à-vis the US dollar until May 2010, when the spread had almost vanished. During the time interval February – end April 2011, the spread was wider than a year earlier and was still enlarging. The enlargement did not fail to pull the single currency above the US dollar 1.4 line. In April the spread suddenly ceased to widen and the single currency continued its ascent for a while, and then fell. [Figure 5](#) shows the strong relation between the 1-m spread and the spot rate for the November 2009 – May 2010 period and for January-early April 2011. The same pattern is replicated in the 3-m spread figures. What emerges from the comparison of Figure 3 with Figure 5 is that, for instance, a USD/EUR spot rate equal to \$ 1.3 is consistent with negative LIBOR spreads (in 2007 and 2008) and also with positive LIBOR spreads (in 2009-2010-2011). This obviously confirms that a given spread, while satisfying the CIP, can coexist with many different levels of the spot rates. Our point was that we actually know the entire time profile of each spread and thus that it is the cycle in this profile that can be used as a heuristic¹⁷ for guessing the direction of change of the spot rate and expectations on the future spot exchange rate over short periods of time. The direction of change is quite important to investors since at least two of the three dominant strategies can profit from its knowledge and possibly reinforce the trend itself. Trend trades are based on technical analysis and seek to exploit a deep knowledge of the trend and its turning points. Carry trades allow investor to buy high-yielding or investing currencies by selling low-yielding or funding currencies. Carry traders must be confident that they will not be forced to unwind their positions by any surprise change in the trend in interest rates or by a sudden restraint in liquidity.

¹⁷ A different heuristic can be found in the statistical data on the commitments of commercial and non-commercial traders reported by the US Commodity Futures Trading Commission or in the term structure of the exchange rate expectations implied by Eurocurrency yield curves.

Over the longer period of time, the nominal exchange rate has an obvious role to play in the adjustment in the real economy, particularly when prices move sluggishly and the real exchange rate mimics the nominal one. This adjustment takes place through changes in real exchange rates and in the long run real interest rates matter simply because they hinge directly upon real exchange rates. Thus, changes in nominal interest rates can be irrelevant to the nominal exchange rate if the changes in nominal interest rates fail to move the level of real interest rates in the right direction and thus appreciate or depreciate the national currency in real terms. In April 2011 interest rates were trending upward. Indeed, the European Central Bank had moved ahead of the Federal Reserve by joining the ranks of central banks that had started to tackle the rise in inflation expectations with higher interest rates¹⁸.

These findings have some policy implications. In the first place, exchange rate gyrations have obvious effects on the different economies which manifest themselves in domestic monetary policy decisions and, sometimes, unilateral or coordinated interventions in the foreign exchange markets. In the second place, the current arrangement of the international monetary system and global finance cannot work without the Eurocurrency markets or some other form of outside circulation. Since in the Eurocurrency markets country risks are absent and substitutability is highest, currency substitution is pervasive. Exchange rate volatility is then inevitable and thus here to stay. These policy implications will be further touched upon in the next section.

5. Policy considerations

The very existence of Eurocurrency, i.e. offshore markets for the domestic currencies, has always been regarded with suspicion by regulators. The reason is that offshore markets for currencies, bonds and derivatives basically allow banks to achieve their desired asset and liability positions partially escaping the regulation in the domestic jurisdiction. Suspicion has grown recently since derivatives had a special role in and after the recent 2007-8 crisis.

As far as the outside market for the domestic currency is concerned, preoccupations are understandable since the existing stock of bank time deposits, and thus loans at London

¹⁸ The Reserve Bank of Australia was the first to raise interest rates (April 2010).

and at the other offshore centres, bears directly upon the demand and the supply sides of the money market in the domestic economy and has grown enormously over the years (Dufey and Giddy, 1994; Cassis, 2005; BIS, 2010a). The existence of offshore markets also bears on monetary and financial stability because they are less regulated than onshore markets. Offshore banking, like any other type of banking activity, adds to aggregate liquidity. Yet, according to some early assessments (e.g. McKenzie, 1992; Dufey and Giddy, 1994), national central banks have been able to retain control of domestic monetary policy. However, starting from the Eighties central banks have increasingly realized that outside circulation compounded the uncertainties surrounding the relationship between money growth and inflation and from the early Nineties have replaced traditional quantitative targeting with inflation targeting and the direct control of interest rates.

Offshore markets for time deposits and loans in US dollars and euro are obviously different from the FX, i.e. the foreign exchange rate market, where means of payments are traded in pairs, yet the interdependencies between the two Eurocurrency markets and the FX market are complex. From one side, exchange rates impact on costs, inflation rates and thus on domestic monetary policy; from the other, domestic monetary policy and domestic interest rates feed upon LIBOR rates, whose behaviour has a bearing on exchange rates. Indeed, the later link was the issue of the preceding paragraph, in which we argued that there is evidence of a clear relation between the time profile of LIBOR rates and the trend in the USD/EUR exchange rates. In the current transition phase of the international monetary arrangement, domestic regulation and exchange rate policy matter a lot for phenomena such as currency substitution, competition among financial centres, and internationalization of currencies.

Offshore or Eurocurrency markets are definitely for reserve currencies and, to a lesser extent, for the currencies of developed countries such as the Australian dollar and the Canadian dollar¹⁹. The current international monetary arrangement, which is structured around the US dollar and a handful of national currencies²⁰, needs to allow the national currencies to circulate outside the origin countries and this creates a tension between the needs of the international monetary system and the management of money and credit inside the single countries. Currently, the outside circulation is

¹⁹ These are the so-called commodity currencies.

²⁰ The currency ranking can be approximated by the share in the deposits at the offshore banks.

made possible by offshore markets. To be deposited in offshore banks, the mass of offshore US dollars and euro must yield more than what can be earned in the onshore banks. To be borrowed profitably, loans at offshore banks must be priced below their onshore equivalent. Indeed, the absence of reserve requirements, the lower level of remaining costs and the absence of country risk make the offshore banks undercut onshore banks by asking for narrower spreads (Dufey and Giddy, 1994). Yet competition reigns among the international currencies at the international banks at the international financial centres. The cheaper currencies are called funding currencies, particularly if they are deemed to depreciate²¹, because they offer the cheapest source for getting a loan to investors worldwide. The dearest currencies are called investing currencies, particularly if they are expected to appreciate since they offer the most profitable destination of liquidity. The peculiar feature of any bank in the Eurocurrency market therefore is that of offering US dollar (euro) deposit rates which compete with the higher US corresponding domestic rates and, at the same time, with the deposit rates in the parallel euro (US dollar) Eurocurrency markets. The same Eurocurrency bank bids a US dollar (euro) loan rate which, while being lower than the corresponding US dollar (euro) domestic rate faces the competition of the parallel euro (US dollar) Eurocurrency banks. We argue that competition exerts a force that narrows spreads across currencies, while differences in the policy stance across countries bring the spread into existence and make it widen. The two forces are opposite and thus make spread cycles and currencies swing, as we have pointed out. Our basic contention is that the domestic monetary policies and conditions in the US and the euro zone and the just sketched competition mechanism produced the correlation shown in Figures 2 and 4.

There are distinct forces favouring the growth in size of the international money market, of which the US dollar and the euro are the two larger parts. We have already argued that the existing international monetary arrangements need an international money market where banks, companies and investors can deposit and borrow international currencies with the lowest possible transaction costs and country risk. London and New York are not alone since this market is formed by a whole network of banks whose offshore portions are clustered in London and in a number of other international centres (Goez, 2010). The business of international banking is highly profitable and this entails incentives for the different centres

²¹ According to the uncovered and the covered interest parity conditions, they should appreciate.

and countries to adopt strategies by offering the best business environment, infrastructure, stable tax regime and regulation to gain a larger share of the whole global business. Among the various location advantages able to attract international banks, under-regulation is key. However, the under-regulation keenness found at every single competing location inevitably reduces the chances of reaching a common and thus really effective regulation strategy at a global level. The resulting tension is certified by the current diatribe between the US, UK and Asia over regulation (FT, 8 June 2011). It is safe to predict that global growth will increase the size of the international banking and offshore markets of national currencies along the trend observed in the last few decades although increased regulation, limits to capital mobility and regime changes in the international monetary system could temper or modify the trend.

There are forces that shape the composition of reserves, too. The observed structure of the Eurocurrency market is the result of currency substitution. The latter reflects the fact that in today's globalized economy many agents, and notably international banks, have assets and liabilities in more than one currency. Agents obviously constantly try to minimize the risks of holding assets in depreciating currencies and liabilities in appreciating ones. Anticipations of significant changes in exchange rates thus inevitably trigger currency substitution which might turn into a full-blown crisis with all its disruptive effects. Indeed, when the amount of currency circulating outside the country is large relative to that circulating inside, as is by definition the case of the US dollar, the shift in the demand resulting from the reaction to anticipations might have huge destabilizing effects. Exchange rate policies of central banks and, particularly, coordinated interventions in the exchange market aim at mitigating or inhibiting such phenomena. As a matter of fact, the rates of exchange between the major free floating currencies are not entirely free since coordinated interventions aimed at correcting excessively large changes have been infrequent, but not rare, during the last few decades. Central banks managing the existing reserve currencies primarily target their monetary policies to domestic inflation and growth, but have sometimes felt free to intervene in the foreign exchange market. The desire to limit the repercussions of exchange rate volatility was dictated more by domestic inflation and growth considerations, and thus by their interest rate policy, rather than by any particular target zone or value for the exchange rate. As a matter of fact, with their interventions to reduce the fluctuations of the single currency, central banks implicitly dampened the fluctuations of the

Special Drawing Right, i.e. of the basket currency which from a mere unit of account is expected to surge to the role of key reserve unit.

Given that China and other emerging economies have become giant participants in world trade and large suppliers of saving, companies, commercial and central banks worldwide could start finding it convenient to hold balances in renminbi, rupees and so forth. Historically, all countries that have become leaders in terms of production and trade, have made their own currency a vehicle and reserve instrument. China, in particular, is set to surpass the US and the EU in these regards, but the process leading to the acquisition of the status of vehicle and reserve currency is long as its advance depends on many factors. The international demand for any currency as a vehicle and a reserve currency depends on intrinsic characteristics of the currency such as liquidity, stability and confidence in its value and convertibility. The supply depends on the existence of an adequate outside circulation of the currency. China is promoting as much as possible the role of renminbi as a vehicle currency in the bloc in East Asia, not only by trying to stabilize domestic inflation and the renminbi's bilateral exchange rates, but also by offering time deposits and loans at rates competitive with onshore and offshore interest rates. In the future it will certainly allow foreigners holding renminbi to buy many assets in China and not only goods which will make the willingness to hold renminbi soar worldwide.

We argued that the Eurocurrency or offshore markets for domestic currencies, bonds and other assets such as derivatives allow banks to achieve their desired asset and liability positions and partially escape the regulation in the domestic jurisdiction. However, the US and the EU, whose currencies have a preeminent role and China, which is trying to get one in the existing international monetary system, basically accept the status quo at least because to work properly the system needs to let reserve currencies have an outside circulation formed by their currencies. In the second place, international banking is a highly sophisticated and profitable economic activity and thus highly qualified from the point of view of politicians and managers looking after the economic attractiveness and fortunes of individual cities. From a purely economic point of view, the outside circulation of international currencies increases (for better or for worse) the overall efficiency and profitability of intermediation. During the 2007-8 crisis, the offshore markets and the foreign exchange rate market (Baba et. al, 2010) even had the capacity to reduce the liquidity gap

and the ensuing strain in domestic money markets.

In the previous section we argued that LIBOR rates reflect conditions prevailing in domestic monetary policy and that changes in LIBOR spreads have driven the swings in exchange rates from 2007 to 2011. From this it follows that these swings are indirect effects of divergences in national monetary policies. Exchange rates feed upon domestic prices and domestic inflation which, in turn, is the prime target of monetary policy in countries where the central bank adopts inflation targeting. At the same time, the effects on domestic inflation exerted by exchange rates are only one of the reasons why central banks decide to intervene in the foreign exchange market directly and sometimes in a coordinated way. We do not intend to analyse this aspect and we limit ourselves to recalling that there is extensive literature on the relatively limited influence of exchange rate changes on domestic inflation or pass-through in large and high-income economies such as the US and the EU (Taylor, 2000). It would nevertheless be unwise to rate down the domestic implications of nominal exchange rate changes since such nominal changes bear upon real exchange rates and, in turn, the current account balance and net foreign country liabilities. In other words, real exchange rates follow passively the vagaries of nominal exchange rates. The latter are felt as excessive because the pass-through is limited. Not surprisingly, excessive volatility is felt as a problem, but quite paradoxically, even too little flexibility is showing it has its own limits.

Inside the European Monetary Union, the nominal appreciation of the common currency should be followed by a lower rate of increase in domestic prices, otherwise the member countries would see their real exchange rate appreciate vis-à-vis the rest of the world. In the case of the euro zone, inflation rates have been permanently different across countries. The peripheral economies, in particular, have not been able to make their rates of productivity growth and unit cost converge adequately to the average thus the euro zone is affected by structural misalignments in its internal real exchange rates. Indeed, although the euro floats against the US dollar and the other currencies, the real exchange rates of the single member countries present serious misalignments both inside and outside the euro zone. These misalignments reflect both the pass-through and the existing structural differences in the inflation rates in that countries where prices increase structurally faster than the average suffer from a comparatively higher overvaluation. The problem that follows from these misalignments is the combination of a structural current

account imbalance with a growing net foreign debt and an overvalued currency. After the great 2007-2008 crisis, unlike the stronger members of the euro-zone, some peripheral economies suddenly faced a steep fall in the growth rate and a steep rise in the interest rate on their debt. A sudden stop in the inflow of capital occurred. Those countries can neither bear the overvaluation of the common currency, nor they can easily correct the overvaluation and thus resume their previous growth trend. They cannot even exit and adopt their old national currency because the ensuing inevitable depreciation of their old currency would expose them to the worst possible currency mismatch in the domestic banks and thus to deep financial instability.

6. Summary and conclusions

In the analysis regarding the few skirmishes that the US dollar and the euro had from 2007 to 2011, we gleaned a few small lessons on what has driven, and possibly what will drive, the USD/EUR exchange rate in the short run, in the current international monetary arrangement. This arrangement is a de facto multi-polar system entailing a consistent outside circulation of the US dollar and a few other national currencies and a gigantic and ever expanding FX market. In this market the pillars of the whole system are exposed to all the vagaries of market sentiment, if not to real full-blown crises. The FX market is an asset class of its own; it is increasingly tied to other asset classes and to the outside market for national currencies. The bottom line of our analysis is the clear empirical relation between the time profile of the spread in US dollar and euro LIBOR rates and the USD/EUR exchange rate, i.e. a stylized fact regarding how the impulse coming from the money market bears upon the exchange rate of the two major currencies. The two recent and distinct sharp falls of the euro against the US dollar in 2008 and 2010 show that instability is entirely possible. The falls were almost identical in size, but rather different in nature. Indeed, the first fall of the euro was the effect of a sudden unwinding of positions held by investors in different asset markets reflecting a sharp liquidity constraint. The unwinding triggered the sharp appreciation of the dollar. The second episode was the reaction of the exchange market reflecting a fall in confidence in the euro and amid abundant liquidity, i.e. an environment exactly the opposite of that in 2008 (Sections 1 and 2).

We considered three distinct periods from 2007 to 2008 which were characterized by peculiarly high interest rates in

domestic and international money markets and two episodes from 2009 to 2011 which, instead, were characterized by definitely lower interest rates everywhere. LIBOR rates are far from being equalized across countries. They are tied to interest rates prevailing in the domestic money markets but are interconnected. They also show spreads that are definitely cyclical, as is the case for interest rates. The time profile of LIBOR rates for the different maturities seems able to guide the trend in the USD/EUR exchange rate in a different way from that predicted by interest rate parities. More exactly, while the covered interest rate parity predicts that the high-yielding currency appreciates and, at the same time, is expected to depreciate against the low-yielding currency, we found that it appreciates (depreciates) gradually when its spread increases (decreases). The same currency changes direction only when the spread changes its own direction (Section 3). This finding is an interesting one as it affects our view of how the market in which the reserve currencies – the pillars of the current international monetary system – operates.

The existence and working of Eurocurrency and FX markets pose obvious macroeconomic policy problems which have been succinctly discussed in this paper. The most obvious problem is perhaps that stemming from the excessive volatility of the exchange rates of reserve currencies. In the short run, exchange rate swings reflect what is going on in the domestic and the international money markets and could provoke large and unintentional substitution phenomena among reserve currencies. Such swings obviously feed back on to the domestic economies through wealth and saving-investment balance notwithstanding the limited pass-through prices. It is easy to predict that the current pattern of imbalances and privileges, together with the structure of foreign reserves, is evolving rapidly rather than rebalancing. Further important issues are raised by the seemingly unstoppable growth of the international money and foreign exchange markets; and these have also been discussed in Section 4. The biggest issue is certainly the regulation of finance in general and that of international banking in particular. The business is big and equally vital for the urban centres hosting it. The competition between the historical and emerging international financial centres is strong; and the ambitions of China and other large emerging economies vis-à-vis those of old Europe and America are making progress which is likely to be slow (Section 4).

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