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Currency Market Participants' Mental Model and the Collapse of the Dollar: 2001-2008

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Abstract: It is well accepted among Institutionalist and Post Keynesian scholars that portfolio investment markets are driven by agents' expectations rather than "the fundamentals." This explains, it is argued, why asset and currency prices are so much more volatile than and often clearly out of line with what we would otherwise consider to be their underlying determinants. What is rarely addressed, however, is how those expectations are formed. This paper fills the void by proposing a specific view of agents' expectations based on the mental model they employ to understand currency movements. The paper derives this schematic by examining market participants' psychological propensities and the world view of the subculture of which they are members. It will be shown that the model is consistent with the salient features of the foreign exchange market and it is employed to explain the dollar's fall from 2001 through 2008.

Keywords: mental model, psychology, exchange rates, foreign currency

JEL Classification Codes: F31

The dollar's fall from 2001 through 2008 was steep, sustained, well publicized, and, in terms of "fundamentals"-based models, inexplicable. Even if one argues, as C. Fred Bergsten did before Congress in 2008, that this merely represents a correction to levels experienced in earlier decades, it begs the question of why such massive swings occurred in the interim (Bergsten 2008). Neoclassical economics leaves us with the less-than-comforting observation that "exchange rates appear to be influenced by forces so far unknown" (Gehrig and Menkhoff 2005, 522).

The problem, however, is not the enigmatic nature of currency prices, but the models used to explain them. In Neoclassicism, physics is seen as the ideal metaphor and thus economies are imagined to be driven by rational, deterministic forces in a world populated by atomistic individuals. But markets are social institutions . . .

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> . . . like democracy and marriage . . . They serve to organize and guide human behavior through sanctions (formal and informal, negative and positive), mores, norms, status, and shared worldviews. Activities of markets are the activities of people and societies. (Harvey 1993a, 679)

The lesson here is that if we are having difficulty explaining exchange rates, then perhaps the answer lies in trying to understand the currency market as a cultural phenomenon and not a physical one. Our focus should be on the people involved and the subculture of which they are members.

To that end, the goal of this paper is the specification of currency market participants' *mental model*, or their internal representation of the workings of the real world.[1] This is what they use to define, understand, interpret, and interact with "reality." It tells them what to expect when given events occur, it determines for them what is and is not worth monitoring, and it suggests what actions they should take in various circumstances. While, strictly speaking, the mental model exists solely in the minds of those being studied, it is nevertheless social in nature. Market participants do not invent it in isolation, but as they seek each other's advice, publish and read scholarly and professional opinions, experiment with new approaches, train neophytes, enforce formal and informal sanctions, interact with colleagues professionally and socially, et cetera. If we can understand what currency market participants think they are doing, then — since they are the ones who actually set the currency prices — we can understand what moves foreign exchange rates.

The paper will proceed as follows. In the next section, the basic structure of the mental model is outlined. Following that, facts regarding its operation are offered. The mental model is then used to explain the dollar's collapse between July 2001 and March 2008 and from that exercise lessons are drawn. Conclusions, including policy, follow.

The Mental Model: Basic Structure

The market for foreign currency is dominated by portfolio capital flows. The 2004 *Bank for International Settlements* (BIS) survey indicated that the average daily value of currency transactions (based on April of that year) was, net of double counting, around $1.9 trillion (BIS 2005, 1). At an annualized rate, this was sufficient to finance world trade over 40 times (BIS 2005, 1; *World Trade Organization* 2005, 3). Imports, exports, and direct foreign investment obviously have an impact on the price of currency as foreign exchange is purchased when those activities are undertaken, but their effect is secondary at best. International financial markets drive foreign exchange rates.

What drives international finance are the forecasts of market participants, primarily currency dealers and fund managers. When they believe that the value of the yen or yen denominated assets will increase, they purchase them. If sufficient numbers of their colleagues agree and follow suit, an appreciation does, indeed,

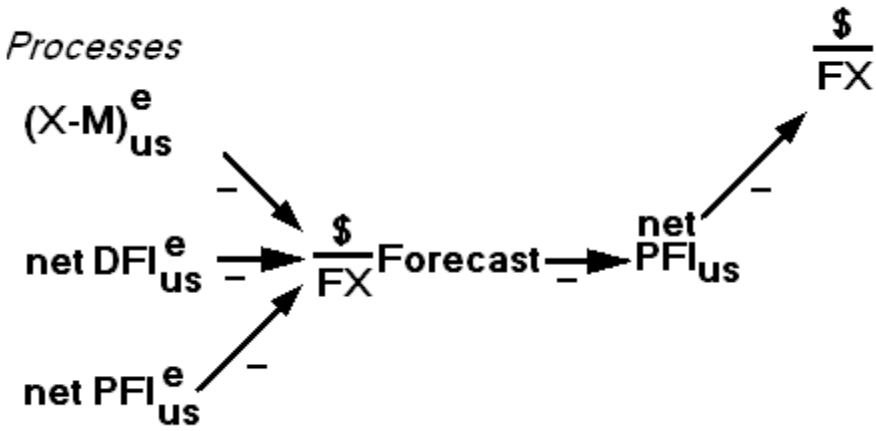
follow. The question is what made them decide to take such a stance in the first place; the answer is to be found in the mental model they employ.

Everyone uses a mental model. Without it, we could not interact with the world around us. It defines for us what external stimuli warrant our attention, what characteristics they have, what they might cause to occur next (or what caused them), and what consequences our actions may have. Currency market participants' version of a mental model can be distilled from a number of sources, including surveys, empirical studies, and psychological investigations. Before sifting through the literature, however, let us first make some very basic assumptions about agents' understanding of the structure of the market. First, it is safe to say that they understand that, outside of official intervention, there are only three reasons to buy foreign currency: import/export (or trade), direct foreign investment, and portfolio foreign investment. Thus, events that may have an impact on one of these three processes will be viewed as having the potential to move exchange rates (and others will not). There is also little doubt that they know that they and their colleagues make money not by waiting for those events to work their way through various economic channels to affect the exchange rate, but by acting *in anticipation* of those effects. Thus, when new information suggests, for example, that direct investment flows may be altered, the impact is both immediate and not on direct investment, but in the financial capital market as agents adjust their portfolios to position themselves to take advantage of the forecast movement. In other words, the initial impact of information relating to any of the three reasons for purchasing foreign exchange is on portfolio foreign investment. The reaction time is known to be very fast and it is for this reason that agents care much less about the accuracy of news than in getting it before their colleagues (Oberlechner and Hocking 2004, 418)! It does not have to be true for the financial market to react to it, and if there was a reaction then money was made and lost — better not to be in the latter group.

Figure 1 illustrates these basic principles regarding the mental model. At the center is the object of every agent's efforts, the currency forecast, measured as dollars per unit of foreign exchange (FX). Consistent with the above discussion, the determinants of that forecast are $(X–M)^{e}_{us}$ (expected net U.S. exports), net DFI^{e}_{us} (expected net direct foreign investment into the United States), and net PFI^{e}_{us} (expected net portfolio foreign investment into the United States). The negative signs on the links between these variables and the forecast reflect the fact that agents assume that a rise in any one of them creates a net demand for dollars, indicating a dollar appreciation (i.e., a fall in \$/FX). The "e" superscript on these processes reflects the fact that agents are making their foreign exchange forecast based on what they expect to occur in trade, DFI, and PFI. Realized levels of (X–M), DFI, and PFI are obviously important foci for their expectational counterparts, but are insufficient to serve as the sole inputs into a forecast (particularly when most realized values will not be known one month or more after the event).

The \$/FX forecast itself then drives actual (as opposed to expected) net portfolio foreign investment flows into the United States (shown as net PFI_{us}). The link is shown as negative because as agents upwardly revise their \$/FX forecast, this means

Figure 1. Mental Model: Processes

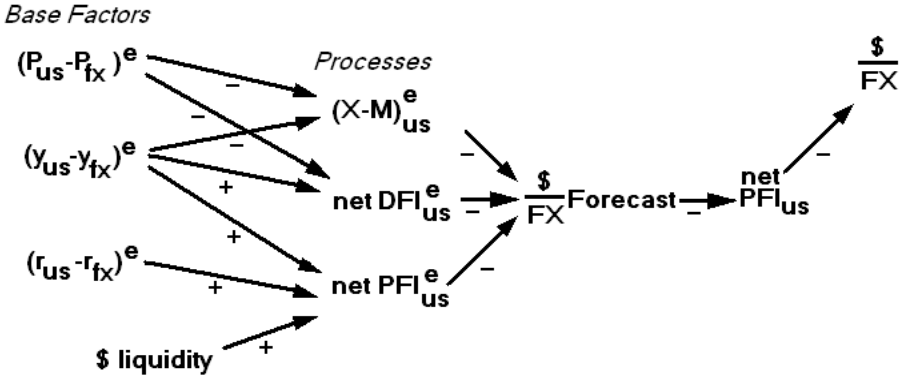


they expect the dollar to be worth less in the future. This causes the reverse (i.e., a fall) in net portfolio foreign investment into the United States. The net PFI_{us} then shows a negative link to the actual \$/FX exchange rate since a rise in net inflows would cause a dollar appreciation (a fall in \$/FX). Thus, any forecast change in \$/FX becomes realized as financial capital flows adjust.

The next question is what market participants believe affects the three processes shown on the left in Figure 1. Unfortunately, market participants' forecasts appear to go through fads and fashions. What may be considered an important factor one month may be ignored the next. To account for this fact, only the most consistently referenced base factors impacting on the processes shown in Figure 1 will be listed explicitly. Studies have shown these to be interest rates, macroeconomic growth and stability (as represented variously by unemployment, GDP, durable goods orders, and retail sales), inflation, trade flows, and the money supply (see for example Cheung and Chinn 2000; Cheung, Chinn and Marsh 2004; Ederington and Lee 1993). As money supply has become much less popular over the past five to ten years and since, at any rate, it was really being used as an input into the inflation and interest rate forecasts, it will not enter into the discussion at this stage. Also, trade flows already appear as a process. This leaves us with three base factors: relative prices/inflation, interest rates, and macro growth and stability. In addition, it appears that currencies are viewed as being more or less useful in retiring debt or acquiring foreign goods, services, and assets. This is shown as "liquidity" and will comprise a fourth base factor.

These additions are shown in Figure 2, with $(P_{us}-P_{fx})^e$ representing expected prices or inflation (U.S. minus foreign), $(y_{us}-y_{fx})^e$ expected macroeconomic growth and

Figure 2. Mental Model: Processes and Base Factors



stability (U.S. minus foreign), $(r_{us}-r_{fx})^e$ expected relative interest rates (U.S. minus foreign), and "$ liquidity" expected dollar liquidity relative to alternatives. In terms of the links between the base factors and processes, anecdotal evidence combined with knowledge derived from empirical studies suggests the patterns shown (Akiba 2004; Harvey 2004; 2002; 1998-99; 1993b; Harvey and Quinn 1997; Moosa 2007-8; 2004; 2002). They are also consistent with economic explanations of the interrelationships. Starting with the expectation of relative prices (or relative rates of inflation), a rise would impact negatively on agents' forecast of net U.S. exports as imports would become cheaper and exports more expensive. A rise in expected relative prices is also a negative force with respect to net DFI^e_{us}, as resource-seeking direct foreign investment is discouraged by increasing input costs. Changes in the prices of goods and services have no direct impact on portfolio investment and so no link between them is shown.[2]

Expectations of rising (relative) macro growth and stability would cause agents to forecast a fall in net exports (as rising incomes cause an increase in U.S. imports), a rise in net DFI^e_{us} (as market-seeking direct foreign investment increases), and a rise in net PFI^e_{us}. The last will result because a) asset issuers will be seen as more likely to earn profits in an environment of macro growth and stability; b) at least part of the rising domestic incomes may be diverted into the asset market, driving up prices; and c) government-issued securities increase in value because as the tax base grows this diminishes the likelihood of default.

The base factor that attracts agents' attention most consistently is relative interest rates. While these have no direct connection to net exports or direct foreign investment, a rise in $(r_{us}-r_{fx})^e$ (ceteris paribus) makes interest-bearing assets and

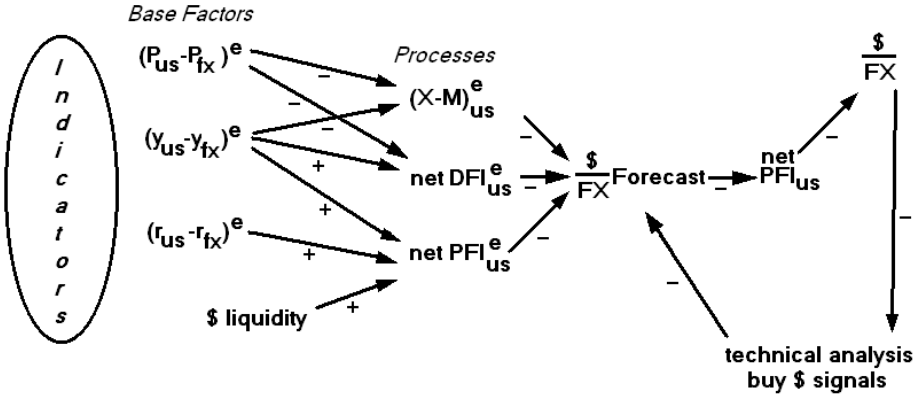
deposits more attractive to investors and leads to portfolio capital inflows (net PFI^{e}_{us}). Several of the sustained post-Bretton Woods foreign exchange swings have had at their core an existing or expected interest-rate differential in favor of the appreciating currency.

Last, the relative ease with which agents believe that currency can be used to retire debt or purchase goods, services, and other assets (i.e., its liquidity) leads to a favorable adjustment in portfolio composition (if, for example, the dollar is viewed as more liquid then this would be reflected by a rise in PFI^{e}_{us}). This effect is most obvious when there is a safe-haven rush to the dollar in international markets or when nations prefer one currency to another as reserve.

Listing these four base factors and tying them into the three processes offers a basic overview of the mental model, but the fads and fashions mentioned earlier are too important to omit. As their very nature precludes specifying a list of the relevant variables, they are captured by the set of determinants labeled as "Indicators" on Figure 3. These are any of the evolving set of determinants thought to reflect, affect, or predict the base factors and sometimes the processes themselves. These can include central bankers' speeches, political news, unique economic events, and so on — anything that agents believe (however fleetingly) has an impact on the base factors or processes.

Figure 3 also includes the effect of technical analysis. It is now well accepted that trading rules are widely used, despite objections from Neoclassical economics that it represents irrational behavior (Taylor and Allen 1992). Thus, a key part of agents' mental model is their belief that using past time series to forecast future trends is an indispensable part of their arsenal, particularly over the short run. Since the majority of rules are some variety of moving average, as the dollar appreciates (shown by a fall in \$/FX) this will tend to generate a "buy dollar" signal (rise in "technical analysis buy \$ signals"). Agents acting on this information will adjust their portfolios accordingly (a rise in PFI^{e}_{us}), leading to an actual appreciation in the dollar. Note that "technical analysis buy \$ signals" forms part of a positive feedback loop.

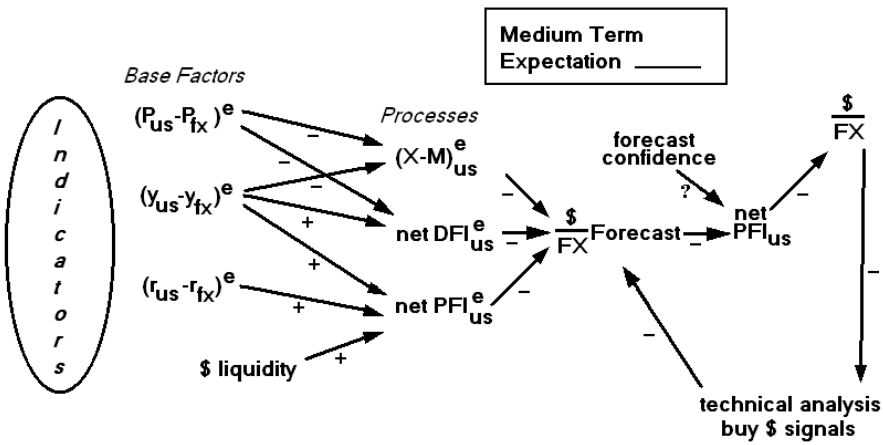
Figure 3. Mental Model: Processes, Base Factors, Indicators, and Technical Analysis



Another component to be added to the mental model is a function of the fact that agents operate with at least two time horizons in mind, both the short term represented by the $/FX Forecast and the medium-term expectations shown in Figure 4 (see especially Schulmeister 1987; 1988; see also Gehrig and Menkhoff 2005; Cheung, Chinn and Marsh 2004; Cheung and Chinn 2000; and Menkhoff 2001). Though the latter may take a particular value, it is best understood as being one of three states: bullish, bearish, or neutral with respect to a currency. In this way, it acts as a lens through which agents view and interpret information fed into the mental model. If the medium-term expectational bias were bullish on the dollar, for example, the effect is to magnify pro dollar inputs that appear on the mental model and to downplay or even ignore anti dollar news and events. Analogously, if the medium-term bias were bearish on the dollar, the impacts of pro dollar factors on the mental model are diminished and anti ones are reinforced. Neutral means no particular bias is held.

The medium-term expectational bias shown in Figure 4 is an integral part of the mental model, but no physical connections with the rest of the diagram are shown since the specific manner in which it affects the variables would be difficult to model. It should be easy enough to bear in mind, however, that if "down-arrow $/FX" (a pro-dollar bias) is entered into the blank after "Medium-Term Expectation" that the impact of indicators, base factors, and processes that would lead to a rise in the dollar should be magnified while the effect of others should be diminished. In terms of its determinants, they are a moving average of what determines the $/FX Forecast (Harvey 1993b). One could add some sort of link from $/FX Forecast to Medium-Term Expectations to make this more explicit, but I opted not to further complicate

Figure 4. Mental Model: Processes, Base Factors, Indicators, Technical Analysis, Medium-Term Expectations, and Forecast Confidence



the diagram. Note that though these are called "Medium-Term" Expectations, the implication here is not that they have a greater impact over longer time horizons. Everything that happens does so in the short run. Rather, the primary role of Medium-Term Expectations is to modify how agents interpret information in the present.

The last factor to consider is confidence (already included in Figure 4). This vital component is often overlooked in discussions of expectations. Clearly, even if the consensus forecast is that the euro will, for example, appreciate, whether it does so and by how much is strongly affected by agents' collective confidence in that forecast. A total lack of confidence, for example, would mean that the expectation of appreciation would have no effect on spot prices whatsoever. On the other hand, complete confidence would mean that any gap between the current rate of exchange and the aggregate expectation would be rapidly and totally closed. With respect to the level that generally prevails in asset markets, a curious juxtaposition of forces exists. On the one hand, Keynes tells us that confidence is typically quite low as agents' are faced with the fundamentally uncertain nature of the economy (Keynes 1964, 154). On the other, market participants are, due to animal spirits, prone to action rather than inaction and they are desirous of quick results (Keynes 1964, 157 and 161). Hence, periods of intense and eager trading may drive a currency price in one direction only to be suddenly stopped and reversed because forecasts held with low confidence are ". . . liable to change violently as the result of a sudden fluctuation of opinion" (Keynes 1964, 154). This cannot be shown directly on the model but placing a reference to it (i.e., "forecast confidence") reminds us to take its impact into account.

The Mental Model: In Operation

This completes the mental model. Though one more factor will be added momentarily, strictly speaking it is not part of agents' conceptualization of the world with which they interact. The latter is shown in its entirety in Figure 4. The mental model demonstrates that currency market participants spend intense hours every day in search of information that may allow them to generate the $/FX Forecast. They understand perfectly well what is shown in Figure 4, that is, that the aggregate market forecast drives financial capital flows and thereby sets the actual exchange rate. This means that they are terribly concerned with discovering what their colleagues think will happen (regardless of whether or not it is true) and so a vital part of the forecasting process is an attempt to gauge market attitudes. How they do so and what information they seek (as defined by the mental model) are important questions to be answered.

According to Oberlechner and Hocking, foreign currency dealers' top source of information in this endeavor are the wire services (followed by personal contacts and analysts; Oberlechner and Hocking 2004; 412). Their research further indicates that the financial journalists authoring those reports rely primarily on dealers in gathering their data, thus creating a feedback loop in the creation of the information that moves

currency prices (412). The consequence has been that "financial markets may be less about the actuality of economic facts than about how information is perceived and interpreted by market participants" (422). This does not mean that the market is simply reacting to sun spots. Indeed, it is generally the case that there is some economic event underlying the trends that emerge — but, not always, and nor is the response necessarily the same every time or well measured. The fact that agents prefer information that "[i]s available to me before it is to others" and "[w]ill influence market participants" over that which "[i]s reported by a reliable source" or "[s]eems accurate to me" creates a situation in which rumors take on an air of truth as they cycle through the loop (415 and 421). Such rumors must have some connection to the mental model and there may be some correction after false information is exposed, but a) given the complexity of the international financial market, there is no guarantee that the latter will occur and b) if currency prices are moved by rumor, then other economic variables have already been forced to adjust. We cannot go back in time and have the Walrasian auctioneer recontract everything.

In terms of where in the mental model diagram new data enter, it varies. Whenever possible, agents would love to be able to discover inputs as close to $/FX Forecast as possible so that less interpretation is necessary. In addition, agents prefer finding data that they assume will impact more directly on portfolio capital flows since these are the dominant force in currency markets. Ceteris paribus, extra weight can be expected to be placed on such data. As suggested above, in practice it is interest rate information that moves the market most consistently.

In thinking about how agents use the mental model, it is important to ask how they understand the operation of the market in general. Do they view it as mechanistic, random, and manipulable? Oberlechner, Slunecko and Kronberger asked this very question and sought to answer it by undertaking a series of interviews with foreign exchange market participants. They then analyzed the interviews to determine what metaphor or metaphors agents used to understand currency price movements. They argue first that foreign exchange is a "human construction which emerges from the shared understandings of market participants" (Oberlechner, Slunecko and Kronberger 2004, 152). Also consistent with the analysis here, they believe that the predominant metaphor may shift over time (153-4). They further distinguished between metaphors agents volunteered when queried (explicit metaphors) and those determined by studying the interviews (implicit metaphors). When asked directly, agents' most common responses were that they viewed the market as a bazaar or sports; implicitly, however, it was evident that interviewees saw foreign exchange as a living being or an ocean (151). It is important to note here that ". . . explicit metaphors may, at least partly, be indicative of how market participants think they should talk about the market," while the implicit may represent, "the participants' understanding in practice." Thus, while the bazaar or sports may be what they say, in fact, it appears that agents view the currency market as (taking the living being metaphor) "an animated organism following its own rhythm," something that reacts "emotionally" and "is not always intelligible," dependent more on "mood" than "fixed rules" (143-4). In addition, it is (taking the ocean metaphor)

marked by "flows, levels, currents, streams, and channels," "less predictable and less deterministic than as a machine," and capable, in the normal course of events, of "quiet and of dramatic times" (145-6). In thinking in terms of both implicit metaphors, it seems that market participants believe that the force of the individual is puny. It also appeared to be the sense of the interviewees that while we can struggle to understand the ways of the market — indeed, those interviewed must do so if they are to perform their job — a firm grasp of the workings of a phenomenon so vast, moody, and complex will surely elude us. We must muddle through as best we can.

As suggested above, one last process will be added to the mental model even though it is not, strictly speaking, part of agents' conceptualization. However, its role is so central to the determination of exchange rates that, if the rest of this paper is to be an analysis of actual currency movements, it must be considered. This is the bandwagon effect, or the tendency of market participants to copy one another's behavior. The most visible manifestation of this phenomenon is when agents buy an appreciating currency simply because it is appreciating (or sell one simply because it is depreciating). I have argued elsewhere that this phenomenon is a result of a variety of psychological factors (Harvey 1998; 2006; 2009). Others, too, have found considerable support for the existence of herd behavior (see for example Beine, Benassy-Quere and Colas 2003; Oberlechner and Hocking 2004; Oberlechner and Osler 2008). In the context of the mental model diagram, bandwagon effects make themselves felt through purchases of financial assets. As a currency appreciates, agents are induced to "jump on the bandwagon" by altering their portfolios to include more of those denominated in that currency. This, of course, contributes to the currency appreciation and attracts even more bandwagon jumpers (as is shown in the positive-feedback loop: *bandwagon purchases of US assets-net* PFI_{us}*-$/FX*). This process can pull the current spot price of the currency well out of line with what the mental model would otherwise have justified (particularly if it works in tandem with medium-term expectations). As this process continues, so agents' confidence may decrease, further diminishing the direct impact of the mental model. During such episodes, one may find financial reporters quoting dealers as being confused by the market and unable to understand how the price is continuing in the given direction (yet dealers continue to contribute to the bandwagon for fear of missing the boat). It is furthermore not uncommon for market participants to openly suspect the operation of bandwagon effects.[3] If the bandwagon creates a separation between the actual spot price and the one justified by the mental model continues, then it requires an increasingly mundane event to start a sudden and potentially catastrophic run in the opposite direction.

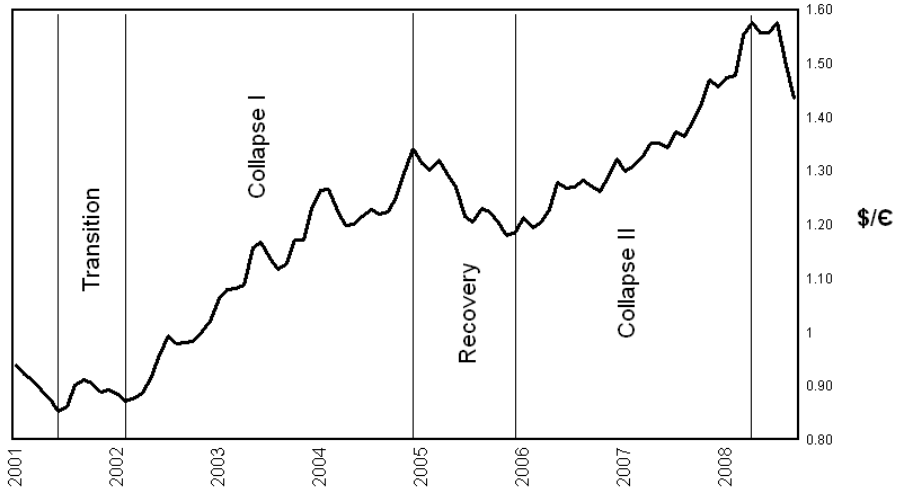
This completes the theory portion of the paper. To summarize, the primary driver in the foreign exchange market is the demand for currency arising from the desire to purchase foreign financial assets. In determining which assets they want in their portfolio, agents continually forecast future currency price movements, which really means trying to decide what their colleagues are thinking. Assets denominated in currencies expected to appreciate are preferred to those denominated in currencies expected to depreciate.

Behind that all-important forecast is the mental model, or agents' conceptualization of the operation of the foreign currency market. While it exists only in their minds, it is nevertheless a social phenomenon as it is created and evolves when market participants interact professionally and socially with their colleagues, publish and read scholarly and professional opinions, train new dealers and are trained, et cetera. Because they understand currency markets as a living organism and an ocean, they expect that even carefully constructed forecasts will be frequently disappointed as emotions and moods impact prices. Their generally low level of confidence creates the volatility about which Keynes warned (Keynes 1964, 154).

Collapse of the Dollar: 2001-2008

The following examination (drawn from the very detailed accounts in the Federal Reserve Bank of New York's "Treasury and Federal Reserve Foreign Exchange Operations") of the dollar-euro market since 2001 will, consistent with the theory outlined above, find evidence of bandwagon effects, pre-existing biases emerging from medium-term expectations, an almost exclusive focus on variables associated with portfolio investment (particularly interest rates), rapid and sometimes very large reevaluations of future price movements, and (as a consequence of the last) large swings in the actual rates at which foreign exchange trades. For purposes of analysis the period of dollar depreciation can be divided into four segments: Transition (July 2001 through March 2002 — this is broken into two parts in terms of the mental model schematic), Collapse I (April 2002 through December 2004), Recovery (January 2005 through December 2005), and Collapse II (January 2006 through March 2008). The discussion will be organized accordingly. The whole period is shown in Figure 5.

Figure 5. Stages of Dollar Collapse (Data from www.economagic.com)

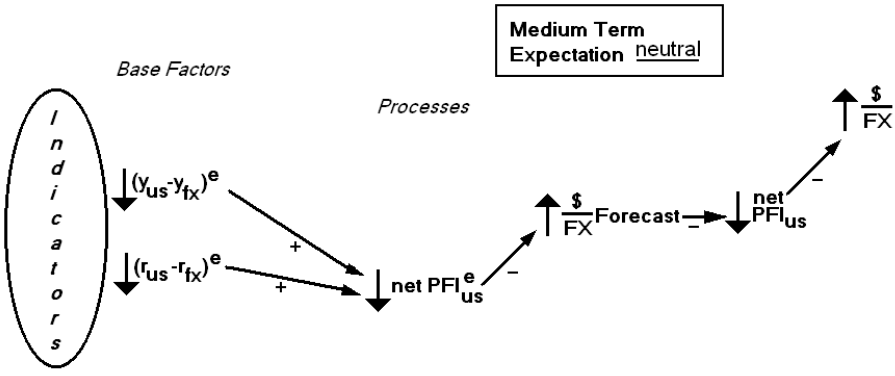


Transition: July 2001 through March 2002

The euro was introduced on January 1, 1999 at a price of $1.1812. It very quickly proceeded to lose value to the dollar and continued to do so until mid 2001.[4] Although this was due primarily to interest rate differentials, the dollar's LIBOR advantage had actually peaked in December 1999 and turned negative during the second quarter of 2001. On top of this, U.S. economic indicator releases tended to be negative throughout the first half of the year. Still, the dollar continued to climb, apparently on the strength of its momentum (i.e., bandwagons and medium-term expectations) and agents' feeling that growth in Europe would be even weaker — how much of the latter was a function of the medium-term bias is difficult to say. Factors were accumulating, however, that were leading agents (through their mental model) to reevaluate the dollar's strength.

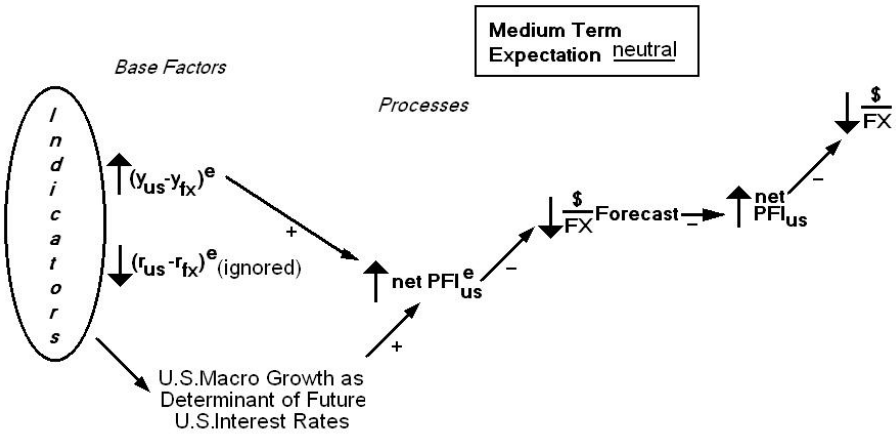
Indeed, by July, poor macro data and falling dollar interest rates (shown in Figure 6 by the downward arrows on $(y_{us}-y_{fx})^e$ and $(r_{us}-r_{fx})^e$) had become central in agents' mental model. Because each of these would cause market participants to move away from dollar assets, agents believed that there would be a net outflow of financial capital from the United States (down-arrow net PFI^e_{us}) and, as a consequence, a dollar depreciation (up-arrow $/FX Forecast). For that reason, they sold dollar assets, which caused the forecast capital outflows (down-arrow net PFI_{us}) and the dollar depreciation (up-arrow $/FX). There was no strong medium-term expectation in favor of or against the dollar at this point (given that it was a period of transition) and bandwagon forces did not appear to play a significant role.[5] All of this is illustrated in Figure 6, where factors that did not play a significant role are omitted so that the main currents are more visible (this convention is followed throughout the analysis).

Figure 6. Mental Model: First Half of Transition (July-September 2001)



But, agents had yet to establish a firm opinion of the dollar and there was, in fact, a quick recovery as agents came to believe that, even if there were a slowdown, it would be less severe in the United States (up-arrow $(y_{us}-y_{fx})^e$ in Figure 7). Furthermore, their belief was so strong that a continually shrinking $-euro interest rate spread was completely ignored because they expected that the U.S. advantage in growth was seen as an indicator of a future reversal of that trend. This is shown in Figure 7.

Figure 7. Mental Model: Second Half of Transition (October 2001-March 2002)



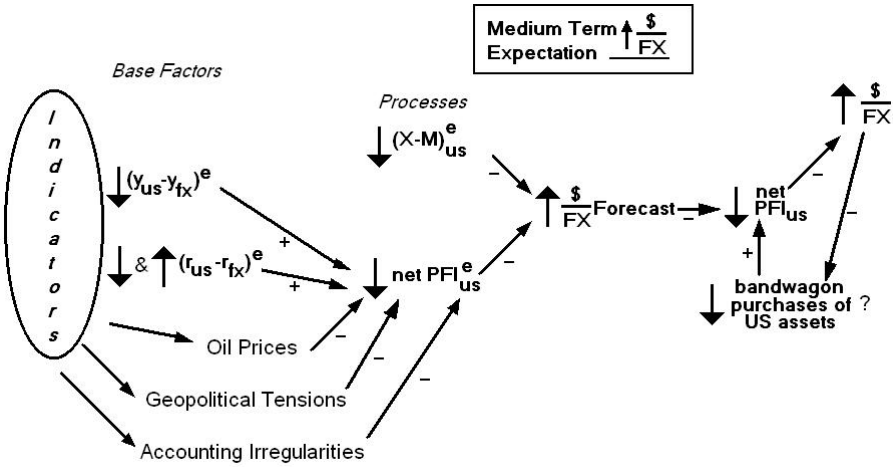
Collapse I (April 2002 through December 2004)

This turned out to be short-lived, however, as medium-term expectations soon turned anti-dollar. As a consequence, when, in the second quarter of 2002, the U.S. equity market declined, interest rates fell, growth rates were downwardly revised, and as the equity market suffered, the dollar went into a steep slide. Of the twenty-two trading days in April, the dollar fell on fifteen of them as the euro went from $0.8806 to $0.9002. The bad news continued through the end of the year as dollar interest rates hit historic lows, geopolitical tensions in Iraq and Korea and rising oil prices were thought to hurt the United States more than others, economic indicators continued to paint a bleak picture, and the news of accounting irregularities in U.S. industries came to light. By December 31, the euro had come to rest at $1.0485 — a fall of 16% just since April 1.

With the euro rising from $1.0361 on January 1 to $1.2597 on December 31 (almost 18%), 2003 was much of the same. The issues were similar: Iraq, oil prices, low interest rates, and slow growth. In addition, the market became concerned with

the U.S. trade deficit (all indicated in Figure 8). It was slightly more mixed, but 2004 still saw the dollar fall by roughly 7% (actually, the first half of the year witnessed a slight dollar recovery as agents began to believe that the U.S. interest rates might recover — hence the combination of up and down arrows on $(r_{us}-r_{fx})^e$ in Figure 8; in the end, the net impact was an expectation of a fall in the dollar interest rate differential). By the end of the year, negative medium-term expectations for the dollar led good news to be ignored (such as rising interest rates and improving economic indicators) and bad news to move the dollar disproportionately. It may also be that bandwagon effects were playing a role in holding the dollar down as well, though it is not entirely clear (hence the question mark after "bandwagon purchases of U.S. assets").

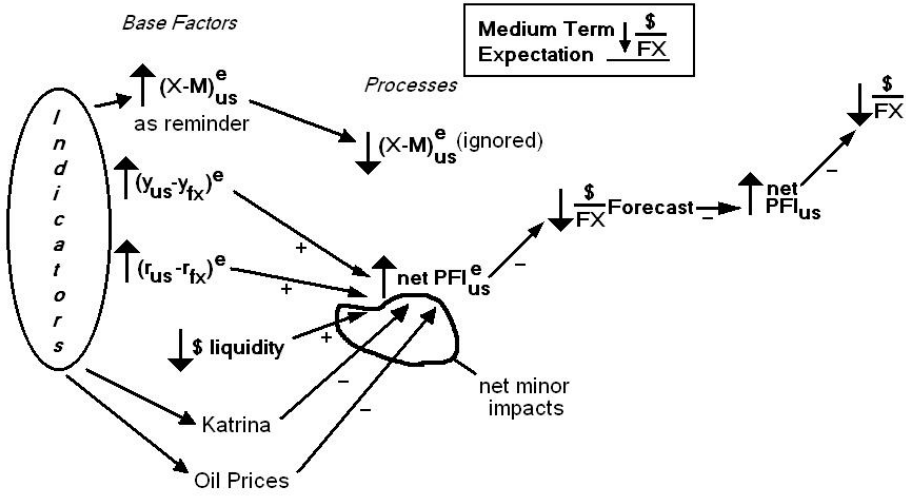
Figure 8. Mental Model: Collapse I (April 2002-December 2004)



Recovery (January 2005 through December 2005)

Apparently, the good news regarding the dollar was not being totally ignored, however, as a shift in medium-term expectations did eventually take place and the dollar recovered. Most of the increase over the year took place in the first half when, despite attention being refocused on the large U.S. trade deficit (note that it is marked "ignored" in Figure 9), the pro-dollar bias meant that positive developments regarding U.S. economic growth and interest rates dominated. For the remainder of the year, the dollar rose slightly despite market participants' fears that countries may move away from the dollar as reserve currency and concerns regarding oil prices and hurricane Katrina (note these labeled as "net minor impacts" in Figure 9). Bandwagon effects, too, may have supported the dollar.

Figure 9. Mental Model: Recovery (January 2005-December 2005)

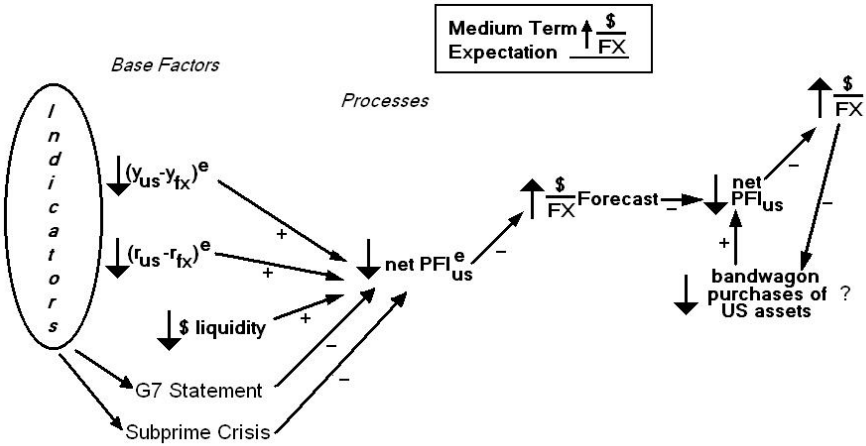


Collapse II (January 2006 through March 2008)

Negative dollar news finally tipped the scales as medium-term expectations swung the other way and agents began to expect a close in the dollar's interest-rate advantage. Their predictions soon came true, adding to a relatively moderate decline in the first quarter of 2006. In April, new fuel was added to the fire when G7 statements calling exchange-rate flexibility in emerging markets a good thing was taken as tacit approval of a dollar fall (something officials were quick to deny, but to no effect). The remainder of 2006 was generally bad for the dollar as the interest-rate spread continued to close and there was some speculation that central banks were shifting reserves away from the dollar.

It started slightly better, but soon 2007 slipped into the same pattern as the interest-rate differential closed throughout the year, the subprime concerns hit the headlines, credit markets tightened, and U.S. consumer confidence fell (see Figure 10). This continued through the first quarter of 2008 when there was a very steep decline as negative data accumulated, including financial sector losses. As agents' confidence in their ability to forecast the volatile market decreased, they retreated from speculative positions and the dollar finally stabilized — at almost half of its value from eight years earlier. The collapse had finally come to an end.

Figure 10. Mental Model: Collapse II (January 2006-March 2008)



Lessons

A number of important lessons emerge from this short history of the dollar as seen through the mental model. First, it must be recognized that, even though we have perhaps been jaded by witnessing daily financial-market volatility, the currency price swings during this period were extremely large and clearly excessive. Consider the fact that during the oil crises of the 1970s and 1980s, U.S. annual inflation never reached 14%, even though it was considered dangerously high at the time. By contrast, Table 1 shows that once the transition period was over, the dollar-euro shifts were never less than that (albeit over longer periods during the two collapses) and for most of six years were, in fact, much higher. These magnitudes would never have been tolerated had this been consumer price inflation, and yet for certain sectors in the effected economies the impact was the same. Even worse, there was no fundamental reason (like an OPEC oil embargo) for this to have happened. It was absolutely avoidable and suggests that allowing international financial investors free reign in determining currency values (via the mental model) is not costless and certainly cannot be defended on efficiency grounds.

Second, this pattern of momentous swings in one direction offset by equally momentous ones in the other is systemic and a function of the fact that currency prices are "mis-determined" because of their short-term orientation (Harvey 2009, 124). The ultimate goal of economic activity is output and employment. If exchange rates are to play a positive role in this process then they should reflect the relative attractiveness of goods and services and real investment across nations. Since this can be expected to change only gradually, we should witness slow adjustments in exchange

Table 1. Summary Dollar Movements from July 2001

Period	$-euro movement
Transition (July 2001-March 2002)	3% dollar depreciation
Collapse I (April 2002-December 2004)	35% dollar depreciation
Recovery (January 2005-December 2005)	14% dollar appreciation
Collapse II (January 2006-March 2008)	24% dollar depreciation

rates. By contrast, what we have seen is a 35% decline in the dollar followed by a 14% rise and then another 24% fall. There is simply no reasonable justification for this. It occurred because exchange rates follow the very short and volatile time horizon of financial markets rather than that for goods and services.

Third, as suggested by dealers' implicit metaphor, the currency market is more akin to an organism than a mechanism. The causal processes are identifiable but constantly changing. This is in no small part because of the market participants' lack of confidence in their forecasts, which is what ultimately drives the market. With their expectations they are trying to hit a moving, evolving, uncertain target, their information source turns out ultimately to be themselves and their colleagues, and social pressures exist to buy and sell (via bandwagons) currencies even when their tentative expectations suggest that they should do otherwise. Little wonder we see so much variation in Figures 6 through 10, variation that forces us to use a tool of analysis like the mental model to understand the workings of the foreign exchange market.

Last, even though the specifics of the mental model may vary over time (sometimes rapidly), there are some basic facts that remain the same. First, economic variables and world events will almost invariably be interpreted in terms of how they may affect financial markets, most often via interest rates. In addition, agents will form biases for and against currencies and this will strongly impact the interpretation of inputs (to the point that some otherwise important pieces of information may be totally ignored). Bandwagons will occur and these may exacerbate the typical low confidence levels in the market by drawing prices away from what agents might otherwise have seen as reasonable (while agents, nevertheless, continue to contribute to the bandwagon, fearful of missing the boat). Biases and bandwagons will cause currency runs to continue for months after cooler heads would have suggested otherwise. And there will be swings well out of proportion to any fundamental factors as agents act both in ignorance but with animal spirits and a desire for quick money. These are not the only reasons for the volatility we witness, but they contribute (for more see Harvey 2009, 51-52).

Conclusions

The mental model offers a specific explanation of processes and consequences that will not surprise the readers of this journal. It is yet another nail in what should be the coffin of the fetish of liquidity. Free flow of financial capital across national borders is what allows the sort of numbers shown in Table 1 and because there is no justification for it, step one in any reformation of the international monetary system must be a serious attempt to limit international capital flows. Time will tell whether or not the current (as of November 2008) global financial crisis will spur world leaders, including the newly elected President of the United States, to finally take such measures.

Notes

1. This model is based on one originally developed in chapter five of Harvey 2009.
2. That said, it has been very common, particularly since the early 1980s, for agents to interpret rising inflation as an indicator of future central-bank initiated increases in the rate of interest. In that event, however, this would impact the forecast via "indicators" (to be introduced shortly) and subsequently through relative interest rates.
3. What makes all this especially interesting is that these individuals **are** the market, yet they are expressing confusion over how the market is operating. Note how well this fits Oberlechner, Slunecko and Kronberger's (2004) argument regarding dealers' reliance on the living being and ocean metaphors.
4. The euro's low was reached in October of 2000 when it hit $0.827; but, after recovering somewhat through the end of that year it started on another downward vector in 2001 and fell to $0.837 in early July.
5. Technical analysis will not be seen to have been important throughout the period covered but was included in the theory section of this paper for completeness. Forecast confidence plays a role, but because it is rather indirect it is not shown.

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