What Determines the Exchange Rate: Economic Factors or Market Sentiment?

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Readers of the financial press are familiar with the gyrations of the currency market. No matter which way currencies zig or zag, it seems there is always an analyst with a quotable, ready explanation. Either interest rates are rising faster than expected in some country, or the trade balance is up or down, or central banks are tightening or loosening their monetary policies. Whatever the explanations, the underlying belief is that exchange rates are affected by fundamental economic forces, such as money supplies, interest rates, real output levels, or the trade balance, which, if well forecasted, give the forecaster an advantage in predicting the exchange rate.

What is not so well known outside academia is that exchange rates don't seem to be affected by economic fundamentals in the short run. Being able to predict money supplies, central bank policies, or other supposed influences doesn't help forecast the exchange rate. Economists have found instead that the best forecast of the exchange rate, at least in the short run, is whatever it happens to be today.

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In this article, we'll review exchange-rate economics, focusing on what is predictable and what isn't. We'll see that exchange rates seem to be influenced by market sentiment rather than by economic fundamentals, and we'll examine the practical implications of this fact. Sometimes, there are situations in which market participants may be able to forecast the direction but not the timing of the movement. We'll also see that volatility of exchange rates and correlations between exchange rates are predictable, and we'll examine the implications for currency option pricing, risk management, and portfolio selection.

THE EXCHANGE RATE AND ECONOMIC FUNDAMENTALS

The earliest model of the exchange rate, the monetary model, assumes that the current exchange rate is determined by current fundamental economic variables: money supplies and output levels of the countries. When the fundamentals are combined with market expectations of future exchange rates, the model yields the value of the current exchange rate. The monetary model might also be dubbed the "newspaper model." When analyzing movements in the exchange rate, journalists often use the results of the monetary model. Similarly, when Wall Street analysts are asked to justify their exchange-rate predictions, they will typically resort to some variant of the monetary model. This model is popular because it provides intuitive relationships between the economic fundamentals and it's based on standard macroeconomic reasoning.

The reasoning behind the monetary model is simple: the exchange rate is determined by the relative price levels of the two countries. If goods and services cost twice as much, on average, in U.S. dollars as they do in a foreign currency, $2 will fetch one unit of the foreign currency. That way, the same goods and services will cost the same whether they are bought in the U.S. or in the foreign country.[1]

But what determines the relative price levels of the two countries? The monetary model focuses on the demand and supply of money. If the money supply in the United States rises, but nothing else changes, the average level of prices in the United States will tend to rise. Since the price level in the foreign country remains fixed, more dollars will be needed to get one unit of foreign currency. Hence, the dollar price of the foreign currency will rise: the dollar will depreciate--it's worth less in terms of the foreign currency.

Money supplies are not the only economic fundamentals in the monetary model. The level of real output in each country matters as well because it affects the price level. For example, if the level of output in the United States rises, but other fundamental factors, such as the U.S. money supply, remain constant, the average level of prices in the United States will tend to fall, producing an appreciation in the dollar.[2] Future economic fundamentals also matter because they determine the market's expectations about the future exchange rate. Not surprisingly, market expectations of the future exchange rate matter for the current exchange rate. If the market expects the dollar price of the yen to become higher in the future than it is today, the dollar price of the yen will tend to be high today. But if the market expects the dollar price of the yen to be lower in the future than it is today, the dollar price of the yen will tend to be low today.

Here's an example of how to use the monetary model: suppose we wanted to predict the

[1]When purchasing power parity holds, particular goods and services cost the same amount in the domestic country as they do in the foreign country. There is an extensive literature that documents that purchasing power parity doesn't hold except perhaps in the very long run.

[2]In the monetary model, the price level must fall in this situation to ensure that money demanded by consumers is the same as money supplied by the central bank.

dollar-yen exchange rate. The first thing we need to do is think about the relationships between the fundamentals and the exchange rate. The monetary model implies that if the U.S. money supply is growing faster than the Japanese money supply, the dollar price of the yen will rise: the dollar will depreciate and the yen will appreciate. So, the analyst needs to assess monetary policy in the two countries. The monetary model also implies that if output is growing faster in the United States than it is in Japan, the dollar price of the yen will tend to fall: the dollar will appreciate and the yen will depreciate. Finally, the analyst must assess expectations about the future exchange rate. If the market's expectation of the future exchange rate were to change, the current exchange rate would move in the same direction. When making an exchange-rate forecast based on the monetary model, the analyst must consider the effect of all the fundamentals simultaneously. He can do this by using a statistical model or by combining judgment with the use of a statistical model.

In practice, using the monetary model to make exchange-rate forecasts is difficult because the analyst never knows the true value of the economic fundamentals. At any time, money supply and output levels are not known with certainty; they must be forecast based on the available economic data. Of course, expectations about the future of the exchange rate are even harder to assess because these expectations are unobservable. The analyst can always survey market participants about their expectations, but he can never be sure if the surveys accurately reflect the market's views. If we assume the monetary model is valid, the goal of the successful exchange-rate forecaster is to predict the values of the fundamentals better than the competition and then use the monetary model or some variant to derive forecasts of the exchange rate.

The fatal flaw in this strategy is the assumption that the monetary model can be used to successfully forecast the exchange rate once the values of the fundamentals are known. Although the monetary model had some early success, economists have established that the model fails empirically except perhaps in unusual periods such as hyperinflations.[3] For one thing, research did not establish a strong statistical relationship between exchange rates and the values of the fundamentals. Moreover, a key assumption of the model was found to be false: the model assumes that the price level can move freely. Yet the price level seems to be "sticky," meaning that it moves very slowly compared with the movement of the exchange rate.

What about other models? After the failure of the monetary model became apparent, economists went to work developing other ideas. Rudiger Dornbusch developed a variant of the monetary model called *the overshooting model,* in which the average level of prices is assumed to be fixed in the short run to reflect the real-world finding that many prices don't change frequently. The effect of this assumption is to cause the exchange rate to overshoot its long-run value as a result of a change in the fundamentals; eventually, however, the exchange rate returns to its long-run value. Ultimately, this model was shown to fail empirically: economists couldn't find the strong statistical relationships between the fundamentals and the exchange rate that should exist if the model were true.[4]

Another extension of the simple monetary model is called *the portfolio balance model.* In this approach, the supply of and demand for foreign and domestic bonds, along with the

[3]See the papers by Frenkel (1976, 1980), Bilson (1978), and Hodrick (1978) for empirical analysis of the monetary model.

[4]For an empirical treatment of the overshooting model, see the paper by Backus (1984).

supply of and demand for foreign and domestic money, determine the exchange rate. Early tests of the model were not very encouraging.[5] Later, economists formulated a more sophisticated version of the portfolio balance model, in which investors were assumed to choose a portfolio of domestic and foreign bonds in an optimal way. According to the more sophisticated portfolio balance theory, the degree to which investors are willing to substitute domestic for foreign bonds depends on how much investors dislike risk, how volatile the returns on the bonds are, and the extent to which the returns on the different bonds in the portfolio move together. Unfortunately, economists did not find much empirical support for the more sophisticated version of the portfolio balance model.[6]

Economic News. Thus, the three major models of the exchange rate—the monetary, the overshooting, and the portfolio balance models—do not provide a satisfactory account of the exchange rate. Nonetheless, it is possible that *news about the fundamentals* affects the exchange rate even if the fundamentals themselves don't influence the exchange rate in the manner suggested by the three major exchange rate models.

The news about the fundamentals can be defined as the difference between what market participants expect the fundamentals to be and what the fundamentals actually are once their values are announced. For example, market participants form expectations about the value of the money supply before the government announces the money supply figures, and these expectations are translated into decisions to buy or sell currency. These decisions ultimately help to determine the current level of the exchange rate. Once the government announces the value of the money supply, market participants buy or sell currencies as long as the news is different from what they expected. Thus, news about fundamentals, under this view, is an important determinant of the exchange rate.

The difficulty in testing this view is that economists don't know how to measure the news because they don't know how to measure the market's expectations. One solution is to assume that market participants form their expectations using a statistical device called linear regression. Using linear regression, an econometrician could estimate the expected level of a fundamental, such as the U.S. money supply, for each quarter during the past 20 years. He could then subtract the value of the estimated expected money supply from its actual value in each quarter to generate an estimate of the news about the quarterly U.S. money supply. The news for other fundamentals can be estimated in a similar way.

Once the econometrician has estimated each fundamental's news for each quarter during the last 20 years, he can check to see if it explains the level of the exchange rate. Studies by economists who have carried out this procedure generally indicate that news about the fundamentals explains the exchange rate better than the three major exchange-rate models.[7] However, two factors make this result hard to interpret. First, we have no direct evidence suggesting that market participants form their expectations using linear regression models or that they form their expectations as if they were using these models. Second, these

[5]See, for example, the paper by Branson, Halttunen, and Masson (1977).

[6]See the papers by Frankel (1982) and Lewis (1988) for empirical analysis of the more sophisticated portfolio balance model. The fundamental problem with the model is that investors must have an implausibly high aversion to risk to explain the exchange rate.

[7]For empirical analysis of news models, see the papers by Branson (1983), Edwards (1982, 1983), and MacDonald (1983).

studies use the final values of the fundamentals, values released by governments months, if not years, after the forecasts were made. Yet, forecasters must use the government's preliminary estimates of the fundamentals when they make their predictions. In other words, the econometrician is assuming that market participants are making forecasts using information they don't have. Hence, the result that news about the fundamentals seems to explain the level of the exchange rate better than the models is hard to interpret.

One way to avoid the problem of using final values of fundamentals is to collect the initial estimates from newspapers, government announcements, and wire services and examine their ability to affect the level of the exchange rate. Studies that have done this have found that *announcements about fundamentals* affect the exchange rate only in the very short run: the effects of announcements generally disappear after a day or two.

When we look at the evidence from the three major exchange-rate models, from the news analysis, and from the effects of announcements, it is hard not to be pessimistic about the fundamentals' ability to explain the exchange rate. But the evidence we have examined so far is backward-looking: the fundamentals don't seem to explain exchange-rate behavior over the past couple of decades. However, we can also do a forward-looking analysis: do the fundamentals help us forecast the level of the exchange rate?

The surprising answer to this question, given by economists Richard Meese and Kenneth Rogoff in the early 1980s, is no. Meese and Rogoff examined the ability of the fundamentals to predict the level of the exchange rate for horizons up to one year. They considered fundamentals-based economic models as well as statistical models of the relationship between the fundamentals and the exchange rate that did not incorporate economic assumptions. They found that a *naive strategy* of using today's exchange rate as a forecast works at least as well as any of the economic or statistical models. Worse, they found that when they endowed the economic or statistical models with final values of the fundamentals—giving the models an advantage that forecasters could not possibly match—the naive strategy still won the forecasting contest. Despite many attempts since the publication of Meese and Rogoff's results, economists have not convincingly overturned their findings.

Thus, if we look backward or forward over periods of up to a year, the fundamentals don't seem to explain the exchange rate, contrary to what standard models in international finance textbooks imply. But this result might be dismissed by claiming that only the models tested have failed to explain the exchange rate. Perhaps economists will discover a model that works in the future.

Although a fundamentals-based model that works is a possibility, evidence from other countries suggests otherwise. In the European Exchange Rate Mechanism (ERM), exchange rates between major European currencies are kept relatively stable by the countries' central banks. If fundamentals are closely associated with the currencies, they should be stabilized as well. However, when we examine European fundamentals, we find that they fluctuate about as much as do the fundamentals of nonstabilized currencies, such as the U.S. dollar. Hence, the evidence from the European experience does not suggest a close connection between the fundamentals and the exchange rate, leading one to suspect that no fundamentals-based model will predict the short-run exchange rate.[8]

It's possible that the fundamentals really do explain the exchange rate, but we can't see the relationship because we can't observe the true fundamentals. Perhaps if economists discov-

[8]See Rose (1994) for a detailed discussion of this point.

ered different economic models that use fundamentals other than money supplies and real output levels, the exchange rate could still be explained in terms of basic economic quantities. For example, some economic models imply that the true fundamentals are business technologies and tastes and preferences of consumers. However, the evidence from European countries renders this potential solution implausible. According to such a model, stabilization of European currencies in the ERM corresponds to stabilization of the true fundamentals. But why should business technologies and tastes and preferences of consumers change less in Europe than they do in the United States? At present, economists have found no evidence to suggest they do and, indeed, have little reason to suppose that they will ever find such evidence.

THE ALTERNATIVE VIEW: MARKET SENTIMENT MATTERS

The alternative view is that exchange rates are determined, at least in the short run (i.e., periods less than two years), by *market sentiment*. Under this view, the level of the exchange rate is the result of a self-fulfilling prophecy: participants in the foreign exchange market expect a currency to be at a certain level in the future; when they act on their expectations and buy or sell the currency, it ends up at the predicted level, confirming their expectations.

Even if exchange rates are determined by market sentiment in the short run, the fundamentals are still important, but not in the commonly supposed way. From reading the newspapers, we know that market participants take the fundamentals very seriously when forming exchange-rate expectations. Thus, if we wish to understand the level of the exchange rate, we need to know the values of the fundamentals and, more important, how market participants interpret those levels. However, the evidence we reviewed shows no pattern or necessary connection between the fundamentals and the level of the exchange rate. When market participants use the fundamentals to form expectations about the exchange rate, they don't use them in any consistent way that could be picked up by an economic or statistical model. As we have seen, we can do as well forecasting the exchange rate by quoting today's rate.

Although the naive forecast is at least as accurate as statistical or model-based forecasts, it's still not very good. It's just that statistical or model-based forecasts are so bad that even the naive forecast can do at least as well. How can we improve our forecast? Unfortunately, economists are just starting to build models of market sentiment, so we can't get much guidance from economic theory just yet. Nonetheless, we know that exchange rates are likely determined by market sentiment, so it seems reasonable to try to understand the psychology of the foreign exchange market to improve forecasts of the short-run exchange rate.

To understand the psychology of the foreign exchange market, we need to know about the various economic theories. Even if they aren't very accurate, their implications may still influence expectations in the market, although we would not expect any particular model to have any consistent influence. We also need to find out what the market is thinking. Probably the best way to do so is to be an active participant in the foreign exchange market and to talk to other participants to learn which events they think are important for a particular currency's outlook. These events might be announcements of fundamentals, political events, or some other factors. The analyst could then concentrate on forecasting those events. Of course, there will probably be no pattern to which events are important. For example, the U.S. budget deficit may well be important for the dollar one year and unimportant the next.

Speculative Attacks. In some cases, the forecaster might be able to make a reasonable guess about the direction of the exchange rate's

movement, even if he can't be precise about the timing. As an example, let's review what happened to the exchange rate between the Swedish krona and the German deutsche mark in the early 1990s.

Sweden applied to enter the ERM in May 1991 in a bid to stabilize its currency. To stabilize the krona-deutsche mark exchange rate, interest rates in Sweden and Germany had to be the same. Therefore, the Swedish and German central banks couldn't independently use monetary policy—that is, change short-term interest rates—if they wanted to keep the exchange rate stable.[9] If Sweden wanted to act independently, it had to use fiscal policy (tax and government spending policies) to stimulate the country's growth rate.

However, a weak Swedish economy provoked speculators, who mounted an attack on the krona in September 1992. Speculators knew that the weak economy would tempt Sweden to abandon its fixed exchange rate and use monetary policy to cut short-term interest rates, especially since the new Swedish government was adopting restrictive fiscal policy. Speculators believed that if the Swedish central bank cut the short-term interest rate, the krona wouldn't be as attractive to investors. Thus, the speculators thought that after interest rates were cut, the currency would depreciate with respect to other ERM currencies. But since speculators expected the depreciation to happen, they decided to sell the currency immediately, i.e., mount a speculative attack on the currency.

This attack put the Swedish central bank in an uncomfortable position. To combat the currency's depreciation, the central bank raised short-term interest rates temporarily to repel the speculative attack—exactly the policy it didn't want in the face of sluggish economic growth. In fact, the Swedish central bank raised the short-term interest rate to an astonishing 500 percent and held it there for four days.[10]

The speculators were deterred, but not for long. The speculators understood that the Swedish central bank had to raise short-term interest rates temporarily to support the currency. But they were betting that the central bank wouldn't fight off the attack for long, especially in the face of disquiet in the country resulting from weak economic growth and the higher interest rates needed to fight the speculative attack. The high short-term interest rates had made the economic situation in Sweden even more precarious, so, in November, the speculators attacked again, selling the krona in favor of other ERM currencies. This time the Swedish central bank did not aggressively raise interest rates and the krona depreciated.

Profit opportunities such as this one can sometimes be exploited by speculators who recognize that a country's exchange-rate policy is inconsistent with the monetary policy needed, given a country's domestic situation. By paying careful attention to a country's economic and political developments, a speculator can sometimes forecast the direction of a

[9]If a central bank can't change the short-term interest rate independently, it can't use monetary policy independently to stimulate the economy. Hence, countries with stabilized exchange rates must give up the independent use of monetary policy.

[10]If speculators expect the value of the currency to fall, and they are right, speculators can profit by selling the currency short. As an example, suppose a speculator anticipates that the value of the Swedish krona with respect to the deutsche mark will fall in one week. The speculator could borrow krona and sell them for deutsche marks at the current exchange rate. If the speculator is correct and the krona does depreciate, at the end of the week the speculator can buy back the krona for fewer deutsche marks than he sold them for. Provided the krona fell enough over the week, the speculator can repay the loan with interest and make a profit in deutsche marks. However, if the central bank makes short-term interest rates high enough, it can make this transaction unprofitable. Thus, one defense against a speculative attack is to dramatically raise short-term interest rates.

currency's move when it breaks out of a stabilized exchange rate system. But the timing is not easily forecast; it is probably determined by market sentiment.[11]

WHAT ABOUT TECHNICAL RULES?

Many market participants don't rely on the fundamentals. Instead, they use technical rules, which are procedures for identifying patterns in exchange rates. A simple technical rule involves looking at interest rates in two countries. Suppose the first country is the United States and the second is Canada. If the one-month U.S. interest rate is higher than the one-month rate in Canada, the U.S. dollar will tend to appreciate with respect to the Canadian dollar. But if the one-month Canadian interest rate is higher, the U.S. dollar will tend to depreciate with respect to the Canadian dollar. Economists and foreign exchange participants have often noted this fact.[12]

Indeed, it is possible to make money, on average, by using this rule. The problem is that implementing this rule carries risk. There is an ongoing debate about how big this risk is, and whether the average profits are explained by the level of risk. After all, it would not be surprising that the market pays a premium to those willing to assume substantial risk. Furthermore, the profits may have occurred only by chance and may not recur. Sometimes, economists report other technical rules that seem to make money in the foreign exchange market.[13] However, the considerations noted in the interest-rate differential rule apply to any technical rule. Even if the rule makes profits on average, the profits might be explained by the level of risk assumed in applying the rule. Moreover, the profits may well disappear when we account for technical statistical problems. Since economists are undecided at present about whether technical rules really do make money, it seems prudent to be cautious when evaluating the merits of any such rule.

WHAT ABOUT LONG-RUN FORECASTING?

Even though economic models or the fundamentals don't help us understand the exchange rate in the short run (except to the extent that they influence market psychology), there is evidence that models do better in the long run. For example, economists Martin Eichenbaum and Charles Evans report that currencies react as theory would suggest to unanticipated movements in the money supply, but only in the long run, after a period of about two years. Standard monetary theories would imply that an unanticipated decline in the U.S. money supply would lead to an appreciation of the dollar with respect to other currencies. Eichenbaum and Evans found that the dollar does, in fact, appreciate in response to an unanticipated monetary contraction; however, the full effects on the dollar are not registered until two years after the contraction, suggesting that models may well work in explaining the exchange rate in the long run.[14]

IS ANY ASPECT OF THE EXCHANGE RATE PREDICTABLE IN THE SHORT RUN?

Although the level of the exchange rate in the short run is not very predictable, volatilities and correlations of currencies are much

[11]For further discussion of the myriad problems that can arise when countries attempt to fix their exchange rates, see the article by Obstfeld and Rogoff (1995).

[12]See my 1994 *Business Review* article for a nontechnical discussion.

[13]For an example, see Sweeney (1986).

[14]For further evidence on the effects of unanticipated monetary contractions on the exchange rate, see Schlagenhauf and Wrase (1995).

more predictable. The daily volatility of a currency measures the extent to which the currency's value in terms of another currency fluctuates each day. The value of high-volatility currencies fluctuates more each day than that of low-volatility currencies. Correlations measure the extent to which currencies move together. In general, volatilities and correlations vary with time, rising or falling each day in a somewhat predictable way.

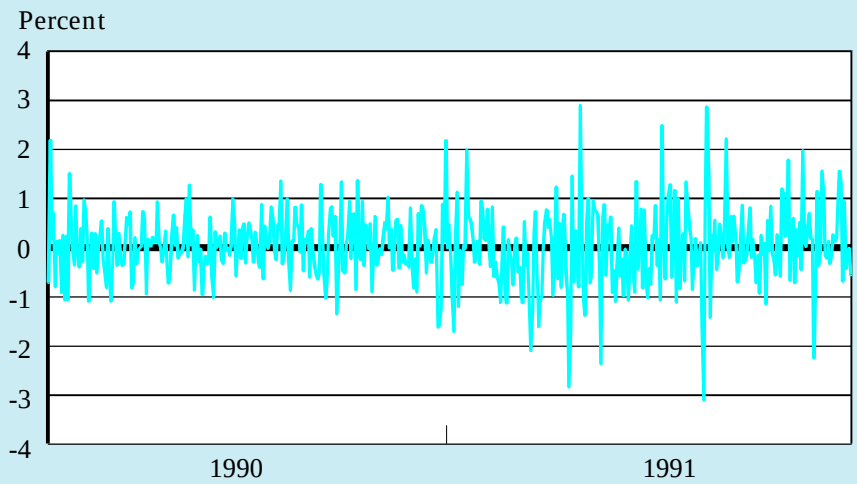
The time-varying nature of the daily volatility of the dollar in terms of the deutsche mark can be seen in the figure. Notice that, in 1991, days on which the volatility of the dollar is high tend to cluster together, and in 1990, days with lower volatility follow one another. Since daily volatility clusters together, it is predictable. If we want to predict tomorrow's volatility, we need only look at the recent past. If daily volatility has been high over the recent past, we can be reasonably sure that it will be high tomorrow.

This idea forms the basis for statistical models of a currency's volatility. The GARCH model, developed by economist Tim Bollerslev, who built on work by economist Robert Engle, uses the volatility-clustering phenomenon to predict future volatility. In essence, a GARCH model measures the strength of the relationship between recent volatility and current volatility. Once this strength is known, it can be used to forecast volatility. GARCH models have good empirical support for exchange rates and are being used in practical applications in the foreign exchange market.[15]

GARCH models can be extended to handle two or more currencies, and they can measure the strength of recent correlations in predict-

[15]GARCH stands for Generalized Autoregressive Conditional Heteroskedasticity. For the technical details of how GARCH models work, see Bollerslev (1986). Examples of technical applications of GARCH models of exchange rates include Bollerslev (1990) and Kroner and Sultan (1993). Heynen and Kat (1994) use GARCH to forecast volatility.

Daily Percent Dollar Return on Deutsche Mark



ing current ones. Once this strength is understood, it can be used to forecast correlations.

USES OF VOLATILITY AND CORRELATION FORECASTS

Volatility and correlation forecasts have important uses in finance. First, currency derivatives, securities whose value depends on the value of currencies, require measures of volatility and sometimes correlations to price them. GARCH models can supply estimates of these volatilities and correlations. Second, volatilities of individual currencies coupled with correlations between currencies can be combined to determine the volatility of a portfolio of currencies. Since the volatility of a portfolio measures the extent to which the portfolio's value fluctuates, the volatility can be used to assess a portfolio's risk. Portfolios with higher volatilities are riskier because they have a tendency to lose more per day—or gain more per day—than do portfolios with lower volatilities (see *Using GARCH to Measure Portfolio Risk*). Finally, knowledge of volatilities and correlations can help an investor choose the proportions of each currency to hold in a portfolio. For example, knowing a portfolio's volatilities and correlations may show an investor how to rearrange

Using GARCH to Measure Portfolio Risk

Here, we illustrate the use of a GARCH model to manage risk in a simple portfolio of two currencies, the yen and the deutsche mark. Using daily data on the yen and the deutsche mark from January 2, 1981, to June 30, 1996, the time-varying volatilities and correlations were estimated using Engle and Lee's (1993a,b) GARCH model. Suppose we have a portfolio with $1 million invested in yen and $1 million invested in deutsche marks. Then we can calculate the value at risk (VaR) of the portfolio. The VaR is the maximum loss the portfolio will experience a certain fraction of the time during a specific period. For example, we can see from the table that daily VaR at the 95 percent confidence level is $12,000. That means that 95 percent of the time, the largest daily loss on the portfolio will be $12,000. But 5 percent of the time, the loss will be bigger, sometimes by a substantial amount. The daily loss measures the difference between the value of the portfolio at the end of one trading day and its value at the end of the next trading day.

As another example, consider weekly VaR at the 98 percent confidence interval. The numbers indicate that 98 percent of the time, the loss over five trading days will not exceed $35,000. But 2 percent of the time, the losses will be bigger. See Hopper (1996) for more discussion.

Value at Risk of a Currency Portfolio with $1 Million Invested in Both Yen and Deutsche marks

	One-Day Horizon	Five-Day Horizon
95 percent	$12,000	$27,000
98 percent	$15,000	$35,000
99 percent	$18,000	$41,000

These numbers for the value at risk apply to the risk in the portfolio on July 1, 1996, the day after the end of the data period. However, the reason for using a GARCH model is that volatility varies over time. The value at risk would be higher in times of greater volatility and lower when the market is less volatile.

the proportions of currencies in a portfolio so that he has the same return, on average, but a lower risk of loss.

CONCLUSION

The evidence discussed in this article suggests that economic models and indeed fundamental economic quantities are not very useful in explaining the history of the exchange rate or in forecasting its value over the next year or so. This fact has important implications for market participants. It is all too common to encounter private-sector foreign exchange economists who tell very cogent stories designed to buttress their short-term forecasts for the values of currencies. These stories are often based on plausible economic assumptions or models. These economists hope that market participants will act on their forecasts and trade currencies. However, if these forecasts are justified by a belief that economic models or fundamentals influence the exchange rate in the short run, it's likely they are not very good. Indeed, we have seen that these forecasts will probably be outperformed by the naive forecast: tomorrow's exchange rate will be what it is today.

On the other hand, to the extent that these forecasts reflect market sentiment or a self-fulfilling prophecy, they may be useful. Unfortunately, it is difficult to judge when this is the case. The difficulty is accentuated by the unobservability of market expectations. A forecaster might be using a model he believes in, and his forecast might turn out to be correct if the market also temporarily believes the implications of the model. But it is hard, if not impossible, to know what the market expects; hence, it is hard to judge the merits of a forecast.

Fortunately, the situation is better regarding volatilities and correlations, which follow predictable patterns. The GARCH model and its more sophisticated variants can be used to price derivatives, assess currency portfolio risk, and set allocations of currencies in portfolios. Economists are continually discovering new empirical facts about volatility and correlations. No doubt the GARCH model will eventually be supplanted by an alternative, but for now, economists will use the GARCH model, or some variation of it, to forecast volatilities and correlations of currencies.

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