
Fundamental and Technical Analysis in Currency Forecasting

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All global bond managers want to make accurate currency forecasts, but unfortunately, it is not an easy task. Although fundamental economic and policy considerations determine exchange rates, technical analysis is valuable as a disciplining mechanism for fundamental judgments.

Getting the currency forecast right is a critical objective of all global investment managers. Roughly 30 percent of the variability of a foreign equity portfolio, in U.S. dollar terms, is accounted for by exchange rate fluctuations, and roughly 60 percent of the variability of a foreign bond portfolio is accounted for by changes in exchange rates. Getting the exchange rate right may be important, but unfortunately, it is not an easy task. First, forecasts tend to go awry if analysts' interpretations of the fundamentals that are driving an exchange rate are flawed. If expectations for monetary policy, fiscal policy, and other factors are misguided, then forecasters will get the direction of the exchange rate wrong. Second, even if interpretations of the fundamentals are correct, forecasts can still go awry because short-run speculative forces may be so powerful that they drive an exchange rate far away from its fundamental, equilibrium path. In other words, an exchange rate can simply overshoot its equilibrium level.

This presentation presents an overview of analytical techniques (fundamental versus technical) in currency forecasting. It focuses on the fundamental considerations that determine exchange rates and on the value of technical analysis as a means of disciplining one's fundamental view.

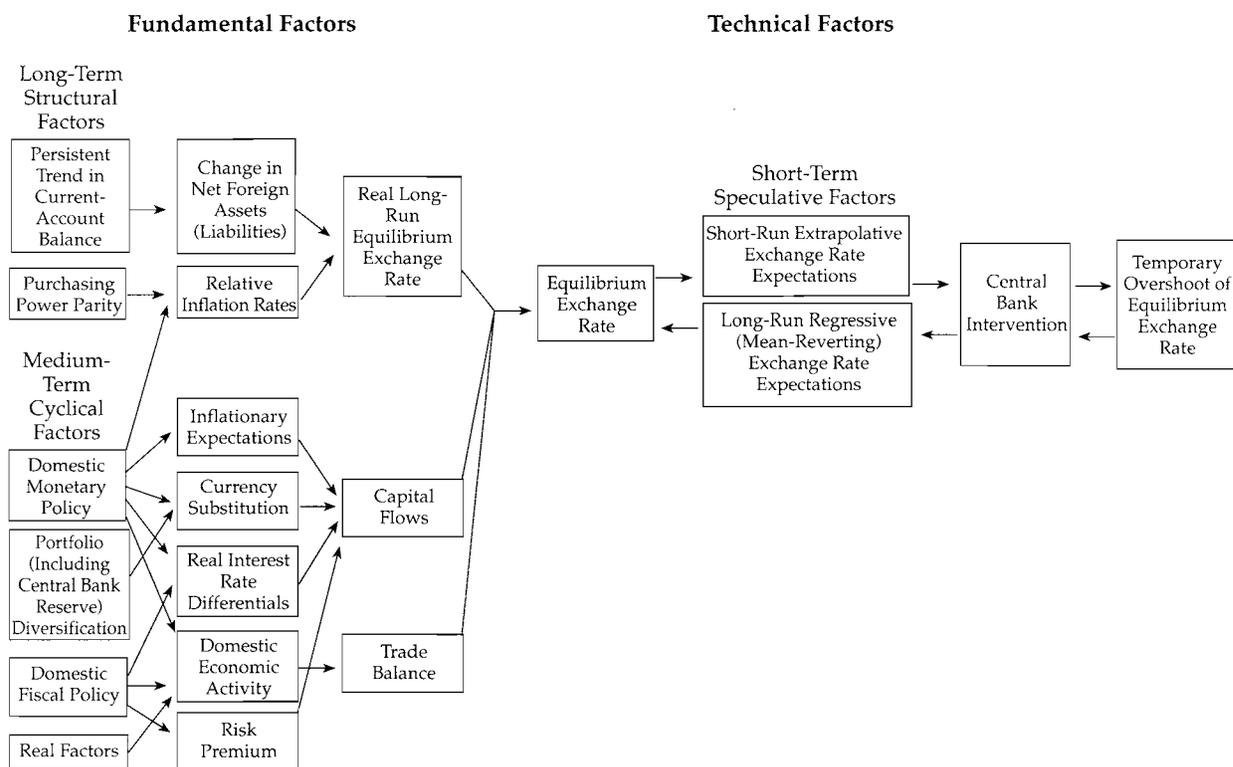
ANALYTICAL TECHNIQUES

Fundamental and technical forces affect exchange rates through a wide range of channels. As shown in **Figure 1**, long-term structural, medium-term cyclical, and short-run speculative factors are all operating simultaneously on exchange rates. This elaborate diagram shows why forecasting exchange rates is

difficult. A currency manager who has a particular model of exchange rates—be it purchasing power parity (PPP), a monetary policy approach, or a current-account balance approach—and who focuses on that one model to the exclusion of others can miss some important forces that are driving exchange rates. But trying to balance all factors simultaneously becomes very complicated.

Figure 1 can be simplified into **Figure 2** to show exchange rates as being determined by three different forces operating simultaneously. One force is the long-term path that a currency takes over time. That long-run equilibrium path is determined by either external balance considerations, such as PPP and long-term trends in current-account balances, or by internal balance considerations, such as ever-rising unemployment rates or extreme fragility in a financial system. Around that long-term path are medium-term cyclical fluctuations, which are determined by short-run changes in monetary policy, fiscal policy, or interest rate differentials. These medium-term fluctuations may cause the exchange rate to deviate from its long-term path or to move in the direction of that long-term path. The resulting deviations can be large and can persist for significant periods of time. These two fundamental forces—the fundamentally driven long-term equilibrium path and the medium-term cyclical path—produce the fundamental equilibrium path that a currency takes. Unfortunately, actual situations do not work out as simply as **Figure 2** shows. Sometimes an exchange rate wanders away from even its fundamentally driven long-term equilibrium path either because of “bandwagon,” or herd behavior, effects in exchange markets or because the exchange rate seems to display a tendency to overshoot its

Figure 1. Forces Affecting Exchange Rates

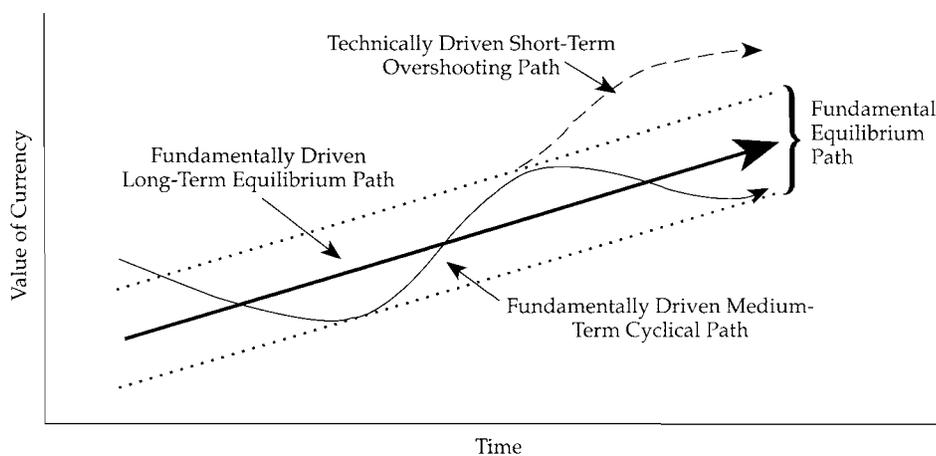


equilibrium path. These deviations represent a challenge to the currency manager.

In the face of these deviations from equilibrium, technical analysis may provide some help because trend-following trading models that are based on technical analysis are designed to keep an investor trading with, and not against, the market trend. The only time a currency manager, or a bond portfolio manager dealing with the interest rate risk of a portfolio, should aggressively overweight or underweight a currency is when one's technical assessment

confirms one's fundamental assessment—either both bullish or both bearish. When the technicals fail to confirm the fundamentals—that is, when one is bullish (bearish) on the fundamentals but bearish (bullish) on the technicals—the best strategy is to be neutral. When an exchange rate is following its fundamental equilibrium path, then fundamental and technical analysis should produce the same strategies. But if an exchange rate wanders away from its fundamental path, currency managers who use only fundamental analysis often find themselves

Figure 2. Short-, Medium-, and Long-Term Trends in a Currency's Value



leaning against the wind; technical analysis serves as a way to discipline one's fundamental view—a way to prevent a manager from leaning too heavily against the wind.

In this presentation, I will discuss various long-term and short-term models of exchange rate determination. In addition, I will discuss the role of technical analysis in currency management.

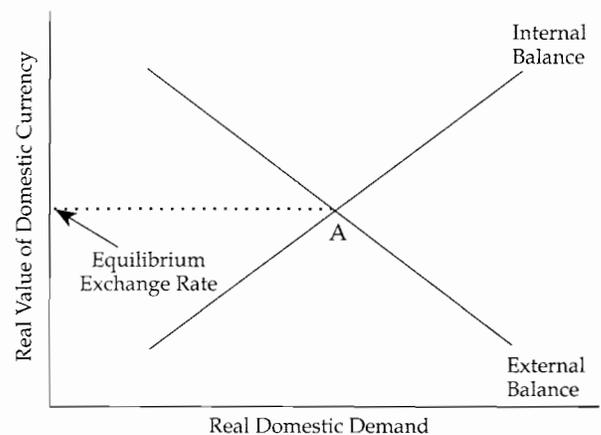
EXTERNAL AND INTERNAL BALANCE

An equilibrium exchange rate is the exchange rate that results in the simultaneous attainment of internal and external balance. **Figure 3** is a simple textbook diagram illustrating this definition. Only one exchange rate simultaneously satisfies the requirements for internal and external balance. External balance means that the current account is broadly in balance (i.e., that a currency is broadly in line with its PPP level). Internal balance means that a country is close to full employment and that it has a relatively stable financial system.

External Balance

Historically, although internal and external balance are key determinants of exchange rates, internal balance in the United States, Germany, and Japan has not been a serious problem in the past 20–25 years. If these countries' economies deviated from full employment, the deviations were small, and all three had stable financial systems. So, for the past 20–25 years, external balance considerations drove exchange rates for the most part in those three countries. Therefore, as Japan ran ever-larger current-account surpluses, the Japanese yen experienced a long-term appreciation over time. As the United

Figure 3. Equilibrium Real Exchange Rate



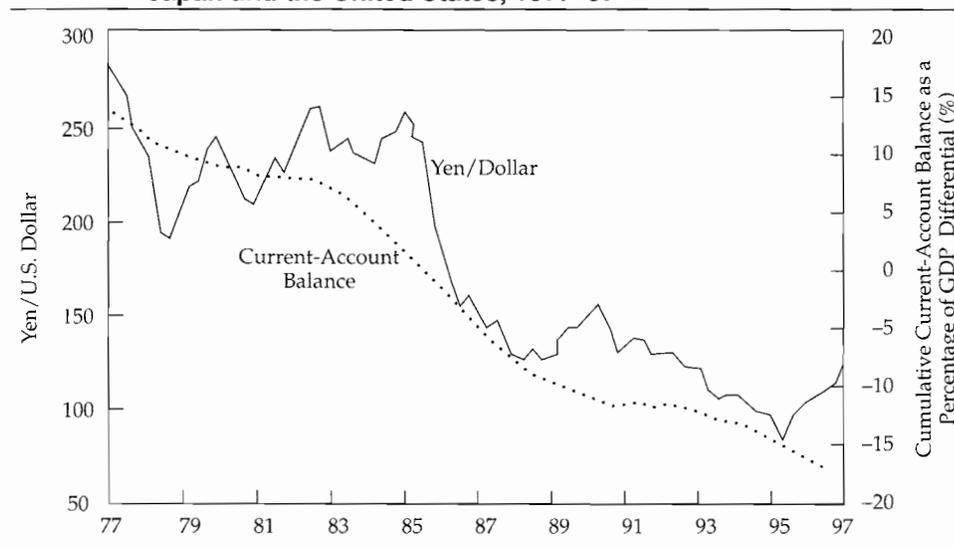
Source: Clark et al. 1994. "Exchange Rates and Economic Fundamentals." IMF Occasional Paper No. 115 (December).

States ran ever-larger deficits on current accounts, the dollar weakened. **Figure 4** shows that for the 1977–97 period, the long-term trend in current-account balances did a good job of explaining the long-term path that the yen took against the dollar.

Internal Balance

Although external balance is still important, internal balance problems, particularly in Europe and Japan, are now having a major impact on exchange rate trends, which was not the case in the previous 25 years. In particular, these internal balance problems are leading to a reversal in the long-term appreciation paths of currencies such as the German mark, the Swiss franc, and the Japanese yen.

Figure 4. Exchange Rates and Cumulative Current-Account Deficits: Japan and the United States, 1977–97



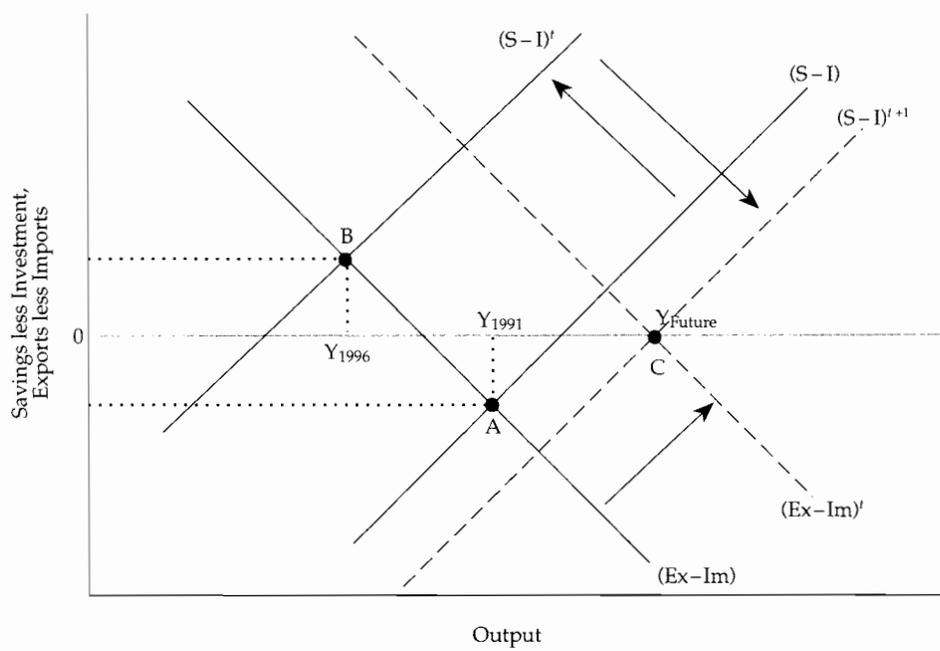
■ *Europe.* Europe has witnessed a secular rise in its unemployment rate over time, from an average of 2 percent in the 1960s to 8 percent in 1990 to 11 percent in the mid-1990s. Germany's unemployment rate is 11.6 percent; France has a 12.5 percent unemployment rate. In the early 1990s, when unemployment was only 8 percent, Europe ran a current-account deficit of nearly US\$80 billion; Europe now runs a current-account surplus of nearly the same magnitude. Thus, Europe is an excellent example of whether internal or external balance considerations are more important in the determination of exchange rates. If external balance considerations were currently the sole determinant of exchange rates, European currencies would be strengthening against the dollar because of Europe's rising current-account surplus. But Europe has record-high unemployment, which has helped push the dollar higher against the European currencies in the past two years. Therefore, internal balance considerations are now dominating the trend in the dollar versus the European currencies.

Figure 5 shows how the weak European economies have contributed to the improving trend in Europe's current-account balance. Figure 5 shows that the equilibrium level of output is determined at the point where the gap between savings and investment ($S - I$) equals the trade imbalance ($Ex - Im$); Point C is full employment. In 1991, Europe was operating at Point A, well below the full employment level of output. In other words, when Europe had 8

percent unemployment, full employment might have been closer to 5 percent. In the early 1990s, Europe pursued overly tight fiscal and monetary policies. For instance, the Bundesbank's tight monetary policies in the early 1990s following German unification drove short-term rates to 10 percent, which eventually led to the breakup of the Exchange Rate Mechanism in 1992. In more recent years, the pursuit of austere fiscal policies required to meet the Maastricht Treaty criteria have led to a leftward shift of the savings-investment balance in Europe. European output, therefore, has moved from Point A to Point B in the past five years. As Figure 5 illustrates, Europe is now running a current-account surplus at Point B, but this improvement stems from weakness and not from strength. Consequently, the market should not reward Europe just because it is running a current-account surplus. Instead, the market should penalize Europe for having such weak economies.

The World Economic Forum annually surveys countries in terms of global competitiveness. The 1996 rankings place the United States fourth, after Singapore, Hong Kong, and New Zealand. The internal balance problems—overvalued exchange rates, high labor costs, and high unemployment rates—have combined to place European countries at very low positions in the rankings: France 23rd, Germany 25th, and Italy 39th. Thus, Europe's overvalued exchange rates need to be corrected to bring about a decline in unemployment rates and at the same time help restore competitiveness.

Figure 5. Equilibrium Level of Output, Europe



■ *Germany.* Germany's problems directly mirror the problems with other European economies in general. The German mark has been on a weakening trend for more than two years, and that trend will likely continue because Germany's internal balance problems have become so pervasive. The Bundesbank pursued an extremely tight monetary policy in the early 1990s, which led to a weaker German economy. The unemployment rate in Germany went from about 7 percent to 11.6 percent, a new postwar high. That tight monetary policy has led to an overvaluation of the mark, which has led to a decline in Germany's share of world exports—from more than 12 percent in 1987 to less than 10 percent for both 1996 and 1997. Although export market share has dropped, import market share has dropped even more because of the weak German economy.

The continued overvaluation of the mark is having a cumulative effect on the German economy. The overvaluation has hollowed out the manufacturing sector of the German economy because German companies are shifting production to cheaper centers in Eastern Europe, which only adds to the unemployment problem. The trends in unemployment in Germany versus the United States during the past few years are telling. In the early 1990s, the two unemployment rates were virtually the same, but the legacy of the Bundesbank's tight policies, and the resulting overvaluation of the mark, has pushed German unemployment higher as U.S. unemployment has moved lower.

In summary, the German economy has become highly dependent on a weak German mark to promote growth. The legacy of high unemployment has had an impact on domestic demand, which has not grown since 1991. The only strength for Germany is coming from a pickup in foreign orders (stemming from the weak mark), which have trended upward since 1993. Therefore, Germany needs a weak currency for internal, not external, balance considerations.

■ *United Kingdom.* The United Kingdom is an example of how a country can correct its internal balance problems and, by doing so, promote a stronger currency. The United Kingdom pegged its currency to the German mark in the early 1990s, so when the Bundesbank tightened, it forced the rest of Europe, including the United Kingdom, to also tighten. As a result of that tightening, the unemployment rates in Germany and the United Kingdom moved higher. In fact, the United Kingdom's moved even higher than Germany's.

Speculative attacks on the pound pushed that currency out of the Exchange Rate Mechanism in 1992, which allowed the United Kingdom to pursue

an independent monetary policy for the first time. Because of this flexibility, the United Kingdom was able to bring about a decline in the value of the pound, which allowed it to reduce its unemployment rate to 5.5 percent by mid-1997 while Germany's unemployment rate moved up to 11.6 percent. The U.K. case illustrates that a country can reduce its unemployment rate if it pursues an expansionary monetary policy, if it allows its currency to weaken over time, and if it removes the structural rigidities in its labor markets. The United Kingdom has taken these measures and Germany has not. As a result, the pound has moved up steadily against the German mark throughout 1996 and early 1997.

■ *Switzerland.* Switzerland illustrates the importance that internal balance factors can have over external balance factors when internal problems become pervasive. Switzerland has had the most overvalued exchange rate in Europe for probably the past decade. Consequently, the Swiss economy has slowed appreciably, and real GDP growth actually has been zero or negative in four of the past six years. Switzerland's unemployment rate has risen from less than 1 percent in 1990 to more than 5 percent in early 1997. In fact, for the first time ever, the U.S. unemployment rate is lower than the Swiss unemployment rate. But the Swiss current-account surplus is huge, averaging 6–8 percent of GDP since 1992.

If Switzerland has an unemployment problem and a growth problem, monetary policy needs to be eased aggressively. The Swiss authorities have driven their discount rate toward 1 percent to try to stimulate the economy and, hopefully, to weaken the Swiss franc. They are not trying to weaken the franc so that they can run a surplus of 10 percent of GDP but, rather, because the overvalued franc is crippling the Swiss economy.

■ *Japan.* The yen is a final classic example of how internal balance factors can dominate external balance considerations. The yen has been overvalued for at least the past decade, which has had a cumulative negative effect on the Japanese economy and the Japanese financial system. The unemployment rate and corporate bankruptcies in Japan have moved to record highs. The economic problems have filtered into the banking system, which has become extremely fragile. The Bank of Japan has had to drive short-term rates practically to zero to try to support the banks, but even with record low short-term rates, banks' stock prices have tumbled since 1990. Concerns about the Japanese banking system remain. Japanese interest rates are still low, and Japan has some huge unfunded pension liability problems ahead. Japan's budget deficit last year, excluding social security, stood at the highest in the G-7

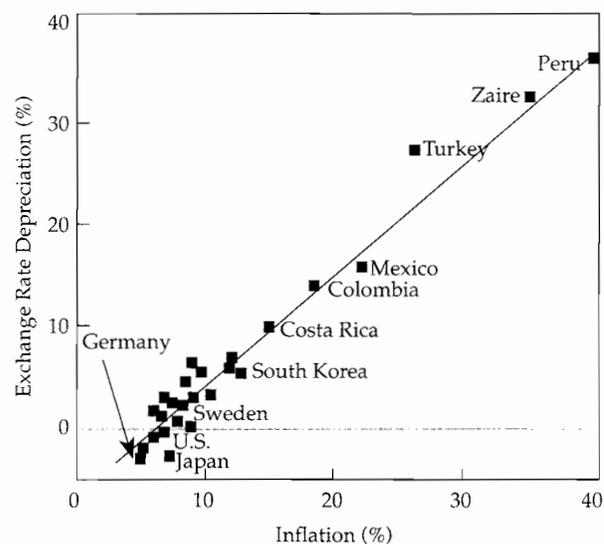
group—7.3 percent of GDP. Japan’s deficit, if not controlled, will explode to 20 percent of GDP next century, and its debt-to-GDP ratio will rise to 400 percent, three times the size of Italy’s today. Therefore, Japan clearly has major internal problems that will require severe fiscal tightening in the years to come. A tight fiscal and easy monetary policy should promote a weaker yen over time.

Purchasing Power Parity

Purchasing power parity, which has been shown to exert a negative impact on the German mark, the Swiss franc, and the Japanese yen, states that changes in exchange rates over time should reflect differences in national inflation rates. Therefore, countries that have low inflation rates should see their currencies appreciate over time, and countries with high inflation rates should see their currencies weaken over time. The problem with PPP is that it is a long-run proposition, and the deviations from PPP can be large. Unfortunately, PPP has been so widely criticized as a useful theory that many people reject it completely. But **Figure 6** shows that the long-run trends in exchange rates are in fact driven by PPP considerations; in other words, the connection between PPP and exchange rates is a valid long-run proposition. Countries with relatively high inflation rates see their currencies weaken and vice versa.

The problem with PPP lies in predicting how and when deviations from PPP will be corrected, as shown in **Figure 7**. The typical approach that analysts take is to assume that a PPP overvaluation will lead to a loss in competitiveness and a deterioration in trade. The deterioration in trade will then lead to a decline in the overvalued currency. In other words, external balance represents the primary channel to correct deviations from PPP. But the examples of Europe in general and of Germany, Switzerland, and Japan specifically suggest that the internal balance channel is becoming much more important. In such cases, an overvalued currency leads to a significant decline in domestic economic activity, forcing mone-

Figure 6. Exchange Rate Changes and Inflation



Source: Sachs, Jeffrey D., and Felipe B. Larrain. 1993. *Macroeconomics in the Global Economy*. Englewood Cliffs, NJ: Prentice Hall.

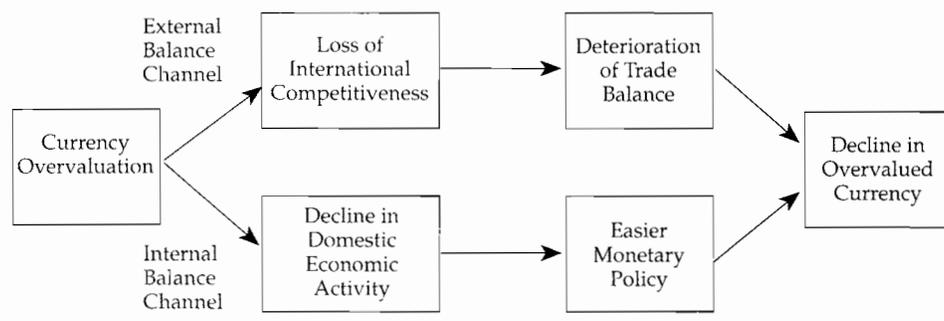
tary policy to be extremely easy, which in turn leads to a decline in the overvalued currency.

Many analysts continue to operate as if the external channel were the only channel that mattered. Therefore, they look only at trade flows to determine where the dollar is headed. So, if the United States runs a trade deficit while Japan and Europe are running trade surpluses, such analysts believe that the dollar has to decline over time. The fact is, if the overvaluation is crippling the Japanese, German, and Swiss economies, then those currencies need to weaken even if they are running trade surpluses.

SHORT-TERM CONSIDERATIONS

Internal versus external balance and PPP analysis focus on long-term value in the currency markets. For short-term analysis of exchange rates, economists tend to focus on alternative models that emphasize changes in monetary policy, fiscal policy, portfolio balance, and interest rate differentials.

Figure 7. PPP: How Exchange Rate Overvaluations Are Corrected



Monetary Policy

Monetary policy is an important factor driving exchange rates. **Figure 8** shows how a country that pursues an expansionary monetary policy will see its currency weaken, either because rates move lower, which leads to a capital outflow, or because of an expansion in domestic economic activity, which leads to a deterioration in the trade balance. Whatever the reason, the currency should weaken over time; what is known with absolute certainty is that an expansionary monetary policy leads to a weaker currency and a restrictive policy leads to a stronger currency.

For example, the Bundesbank had a very tight monetary policy in 1994 and early 1995. Although the Bundesbank was not raising short-term rates during this period, the demand for money in Germany declined dramatically. The Bundesbank should have aggressively eased its monetary policy in response to that decline in demand for money. By not easing, it permitted, perhaps inadvertently, a major decline in German money supply growth. That contraction in money supply growth led to a major tightening in the German money market, which led to a stronger German mark. Since mid-1995, German monetary policy has been eased aggressively. As a result, German money supply growth has increased, and the mark has been weakening accordingly. Changes in monetary policy have also played an important role in driving the yen lower since mid-1995.

Fiscal Policy

Monetary policy has an unambiguous effect on exchange rates: An expansionary monetary policy leads to a weak currency and a tight policy leads to a strong currency. Fiscal policy, however, operates on exchange rates through two different channels, and thus the ultimate effect is ambiguous. If a country runs an expansionary fiscal policy, it will lead to a rise in interest rates and a rise in the interest rate differential, which will ultimately lead to a rise in the

currency's value. But if a country runs a persistent budget deficit and has a huge increase in debt outstanding, the risk premium on that debt will grow and will lead to a long-term decline in the currency's value.

The problem is how to reconcile those two opposing forces, and the reconciliation lies in the policy time horizon. The early stages of fiscal stimulus tend to lead to a strengthening of a currency over time. If a country runs an expansionary fiscal policy, interest rates will rise, as will the currency's value. If a country lets that expansionary stance persist, eventually it will lead to a decline in that currency's value, and the decline may even be larger than the initial rise. The United States presents a classic example of the impact of fiscal policy on exchange rates. The dollar rose sharply in the early 1980s as a result of the very expansive fiscal stance by the United States; huge tax cuts and increases in defense spending drove real rates up, and the dollar soared. As that fiscal stance continued in the mid-1980s, the dollar eventually moved lower.

According to the Mundell–Fleming model of exchange rates, a country's policy mix—the mix of fiscal and monetary policies—has a powerful impact on exchange rates. **Figure 9** indicates that a country pursuing an expansionary fiscal and restrictive monetary policy will normally generate an appreciating currency, which is what happened in the United States in the early 1980s. President Ronald Reagan's expansionary fiscal policy and Federal Reserve Chair Paul Volcker's tight monetary policy led to a rise in the dollar's value during that period.

Similarly, relatively restrictive fiscal policies and expansionary monetary policies lead to a weakening currency. Japan and Europe, Germany in particular, now fall into this category. Huge, unfunded pension liabilities will cause budget deficits to explode in the next few years unless restrictive fiscal policies are implemented in Japan and Europe. Concurrently, the

Figure 8. Mundell–Fleming Model Transmission Mechanism

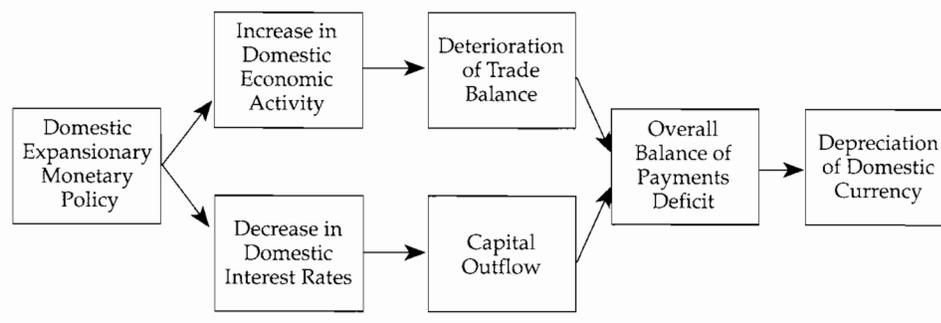


Figure 9. Monetary/Fiscal Policy Mix

	Expansionary Monetary Policy	Restrictive Monetary Policy
Expansionary Fiscal Policy	Ambiguous	Domestic Currency Appreciates
Restrictive Fiscal Policy	Domestic Currency Depreciates	Ambiguous

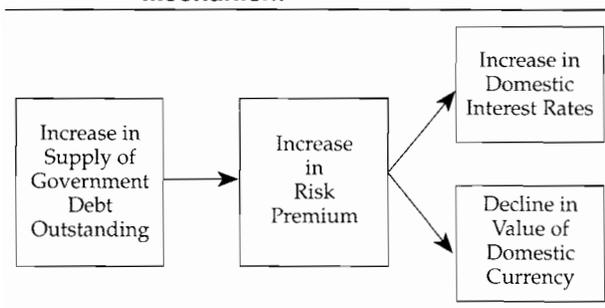
Maastricht Treaty is trying to impose fiscal discipline on Europe, forcing the European central banks to pursue expansionary monetary policies as an offset.

Portfolio Balance

The monetary approach looks at the effect of supply and demand on exchange rates. In contrast, the portfolio balance approach, shown in **Figure 10**, looks at the effect of supply and demand for bonds on exchange rates. A country that runs persistent budget deficits over time can do so only if it can find willing investors to buy and hold the rising debt being issued. Normally, investors will not buy and hold that debt unless they are compensated in the form of a higher expected return or a higher risk premium, which could come through either higher interest rates on that debt or a weaker currency.

Thus, if a country runs a persistent budget deficit over time, its currency will tend to weaken; a classic example of this phenomenon is the Canadian dollar. Because Canada has run huge deficits over time, a huge supply of outstanding debt now lies in the hands of international investors. So, whenever Canada's budget deficit tends to rise, the Canadian dollar tends to weaken. When the budget deficit comes down, the Canadian dollar tends to strengthen. Currently, the budget deficit in Canada is coming down so rapidly that by 1998 or 1999, Canada will probably be running a budget surplus, which will have a very

Figure 10. Portfolio Balance Model Transmission Mechanism



positive effect on the Canadian dollar and has already had a major impact on the Canadian bond market. Historically, Canadian bonds have traded well above U.S. bond yields, but currently, Canadian bond yields are well below U.S. bond yields across the entire yield curve.

Interest Rate Differentials

A country's mix of monetary and fiscal policy has a powerful impact on interest rates, and interest rate differentials are a key determinant of exchange rates. For instance, from 1993 to early 1997, and to a lesser extent during a much longer period stretching back 20 years or more, changes in the value of the U.S. dollar against the mark have mirrored changes in real interest rate differentials between the United States and Germany.

TECHNICAL ANALYSIS

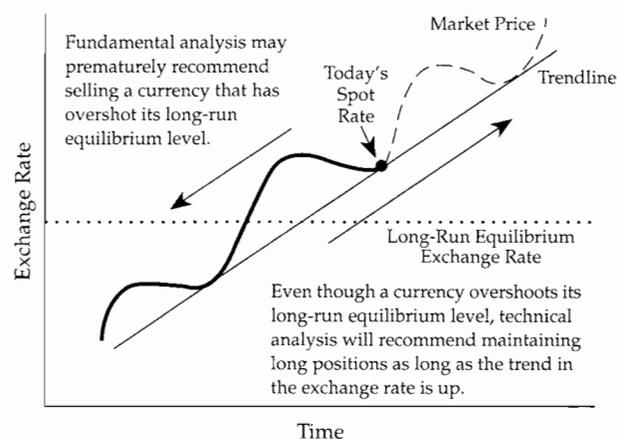
Fundamental exchange rate models are, by nature, flawed because an exchange rate often overshoots its fundamental equilibrium level. On the other hand, technical analysis offers investors an advantage in that an investor need not get confused with the facts; technical analysis concentrates only on trends, which is very useful if and when an exchange rate overshoots its fundamental equilibrium value.

Theory and Practice

Technical analysis generates forecasts of exchange rates by extrapolating the past movement of exchange rates into the future. **Figure 11** illustrates the underlying methodology of technical analysis. The technical analyst identifies a trend, presumes that trend will continue, and rides that trend for profit. If an exchange rate overshoots its equilibrium level, a fundamental approach would argue that the currency should weaken back to its equilibrium. A technical approach has no idea what equilibrium is; it simply chases the trend. If the currency continues its overshooting trend, the investor wants to be riding that trend and not fighting it.

The basic theory behind technical analysis is that successive peaks and troughs establish whether a currency is in a firm uptrend or not. An uptrend is indicated when advancing prices achieve successively higher peaks and intervening declines in prices fail to fall below preceding troughs. A downtrend is indicated when declining prices achieve successively lower troughs and intervening increases in prices fail to rise above preceding peaks. The focus is on what might be called the primary waves that are taking currencies up and down, rather than on the secondary waves, which are simply corrections to the primary wave.

Figure 11. Technical Analysis



Once a long-term trend is identified, the more times that market prices touch a long-term up or down trendline without breaking through, the more likely that the prevailing trend will continue. A market reversal, on the other hand, can be identified by a breakthrough of that up or down trendline and confirmed when prices fail to rise above previous peaks and troughs. An example of a market reversal is the famous head-and-shoulders pattern. Consider three consecutive rallies in which the second rally is higher than both the first and third rallies. The less-enthusiastic third rally is seen as an initial indication of weakening demand for the currency. An eventual drop through the trendline would confirm that a reversal has taken place. Interestingly, a Federal Reserve Bank of New York working paper shows that head-and-shoulders patterns work in foreign exchange markets. This econometric study examined U.S. dollar/mark, U.S. dollar/yen, and a number of other exchange rates and found that head-and-shoulders patterns do work as a signal to indicate when a market trend is reversing.

Many currency managers have moved away from purely chartist approaches toward computer-based systems for technical forecasting. One of the more popular approaches widely tested in academic studies is the filter rule. Empirical work suggests that filter rules work well in foreign exchange markets. An x percent filter rule simply says, if a currency rises by x percent above its recent trough, a buy signal is generated. The investor holds onto that position until the currency drops x percent from its peak, generating a sell signal. Moving-average systems use similar methodology. For instance, a buy signal is issued when a short-run moving average of the exchange rate moves above its long-run moving average, and a sell signal is generated when a short-run moving average moves below its long-term moving average.

Because all technical models are based on extrapolation, buy and sell signals may be vulnerable to “whipsaw” losses caused by false signals. Even though technical analysis has been found to be profitable, evidence shows that it generates more losing trades than winning trades.

Trend-following trading rules are profitable as long as the correctly predicted exchange rate swings are sustained and pronounced. Investors can actually incur a lot of small losses generated by false signals if they can ride the correctly predicted big swings for profit. In other words, riding the big swings for profit tends to offset the more-frequent losses generated when markets whipsaw. More than 50 percent of the time, investors will lose money, but in the long run, the empirical evidence clearly shows that they will make money. But this is not a risk-free investment strategy; the many small losses may well occur in advance of the single big profit, so having adequate risk capital is paramount.

Empirical Tests

Empirical tests of technical analysis have typically taken one of two forms. First, serial correlation tests try to examine whether a stable linear relationship exists between current exchange rates and exchange rates in previous periods. If positive serial correlation exists, then a positive movement in today’s exchange rate will lead to positive movements in exchange rates in the future; in other words, trends are present. So, technical analysis works if the researcher finds positive serial correlation. If zero correlation exists, then exchange rates basically follow a random walk. Most serial correlation tests have found that exchange rates follow a random walk. Such evidence has been used to argue that technical analysis cannot be profitable.

The second test of technical analysis is to evaluate actual technical strategies: How would a 5- or 20-day moving-average trading rule or a 1 or 2 percent filter rule work over time? The evidence conclusively shows that such technical trading rules would have generated huge profits over time. This finding raises an obvious question: How can technical models generate profits if exchange rates seemingly follow a random walk?

A recent study by Levich and Thomas addressed this question by examining how exchange rates actually moved over time.¹ Their tests on actual exchange rate movements suggest that trading rules applied to

¹Richard Levich and Lee Thomas, “The Significance of Technical Trading-Rule Profits in the Foreign Exchange Market: A Bootstrap Approach,” National Bureau of Economic Research Working Paper 3818, 1991.

the original time-series data are quite profitable. But when conducting serial correlation tests, they found that exchange rates fluctuated randomly (i.e., zero correlation). To reconcile the disparate results, they undertook an ingenious test to explain this seeming dilemma. They randomly reordered the original exchange rate data and applied the same trading rules to the randomly generated series. They found that the randomly generated data were zero serially correlated, but they also found that the profits from using the technical strategies on the randomly generated data were close to zero.

Both the original series and the random series exhibited zero correlation, but the technical models worked only in the former instance and not in the latter. Something in the original time series must have allowed the technical models to work; that something is nonlinear dependence in the original time-series data. Serial correlation tests examine whether a stable linear relationship exists between today's change in exchange rates and yesterday's change in exchange rates. Zero correlation says that no linear relationship exists but says nothing about the presence or absence of a nonlinear relationship. Most technical models, however, are not constrained to linear relationships; they are nonlinear models and thus can exploit the nonlinear dependence of exchange rate movements. Therefore, exchange rates can seemingly fluctuate randomly, and at the same time, technical models can still work.

Application to Global Bond Management

Because technical analysis has been found to be effective in currency management, it can be used effectively in global bond management. Consider a global bond portfolio with the following strategy: If a U.S. investor is bullish on the dollar, invest 100

percent in U.S. dollar bonds and nothing in foreign bonds, and if that investor is bearish on the dollar, invest 80 percent in U.S. dollar bonds and 20 percent in foreign bonds. The tactical use of foreign bonds in a U.S. portfolio can help in the management of an otherwise pure U.S. domestic portfolio. The first part of the analysis requires deciding what criteria should determine whether to be bullish or bearish on the dollar. A simple trading rule will suffice: When the dollar rises above its 12-month moving average, that is a bullish dollar signal, and when the dollar falls below that average, that is a bearish dollar signal. By following a 100/0 versus an 80/20 portfolio mix strategy during the period from 1976 to early 1997, a U.S.-based investor could have outperformed the U.S. Treasury domestic benchmark index, on average, by about 150 basis points a year. Thus, a simple trading rule can become a tool for tactically allocating money away from domestic bonds into foreign bonds to achieve above-average performance.

CONCLUSION

The complexities of the foreign exchange markets favor, almost dictate, a composite approach to currency forecasting, one that integrates fundamental and technical analysis. Fundamental factors—issues of external and internal balance, and monetary and fiscal policy—clearly drive exchange rates in the long run, but technical analysis helps discipline a fundamental-based investor when exchange rates overshoot in the short run. An investor who relies too heavily on the fundamentals takes undue risk during those inevitable times when market forces are moving against fundamental forces; technical models can help mitigate that risk.

Question and Answer Session

Michael R. Rosenberg

Question: What is the correct quantitative measure of internal balance?

Rosenberg: Most of the time we think of full employment as the sole criteria for internal balance, but it is really country dependent. Most countries would love to have Japan's unemployment rate but would not want to have Japan's banking system problems. The real question is whether there is a major imbalance somewhere in the domestic economy that will compromise the conduct of monetary policy and, therefore, affect the exchange rate.

Question: Please comment on the phenomenon of getting paid for hedging a weak currency (e.g., going long German bonds but hedging the German mark into U.S. dollars and gaining the short-term interest rate differential).

Rosenberg: This strategy has been very useful in the past year and a half or so, when U.S. bond yields have risen relative to German bond yields and the dollar has risen over time. Therefore, had you been long German bonds, you would have done well on the bond side, but if you were unhedged, you would have done poorly on the currency side. The correct strategy would have been to go long German bonds but hedge the exposure back into U.S. dollars.

Similarly, looking at German equities and the mark/U.S. dollar exchange rate shows something very interesting. In the past year, the mark/U.S. dollar exchange rate has been strongly correlated with Germany's stock index, the DAX; that correlation now exceeds 0.9. The reason the DAX has surged is in part because the mark has been weak, which has made German

companies much more competitive. Therefore, if you had forecasted that the dollar would go higher, the right strategy would have been to go long German equities. But if you invested in German equities on an unhedged basis, you would have lost at least half of what you made on the equity side by being long marks because the German mark was weakening. Again, the right strategy would have been to be long German equities but hedged back into the U.S. dollar.

Question: Are there indicators of confidence or emotion that one should consider when forecasting exchange rate movements?

Rosenberg: Hopefully, you can capture that emotion with technical analysis. Where the technicals may fail is when you get a major break that is so sharp, so rapid and instantaneous, that even the technical models are too late to capture it.

At Merrill Lynch, we try to capture some of that emotion each quarter by conducting a global investor survey. We ask investors about their positions in the major currencies and bond markets around the world. The survey results are used as a contrarian indicator. If we find that investors are heavily overweighting the dollar, it may serve as an indication that at some point the dollar could be ripe for a reversal. You can also use the weekly surveys of bullish consensus from Market Vein and Consensus to try to formulate a similar contrarian strategy.

Question: Research shows that PPP convergence takes three to eight years in developed markets. Have you seen any evidence of convergence in emerging markets?

Rosenberg: The difference between emerging markets and

developed markets is that in emerging markets, exchange rates more often than not are an instrument of policy, whereas in the developed world, exchange rates are largely determined by market forces with periodic intervention. In emerging market countries, currencies are pegged, and the peg is sometimes maintained through capital controls. The result can often lead to significant misalignments of exchange rates that are not adequately corrected. Misalignments also occur in developed markets, but the problem in countries with capital controls is that attacking a currency is not that easy if speculators cannot actually buy and sell currencies forward with the freedom that they can in developed markets. Exchange rates do return eventually to equilibrium; the question is when, and the answer is probably more slowly in emerging markets than in developed markets.

Question: Many currency trades are set up with stop losses at specific levels; how important is this to the forecasting process?

Rosenberg: With stop-loss orders, you will get breaks in trends and the formation of new trends. Although fundamentals cannot capture what is going on with the stop-loss orders, hopefully, technical models will be able to capture these shifts in trend. The fundamentals may indicate that a currency will go up over time, but if you get a quick move, as recently happened with the yen, stop-loss orders get triggered, resulting in a bigger move in the yen than is warranted. In such a case, the fundamentals may indicate that the yen should be weak, but the technicals clearly have become much more yen positive.