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DRAFT

An Asset Price Theory of Exchange Rates

Abstract

The incapacity of explaining the determination of exchange rates is one of the Achilles heels of mainstream economics. Extensive empirical analysis has not been able to forecast short- and medium-term exchange rates. Obviously “fundamentals” play a marginal role. In contrast, it is held that in the long-run traditional neoclassical exchange rate theories are valid, fundamentals are their key determinants. The switch from the short- and medium run to the long run is unexplained and enigmatic. The paper reviews mainstream, Keynesian and behavioural finance theories of exchange rates and pleas for a thorough reconsideration of exchange rates which play an increasing role in a globalising world. It is held that over long periods non-fundamentals determine exchange rates, leading to asset bubbles since foreign exchange is an asset class of its own. Modern algorithmic technical trade increases short-termism and drives speculative long waves of appreciation and depreciation in flexible exchange rate regimes. The enigma of exchange rates has its roots in speculation. Modern flexible forex markets are, most of the time, speculative markets par excellence, in contrast to rational expectations theory and the concomitant concept of efficient markets. However, exchange rates cannot rise or fall forever. Since both strong over- and undervaluation create huge macroeconomic problems for employment, output and inflation, as well as for the functioning of the world economy, fundamentals gain great weight before and during the turning points of exchange rate dynamics. “Fundamentals” is an umbrella term that includes heterogeneous determinants which often point in different directions and do not always provide clear signals. A visible hand that is responsible to take care of the fundamentals is missing. Hence forex markets need regulation and prudent macroeconomic management. The paper illustrates the new approach with a descriptive analysis of the cyclicity of the dollar/DM-euro rate for the period 1970-2014.

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1. Enigmatic exchange rates

Nobody will doubt that in a globalized market economy, exchange rates are a key price in the trade with goods, services and capital. The evaluation of tradable goods, capital values and hence also expected returns are dependent on them. However, foreign exchange markets on which exchange rates are established seem to be quite mysterious. They rather resemble a kaleidoscope than the common microeconomic perception of a normal market. Apparently there is no stable equilibrium exchange rate, and we do not know what really determines the actual exchange rate. Countless studies were conducted, but the undisputed finding seems to be that the result of Meese/Rogoff (1983, 1988) is confirmed (Rossi 2013): For a period of one to two years exchange rate forecasts seem not to be better than random walk. It is often added, that the purchasing power parities determine exchange rates in the long term, and consequently also the “equilibrium” on the foreign exchange markets. In this respect, however, the long term is only rarely defined and the switch from short term to long term is not explained. Thus, a contradiction remains: If there are imbalances in the short term, then this „short term“ apparently does not apply for all the years under review, and the „long term“ would happen only by accident and would then be terminated randomly. On these grounds, a long term equilibrium on the foreign exchange market is like a lull in the wind or the Atlantic Ocean when calm and like a mirror – two rare and only temporary phenomena that meteorologists would not call „long term“ or even „balanced“.

Exchange rate theory is in crisis. The prevailing opinion rests on the traditions of purchasing power parity theory, monetary exchange rate theory and theories of covered and uncovered interest parities. Deviations are interpreted as exogenous shocks, that act like a legitimation for failure of the respective theory as shocks are not predictable. However, the observed shocks are not normally distributed as empirical studies have shown. According to these studies, fundamental factors play a minor role for exchange rate determination. There is a general agreement with respect to the expectations of foreign exchange dealers: They are considered important, but cannot be measured. Hence, empirical evidence is limited. Again, it is implied that „rational” expectations prevail somehow in the long run that they lead to balanced and fundamentals-based exchange rates.

The most common international textbooks on macroeconomics of monetary foreign trade undauntedly teach David Humes' monetary theory (Nordhaus/Samuelson), purchasing power parity, uncovered interest parity, the Dornbusch model with temporary divergence of purchasing power and interest rate parity - the crushing empirical criticism is not mentioned. Speculation is an alien concept. Students do not learn to understand the reality of foreign exchange markets with flexible exchange rates. Exchange rate theory is not highly valued by macroeconomic research; the profession shies away, while the reality of modern foreign exchange markets seems to become increasingly turbulent and involves more and more currencies.

Keynes did not develop his own exchange rate theory, but he seemed to be wary of market forces. He knew currency speculation from personal experience. Most Keynesians had no great interest in exchange rate theory, however, they tended to prefer rather stable exchange rate regimes. Keynes's "General Theory" focuses on a closed economy, exchange rates are not discussed. Keynes himself, but especially Paul Davidson, Charles Kindleberger and Hyman Minsky, however, had investigated expectation formation and

speculation on asset markets and viewed it as vitally important for the functioning of market economies. These approaches to the theory of expectations in asset markets can be very well applied to foreign exchange markets, because holding money in various currencies is an important form of differentiated liquidity preference on a special variant of asset markets. Few Keynesians work on exchange rate theories (cp. Harvey 1991 and 1996, Schulmeister 1988). The innovative contributions come from the field of "behavioral finance", which is no clearly defined theoretical movement; upon closer inspection, significant parallels to the aforementioned views of Keynes, Davidson, Kindleberger and Minsky and other Keynesian authors become apparent.

The following two sections give a brief overview of the crisis of the predominating old theories, followed by Keynes's, the Keynesians and Paul De Grauwe's position, and the latter representing "behavioral finance". In the third section five theses are developed, that could represent the starting points for a new exchange rate theory: (a) Flexible foreign exchange markets are "financialized"; (b) there are multiple equilibria; c) the diverse fundamentals do not always point in the same direction and are often perceived in a selective and distorted manner in foreign exchange markets; (d) fundamentals play an important role, especially at the turning points of the exchange rate cycle; (e) a cyclical bubble-crash dynamic of exchange rates exists, as in other asset markets. In the fourth section, the exchange rate between DM/euro and the dollar is examined, particularly regarding turning points in the exchange rate cycle that are underexposed in exchange rate theory.

2. Crisis of exchange rate theory

2.1 Conventional exchange rate theories

Since David Ricardo, and especially Gustav Cassel (1918) the *theory of purchasing power parity* (PPP) is the benchmark when it comes to exchange rate formation. It is based on the law of one price for the same product in different countries, adjusted for transaction costs, especially transportation costs. Perfect competition is assumed, leading to goods market arbitrage. Ricardo excluded capital mobility, so that trade balances had to be zero by definition. Strictly speaking, the theory of absolute PPP only applies to tradable goods. In developed countries, however, the prices and costs of tradable and non-tradable goods develop largely in parallel. Then at least the attenuated variant of the *relative* PPP should apply, i.e. no real exchange rate changes should occur. In this case price level differentials would persist but would not change. Exchange rate changes would only compensate for inflation differentials. The empirical evidence for the PPP theory of the exchange rate is weak in its absolute as well as in its relative variant (cp. Isard 1995, 63 ff. and section 4 below). Apparently goods arbitrage is not able to compensate for exchange rate-induced price differences. Also the law of one price applies only to a limited extent for tradable goods. However, against the background of nearly free trade, at least regarding tariff barriers, between the United States and the Eurozone there are enormous changes in real bilateral exchange rates. Strong deviations were corrected repeatedly, but only in very long cycles of five to ten years. These cycles usually lead to overshooting in the other direction.

According to the theory of *uncovered interest rate parity* (UIP), interest rate differentials for identical financial assets reflect expectations of exchange rate changes when there is free movement of capital. Financial arbitrage prices in the exchange rate risk - higher interest rates in a country indicate devaluation expectations and vice versa. Such expectations cannot be measured empirically. Furthermore, the time horizon of expectations is unclear. Empirically, what often happens is the opposite of what UIP theory predicts: higher interest rates in one country frequently lead to nominal and real appreciation, which may last a long time. Interest rate differentials do not always reflect inflation differentials or differences in money growth, as claimed by the monetary theory of exchange rates. The theory of *covered interest parity* (CIP) considers the difference between spot and forward rates as an indicator of future exchange rate changes. This implies that already in the present there is a market for the future exchange rate, which reflects rational expectations. Although futures markets can insure against short-term exchange rate risks, according to empirical findings they serve as a poor indicator for the future spot rate. Theories that assume arbitrage to compensate for real interest rate differentials fail to recognize that most capital flows follow nominal interest rate differentials. Dornbusch's synthesis of UIP for the short term and delayed PPP because of goods prices which are rigid in the short term also fails to accurately reflect reality. Both do not occur, neither in the short nor in the long term. Rogoff, once a fervent follower of Dornbusch's theory of overshooting exchange rates (cf. Rogoff 2002, 2002a), had to concede that the theory is not tenable.

The *portfolio balance approach* of exchange rates, developed by Branson and others, departs from PPP theory. It considers exchange rates from the point of view of the optimization of international asset portfolios of financial asset owners and their agents. The approach differs from the interest rate parity theory and monetary theory because it is presumed that apparently similar financial assets of different countries/currencies are different, because country-specific risk premiums exist. The exchange rate is then determined by the desire for portfolio diversification depending on risk preferences and expected returns. It's not about flows, but rather about regrouping of stocks of financial assets. Expectations of yields on assets and country risk premiums guide portfolio shifts. Changes in the current account balance are reflected in the international investment position of a country which thus becomes an important indicator of changes of the exchange rate.

In contrast to or complementary to the previously considered fundamental factors, Krugman/Obstfeld (2006, 504ff.) and others emphasize the fact that relatively stronger global demand for the output of a country leads to stronger demand for her currency and hence to real appreciation. Thus, the differences in growth rates are a decisive factor in determining the exchange rate. However, this supposed fundamental factor can stand in contrast to other fundamentals when expected high growth leads to higher inflation, higher interest rates and a worse current account balance. The approach is based on constellations of the real economies, as opposed to portfolio theory.

Combining the aforementioned approaches, which all focus on the fundamentals as the center of exchange rate determination, the following equation holds for the exchange rate s of period t (indirect quotation²) vis-à-vis foreign countries, marked with an asterisk:

$$s_t = \alpha (y_t - y_t^*) + \beta (PPP^* - PPP_t) + \lambda (\pi_t^* - \pi_t) + \gamma (\dot{i}_t - \dot{i}_t^*) + \varepsilon_t \quad (1)$$

If $i = r + E_t \pi_{t+1}$ according to the Fisher equation, based on expected values for the next period, the following equation holds:

$$s_t = \alpha E_t(y_{t+1} - y_{t+1}^*) + \beta E_t(PPP^* - PPP_t) + \lambda E_t(\pi_{t+1}^* - \pi_{t+1}) + \gamma E_t(r_{t+1} - r_{t+1}^*) + \varepsilon_t \quad (2)$$

y is the growth of real GDP, r is the real interest rate, PPP is purchasing power parity relative to the reference country, for example the USA; at parity a value of 1 applies, at a lower domestic price level the value is < 1 ³. π is the inflation rate and E is an expected value. The weights of the fundamentals are shown by the parameters α , β , λ and γ . The error term ε shows "white noise", a collective term for non-fundamental factors. Consequently, an appreciation of the domestic currency would be expected the lower the domestic price level relative to the PPP, the lower the expected inflation, the higher output growth and the higher real interest rates are relative to foreign countries. In the monetary variant, the monetary growth differential and the inflation differential would be replaced by the difference in the growth rates of the money supply. In case of changes in the exchange rate only unexpected changes in variables would play a role, because the expected variables are already priced in. The exchange rates are then determined by the expected and the initially unexpected fundamentals. Exchange rates change only if unexpectedly fundamentals change, aside from non-fundamental temporary factors.

The theory of rational expectations and the associated theory of efficient financial markets imply that market participants form their expectations based on the systematic interpretation of publicly available information about the fundamentals and that they immediately price in new information. Thus, profitable speculation on foreign exchange markets is not possible. In his famous essay of 1953, Milton Friedman described destabilizing speculation as nonsensical and at best possible in the short-run, while stabilizing speculation would be helpful for the formation of equilibrium prices while at the same time fending off destabilizing speculators. Consequently, he expected - as did many other advocates of flexible exchange rates during his times - that these rates were stable and that the fundamental factors come to bear. This turned out to be a fateful misjudgment⁴. Since currency trading, going far beyond mere risk-free

² Foreign currency units per unit of domestic currency, so that an increasing exchange rate signifies appreciation.

³ The IMF and the World Bank use the term "purchasing power parity conversion factor" which measures the deviation of the price level in one country by the PPP against the United States (see WDI).

⁴ Olaf Sievert, the former chairman of the German Council of Economic Advisers, an enlightened neo-classicist, wrote two years before the start of the European Monetary Union: "The experiment of flexible exchange rates, with which we have begun in 1973, when the international monetary system of Bretton Woods collapsed, has not fulfilled the promises that have been linked to it by the followers of this system." (1997, 6).

arbitrage, apparently is a large and rapidly growing business area, free forex markets must be regarded as highly inefficient markets in the sense of Eugene Fama's theory of efficient financial markets.

However, if one follows the concept of efficient markets, exchange-rate changes are induced exclusively by unexpected news about the fundamentals. Empirical research has led to the widespread consensus that news about fundamental factors such as money supply, inflation and interest rate or growth differentials only have a marginal influence on exchange rate changes. These predominantly occur independently of fundamental facts. Although the latter are significant, albeit not unambiguous, their evaluation may differ and the relationship between fundamentals and the exchange rate is unstable. De Grauwe summarizes the devastating judgment of conventional exchange rate theory: „*There is overwhelming empirical evidence that the exchange rates of the most important currencies are unrelated to the fundamentals that economic theory has identified.*” (2000, 353) Consequently, α , β , λ and γ in equation 2 are very small, not even the direction of influence (signs) are always correct. What, then, determines the conversion rates? It is apparently "white noise", i.e. ε . This finding is difficult to accept. It may be that econometric methods are not (yet?) able to capture expected values sufficiently. Moreover, it seems that limits to fundamental factors exist, because exchange rates do not move in one direction ad infinitum.

2.2 Keynesian approaches

2.2.1 Keynes

Keynes formulated initial ideas on exchange rate theory in the "*Tract on Monetary Reform*" (1923/2000). First, he discussed Cassel's PPP theory which is already implicit in Ricardo (87). According to him, this theory was actually a "*truism*" (92), if one solely focuses on tradable goods and takes into account transaction costs (primarily duties/taxes and transportation costs), because merchants would take advantage of goods arbitrage, if prices of goods differed between countries. However, Keynes noted that in reality there is at best a long-term approximation of the exchange rate to the PPP because other factors have an impact on the exchange rate as well (including changes of preferences for imports from a country, *terms of trade*, price fluctuations, etc.). Keynes also mentioned that exchange rates may change faster than goods prices, so that the latter adapt to the exchange rates, and not vice versa (96). Ultimately, the internal purchasing power of a country's currency is determined by its respective monetary policy, so that the PPP between two currencies would be determined by the relation of the countries' monetary policies. He considered speculative influences of capital flows and foreign exchange traders to be of little relevance (113). According to Keynes, speculation would have more of a stabilizing effect. There remains a strong sympathy for the PPP theory, at least in the long term (106). Keynes was not searching for a different exchange rate theory.

Nevertheless, Keynes was the first to develop the theory of covered interest parity (CIP) (see Dimand 1986, 81), albeit it can hardly be interpreted as an exchange rate theory. In the "*Tract*", Keynes

examined the differences between spot and forward rates, and traced them back to the difference between the short-term nominal interest rate at home and abroad. However, he did not view the forward rate as a predictor of the future spot rate (see Lavoie 2000, Kaltenbrunner 2011, 77). In this sense Keynes's theory of CIP is no exchange rate theory, but only a theory of the foreign exchange market arbitrage between spot and forward rates.

In the "*Tract*" as well as in the late publications in preparation of the Bretton Woods International Monetary system, Keynes argued for "managed" exchange rates; in 1923 he proposed a sterling and a dollar bloc, in which regional currencies would have been able to peg either to the dollar or the sterling, while the blocs cooperate closely; then it would not make a difference whether a country would follow the sterling or the dollar. Apparently, even then he deemed exchange rate fluctuations so serious that he proposed stabilizing intervention by central banks in the cash and futures markets: „*The best we can do, therefore, is to have two managed currencies, sterling and dollars, with as close a collaboration as possible between the aims and methods of the managements.*“ (204). Thus, the basic idea of the need to stabilize exchange rates through central banks, as embodied in the Bretton Woods system, had already been developed by Keynes as early as 1923. This idea was certainly not driven by the expectation that flexible exchange rates solely determined by markets would generate chaotic fluctuations. It was more about effective national monetary policy and the prevention of competitive devaluations.

Although Keynes did not develop a theory of floating exchange rates on free foreign exchange markets, he nonetheless developed a wealth of ideas that are central to the analysis of asset markets in general and to currency markets as a specific form of asset markets. This particularly concerns the role of expectations under uncertainty, the formation of expectations about expectations using the example of the famous "*beauty contest*", which addresses herd behavior, and the observation that conventions guided by previous experiences can be helpful in the reduction of uncertainty. Thus, important factors are identified that can produce or also tame speculative bubbles in asset markets. The theory of liquidity preference, i.e. changing preferences of the owners of wealth for holding money depending on the degree of uncertainty, can be used to explain exchange rate fluctuations. Also Keynes's thoughts about the determination of asset prices in the "*General Theory*" (1936, chapter 17) could be applied to a Keynesian exchange rate theory; accordingly, the yield r of an asset is determined by the nominal yield ("*yield*", q), the transaction costs ("*carrying costs*", c), changes in the value of assets a and the liquidity premium l : $r = q - c + a + l$. If one considers currency to be a special asset class, then the asset price would be stable, i.e. a would be zero so that $r = q + l$ holds (assuming transaction costs are negligible). If q is considered the expected nominal interest rate, the yield differentials between currencies are determined by interest rate differentials and the difference in liquidity premiums. The latter can be viewed as a currency premium. This would be a significant change in the theory of (uncovered) interest rate parity. These considerations have been incorporated in a number of post-Keynesian studies (e.g. Andrade/Magalhães Prates 2013; Kaltenbrunner 2011, 81 f.).

2.2.2 Davidson, Kindleberger and Minsky

For Paul Davidson, (2011, 265ff.) floating exchange rates are characterized by constantly fluctuating "unanchored" expectations of asset owners who hold short-term assets in other countries' currencies or hold precautionary or speculative balances in foreign currency,. On such foreign exchange markets, exchange rate changes are the result of short-term changes of expectations, which are often self-reinforcing. The decisive factor for Davidson is the elasticity of expectations with respect to the exchange rate, in line with Hicks (1946, 255). If the behavior of asset owners would be in line with the fundamentals, temporary currency devaluations would, for example, be considered transient, but would not be reinforced by sales of that currency. In this case inelastic expectations prevail. For flexible markets there is the risk that market participants react very elastically and thereby increase the deviation from the equilibrium exchange rate. Even if elastic and inelastic expectations were balanced, stability would be lost. Flexible markets tend to be unstable, because there is no long-term orientation, guided by a regulatory hand driven by the fundamentals. Hence myopia and short-term orientation are encouraged by the prevailing order of the foreign exchange market. According to Davidson, this can also lead to discrimination against certain currencies that are classified as weak and to favoring of others, because asset owners simply sleep better at night when they know that their financial assets are secured in supposedly good currency. Corresponding expectations can lead to sudden capital flight, resulting in strong depreciation. Overall, the store of value function of money suffers from flexible, unpredictable, unstable exchange rates, which make the long-term, productive investment of capital more difficult, because it requires safety and long-term, forward-looking contracts. Davidson compares flexible exchange rates to the absence of reliable *forward monetary contracts*, including money wages defined in employment contracts. Thus, the "conventions" that Keynes regarded as an anchor for expectations in the face of fundamental uncertainty about the future are missing. Consequently, Davidson calls for stable exchange rates, managed by central banks as prudent mediators taking a long-term view. One can regard this as a form of foreign exchange market regulation or management.⁵

While neither for Keynes nor for Davidson currency speculation is the salient motif of the actors on the foreign exchange market, and thus exchange rate cycles are not detected, Charles Kindleberger and Hyman Minsky consider foreign exchange markets as dominated by speculation. Kindleberger, an economic historian, examined speculation cycles in various asset classes. He explicitly referred to Keynes and especially to Minsky (Kindleberger 2000, 13 ff.; Minsky 1975, 1982). He criticized the prevailing "IS-LM Keynesianism" because it disregarded credit and asset bubbles and thus neglected the role of unstable expectations (21). Based on Minsky he outlines a prototypical speculation cycle,

⁵ Other Post Keynesians from the camp of Modern Monetary Theory opt for floating exchange rates mainly with the argument that floating offers more policy space for monetary (and fiscal) policy, while fixed exchange rates limit policy space, make currencies susceptible to speculative attacks and risk running out of reserves (Wray 2012, 150 ff.). This very close to mainstream exchange rate theory (e.g. the Mundell-Fleming model) and ignores all the problems so many countries have with roller-coaster-exchange rates. Of course, this is far away from Keynes's thoughts 1923 and in the early 1940s.

which is applicable to all types of assets, particularly to exchange rates: „*One place where the model surely applies today is foreign exchange markets, in which prices rise and fall in wide swings, despite sizable interventions in the market by monetary authorities*“ (21). The notion of stable equilibrium exchange rates is abandoned. Thus, a dynamic exchange rate theory is suggested.

According to Kindleberger and Minsky, the speculation cycle (13ff.) starts with "*displacement*", a positive shock to the real economy, which merges into "*overtrading*", an excessive demand for a type of asset, already observed by Adam Smith who used the same term; "*monetary expansion*" follows, in particular a money-issuing and credit boom that eventually leads to "*revulsion*", which Kindleberger translated with the German word "Torschlusspanik", referring to the sudden sale of assets and the flight into liquidity. The bursting of the bubble is reinforced by "*discredit*" when banks stop accepting speculative assets as collateral for loans. All phases of the cycle are described in detail and in their particular historical manifestations. The initial exogenous shocks can be low central bank interest rates, but also de-or re-regulation or new behaviors by the actors. Kindleberger describes speculation as - primarily – microeconomically rational behavior, which nonetheless leads to collective mania and panic, i.e. irrational macroeconomic consequences ("crashes"), which are associated with large economic losses. As recent examples of exchange rate bubbles after the Second World War he mentions the appreciation of the U.S. dollar after the end of Bretton Woods in 1973, the soaring dollar 1980-85 and its subsequent slump until 1988, among other examples. Kindleberger turns against those economists who view speculative bubbles as childhood diseases of an unbridled capitalism. For Minsky the fragility of the financial system and the vulnerability to speculation is a feature of a new financial capitalism, especially the modern "money manager capitalism" (cf. Wray 2009).

2.2.3 Harvey, Schulmeister and the empirical researchers

John T. Harvey (1991, 1996, 2009), similarly *Kaltenbrunner* (2011), has presented a post-Keynesian exchange rate theory that describes exchange rates as driven by expectations and short-term speculation of forex dealers. According to this theory, equilibrium and stable exchange rates do not exist. Keynes's focus on the theory of PPP is dropped, as are the various types of interest rate parity theory. Currencies are viewed as a special asset class that is well suited for speculation. Expectations of the foreign exchange market traders are heterogeneous and ultimately exogenous; they are strongly influenced by economic psychology and short-term, non-fundamental news. The medium-term development of exchange rates is only in the focus of agents who need foreign exchange for trade, portfolio and direct investment. This medium-term orientation, close to the long-term used by other authors, is systematically dominated by the short-termism of the money traders. Capital flows and volatile expectations drive exchange rates. In the end exchange rates remain undetermined, erratic, driven by psychological factors and unpredictable, both in the short and in the long term. There is no automatic stabilizer that can reverse upward or downward swings (non-ergodicity). Harvey suspects misaligned exchange rates which lead to imbalances in the current accounts. The long-run rate is a mystery too

(1991, 46), there is no return of the fundamentals. Rational bubble theories are rejected. Herd instinct, bandwagon effects and adaptive expectations dominate - given unstable expectations about the future - leading to the predominance of technical analysis among foreign exchange traders. In the end agnosticism seems to dominate - everything but equilibrium is possible; one cannot say much about the determination of exchange rates. There is no automatic stabilizer which brings exchange rates back to – or close to – equilibrium, although exchange rates don't rise or fall forever. Harvey (2009) builds a bridge to behavioral finance. However, the advice of Kindleberger/Minsky on speculation cycles applicable to currency markets is not adhered to. According to Harvey, exchange rates cannot equilibrate trade balances and capital flows at the same time. The economic policy conclusion is the demand for fixed exchange rates and control or regulation of short-term capital flows.

Stephan Schulmeister (1988, 2009) pays more attention to the analysis of the microeconomic functioning of foreign exchange markets. He as well as other empirical researchers have observed the enormous growth of the global currency markets, especially the futures markets and derivative markets, whose volume in 2010 amounted to more than 70 times the global trade of goods and services. The bulk of forex trading is extremely short-term, increasingly high-frequency trading. For short-term speculation which takes place in a time-frame of minutes and seconds or intraday trading, the fundamentals are relatively unimportant. This results in the predominance of technical analysis ("*chartism*"). The speculative exploitation of short-term trends leads to price-surges, which are often prolonged, so that longer trends result from the shorter ones. Trends are often interrupted by periods of sideways movement ("*whipsaws*"), in which short and fast up and down movements alternate. When "*trending*" occurs there is a consensus among the forex traders on the direction of the performance, but not on the strength of gains. As long as there is consensus on the direction, the speculation has a self-reinforcing effect due to self-fulfilling prophecies. Cases of dwindling consensus may lead to a trend reversal. With the help of futures and options great leverage can be achieved in both directions. Therefore, technical trading is profitable on average and thus contradicts the efficient market hypothesis. Schulmeister ascribes the high volatility at high amplitudes in many asset markets (stock markets, commodity markets, etc.), but especially on foreign exchange markets, to the use of derivatives and the predominant technical trade. Thus, fundamental factors are almost irrelevant. However, he assumes long-term, irregular cycles of speculation around fundamental values; so it eventually comes to turning points of exchange rate trends, which he leaves unexplained. Like Harvey, he does not see stable equilibria in modern foreign exchange markets. While Harvey views currency markets as a vehicle for portfolio investments, i.e. capital flows directed to other assets, Schulmeister understands foreign exchange markets as a separate asset class that is not primarily a medium of exchange for goods or securities. The preponderant absence of fundamental determinants in the trade of currencies, creates uncertainty, which abets speculation.

Speculative currency trading requires trading partners who want to speculate in the opposite direction or want to "*cash-in*". Thus, heterogeneous expectations are the prerequisite for currency speculation by

actors. Menkhoff/Taylor (2007) found that forex traders do not only use technical analyses that are focused on the past but in part also utilize fundamental factors (similar to Kaltenbrunner 2011, 210 ff.). Markets incorporate all kinds of news, while sometimes also fundamentals are included. There is not always a consensus among traders on the assessment of news. Moreover, technical analysts apply different rules whose underlying models are kept secret. Information about the intentions of currency traders are therefore asymmetrically distributed. As in other financial markets, forex trading is seemingly chaotic, a far cry from economic theory, with mainly adaptive rather than rational expectations. This stands in stark contrast to rational expectations or currency trading guided by the fundamentals. Since these can - if at all - only prevail in the long term, the short term dominates with technical trading, which is continually replaced by the next short period and can thus last very long.

Ehrmann/Fratzscher (2005), who empirically examine the euro/dollar foreign exchange market, also note that fundamentals clearly find little or no unambiguous consideration. They analyze how forex traders evaluate new information. The authors confirm that fundamentals are not relevant for short-term trading. They made the following findings when "*daily news*" about real economic situations are observed in contrast to "*intraday news*": unexpected news are more important; good news about the performance of a country lead to appreciation of its currency (based on employment growth, consumer behavior, etc.); negative news have greater importance than positive ones; news about the United States are perceived faster and stronger than news about Europe; news about monetary policy decisions of central banks are interpreted differently and therefore do not lead to unambiguous reactions; fundamental news receive more attention in periods of great uncertainty. In general, fundamental information have more significance for the *direction* of exchange rate movement than the strength of the appreciation or depreciation. Thus, the authors confirm that also in technical analyses, forex traders "somehow" take the fundamentals into account and that these do not always lead to unambiguous responses.

The empirical analyses about the microstructure confirm those Keynesian views that rely on the dominance of non-fundamental factors, but also show that fundamental factors can be important in some situations. How long swings up to the turning points last, is not answered in a uniform manner in these analyses or remains unclear.

2.3 Exchange rates and behavioral finance

"Behavioral economics", specifically "behavioral finance", has its starting point in the criticism of the assumption of rational, profit or utility-maximizing representative agents who are guided by rational expectations in the sense of the theory of rational expectations and whose actions lead to "efficient (financial) markets". Paul De Grauwe and Marianna Grimaldi (2006, similar to Westerhoff 2009), have applied these theories to forex markets and exchange rate formation. They fundamentally criticize the dominant paradigm of financial market analysis, namely the theory of rational expectations and the efficient market hypothesis, which they refer to collectively as REEM (Rational Expectations and

Efficient Markets Model)⁶. Their basic assumptions regarding behavioral theory are very simple: in highly complex contexts that are difficult to understand or are completely incomprehensible, market agents look for simple rules, heuristics, whose suitability and favorability is checked regularly. Their actions are often determined by trial and error, they feel their way forward, so to speak. As such, they act rationally, in the sense of "*bounded rationality*". De Grauwe/Grimaldi search for a new microeconomic paradigm and present approaches for a microeconomic foundation of exchange rate theory.

They criticize the dominant exchange rate theories for being unable to solve the empirically determined "*disconnect problem*" (Obstfeld/Rogoff 2000), namely the fact that exchange rates can rarely be explained by the fundamentals and if so only in an unpredictable manner. Furthermore, they point to some empirically observable anomalies that do not fit the REEM model: exchange rate changes, which are not normally distributed and contradict the REEM model ("*fat tails*"); "*volatility clustering*", the succession of periods of high exchange rate changes and phases of very low volatility; the predominance of the chartists who follow trend extrapolations; the very slow i.e. late correction of prohibitively high or low exchange rates; a tendency for exchange rate bubbles that build up slowly and then burst due to sudden crashes and can lead to a free fall in the exchange rate.

The main explanations by De Grauwe and Grimaldi, whose studies are based on model simulations, can be summarized as follows.

The chartists among the foreign exchange traders usually dominate the fundamentalists. Since they work profitably, they feel vindicated in their approach, while, apart from exceptions, the fundamentalists' view is not confirmed. Overall, the currency traders can be considered heterogeneous agents. Fundamentals are taken into account by the chartists, selectively and with certain interpretations, but mostly not considered relevant, especially since fundamental factors such as inflation and growth differentials etc. only change very slowly. Chartists are therefore not displaced by "*rational*" traders, rather the opposite is true. The chartists create "*noise*" that attracts imitators, so that self-fulfilling prophecies come true. Herd behavior occurs. Sometimes, small non-fundamental news can be misinterpreted as disturbances, so that large exchange rate fluctuations arise. The fact that fundamental news are sometimes interpreted as relevant and sometimes viewed as irrelevant results from different "*framing*", i.e. the contextual interpretation by the respective agents.

The forces that could correct exchange rates when they are distorted are weak. Here Obstfeld/Rogoff's (2000) line of argumentation is followed. They see the reason in the lack of arbitrage due to very high transaction costs in the goods market, which is believed to amount to 20 to 40% in traded goods. Consequently, there are multiple equilibria, short and long-term, non-fundamental and fundamental. The

⁶ In De Grauwe (2000, 330), PPP no longer appear as a center of gravity in the characterization of the REEM model, or it is taken as given. Also in his empirical analysis, deviations from PPP do not matter, probably also when it comes to foreign exchange traders' rationale and behavior.

fact that on modern foreign exchange markets currency for transactions in goods is almost irrelevant seems to be overlooked. Even if goods arbitrage would be less expensive, it would probably have little impact on exchange rates. Another reason for lack of arbitrage put forward by De Grauwe/Grimaldi is the fundamentalists' risk aversion on the foreign exchange markets, because competition against the dominant chartists would be risky. Another argument against the REEM model is that there the market outcome is independent of the initial conditions whereas in the behavioral finance model they play an important role, because there is temporary path dependence in trend extrapolations.

De Grauwe and Grimaldi also examine the occasional success of sterilized foreign exchange interventions by central banks. In principle, central banks could be successful here by means of counter-cyclical orientation ("leaning against the wind"), even if the REEM model diagnoses policy inefficiency in this area. The authors find the reason for the fact that such interventions are not always successful in the relative strength of the chartists among the forex market agents under certain conditions. At the same time they favor managed flexible exchange rates, although they focus on the invention of a new paradigm, not yet on political interventions.

Lavoie/Daigle (2011) connect post-Keynesian approaches to exchange rate theory with those from De Grauwe/Grimaldi, while trying to present a stock-flow-consistent model of asset markets. They attempt to model expectations of chartists and fundamentalists, here called "conventionalists": while chartists follow adaptive expectations adapting to the trend of the previous period, conventionalists follow a notion of an equilibrium exchange rate that is compatible with a current account equilibrium. Assuming stable preponderance of the chartists they simulate long cycles of exchange rate movements which automatically change their direction after many periods without necessarily returning to the initial level. The endogenous, automatic turnarounds result from the chosen assumptions. All parameters are held constant. Expectations of the two rivaling trader groups don't change but the weight of the conventionalists increases the bigger the deviation from equilibrium although the shares of chartists and conventionalists remain constant. It is a mechanical model with rigid parameters and always certain expectations of both groups of traders. Uncertainty of expectations is cast out. The very nature of fickle expectations cannot be captured in this model. If expectations are so stable, why should the chartists be backward looking since everything can be foreseen. One might question whether this model is truly behavioural or truly Keynesian. However, the authors go beyond De Grauwe/Grimaldi, Harvey, Schulmeister and others by trying to analyse the cyclicity of modern floating exchange rates.

2.4 Conclusion

There are large similarities between Keynes's notion of "unanchored" expectations in a complex monetary market economy with phases of high uncertainty, which, in combination with flexible exchange rates lead to a flight into the short term, and the "heuristics", identified by the protagonists of behavioral finance, which have led to exchange rate speculation. Often it is only terminology that distinguishes them. Both have the rejection of the theory of rational expectations and of the efficient

market hypothesis, which is derived from it, in common. Both also have similar weaknesses, which they share with the mainstream. Since exchange rates do not rise or fall indefinitely, there must be turning points that once again lead close to notional long-term equilibria, even if they are touched only briefly with subsequent long over- and undershooting. The propositions of reversals through goods market arbitrage on the goods markets, which takes a long time and only takes effect for large deviations from purchasing power parity, neglects the fact that foreign exchange transactions are mainly triggered by financial transactions. Consequently, the arbitrage for similar asset classes in different countries and denominated in different currencies, should be much more important for the reversals than goods markets arbitrage.

Finally, the comparison of fundamental and non-fundamental determinants of exchange rates overlooks the fact that the different fundamentals altogether do not signal unambiguous exchange rate adjustments, but can also neutralize each other. First observed only as indicators, they also require interpretations which may lead to different conclusions.

Reflections on the recommencement of exchange rate theory will be sketched out and summarized in five areas below.

3. Approaches towards a new exchange rate theory

3.1 Financialization

That the reality of modern foreign exchange markets deviates so strongly and for such a long time from the classical fundamentals, especially the purchasing power parity, remains enigmatic in the prevailing exchange rate theory. So do the transitions from the short to the long-term equilibrium and the explanation for their instability. Modern foreign exchange markets are characterized by the predominance of financial flows; foreign exchange demand for goods transactions is quantitatively insignificant. In this sense one can speak of the financialization of exchange rates.

Financialization has three interconnected aspects. On the one hand a foreign currency is a medium of exchange for the purchase of foreign financial assets, on the other hand it is also a store of value, i.e. a separate asset class, with which profits can be realized through appreciation. In the first case increasingly short-term foreign assets are traded, i.e. portfolio investments, in the other case it is the holding of precautionary as well as speculative balances, the latter for speculating on appreciation (and depreciation of the other currency). When exchange rates are flexible, currency risks increase in the case of speculation on appreciation. In this case the prices of all external assets that are acquired by residents become more volatile, when they are rated in domestic currency. As a result, short-term investments are favored, because the way to the exit, in order to minimize currency risk, is shorter. Additionally, the need to hedge currency risks increases. This drives the growth of derivatives markets that promise to do this. On the other hand, this protection makes taking bigger risks and thus speculation possible. Furthermore, under uncertainty risks are often assessed wrongly, i.e. overestimated or underestimated.

Similar to other asset markets, waves of high and low risk aversion are likely to occur when bears and bulls alternate as driving forces.

In this environment, the ultra-short-term business of currency traders thrives, with "*trending*" and "*trial and error*". For the very short term fundamental considerations are completely unimportant, indeed, they are harmful to the business. Fundamentals of all shades are macroeconomic indicators that are important to the rationale of those who have - or should have - the functioning of the economy and the world economy as a whole in mind. On financialized, free, unregulated foreign exchange markets, central banks are absent. Thus, the most important fundamentalists, who could also engage in stabilizing speculation, do not participate. It is outlandish to think that forex traders can adopt the intentions of central banks or governments. Only in times of crises, during which currency valuations threaten to become excessive, it may also be in the short term interest of currency traders to change the direction (sign) of speculation.

Furthermore, forex traders do not act autonomously; they are also agents of those who demand foreign exchange, i.e. the asset owners who structure their portfolio internationally. Here the portfolio theory of exchange rates comes into play, which is lost in case one merely focuses on the immediate agent, the currency trader. Do asset owners focus more on fundamentals than the currency traders? Probably yes, because they tend to be active in all asset classes and their time horizon is usually not as ultra-short as that of the dealers in high-frequency trading. But here it once again holds true that asset prices move in great cycles that often but not always coincide with economic cycles and frequently, akin to forex markets, have a tendency for strong exaggerations.

Exchange rate movements could amplify the fluctuation of the values of foreign assets, calculated in local currency. Foreign securities, boosted by strong price increases, are once again inflated by revaluation of the foreign currency. In case of devaluation speculation, asset prices and the exchange rate fall in tandem. Hedging dampens the volatility of both the asset prices as well as the exchange rate, and thereby decreases speculative profits and losses. Now it depends on the degree of risk aversion and investors' greed for yield. High risk aversion is high liquidity preference in a safe currency, for example a reserve currency, preferably the US-dollar. Low aversion to risk means low liquidity preference and a readiness for currency diversification. This makes it clear that fundamentals, guided by PPP, play a minor role on financialized currency markets. As mentioned before, lower transaction costs of goods arbitrage would have a small effect on foreign exchange markets. While there is no "purchasing power parity" with the same or similar financial products that are denominated in different currencies, even if the expected returns are equal; however, there are estimates of overvaluation or undervaluation of foreign financial assets due to exchange rate risks that international asset owners must take into account.

3.2 Multiple equilibria

Like most financial markets, forex markets belong to the category of "flex-price markets" that are always cleared due to flexible prices. In this sense, flexible foreign exchange markets are always in such an equilibrium. On the other hand, they are in extreme imbalance, since the respective equilibrium is unstable and only of very short duration. Market participants are restlessly searching for a new equilibrium.

Since normally only a small part of the stock of a currency, i.e. the quantity of money, is traded on foreign exchange markets, the exchange rate may result from very large or very small currency transactions. In both cases, in terms of the other currency, *all* prices change on goods, factor as well as asset markets. The system of relative prices thus has to change constantly to find new equilibria, while the foreign exchange markets are perpetually in short term equilibrium. However, this equilibrium changes minute by minute. From this point of view, foreign exchange markets are of tremendous macroeconomic importance in a very open economy, because all microeconomic actors are constantly under pressure to adapt. A much higher degree of price flexibility is required, because the difference in speed between the exchange rate movements and rather sluggish changes in goods and factor prices is enormous.

The fundamental equilibrium is also unstable and can be determined in different ways. It is the real, the notional equilibrium, which comes about either accidentally or through the deliberate actions of those who are responsible for adhering to this equilibrium. It may coincide with a short-term equilibrium, but it can also be tied to a lack of market clearing. In this case central banks intervene by buying and selling or changing of interest rates. Alternatively, foreign exchange trading and controls of the movement of capital must be introduced. If fundamentalists were the opinion leaders on forex markets, i.e. if they dominated in the formation of expectations, it could also come to a coincidence of the short-term and fundamental equilibrium without intervention by the central bank or government. The fundamentalists par excellence are the central bank and the government as principal of the central bank - more specifically at least two cooperating central banks, since non-cooperative central banks could of course pursue offsetting exchange rate targets.

3.3 The heterogeneity of the fundamentals

Although the fundamentals are mostly viewed as a homogenous unity, in reality they are different target values, which do not always point in the same direction and can be met in different degrees. Moreover, predictions are important, i.e. forward-looking expectation values of fundamentals, and these data require interpretation (see De Grauwe 2000). Let us examine the most important ones more closely: PPP, inflation differentials, growth differentials, interest parity at short and long term interest rates and current account balances.

In case exchange rates lead to wide disparities in purchasing power or the price levels of traded goods, there will be attempts to reduce transaction costs. In the longer term, companies and entire industries

that cannot keep up with the competition due to excessive exchange rates will shrink or entirely disappear from the market ("location problems" due to overvaluation). If the exchange rate changes again after years of "*misalignments*", companies or sectors will hardly be able to come back. It can come to de-industrialization or over-industrialization, i.e. to distorted structural changes in the real economy. In this case the statistical approximation to the PPP after correction of the exchange rate is an illusion - the goods whose prices would have to be the same between different countries, are no longer produced or are only produced to a minor extent in one or more countries. The production structure then adapts to the distorted exchange rate, instead of the exchange rate adapting to production⁷. Thus exchange rates affect durable output and employment permanently, i.e. they are not growth-neutral⁸. The alleged return in the long term to the fundamental equilibrium exchange rate would be a *perverted* version of the PPP theory of the exchange rate. From this perspective it holds that after a long departure from the PPP a return is not possible, because irreversible structural changes have occurred and the favored sector has acquired dynamic competitive advantages in countries with undervalued exchange rates. Exchange rate distortions can also induce trade diversion in favor of those countries whose currencies deviate from the PPP less strongly or have fixed exchange rates. This would be a regional trade distortion. Empirical research has hardly paid any attention to the problem of distorted competition.

The logic of the PPP theory, whether in its absolute or relative variant, is unequivocally causally aligned: the exchange rate adjusts so that deviations from parity caused by inflation differentials are eliminated again. In the case of flexible goods prices this would mean that appreciating economies would have to reduce their price levels, and/or depreciating economies would have to increase them so that the real exchange rates could remain more or less stable. If monetary policy aims at stable price levels, i.e. neither inflation nor deflation, then the correction of price level disparities must take place exclusively via nominal exchange rate changes. Even if goods arbitrage were strong, it would be unable to solve the problem. It would therefore be better if the disparities would not arise at all - meaning the internal and external value of money would be equally secured.

Strong deviations of the real exchange rate from the PPP probably encourage current account imbalances. However, bilateral exchange rates are of little relevance to the current account balances, and bilateral positive or negative trade balances are usually not indicative of the entire account balance. However, when there are many countries whose currencies fluctuate in parallel to the currency of another country, for example to the two major reserve currencies. Then, a current account imbalance is

⁷ Keynes already saw this point, but paid little attention to it, because he believed in the power of goods arbitrage: If the exchange rate is equivalent to the PPP, "... it is not possible to say in general whether exchange value will move towards purchasing power parity or the other way round."(1923, 95 f.).

⁸ Olaf Sievert laconically confirmed the Keynesian view: "For a long time it was the prevailing notion among economists that the exchange rate, at least in the longer term, is a purely monetary phenomenon. This would mean that it is neutral with respect to the real economic conditions. We no longer have reason to believe that this is true." (1997, 7) He shows that the labor market in Germany was significantly harmed by long periods of appreciation, without subsequent depreciations being able to undo the damage.

an important indicator of deviations of various bilateral exchange rates from the fundamentals. This indicator would then point in the same direction as the deviation of the bilateral PPP.

Higher interest rates at home than abroad can lead to both appreciation as well as devaluation expectations. If they are perceived as a defense of a weak exchange rate, they indicate devaluation risks. This could also apply if they indicate a more restrictive monetary policy that is supposed to combat higher inflation than abroad. However, it may be true that the expectation of higher interest rates in one country, for whatever reason, even with higher inflation, induces short-term capital inflows, contrary to the theory of uncovered interest parity. Lower expected growth as a result of higher interest rates and a corresponding appreciation could, however, dampen the appreciation once again. Thus, the exchange rate effects of higher interest rates and lower growth could cancel each other out. Conversely, lower interest rates in one country can be interpreted as the start of a recovery process with higher growth, so that expectations of devaluation and appreciation develop in opposite directions.

Higher domestic growth at home than abroad usually leads to a lower current account balance. Again, two fundamental factors can neutralize each other. Inflation acceleration during recovery and higher growth can also induce offsetting exchange rate expectations that cancel each other out and leave the field to the chartists.

Ultimately, the determination of the "correct" fundamental equilibrium exchange rate is a difficult and sometimes ambiguous matter. Assigning the right weight to the different dimensions of the fundamentals in each case, while at the same time evaluating conflicting goals, is also a genuinely political task. Traders and investors perceive financial fundamentals often in a biased manner, by focusing on specific factors, such as growth forecasts, and excluding others (cf. De Grauwe 2000).

The long-standing debate about fundamental exchange rates, which was in particular conducted by the International Monetary Fund (cf. Isard 2007, IEO 2007), led to no practical results. Other authors have provided useful suggestions for fundamentally justified real exchange rates (cf. Williamson 1985, Cline 2013). The conclusion should not be to leave the question of exchange rates to market players but to at least prevent extreme exaggerations and to keep fluctuations small. The classical idea of PPP is still the best, but only if the parity is consistently met or if the deviations are kept low and short, so that perverted parities, as shown above, can be avoided. This also means the promotion of stabilizing speculation and combating its destabilizing variant. However, to enforce this idea in a world of financialized forex markets, which do not care much about the real economy, requires much greater weight of the institutions that follow fundamentals and thus apply macroeconomic considerations.

Also in case of the dollar-euro exchange rate, the fact that the United States as reserve currency country no. 1 has fewer problems with strong exchange rate fluctuations than other countries plays a role. The U.S. thus displays a tendency to the "benign neglect" of the exchange rate, at least over long phases. Those who can borrow in their own currency, be it state actors or the private sector, and can expect a

high currency premium, worry less about exchange rates. Nonetheless, the real overvaluation against China and other emerging economies, resulting in far-reaching deindustrialization has led many to rethink this issue.

3.4 Systematic misjudgment of fundamental factors

Many critical observers of orthodox exchange rate theory complain the lack of recognition of fundamental data by currency traders. This criticism goes too far, even when it comes from Keynesians and representatives of behavioral finance. In the case of strong deviations from presumed fundamental equilibria a reversal takes place. When directional changes occur at the extremes of the exchange rates, fundamental considerations appear to play a dominant role. Otherwise, one could hardly explain changes in direction, unless one points to coincidences. "Fundamentals" play a role in the normal currency trading of the chartists. Those who speculate on appreciation require a dealer who receives a contrary position. This need not necessarily be speculation on depreciation, it can also refer to different expectations regarding the degree of appreciation or other goals such as to "cash in".

Often stereotyped patterns of interpretation play a role. This includes the one-sided, selective interpretation of the many fundamentals and oftentimes the focus on growth expectations while systematically neglecting the PPP. Current account deficits are sometimes viewed as a signal of the strength of an economy and confidence in its currency, because investors are willing to finance the deficits. Sometimes they are also perceived as a deficiency and a risk. During the weakness episode of the euro in 2000, negative assessments such as "euro-sclerosis" played a role. Similar examples include a positive assessment of the U-turn to "Reaganomics" during the appreciation of the dollar after 1980 and probably overly optimistic expectations of an economic miracle in the re-united Germany after 1990. Generally, more attention is paid to the fundamentals in the U.S., following Ehrmann/Fratzscher (2005), than to the DM or the euro. If the fundamental factors display unclear, contradictory signals, there is a tendency to trust the "market forces", meaning the "trending" of the currency traders. There is a lack of systematic, credible guidelines for exchange rates based on fundamentals. This creates room for unfettered speculation.

3.5 Exchange rate cycles and dynamic exchange rate theory

Traditional exchange rate theories, whatever their provenance, are static. The fundamental balance is occasionally disrupted, but the return to the center of gravity in the vicinity of the PPP occurs no later than in the medium-run. Disturbances are viewed as stochastic exogenous shocks, because they cannot be explained endogenously within the REEM model. A quick glance at the most important exchange rate, the DM or euro-dollar exchange rate since 1970, presents a picture of long cycles with amplitudes sometimes exceeding 100% and a time frame of up to ten years from a low to a high. This is also similar for the other major currencies. Kindleberger, Schulmeister and De Grauwe/Grimaldi are right: these are *bubble-crash* cycles as in other asset prices. They are built up slowly, interrupted by occasional sideways

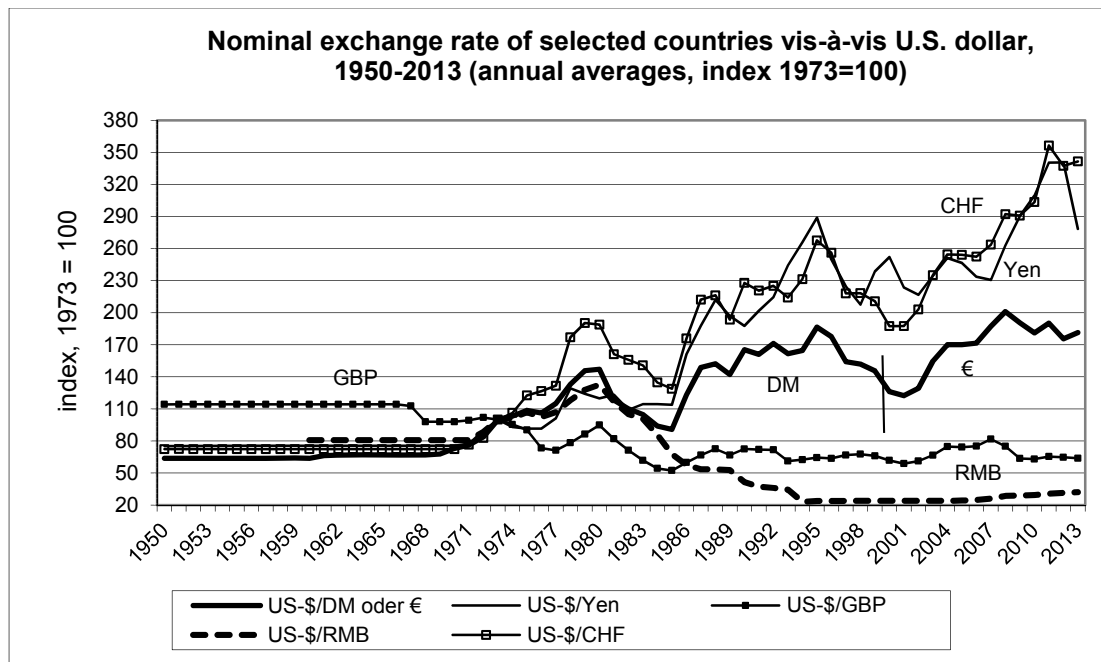
movements or lighter setbacks. The long periods of gradual inflation end with a sudden reversal, leading to a rapid fall and continuing with slower inflation in the other direction without staying near to the suspected fundamentals for long.

Explaining the turning points in exchange rate bubbles is difficult. Possible reasons for their occurrence are the exchange markets themselves on which the fundamentalist traders suddenly take the lead. But why does this happen - often so late that already enormous deviations from the PPP have occurred and current account imbalances and other problems have arisen? Conversely, it could also be the strong pressure of the companies affected by exaggerated appreciation or depreciation and workers at risk of losing their competitiveness and their jobs, while there are inflationary pressures in the depreciating country. Another possible reason could be the central banks which lower the interest rates in the appreciating country and raise them in the depreciating country. It may also be recessions or financial crises that trigger shock waves. Perhaps it is the reversal of the "animal spirits" into risk aversion, when the exchange rate bubble seems to be too large. Econometric research methods are probably not suitable to determine the causes. Each turning point is idiosyncratic and has its own history; mechanical explanations such as thresholds for excessive negative or positive assessment are not always helpful for the prognosis of the correction. As is the case with other asset price bubbles, it is difficult to predict when it bursts. There is much evidence that economic policy problems of various kinds cumulate when it comes to strong exaggerations in the currency markets; several or even all fundamentals speak for an exchange rate adjustment and the fundamentalists gain influence vis à vis the chartists in the end.

4. The DM/euro-dollar exchange rate from 1970 to 2014

In the historical development since the end of Bretton Woods, the exchange rate of the DM and the euro against the dollar illustrates the enormous volatility as well as the super-cycles and low gravity of the PPP and other fundamentals.

Figure 1



Source: Deutsche Bundesbank, Penn World Tables, WDI, own calculations

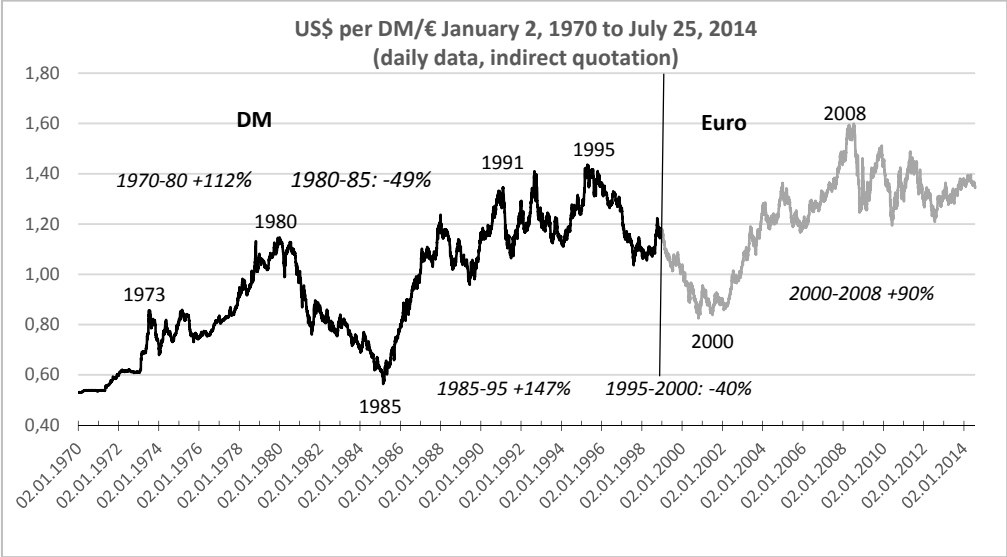
Figure 1 shows the long-term development of the annual averages of the exchange rates of various major currencies since 1950 (and for the renminbi since 1961, respectively). The DM and later the euro followed a secular appreciation trend against the dollar. At the climax in 1995, the DM stood about 95% above its level of 1973, the euro stood around 100% higher in the peak of 2008. Even during the euro's low of 2000, the level of 1973 was exceeded by 22%. The yen and the Swiss franc, two relatively small reserve currencies, appreciated a lot more. All currencies shown - with the exception of the renminbi from the mid-1980s onwards - perform similar movements against the dollar, albeit with different amplitudes.

Three long appreciation phases for the DM/euro occurred: 1970-1980, 1985-1995 and 2000-2008. They were followed by three shorter depreciation periods with durations of five years in the first two cases, while the last devaluation phase of 2014 is still ongoing. With the exception of the low of 1985 and the high of 1995, all extremes on both sides of the Atlantic were tied to recessions; obviously extreme devaluations are no less critical than cases of extreme appreciation. Strong appreciations affect price competitiveness, jobs and growth, induce pressure on wages and consequently on domestic demand, reinforced by buoyancy in capital exports; inflation and interest rates are attenuated to the extent that credit growth and asset prices are fueled. Devaluations have the opposite effect; in particular asset price bubbles can burst. In the case of the dollar, commodity prices react inversely to the devaluation of the dollar, thus fueling global inflation, which also affects appreciating countries and impairs the current account balances of commodity-importing countries.

In the case of the dollar, but increasingly also the euro, there were worries about a weakening of the reserve currency function in case of sharp devaluations and thus a flight from the dollar. But in fact, the

opposite took place in the U.S. after 2008, namely an escape into the domestic currency as a safe haven, due to lack of reserve currencies which could replace it. Overall, the effects of strong currency fluctuations are complex and confusing; individual effects may neutralize or reinforce each other. Thus the extremes create expectation uncertainty and vulnerability to large turbulences in case of small shocks. It is very likely that the risk aversion of asset holders increases in case of extreme exchange rate imbalances, while liquidity preference increases and recessions begin to form on both sides.

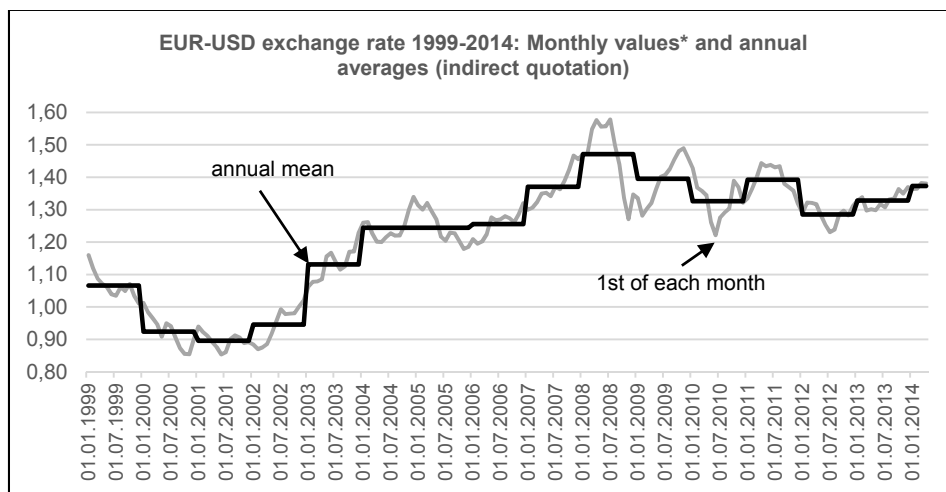
Figure 2



Source: Deutsche Bundesbank, own calculations

Figure 2 shows the same development since 1970, with daily values for the DM and the euro, respectively. The amplitudes are much bigger, and the short-cycle volatility within a year is clearly visible. The nominal appreciation from the low to the high in the three long appreciation phases was 112%, 147% and 90% (annual values). The DM reached its weakest point on 25 February 1985 at a value of 3.44 DM per dollar, its strongest on 19 April 1995 at 1.36 DM per dollar (daily averages in then prevailing direct quotation). The euro reached its low on 26 October 2000 with 0.82 dollars per euro and its high on 15 July 2008 at 1.60 dollars per euro (now in indirect quotation). Within a year, considerable variations occur, sometimes by 20% in a few months (see monthly and annual values in figure 3). Since the fundamentals did not change much, neither over the year nor between the high and low values, it is clear that the exchange rate fluctuations were not driven by fundamentals.

Figure 3



Source: Oanda (online), own calculations

The nominal appreciation trend of the DM and the euro can to a lesser extent be explained by lower inflation in Germany and the euro zone. Figure 4 shows the bilateral real exchange rate in addition to the nominal exchange rate. The bilateral *real* exchange rate also shows a strong appreciation of the DM or the euro in the three phases, namely by 22% from 1973 to 1979, 107% from 1985 to 1995 and by 46.9% from 2000 to 2008 (based on annual data). In other words, about half of the strong nominal appreciation (1973-1980 and 2000-2008) to one third (1985-1995) is explained by inflation differentials. If at all, only a mild long-term trend towards real appreciation of the DM or the euro is recognizable in the entire period 1973-2013, but the deviations of the 1973 index go about 35% above and below its initial value, based on annual averages. For daily or monthly values, the deviations are much stronger.

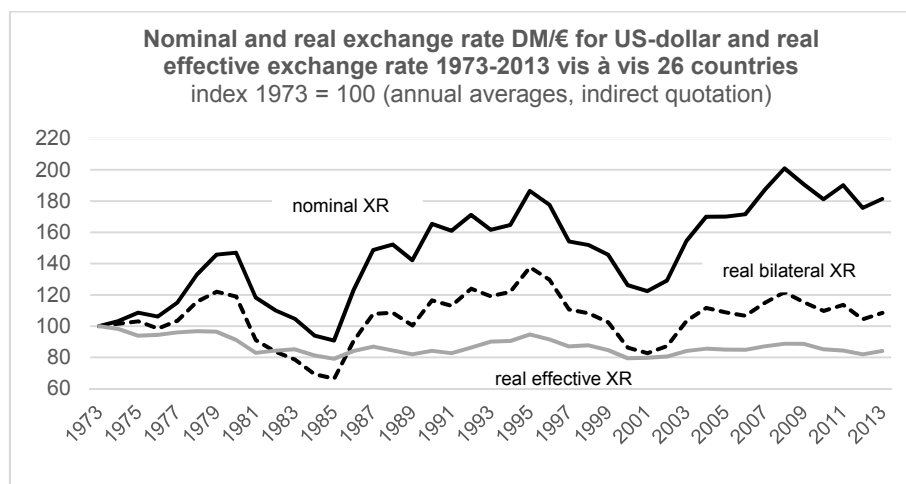
The real effective exchange rate, i.e. the real exchange rate against the major currencies weighted with the shares of trade⁹, shows much less variation for Germany than the real bilateral exchange rate against the dollar and the nominal exchange rate, respectively. There are two main reasons for this. On the one hand, most currencies of the OECD countries, to which the biggest shares of Germany's trade are attributable, vary similar to the euro against the dollar, albeit to different degrees. On the other hand, the most important trading partners are located in the euro zone and the EU. These had already been in a system of fixed but adjustable exchange rates before the founding of the euro zone, in the context of the “snake in the tunnel” and the European Monetary System (EMS) since 1979. This is most likely an important reason why the trade relations between Germany and the EU member countries are much more intense than those with the United States.¹⁰

⁹ We use the World Bank data from WDI which do not explain which and how many trading partners are included in the calculation.

¹⁰ Attempts to stabilize European exchange rates after 1973 and the launching of the euro had been legitimized mainly with the goal of intensifying intra-European trade, among other reasons. This goal was accomplished to a high degree, despite all the deficiencies of the euro system. Reversing the argument, one can reason that the low intensity of transatlantic trade, despite almost negligible tariff barriers, could be caused to a significant degree by the exchange rate regime.

Overall, Germany as well as the other member countries of the euro zone, follow two contrary exchange rate regimes which correspond to the "corner-solutions" (Stanley Fischer): on the one hand basically completely fixed, irreversible exchange rates with a common currency, on the other hand a completely flexible, unregulated exchange rate regime against the United States (and other currencies).

Figure 4



Source: WDI, AMECO, Deutsche Bundesbank, BIS, ECB, own calculations

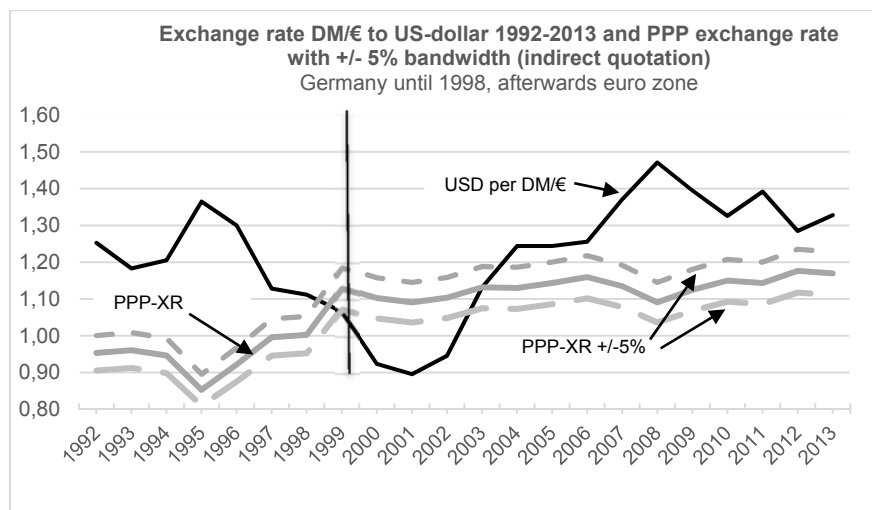
The exchange rate corresponding to the PPP between DM/euro and the dollar is shown in Figure 5 (until 1998 for Germany, afterwards for the euro zone). The data on PPP refer to the GDP as a whole and hence include the prices of non-tradable goods, particularly services. As the price development of tradable and non-tradable goods is similar in developed countries, the indicator computed by the World Bank and IMF can be used as an approximation. Of course, the influence of potentially perverted PPP mentioned above cannot be excluded. In this respect, the data represent only a rough reference point.

Thus, the exchange rate corresponding to the PPP would be about 1.15 dollars per euro as of 1999, in 2013 at about 1.17 dollars. Except for the years 1998-2003, the DM and the euro were significantly overvalued against the PPP. The maximum of the overvaluation of the DM in 1995 was 37.5%; in 2000 the euro was undervalued by about 20%. Since the values from 1999 hold true for the entire euro zone, the overvaluation of the euro for individual member countries is estimated to have been well over 25% in the peak year of 2008.

If one calculates an exchange rate for the euro zone for the period of 1991-1998 based on the conversion rates of 1999 and extends it until 2013, then, for a total of 23 years, the exchange rates (annual values) lie in the corridor of +/- 5% of PPPs in five years, during 11 years in the range of +/- 10%. For Germany (1990-2012), the deviations are larger: in only four out of 23 years the deviation from the PPP stood at +/-5%, in eight years in the range of +/-10% (own calculations based on the sources given for Figure 5). Strong deviations above +/- 15% occurred about as frequently as lower ones in the range of +/- 10%. The median of the deviations is 11.3 and 7.9% for Germany and the euro zone, respectively. For the

latter, the deviations are smaller, because the internal differences between the member states partly compensate each other.

Figure 5

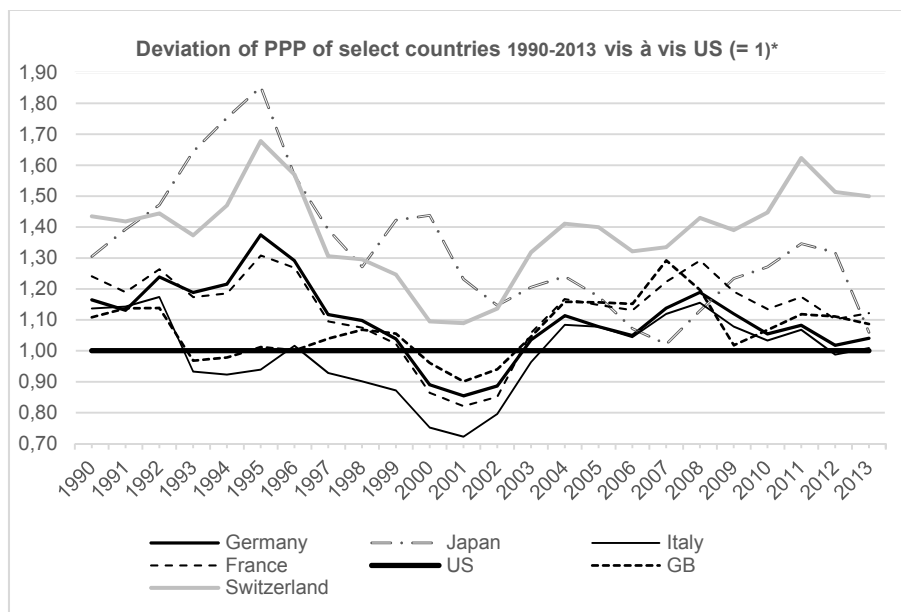


Source: WEO, WDI, own calculations

For most economies, the deviations of the price level from that of the United States due to exchange rate fluctuations are significant. Some countries' currencies such as those of Japan, Switzerland and Norway are chronically overvalued (see figure 6). For some countries in the euro zone, including France and Germany, it can be observed that the differences in price levels have decreased with the introduction of the euro, i.e. goods arbitrage is more intense under fixed exchange rates. The extremes of the deviations from the PPP, mainly towards overvaluation against the dollar, are reached in the same years (1995, 2000, and 2008) in most OECD countries. The information on the PPP include non-tradable and tradable goods¹¹. However, the latter cannot be separated precisely. The purchasing power disparities show strong and very clear signals for over- and undervaluation of currencies and their late correction, which is initially fast but then becomes sluggish.

Figure 6

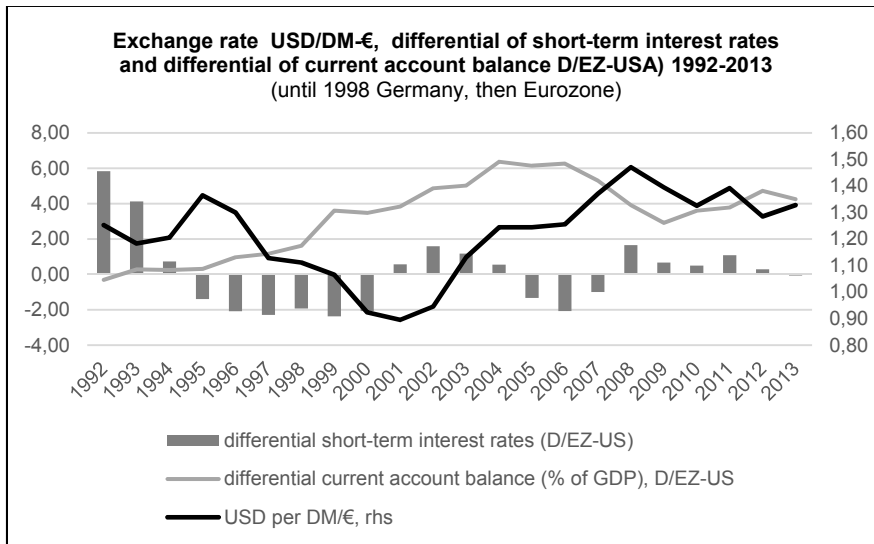
¹¹ Schulmeister estimates the prices of non-tradable goods in the United States to be more expensive than in Europe, so that calculations of the relation between the exchange rate and PPP for traded goods are about 10 percentage points below the corresponding ratio for the PPP on the basis of GDP. This would mean that the overvaluation of the DM or the euro in the years 1980, 1995 and 2008, based on tradable goods, was significantly stronger than shown in figures 5 and 6, while the undervaluation of the euro in 2000 would be lower. See Schulmeister 2000.



Source: WDI, own calculations; * PPP conversion factor from WDI, GDP based on data by the OECD and Eurostat

Often it is assumed that - in line with the theory of interest rate parity - interest rate differentials are the most important short term fundamental. Figure 7 shows that this is not always true. The extremely high interest rates in Germany between 1991 and 1993 did not directly lead to an appreciation of the DM against the dollar; this only took place in 1994/95, when the United States had already returned to higher interest rates than Germany. On the other hand the higher interest rates in the United States in the second half of the 1990s probably drove the value of the dollar up. The positive interest rate differential from 2001 onwards may have contributed to the turning point of the exchange rate cycle. In contrast, the strong appreciation of the euro in 2006/2007 was tied to a negative interest rate differential, which was only reversed in 2008 when the Fed had already lowered interest rates, and the ECB stepped on the brakes further. Apparently, interest rate differentials, even substantial ones (up to almost six percentage points in 1993), have only a limited effect on the exchange rate. It is unlikely that response lags play a major role in short term interest differentials. For short term capital flows, a rapid response would be expected. The difference in current account balances (figure 7) between Germany and, from 1999 onwards, between the euro zone and the United States signaled the growing need for devaluation of the USD in the period from 1990 to 2006.

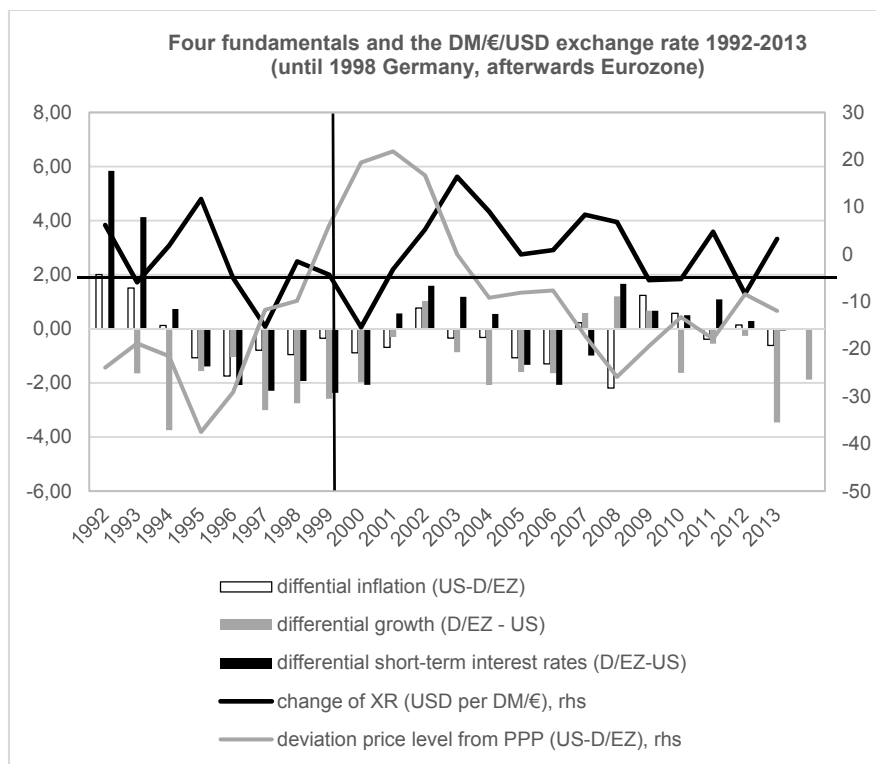
Figure 7



Source: OECD, WDI, WEO, own calculations

Figure 8 shows the development of four fundamentals, namely differences of growth, interest rate, inflation and price level as well as the rate of change of the exchange rate. In case of the fundamentals having negative values, a devaluation of the DM or the euro, respectively, should be expected and vice versa. Between 1995 and 1998 all four factors indicate a need for devaluation in the same direction for the overvalued DM, afterwards the signals mostly point in different directions. This confirms the fact that fundamentals can neutralize each other and thus give more space to non-fundamental vectors. Of all fundamentals examined, the price differences display the greatest volatility, but also the bandwidth of the interest differential, which fluctuated in the period between +5.8 and -2.4 percentage points, is enormous.

Figure 8



Source: OECD, WDI, WEO, own calculations

What are the factors that can explain the turning points in the exchange rate cycle in the years 1980, 1985, 1995, 2001 and 2008? We have no clear answer, only more or less plausible narratives. The hypothesis here is that fundamentals are becoming more important at the turning points of the exchange rate cycle. The contradiction between the traders' assumptions and the facts about fundamentals becomes too big at some point. For the deviations from purchasing power parity it clearly holds that these were very large at the respective extremes. Of course one cannot explain in this way why a reversal did not occur sooner or even later. Moreover, foreign exchange market interventions by central banks can play an important role. The German Bundesbank has undertaken coordinated sterilized interventions together with the Fed and the Bank of Japan in 1985 and in 1987. Furthermore, between 1990 and 1995 it has intervened repeatedly and partially coordinated these interventions with the Fed, in order to suppress the appreciation trend of the DM and to prevent temporary devaluations. The ECB and the Fed have intervened in a coordinated manner in 2000 in order to strengthen the dollar (cf. Wollmershäuser 2003, 39 ff.). Let us look at the five turning points since 1980 more closely.

Without a doubt the approaching end of Bretton Woods led to appreciation expectations for the DM and the yen, which were then realized with full force and exuberance. In 1980, as well as in the other years when the DM or the euro were extremely strong, it was likely clear to everybody that the appreciations had gone too far and were threatening to trigger recessions. In the devaluating country, here the United States, inflation increases, fueled by energy and commodity price inflation, which rises with the weakness of the dollar. From 1979 to 1980 the "Volcker experiment", a result of monetarist policy, led to exorbitantly high interest rates in the U.S. and a significantly positive interest rate differential against

Germany. The following dollar appreciation with an increasing current account deficit in the United States went so far that in 1985 the Plaza Accord was agreed upon. This required international policy coordination of the major central banks in order to protect yen and DM from further decay and stop the soaring dollar. This agreement seemed effective, a reversal of the exchange rate dynamics ensued until at one point the dollar threatened to become weak again while DM and yen threatened to become too strong. The Louvre Accord, which aimed at stabilizing the dollar again, was agreed upon in 1987. It succeeded initially, but in the 1990s the DM once again soared to its record high of 1995. The extremely tight monetary policy of the German Bundesbank had already reached its peak in 1992-93, but the crisis of the European monetary system came about, which probably further fueled the appreciation expectations for the DM. The German Council of Economic Advisers assessed in 1997 that, measured on the basis of purchasing power parities, the DM was clearly overvalued in 1995 (SVR 1997, subparagraph 228). According to the experts, afterwards doubts about Germany as a location for business contributed to the devaluation (no empirical evidence provided). In 1995, the Council had already determined that the appreciation during that year could not be explained by fundamentals (SVR 1995, subparagraph 171).

The fact that the euro fell by 25% since its introduction in 1999 and was thus significantly undervalued according to prevailing opinion remains a mystery to many observers. Some quasi-fundamental factors may have played a role: the initial distrust of the euro, the higher interest rates in the United States in 2000, the exchange of several countries' reserves, previously held in DM, into dollars rather than euros. However, strong non-fundamental, i.e. speculative reasons, may have contributed to the euro's weakness too (cf. De Grauwe 2000). During the shift to the devaluation of the overvalued dollar, the 2001 recession, the bursting of the dotcom bubble and the events of 9-11 could have played a role, but also the reversal of the interest rate differential in favor of the euro as well as the aforementioned coordinated foreign exchange intervention by the ECB and Fed.

The extreme appreciation of the euro in 2008 could have resulted from the strong economy in the euro area (2005-2008), the higher interest rates in the euro zone and the negative evaluation of the record current account deficit of the United States, but could also reflect speculative exuberance beyond these factors. The fact that the ECB has not intervened in the forex market against the euro's appreciation, this time, is probably due to the U.S. current account deficit, which would be suspected to further increase in case of a dollar appreciation. The ECB would have likely had to expect retaliation by the Fed.

The reversal after 2008 might have initially been motivated by the strong liquidity demand in the face of the collapse of the interbank money market and a *safe-haven* effect of many asset holders. Suddenly increased risk aversion of U.S. investors in terms of foreign investments, and thus a high preference for domestic dollar liquidity were added (cf. Sinn in 2009, 39ff.). The purchasing power disparity points to a turnaround, just like in the previous years during which turnarounds occurred. However, it is unlikely

that a sudden onset of goods market arbitrage had caused the foreign exchange markets to revert. The rapid spread of the U.S. financial crisis to Europe was also a reason against maintaining the strong valuation of the euro.

We only know that extreme appreciations and related devaluations cause macroeconomic problems, which often enough led to crises that can eventually clean up the distortion. In this view, the reversal of the exchange rate development triggers problems that the latter themselves had fueled before. On several occasions, central banks have contributed to exchange rate corrections by intervening on foreign exchange markets, although these were also made in a very timid manner and in the end we do not exactly know what the reason for the correction was.

At this point, enigmas remain. We do not know the instincts of bears and bulls on foreign exchange markets, and will probably only be able to explore them to a limited degree. What we definitely know, however, is that flexible exchange rates do not change infinitely in one direction. Eventually they crash. This is what happens with all asset price bubbles.

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