Goldman Sachs

Global Emerging Markets

Portfolio Strategy

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A Long-Term Perspective on Short-Term Risk

Long-Term Discount Rates for Emerging Markets

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- **High volatility in emerging financial markets limits the usefulness of contemporaneous, market determined measures of the cost of capital in valuation analysis. Yet, an assessment of long-term trends is hampered by the short price history of emerging bond markets.**
- **We have developed a model of discount rate determination that permits us to recreate discount rate history and calculate discount rates for 23 emerging markets over the last 25 years.**
- **Our analysis helps bridge the gap between the assessment of near-term market risk typically emphasized by portfolio managers and longer-term risk trends more often looked at by direct investors in plant and equipment.**
- **The comparison of current discount rates versus their long-term trend has powerful investment implications and turns the investment decision on its head. Abnormally high discount rates relative to history (normally interpreted as punishing cash flows) may be a buy signal, while abnormally low rates may be a sell signal.**
- **Current emerging market discount rates are approximately in line with their five-year moving average. From purely a risk perspective, Asian markets appear undervalued, while Latin America and EMEA seem to be slightly overvalued.**

Investment Summary

Stock market valuation without reference to risk is insufficient to make sound investment decisions. However, finding accurate measures of the level of risk associated with a security is not a trivial enterprise in emerging markets. First, high levels of market volatility make measures based on contemporaneous market indicators highly unstable. Second, the limited history of bond market prices in emerging markets makes it impossible to ascertain any long-term trends in risk.

With this piece, we have three objectives: (1) We develop a model of the determinants of discount rates based on local and global fundamental variables. (2) We use this model to "recreate" discount rate history for 23 emerging markets over the last 25 years and produce a database of long-term and contemporaneous discount rates. (3) We illustrate the usefulness of our approach in investment strategy by determining the upside for emerging markets based on a reversion to implied and long-term discount rates and the effects of alternative global scenarios.

In our view, the main contributions of our analysis are as follows:

- We generate estimates of **long-term market-based discount rates for 23 emerging markets**. These rates are a complement to our estimates of contemporaneous discount rates.

- Our methodology permits the calculation of **discount rates for any country, any time, with or without a local bond or stock market**. The basic requirements are a limited set of domestic and global financial and economic indicators.

- Our model highlights **the importance of global monetary conditions, global risk aversion, and commodity prices** in determining emerging market discount rates, complementing domestic cash flow, balance sheet and wealth indicators to enhance our formulation's explanatory power.

- Long-term discount rates provide an important benchmark to assess the current level of observed rates and, in the process, flips the investment decision on its head. **An "abnormally" high (relative to long-term history) discount rate would indicate a buy signal. By contrast, an "abnormally" low discount rate should be interpreted as a sell signal.**

- By allowing for the decomposition of discount rates into bond and stock market variables, and estimation of their fundamental determinants, **our formulation permits us to simulate emerging market risk sensitivity to changes in these underlying domestic and global fundamental variables**.

Some of the findings of our analysis of long-term risk are as follows:

- Global emerging market (GEM) discount rates have been on a downward trend since the early 1980s, despite the noticeable increase during the period between 1997 and early 1999.

- GEM's highest discount rates seen during the early eighties, at 28%, were significantly higher than the 19% rates at the height of the Russian crisis.

- The average discount rate for GEMs on October 15, 1999, was 14.6%, slightly below our estimate for the long-term rate of 14.9%. The rate for emerging Asia was 13.9% versus a long-term rate of 13.2%. The Latin American rate of 15.2% was slightly below its long-term rate of 15.5%, while the rate for EMEA of 14.6% was 1% below its 15.6% long-term rate.

The following are investment implications of our scenario analysis:

- Assuming discount rates reverted to our estimate of the long-term rate would result in a 3% decline in emerging equity markets. Asia would increase 10% while EMEA and Latin America would fall 12% and 3% respectively. Russia, Indonesia, and Argentina would show the best performance while Poland, Hungary, the Philippines and Mexico would decline the most.

- Everything else constant, our current 12-month forecast for 10 year U.S. T-bond rates of 6.2% (from 6.4% today), a 12% appreciation of Goldman Sachs Commodity Index (GSCI), and a 24bp contraction of the BB corporate bond spreads to 235bp from 259bp, would result in a 16% increase in emerging stock markets, 22% in Latin America, 19% in EMEA and 6% in Asia.

- A more optimistic scenario assuming the 10-year T-bond rate at 5.4%, a 20% increase in the GSCI, and U.S. BB corporate bond spreads of 185bp would result in a 54% increase in emerging stock markets, 71% in Latin America, 60% in EMEA, and 24% in Asia.

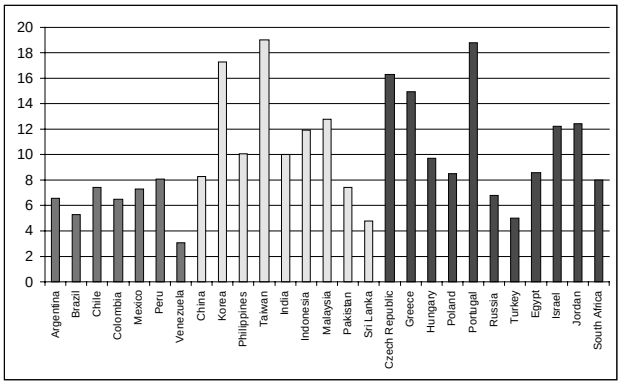
- Our pessimistic scenario assumes the 10-year T-bond rate at 7.0%, a 20% decline in the GSCI, and U.S. BB corporate bond spreads of 335bp. This would result on a 27% drop in emerging stock markets, 28% in Asia, 29% in EMEA, and 25% in Latin America.

The Valuation Puzzle for Emerging Markets

Stock market valuation without reference to risk is insufficient to make sound investment decisions. A simple observation of the absolute level of stock market valuations in emerging markets during the Russian crisis in September 1998 makes the point clearly. As seen in Figure 1, P/E multiples varied widely among Asia, Latin America, Eastern Europe, and the Middle East. It would have been impossible to infer whether the multiples displayed were close, at, or far away from their equilibrium levels. This is so because the risk-adjusted equilibrium multiple may be above or below the observed one.

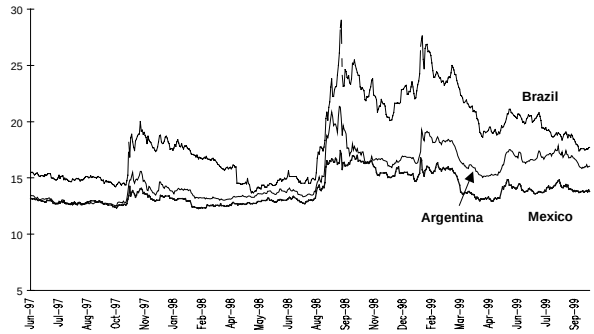
In order to dramatize the point, consider two countries. One country's stock market index (A) has a 12-month forward P/E multiple of 7; the other country's market (B) has a P/E multiple of 15. Leaving accounting and other distortions such as inflation aside, and assuming similar expectations for earnings growth in both countries, a casual observer would conclude that A is more attractively valued than B. Now, assume that owing to its high risk (for example, high historical market volatility), country A has a discount rate twice as large as that of country B. In this case, a cash flow or dividend discount model could yield a different valuation conclusion. It is possible that A is more expensive than B on a risk-adjusted basis. **The fair value P/E multiple could be less than 7 for country A, while it can be more than 15 for country B.**

Figure 1: The Puzzle
12-Month Forward P/E Ratios (September 1998)



Source: I/B/E/S and Goldman Sachs estimates.

Figure 2: Discount Rates Are Quite Volatile



Source: Goldman Sachs estimates.

Finding Useful Discount Rates Is Difficult

From the above discussion, **it would seem that in order to solve the valuation puzzle, we need an accurate way of calculating discount rates**[1]. With these rates, and the use of dividend discount (DDM), discounted cash flow (DCF), or EVA® models, we could ascertain how far above or below equilibrium the market may be at a given point in time. However, assuming market efficiency, the equilibrium calculated by using the current discount rates in the market will likely be very close to where observed prices are. From this perspective, it would seem that the more relevant question is not where are equilibrium multiples today, (the answer being, very close to where current prices are), but rather where is the next equilibrium likely to be, what are the catalysts for the market to shift to another equilibrium, and how soon will the market get there?

A first step in this "guessing game" is to narrow the margin of error by comparing current equilibrium multiples with historical ones. In relatively developed financial markets, a long history of bond and stock market data makes it feasible to undertake this exercise. However, high volatility of short-term discount rates (see Figure 2) and a much more limited data history of bond price data preclude the assessment of long-term trends in emerging market discount rates.

[1] We have written extensively on the calculation of the appropriate emerging market discount rates. See J. Mariscal and R. Lee, *The Valuation of Mexican Stocks*, June, 1993; J. Mariscal and R. Lee, *The Valuation of Latin American Stocks, Part II*, May 1994; J. Mariscal and E. Dutra, *The Valuation of Latin American Stocks, Part III*, November 1995, and J. Mariscal and K. Hargis, *Emerging Market Discount Rates: A Consistent Market Based Methodology for Asia, EMEA and Latin America*, March 1999.

The discount rates estimated in this paper can be used for two purposes. First, the long-term discount rates can be entered into standard DDM, DCF, or EVA® models to evaluate whether current market multiples are consistent with the multiples implied by the equilibrium multiples from our model. Second, assuming current market multiples incorporate available discount rate expectations, the long-term discount rates can be used as a guide for *changes* in future rates to determine the implied upside or downside for the markets.

Defining Discount Rates

We define the sovereign risk-adjusted discount rate (R) as the sum of the risk-free rate (R_u) plus an adjusted equity risk premium (E_a) as seen in Equation 1 below.

(1) $R = R_u + E_a$

For dollar-denominated investors buying emerging market stocks, we use the yield of a long-term U.S. Treasury bond as the risk-free rate.

We define the equity risk premium for a given emerging stock market (E) as a combination of two measures:

1. The country risk spread (R_s = the spread over Treasuries for sovereign, dollar-denominated emerging market bonds of similar maturity).

2. A leveraged measure of the U.S. equity risk premium defined as the equity risk premium in the United States (E_u) adjusted by the ratio of daily volatility of the emerging stock market index (S_b) over the volatility of the U.S. market (S_u). This relationship is shown in Equation 2 below.

(2) $E = R_s + (S_b/S_u)E_u$

Our decision to use the ratio of standard deviations rather than the beta of the emerging market results from our assumption that local market volatility plays a greater role than betas in determining risk for foreign investors.

Substituting Equation 2 into Equation 1, we obtain a discount rate expression as follows:

(3) $R = R_u + [R_s + (S_b/S_u)E_u]$

Adjusting for Double Counting

The model, as presented above, has at least one significant structural flaw. The two components of the equity risk premium in our formulation are not independent and likely overlap, leading to a problem of double counting. Movements in sovereign spreads and equity market volatility are likely to reflect a similar change in risk of the underlying economy. One possible example of this double counting is the exchange-rate linkage. Given that for consistency we are measuring the discount rate in dollar terms, foreign exchange volatility affects both the equity risk premium (measured in dollars) and the sovereign risk spreads. This likely results in an exaggeration of risk and an overestimation of the discount rate.[2]

In order to obtain a more realistic assessment of the true discount rate, we adjust the equity risk premium by subtracting the correlation of dollar returns between the stock market and the sovereign bond, as follows:

(4) $E_a = [R_s + (S_b/S_u)E_u(1 - \text{corr}(S, B))]$

In Equation 4, Ea is the adjusted equity risk premium, and S and B are dollar-denominated stock and bond returns, respectively.

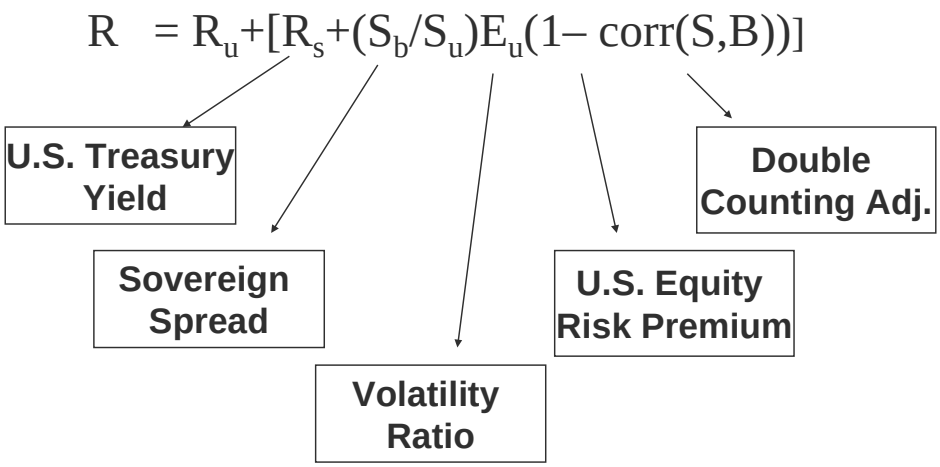
Substituting Equations 4 and 2 into Equation 1, we obtain our basic discount rate formulation:

(5) $R= R_u+[R_s+ (S_b/S_u)E_u(1- \text{corr}(S, B))]$

The first term on the right side represents the long-term U.S. Treasury bond, while the second term incorporates the two components of the unadjusted equity risk premium, adjusted for double counting. A graphic summary of the discount rate equation is shown in Figure 3.

[2] We use local market volatility rather than betas because research on emerging market equities has not been able to determine definitively whether markets are currently segmented or integrated. However, measures of volatility have been found to be able to distinguish between high- and low-return markets better than betas.

Figure 3: Our Formulation to Assess Sovereign Risk Adjusted Discount Rates



Source: Goldman Sachs.

Calculating Stock-Specific Discount Rates

To calculate a stock-specific discount rate, we can adjust the equity risk premium in Equation 5 by company-specific components for the bond spread and the beta of the stock versus the local stock market, as follows:

(6) $R = R_u + [(R_s + R_c) + B(S_b/S_u)E_u(1 – corr(S, B))]$

Take, for example, a company with a large portion of revenues outside the home market, but in a cyclical industry. In this case, the extra component of the spread due to company characteristics (R_c) could be positive or negative. The company may have an extra premium attached to its debt as a corporation. However, the sovereign risk component of the spread can be thought of as a weighted average of the sovereign risk in the markets where the company derives its revenues. Empirically, this can be computed by observing the spreads on the company's corporate debt in the market.

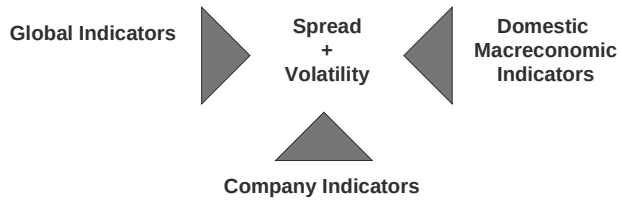
At the same time, the beta on the equity market component may still be greater than one relative to the local stock market. Therefore, we multiply the volatliity ratio component of the equity risk premium by the beta of the company on the local market index. By decomposing betas in this way, the sensitivity of the company to each component of risk can be analyzed separately.

Model of Discount Rate Drivers

Having defined discount rates in the previous section, here we discuss the drivers of discount rates. Risk and perception of risk is determined by a vast and complex set of interacting variables. Schematically, we divide the drivers of risk premia into components attributable to global, country, and company-specific factors (see Figure 4). We will focus on global and domestic factors.

Previous research examining the determinants of sovereign spreads has found significant ability for domestic risk proxies to "explain" differences in spreads at a given point in time. However, these variables by themselves have proven insufficient in explaining their movement over time.

Figure 4: Both Global and Country Risk Indicators Must Be Analyzed



Source: Goldman Sachs.

Global Risk Drivers

We introduce a set of three global variables and find that the global drivers improve considerably our ability to "explain" changes in discount rates over time, while the domestic drivers are more helpful for the cross-section of country spreads at a given point in time.

- **Degree of Risk Aversion in Developed Markets.** From the point of view of emerging markets, global capital scarcity can be the result of tight monetary conditions or a growing preference for relatively low-risk assets. For example, the current uncertainty about U.S. inflation and interest rates, as well as fears associated with Y2K, may be behind the sharp increase in so-called junk-bond spreads in the U.S. in recent weeks. Proxies for risk aversion are the difference between yields of relatively low-quality BB rated corporate credits and high-quality AAA bonds or U.S. Treasuries.

- **Global Monetary Conditions.** Owing to its high dependence on foreign financing, the cost of capital in emerging markets is very susceptible to global supply and demand for money. For example, the Latin America debt crisis in the early 1980's cannot be explained without reference to tight monetary policy in the United States. Proxies for this variable could include the level of U.S. interest rates, the spread between short-term and long-term U.S. rates and the Goldman Sachs Global Monetary Conditions Index.

- **Commodity Prices.** Many emerging market countries are heavily involved in the production and exportation of commodities and raw materials, the prices of which are determined by global supply and demand conditions. Owing to their importance in the balance of payments, commodity prices have a significant impact on domestic exchange rates, interest rates, and fiscal policy. In these and other direct and indirect ways, commodity prices have an impact on the cost of capital of emerging markets.

Domestic Risk Drivers

For countries, as for companies, investment risk depends primarily on the country's ability to generate cash flows and the uncertainty associated with these flows. From a domestic macroeconomic point of view, four aspects of a country's economic makeup are key in assessing risk:

- **Balance Sheet and Wealth.** The proportion of a country's external or government debt to assets, as well as the currency and term composition of its assets and obligations, are important in assessing the country's ability to service its obligations. Proxies for this include the level of external and internal debt relative to assets. Given the lack of consistent data on the level of country assets, we need to divide the level of debt by the income derived from these assets (such as exports and GDP), which proxy for their levels. In addition, a proper balance sheet assessment should include a measure of the level of wealth as given by the physical as well as the human capital stock. One proxy for this is GDP per capita.

- **Income Statement.** The ability of the country to generate current and future cash flows to continue debt service is related to the country's growth and level of income. A proxy for this is GDP growth. Key aspects of a country's income statement include the fiscal gap (tax revenues minus expenditures plus domestic debt amortization) and the external gap (current account balance plus debt amortization).

- **Stability of Cash Flows.** Countries with more stable and sustainable growth rates of cash flows are more likely to have the necessary funds when needed to meet their debt payments. This stability can be proxied by the level of inflation or exchange rate volatility.

- **Debt Service History.** Prior defaults increase the risk perception for an extended period of time. This can be proxied by "dummy" variable for countries that have defaulted on their debt service obligations in the past.

The list of variables and expected signs are shown in Table 1.

Table 1: Sovereign Spread Model Variables

	Model Variables	Expected Sign
Domestic Indicators		
Balance Sheet	Net external debt (gross ext debt minus reserves) divided by exports	Positive
Wealth	GDP Per Capita	Negative
Income Statement	GDP growth	Negative
Stability of Cash Flows	Inflation	Positive
Debt Service History	Dummy for countries defaulting on foreign currency debt	Positive
Global Indicators		
Global Risk Aversion	BB Corporate Bond Spreads	Positive
Monetary Policy Tightness	(U.S. T-Bond - U.S. T-Bill Spread)	Positive
Commodity Prices	Goldman Sachs Commodity Index (GSCI)	Negative

Estimation and Modeling Issues

In this section, we discuss the data set and estimation procedure used to model the drivers of discount rates.

Estimation Procedure

The model is estimated using monthly cross-section and time series data from January 1994 through August 1999 for 21 countries[3], following the specification in Equation 6 (see Table 3). We estimated the model in two ways. First, following traditional panel data techniques, we estimated fixed and random effects models. The fixed effects model assumes that differences in spreads across countries can be captured by differences in the constant term, while in the random effects model, this effect is the sum of a common constant and a cross-sectional random variable.

Second, we estimated the model by pooling the data and estimating by OLS (ordinary least squares). In this specification, all of the country-specific drivers of spreads are assumed to be accounted for by the independent variables. For example, the default history dummy helps explain differences in the levels of spreads across countries, while in the fixed effects model, the characteristics of each sovereign not observed in our independent variables are combined into a country-specific intercept, including effects such as default history and precluding our ability to account for these variables explicitly.

The results of the random effects model and OLS model are generally similar. We use the OLS estimates because we prefer to be able to identify the specific determinants of spreads, including dummies such as default history, rather than attributing some of the variation in spreads to unobservable factors.

The equity risk premium component of the discount rate as defined in Equation 6 is a combination of the sovereign spread and domestic stock market volatility.

We estimate the determinants of sovereign spreads, leaving the endogeneity of the volatility component of the equity risk premium for future research. Modeling of the volatility component of the equity

[3] We do not include the local rates for Singapore and Taiwan in the estimation.

Table 2: Selected Sovereign Benchmark Bonds

Latin America	Sov Bond	Beginning of Sample Period
Argentina	Argentina '06	Jan-94
Brazil	Brazil '08	Apr-94
Chile	Chile '09	Jan-94
Colombia	Colombia '16	Jan-94
Mexico	Mexico '07	Jan-94
Peru	Peru FLIRB	Jun-96
Venezuela	Venezuela '07	Jan-94
Asia (inc. HK and Sing)		
Hong Kong	MTRC '05	Feb-96
Singapore	3m T Bill +.25%	Jan-94
Emerging Asia		
China	China '06	Feb-94
India	Reliance '05	Oct-95
Indonesia	Indonesia '06	Jul-96
Korea	Korea '08	Jan-94
Malaysia	Petronas '06	Feb-96
Philippines	Philippines '16	Dec-95
Taiwan	3m Interbk +1%	Jan-94
Thailand	Thailand '07	Jan-94
EMEA		
Israel	Israel '05	Jan-96
South Africa	South Africa '06	Dec-94
Hungary	Nat Bk of Hung '13	Jan-94
Poland	Poland '04	Jun-95
Russia	Russia '07	Jul-96
Turkey	Turkey '05	Jan-94

***** Sample includes the calculated implied Eurobond rates.

Source: Goldman Sachs.

risk premium is less important than modeling spreads because stock market data are available for a much longer history than bond market data. We could model the determinants of volatility in a similar fashion, as a function of the same domestic and global drivers of risk.

Dependent Variable: Sovereign Spreads

Ideally, the bonds used to calculate sovereign spreads should be as close as possible to an index of sovereign risk. Yet, they must also bear similar maturity and duration characteristics from country to country. We use the spread of a dollar-denominated sovereign Eurobond with a ten-year maturity, subject to liquidity and availability, over a ten-year U.S. Treasury bond.

We use sovereign Eurobonds, as opposed to Brady bonds, due to the limited availability of Bradies outside of Latin America and their hybrid characteristics, which hinders their comparability across markets. Brady bonds contain principal and interest rate guarantees from the United States and are restructured debt.

The main drawback of using Eurobonds over Brady bonds is the lack of history in the former and reduced liquidity in the earlier part of our sample period. However, Brady bonds are becoming less relevant for country risk assessment as "pure" sovereign Eurobonds become more abundant. In addition, the liquidity of Eurobonds has already surpassed that of Bradies in some countries as governments convert Bradies into Eurobonds over time. Going forward, we expect the benchmark status of the Brady market to be overtaken by Eurobonds in their respective markets.

Given the limited time period available for the benchmark Eurobonds we follow, we extend the sample back in some cases by using available Brady bond and other Eurobond spread data to compute an implicit spread on our benchmark Eurobonds[4]. Table 2 provides a list of the bonds we use for current spreads and the time period available for estimation (including the time period when we use the implied spreads).

Domestic Variables

Table 3 shows the results of our estimation. Net external debt/exports, GDP per capita, GDP growth, inflation, and a dummy for countries previously defaulting on foreign currency sovereign debt are all found to be significant in determining spreads.

We estimate that spreads on emerging market bonds increase 66 basis points if the ratio of net external debt to exports increases by 1.0, 62bp if inflation increases from 5% to 10%, and 246bp for countries that have defaulted on the external debt since 1975. Spreads decline 30bp if GDP per capita increases from $1,000 to $2,000 and 26bp for each percentage point of annual GDP growth.

[4] The Brady or Eurobond spread minus the average difference between the Brady or Eurobond and the benchmark Eurobond for the six months after issuance is the implied spread on the benchmark Eurobond.

Table 3: Model Estimates

$$\text{Spread} = \alpha + \beta_1 \text{Net External Debt/Exports} + \beta_2 \text{GDP Per Capita} + \beta_3 \text{Growth} + \beta_4 \text{Inflation} + \beta_5 \text{Default} + \beta_6 \text{BB Spread} + \beta_7 \text{T Bill} - \text{T Bond Spread} + \beta_8 \text{GSCI Index} \quad (6)$$

Explanatory Variables	Coefficient (t-stat)		
Constant	5.24 (4.54)	**Domestic Indicators**	
Net External Debt/Exports	0.66 (9.98)	If the ratio of net external debt to exports increases by 1.0	Then spreads increase 66 bp
Log of GDP Per Capita	-0.43 (-6.33)	If GDP per capita increases from $1000 to $2000	Then spreads decrease 30 bp
GDP Growth	-0.26 (-14.42)	If the economy grows 1% faster	Then spreads decrease 26 bp
Log of Inflation	0.88 (8.55)	If inflation increases from 5% to 10%	Then spreads increase 62 bp
Default Dummy	2.46 (12.98)	If the country has defaulted on its external debt since 1975	Then spreads increase 246 bp
		Global Indicators	
BB Spread	1.69 (6.29)	If U.S. corporate BB spreads increase by 100 bp	Then spreads increase 169 bp
T-Bill - T Bond Spread	0.23 (1.70)	If the T-bill - T-bond spread increases by 100 bp	Then spreads increase 23 bp
GSCI Index	-0.03 (-5.68)	If the GSCI index increases by 10 percent	Then spreads decline 55 bp
R-squared	48%	48% of the cross-section and time-series variation in spreads can by explained by our domestic and global indicators	

*t-stats calculated using White's heteroskedasticity-adjusted standard errors

Source: Goldman Sachs estimates.

Given that GDP per capita and net external debt levels are relatively stable over time and default history is fixed in our specification, the domestic variables that have the largest impact on movements in spreads are accelerating economic growth, expanding exports and declining inflation.

External Variables

Our measures of global risk aversion (BB spread), monetary policy tightness (T-bill – T-bond spread), and global commodity prices (GSCI Index) are all significant in explaining spreads across countries over time. Although our measure of monetary policy tightness is only significant at the 10% level, we include the variable because its lower level of significance is the result of its relatively high correlation with corporate bond spreads.

According to these measures, we estimate that emerging market spreads increase 169basis for each 100bp increase in U.S. corporate BB spreads and 23bp for each 100bp increase in the spread between U.S. T-bills and T-bonds. Spreads would decline by 55bp if the GSCI Index increases 10%.

Among the global variables, the magnitude of the movement in BB spreads has the largest impact, with movements in the GSCI Index having a substantial role, primarily in periods of large movements in commodity prices, as has been the case this year.

Modeling Issues

We face a number of methodological issues in estimating the model given that we are dealing with both cross-section and time-series data and only have a limited data sample to work with. We find

evidence that the errors of the model are correlated across time and have unit roots in some cases. This indicates that either differencing of the spreads or panel cointegration may be appropriate.

The problem that arises when differencing panel data is that the majority of the explanatory power of the cross-sectional information is eliminated. For example, the level of spreads may be higher in Brazil than Korea because of a higher level of external debt or default history. However, when only differences enter the model estimation, differences in average levels of external debt and any dummies for default history no longer enter the model.

Panel cointegration techniques could solve this problem by including levels in the model and estimating the degree of convergence back to this long-term equilibrium. However, the short length of the sample period, unbalanced nature of the panels, and thus our diminished ability to estimate the rate of convergence for each country back to a long-run equilibrium limit the usefulness of panel cointegration techniques. Cointegration requires a relatively long length of time, in addition to a sufficient number of data points, which are not available given the short history of emerging bond markets.

In addition, much of the data, such as external debt and GDP per capita, are only available at an annual frequency, while many of the panels have different starting dates. These factors limit the usefulness and reliability of inferences from more sophisticated econometric techniques, given the uncertain small sample properties of such a data set.

Taking these constraints as given, we do perform a couple of checks on our specification. First, we run the model in differences to check the relationship between the monthly dependent variable (spreads) and the independent variables for which we have monthly data. We find that BB spreads, the GSCI index and our measure of monetary policy tightness all remain significant in differences, giving us more confidence in the specification, while as expected, the changes in annual domestic variables lose much of their significance.

Second, we test for unit roots for each of the individual country residuals from the model, for indications of the presence of a long-run relationship between spreads and our independent variables. While we are not able to reject the hypothesis of unit roots in the original spread data, we are able to reject this hypothesis for half of the individual country residuals, giving some evidence of a long-run relationship.

As a check on the cross-sectional domestic data, we run the cross-sectional regressions for 11 six-month sample periods and find that our variables remain significant in nearly all cases. We account for the heteroskedastic nature of the errors by using White's heteroskedasticity adjusted standard errors, rather than adjusting for a particular form of known heteroskedasticity.

Results of Within Sample Estimation

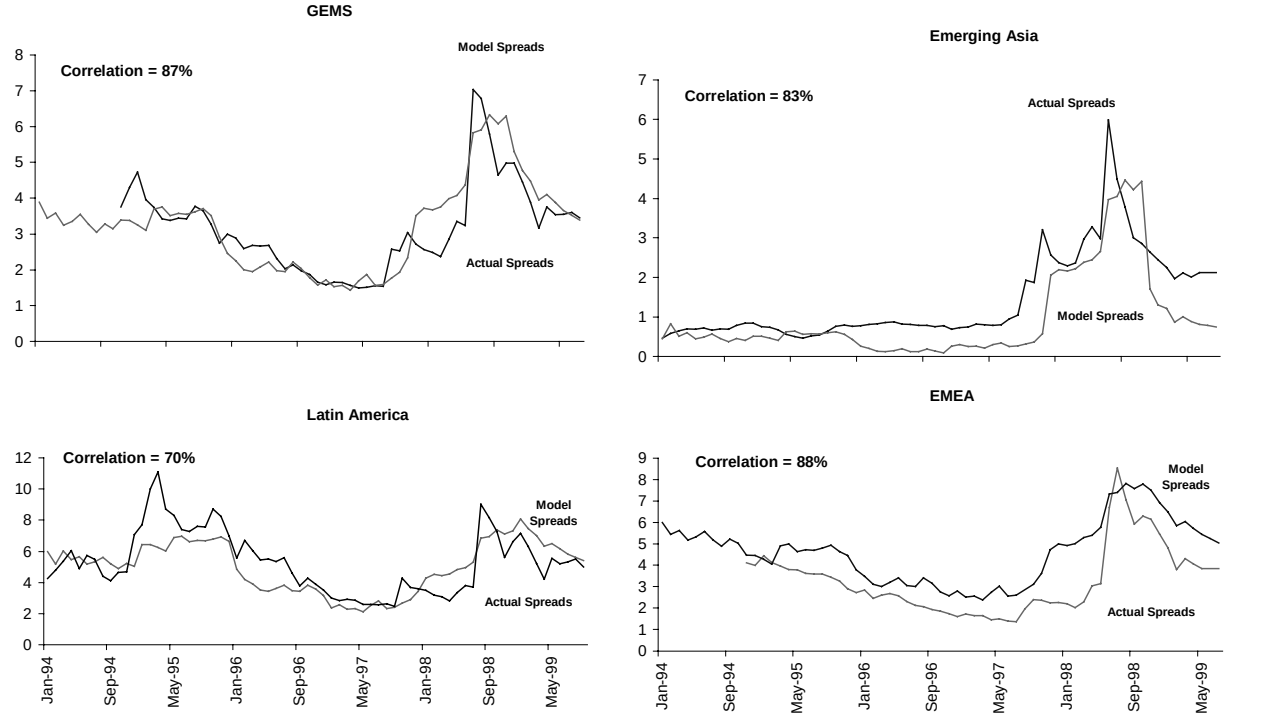
An illustration of the ability of our model to explain spreads is shown in Figure 5, which shows the actual versus predicted spreads for emerging markets and the three regions over the sample period. In addition to explaining differences in the levels of spreads across countries, the correlation between the predicted and actual levels of spreads over time for emerging markets is 87%, ranging from 88% for EMEA to 83% for emerging Asia to 70% for Latin America.

Reconstructing 25 Years of Discount Rates for Emerging Markets

Having estimated our model for the sample period, we now use fundamental data on the independent domestic and global independent variables to "back-cast" what discount rates would have been had we been able to observe them for the previous 25 years.

In this way, our methodology permits the calculation of discount rates for any country, any time, with or without a local bond or stock market. The basic requirements are a limited set of domestic and global financial and economic indicators. This longer-term history is valuable in assessing long-term discount rate trends and creating a benchmark to assess current rates.

Figure 5: Actual vs Predicted Emerging Market Spreads for the Sample Period (1994-1999)



Source: Goldman Sachs estimates.

Does It Work?

If our discount rate estimates (both within and out of sample) are an accurate measure of the true underlying discount rates being used by investors, we would expect to see a strong correlation between these rates and the stock markets in each country. We are encouraged by our finding that the correlation between emerging stock markets and our implied discount rates and sovereign spreads is quite high, at 54% and 46%, respectively. The detailed results of this correlation analysis are shown in Table 4. The specific discount rates globally, by region and country, are shown in Figures 6 through 12.

The highest correlations are found in Latin America, at 70% and 59%, respectively, compared with 53% and 47% in EMEA and 37% and 26% in emerging Asia, respectively. The finding that dollar-denominated discount rates have a stronger relationship with stock markets in Latin America relative to Asia is expected given the dominance of foreign investors and open nature of stock markets in the region.

This intuition is confirmed by looking at the individual country correlations within Asia. The Taiwanese, Chinese, and Indian stock markets have the lowest correlations with our implied discount rates and are also the more closed markets in Asia, in terms of either capital market access or external trade. These findings also correlate well with our previous work showing that correlations between sovereign bonds and stock markets in emerging markets tend to be lower in relatively closed markets dominated by domestic investors (see J. Mariscal and K. Hargis, *Emerging Market Discount Rates: A Consistent Market-Based Methodology for Asia, EMEA, and Latin America,* March 22, 1999).

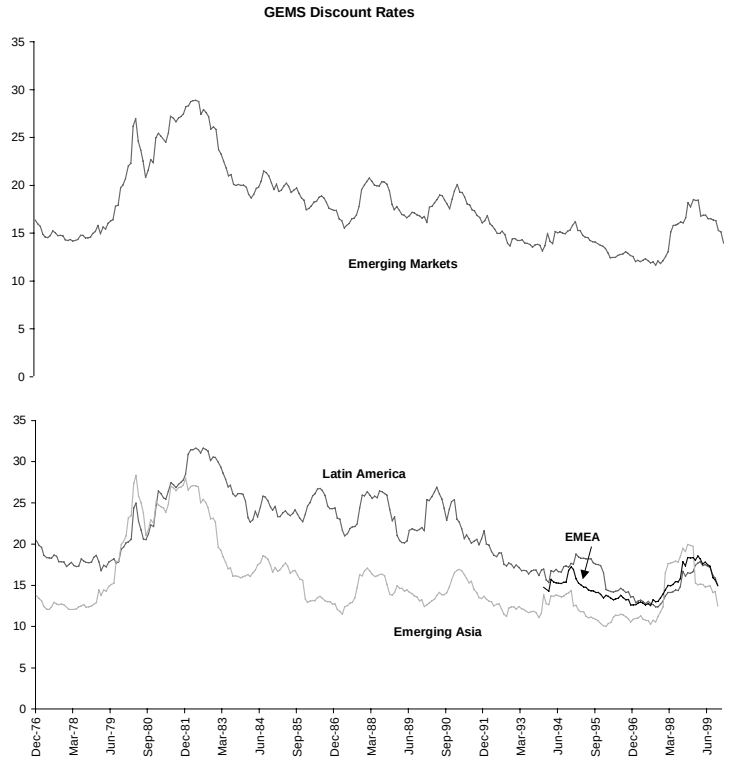
Figures 6 through 12 provide discount rates for GEMS, the regions of Latin America, Asia and EMEA, and individual countries within each region.

Table 4: Correlations Between Stock Market, Spreads, and Discount Rates

	Discount Rates	Sovereign Spreads
Emerging Markets	56	48
Latin America	70	59
Argentina	76	75
Brazil	70	62
Chile	74	63
Colombia	87	67
Mexico	68	50
Peru	65	57
Venezuela	62	58
Asia (inc. HK and Sing)	44	30
Hong Kong	51	23
Singapore	39	18
Emerging Asia	41	37
China	39	12
India	45	22
Indonesia	82	78
Korea	57	42
Malaysia	64	55
Philippines	69	68
Taiwan	14	29
Thailand	55	39
EMEA	54	47
Israel	67	20
South Africa	73	71
Hungary	56	49
Poland	24	14
Russia	93	87
Turkey	21	36

Source: Goldman Sachs estimates.

Figure 6: 25 Years of Discount Rates for Global Emerging Markets



	Current Discount Rates	Long-Term Discount Rate	Peak Discount Rate	Trough Discount Rate
GEMS*	14.6	14.9	28.9	11.7
Latin America	15.2	15.5	31.7	12.4
Asia (inc. HK and Sing)	12.7	12.5	26.1	9.7
Emerging Asia	13.9	13.2	28.3	10.0
EMEA	14.6	15.6	18.6	12.5

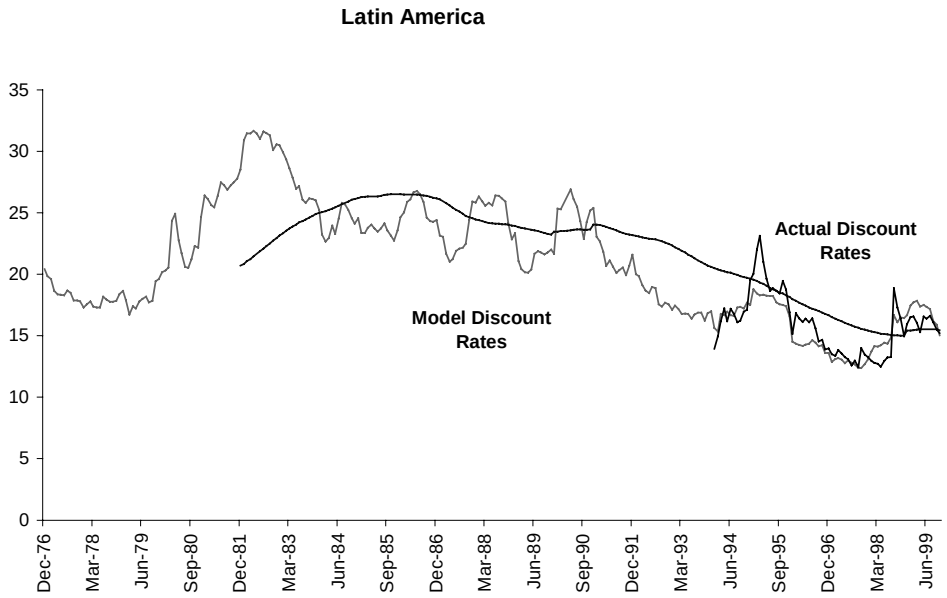
*Weighting is based on the IFCI emerging market indices

Source: Goldman Sachs estimates.

25 Years of Discount Rates for Emerging Markets

- GEMS discount rates have been on a downward trend since the early 1980s, despite the noticeable increase during the period between 1997 and early 1999. Current rates at 14.6% are slightly below their long-term 14.9% rate. The highest rates were recorded in April 1982 around the Mexican default, while the lowest rates are estimated at 11.7% in July 1997, coinciding with the Thai baht devaluation and beginning of the Asia crisis.
- Latin America currently has the highest regional discount rates at 15.2%, compared with 14.6% for EMEA and 13.9% for emerging Asia. Notice Asia's discount rates have historically been the lowest within the emerging markets. While the 1997-1999 crisis homogenized all emerging markets risks, Asian discount rates have declined rapidly since the fourth quarter of 1998.
- Discount rates during the recent crisis reached their highest levels since 1982 in Asia, but as shown in the figure above, GEMs discount rates during the Latin America debt crisis in the early 1980s were nearly twice as high as they are today.

Figure 7: Discount Rates for Latin America



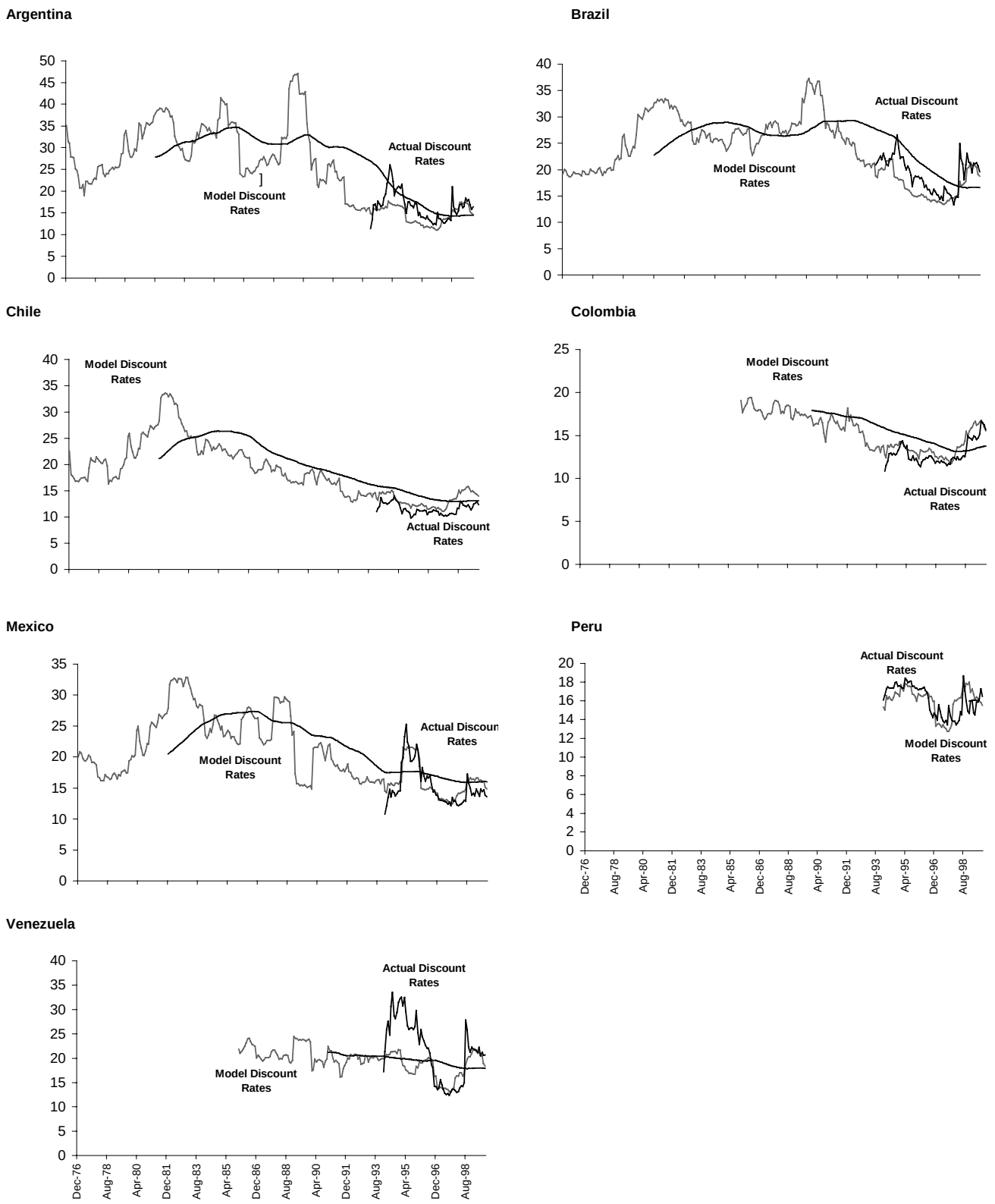
	Current Discount Rates	Long-Term Discount Rate	Peak Discount Rate	Trough Discount Rate
Latin America	15.2	15.5	31.7	12.4
Argentina	16.4	14.5	47.1	11.1
Brazil	18.1	16.5	37.3	13.4
Chile	12.0	13.1	33.7	11.1
Colombia	14.7	13.8	19.4	11.8
Mexico	14.2	16.0	32.9	12.5
Peru	16.6	16.0	18.0	12.7
Venezuela	19.1	17.8	24.5	13.2

Source: Goldman Sachs estimates.

Discount Rates for Latin America

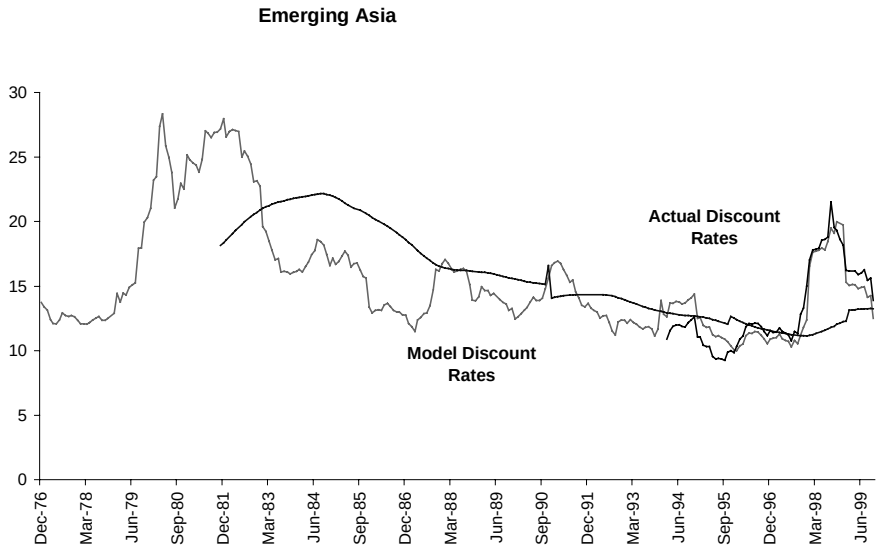
- Latin American discount rates, at 15.2%, have declined significantly from 19% during the Rusian crisis in August last year and 23% during the peak of the Mexican crisis. However, the five-year average of 15.5% is still high as a reflection of these risks.
- Relative to their long-term averages, Argentina and Brazil show the most scope for contraction if rates mean revert. Mexico and Chile have the greatest risk of expanding. While Mexico's fundamentals may appear solid today, the lingering effect of the 1995 crisis still makes the five year average relatively large.
- Although discount rates in the past two years reached high levels relative to the 1990s, these discount rates are well below the peaks reached during the Mexican crisis and the debt crisis of the early 1980s. In Mexico, the peak of 32.9% was reached in April 1982 while peak rates for Brazil are estimated to have occurred in the aftermath of the March 1990 Collor Plan.

Figure 8: Discount Rates for Latin America – Individual Countries



Source: Goldman Sachs estimates.

Figure 9: Discount Rates for Asia



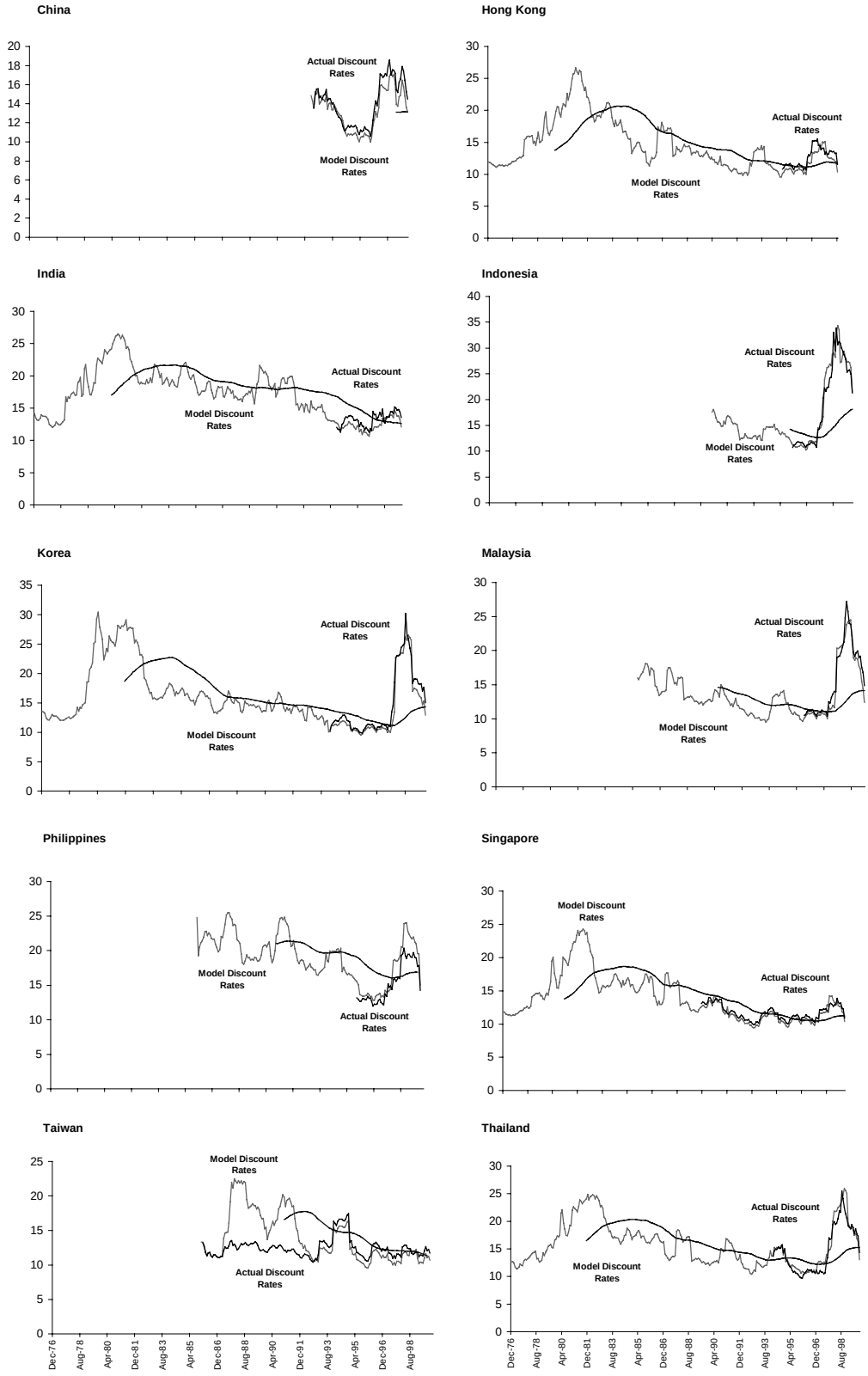
	Current Discount Rates	Long-Term Discount Rate	Peak Discount Rate	Trough Discount Rate
Asia (inc. HK and Sing)	12.7	12.5	26.1	9.7
Hong Kong	11.5	11.7	26.6	9.6
Singapore	10.7	11.2	24.3	9.4
Emerging Asia	13.9	13.2	28.3	10.0
China	14.5	13.1	17.3	10.0
India	13.6	12.7	26.5	10.7
Indonesia	21.3	18.1	34.4	10.2
Korea	15.0	14.3	30.4	9.6
Malaysia	14.9	14.1	24.5	9.5
Philippines	14.3	16.8	25.5	12.8
Taiwan	11.7	11.2	22.5	9.6
Thailand	14.3	15.3	25.9	10.4

Source: Goldman Sachs estimates.

Discount Rates for Asia

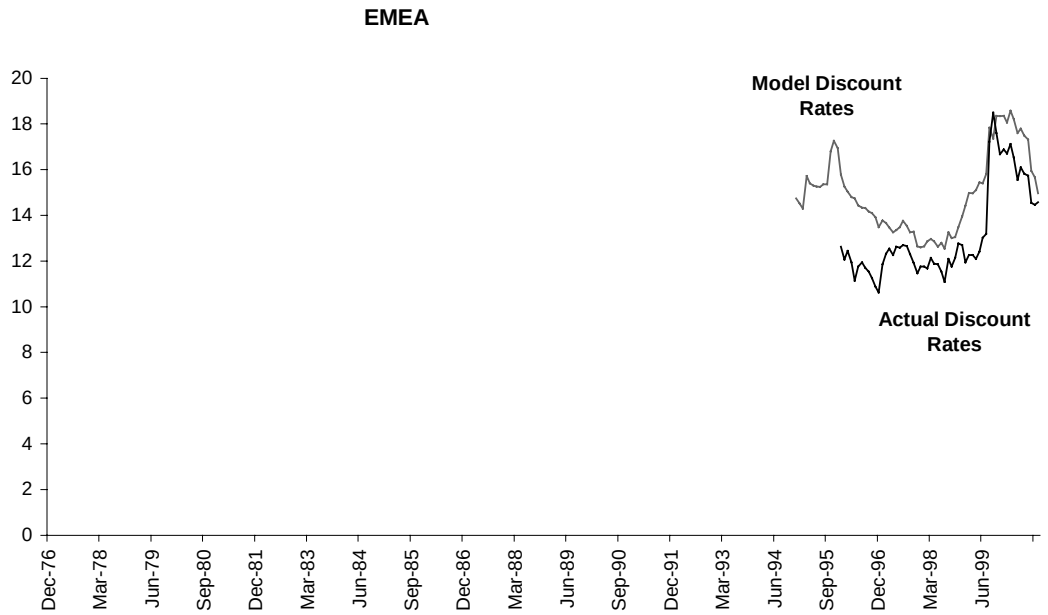
- Emerging Asian discount rates have declined substantially, to 13.9% on October 15, down from their most recent peak of 21.5% at the end of August 1998, but remain above their 10.7% rate in July 1997 (at the time of the Thai baht crisis) and long-term rate of 13.2%.
- Relative to their long-term rates, Indonesia appears to have the most scope for contraction, while the Philippines and Thailand show the greatest risk of increasing if they revert to their long-term average. Discount rates in Indonesia are the highest in the region, while those in Singapore, Hong Kong, and Taiwan are estimated to be the lowest.
- Although Asian discount rates have been very high recently, even higher levels were seen in the early 1980s. This reflects the fact that the emerging Asia index is concentrated in markets such as Korea, as Taiwan was not included until 1986. With inflation averaging 20% between 1975 and 1981 and higher external debt ratios, the Korean market in those days bore more resemblence to Latin America.

Figure 10: Discount Rates for Asia – Individual Countries



Source: Goldman Sachs estimates.

Figure 11: Discount Rates for EMEA



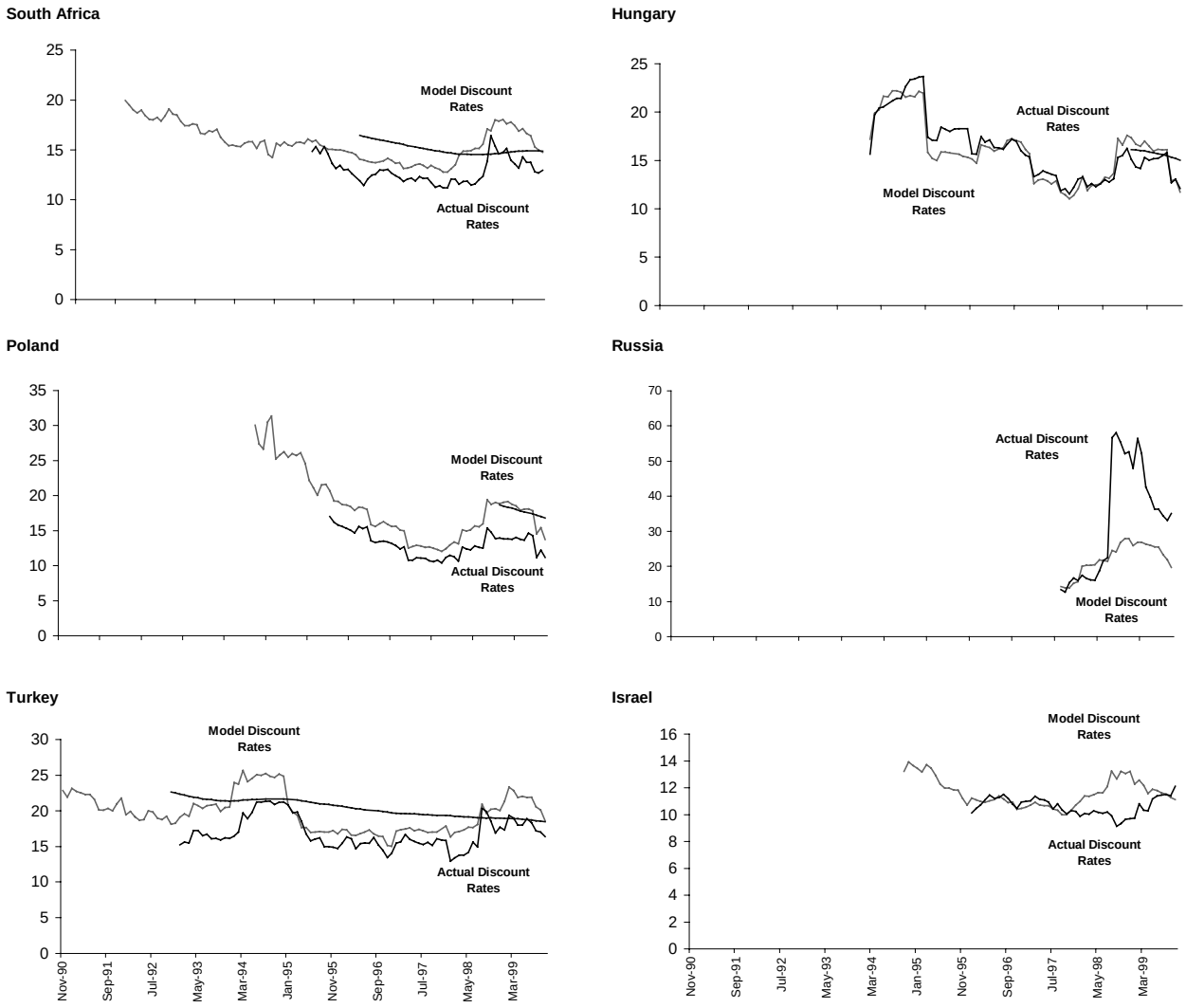
	Current Discount Rates	Long-Term Discount Rate	Peak Discount Rate	Trough Discount Rate
EMEA	14.6	15.6	18.6	12.5
Israel	12.1	11.1	13.9	10.0
South Africa	12.9	14.9	19.9	12.8
Hungary	12.1	15.0	22.2	11.0
Poland	11.2	16.8	31.4	12.0
Russia	35.1	22.2	27.9	13.9
Turkey	16.4	18.5	28.6	15.0

Source: Goldman Sachs estimates.

Discount Rates for EMEA

- EMEA discount rates are down more than 4% to 14.6% from their peak and are now 1.2% below their long-term rate of 15.0%.
- Discount rates in Russia could contract the most in the region if they return to their long-term rates, while discount rates for most of the rest of the region are now below their long-term rates. Current rates in Poland, Hungary, Turkey, and South Africa are all substantially below their long-term averages. Discount rates are currently highest in Russia and Turkey, while those in Poland, Hungary, and Israel are the lowest.
- Although the lack of a longer time series for EMEA limits our perspective relative to the other regions, the near tripling of Russian discount rates during the course of 1998 to 58% would have likely been a historical high even if data were available. The peak rates for Indonesia only reached 34%, while the highest Latin American rates were recorded by Argentina at 47% during 1982.

Figure 12: Discount Rates for EMEA – Individual Countries



Source: Goldman Sachs estimates.

Investment Strategy Implications

By allowing for the decomposition of discount rates into bond and stock market variables, and estimation of their fundamental determinants, **our formulation permits us to simulate emerging market risk sensitivity to changes in these underlying domestic and global fundamental variables**.

We illustrate the usefulness of our approach in investment strategy by determining the upside or downside implied by different assumptions about the drivers of risk in emerging markets. We describe five scenarios.

Scenario I: Rates Implied by Current Global Indicators

First, we determine the market upside if discount rates revert to the implied rates from our model, based on current global indicators shown in Table 5 and 12-month forward measures of our domestic indicators, based on the forecasts of our GEMs economics group in Table 6.

Table 5: Current Global Indicators

Interest Rates	
3 Month Treasury Bill	5.01
10 Year Treasury Bond	6.41
T-Bill - T-Bond Spread	-1.40
U.S. BB Corporate Spreads	259 bp
GSCI	187

We estimate that stock markets in GEMs would rise 5% if discount rates move back to their implied rates, with Asia up 23%, Latin America rising 2%, and EMEA down 4% (see Table 7). The markets with the greatest appreciation would be Russia, Korea, Malaysia, Argentina and Venezuela. The greatest downside would be recorded by Poland, South Africa, Chile, and Turkey if rates reverted back to their implied rates.

Scenario II: Reversion to Long-Term Rates

We have defined the long-term discount rate to be the five-year average of rates implied from the model, with the intuition that the average of fundamentals over the past five years would be a

Table 6: Domestic Economic Indicators and Forecasts

	CPI Inflation (%, e.o.p.)			Real GDP Growth (% of GDP)			Net Debt/ Exports	GDP Per Capita	Default
	1998E	1999F	2000F	1998E	1999F	2000F	1999	2000	Indicator
Latin America									
Argentina	0.7	-1.7	-0.2	3.9	-2.7	5.2	4.2	8,131	1
Brazil	-1.8	8.5	7.0	0.0	-1.0	3.0	3.2	2,993	1
Chile	4.7	2.8	3.5	3.4	-0.6	5.5	1.2	4,612	0
Colombia	16.7	10.0	10.0	0.6	-4.5	2.0	2.1	2,508	0
Mexico	18.6	13.5	10.0	4.8	3.0	4.0	1.0	4,794	1
Peru	6.0	4.0	4.5	0.3	2.3	5.0	2.8	2,344	1
Venezuela	29.9	23.0	30.0	-0.7	-6.0	2.5	1.0	4,336	1
Asia (inc. HK and Sing)									
Hong Kong	-1.4	-0.5	3.0	-5.1	0.6	2.8	N/A	22,597	0
Singapore	-1.5	1.7	0.8	0.3	4.0	4.8	N/A	23,380	0
Emerging Asia									
China	-0.8	-1.5	0.5	7.8	7.3	7.6	0.0	932	0
India	4.9	2.0	4.0	6.0	5.8	5.8	1.2	427	0
Indonesia	77.6	6.2	16.1	-13.4	-1.7	2.5	1.6	833	1
Korea	4.0	2.1	2.5	-5.8	8.0	6.0	0.4	10,370	0
Malaysia	5.3	2.4	3.4	-7.5	5.2	5.0	0.1	3,617	0
Philippines	10.3	5.0	6.4	-0.5	3.0	4.0	1.1	1,055	1
Taiwan	2.1	0.6	2.0	4.7	5.3	5.5	-0.6	13,877	0
Thailand	4.3	0.3	2.5	-9.4	3.7	4.0	1.0	2,121	0
EMEA									
Israel	8.6	3.0	3.8	2.0	2.2	3.4	1.2	15,426	0
South Africa	9.0	3.5	5.0	0.5	1.0	2.6	1.0	2,954	0
Hungary	10.3	11.8	9.0	5.1	4.5	4.0	0.7	5,677	0
Poland	8.6	7.9	6.5	4.8	3.0	4.5	0.3	4,387	1
Russia	84.4	47.0	35.0	-4.3	1.1	2.3	2.0	1,497	1
Turkey	69.7	65.0	45.0	3.8	-3.3	1.7	2.6	3,046	1

Source: Goldman Sachs Economics Group.

good representation of the future.

We estimate that stock prices in emerging markets would decline 3% under the scenario that discount rates move back to their long-term rates. Asian markets would perform the best, rising 10%, while Latin America would decline 3% and EMEA would fall 12%.

The strongest performers globally among emerging markets in a long-term mean reversion scenario would be Russia, Indonesia, and Argentina. Markets that would show the most downside in such a scenario are Poland, Hungary, the Philippines, and Mexico.

One could argue that fundamentals in these markets have improved relative to the past five years. However, we find similar ranking of top market performers under both scenarios, with an 89% correlation between the market upside based on our long-term rates and implied current rates.

Table 8: Optimistic Scenario

	Optimistic	Current
Interest Rates		
3 Month Treasury Bill	4.20	5.01
10 Year Treasury Bond	5.00	6.41
T-Bill - T-Bond Spread	-0.80	-1.40
U.S. BB Corporate Spreads (bp)	185	259
GSCI	225	187

Source: Goldman Sachs.

Scenarios III, IV, and V: Optimistic, Pessimistic and Current Global Assumptions

To illustrate the sensitivity of the model to global risk indicators, we pose optimistic and pessimistic global scenarios, along with the implications of our current global forecasts.

Table 7: Investment Implications of Different Scenarios

	Current Discount Rate	Implied Discount Rate	Long-Term Discount Rate	Based on Global Scenarios: Optimistic Scenario	Pessimistic Scenario	Current Forecasts	Market Upside Based on: Implied Rate	Long-Term Rate	Market Upside Based on Global Scenarios: Optimistic Scenario	Pessimistic Scenario	GS Forecasts
Emerging Markets	14.6	14.3	14.9	11.5	17.0	13.2	5	-3	54	-27	16
Latin America	15.2	15.0	15.5	11.4	17.9	13.6	2	-3	71	-28	22
Argentina	16.4	14.6	14.5	10.8	17.2	12.9	24	26	79	-26	26
Brazil	18.1	16.5	16.5	12.8	19.3	15.0	20	19	63	-25	20
Chile	12.0	13.7	13.1	10.0	16.5	12.2	-23	-16	86	-30	26
Colombia	14.7	14.0	13.8	10.3	16.8	12.5	10	13	81	-29	24
Mexico	14.2	14.7	16.0	11.2	17.7	13.4	-7	-21	70	-29	20
Peru	16.6	15.3	16.0	11.7	18.2	13.9	17	7	68	-28	20
Venezuela	19.1	16.4	17.8	12.6	19.1	14.8	29	13	58	-22	20
Asia (inc. HK and Sing)	12.7	11.6	12.5	10.4	13.7	11.3	20	3	23	-27	5
Hong Kong	11.5	10.4	11.7	9.4	12.8	10.2	22	-3	22	-33	4
Singapore	10.7	10.4	11.2	9.4	11.2	10.2	5	-10	22	-13	4
Emerging Asia	13.9	12.5	13.2	11.2	14.7	12.1	23	10	24	-25	6
China	14.5	13.1	13.1	12.1	15.1	12.9	20	20	16	-23	3
India	13.6	12.1	12.7	9.4	15.1	10.8	24	14	64	-34	25
Indonesia	21.3	21.5	18.1	18.0	24.5	20.2	-2	33	37	-20	12
Korea	15.0	12.9	14.3	11.9	15.2	12.7	33	9	17	-27	3
Malaysia	14.9	12.4	14.1	11.4	15.3	12.2	41	10	18	-32	4
Philippines	14.3	15.0	16.8	11.5	18.0	13.7	-9	-26	65	-28	19
Taiwan	11.7	10.7	11.2	9.7	12.3	10.5	19	10	21	-23	4
Thailand	14.3	13.1	15.3	11.3	16.3	12.1	19	-11	32	-34	16
EMEA	14.6	15.0	15.6	11.7	17.9	13.6	-4	-12	60	-29	19
Israel	12.1	11.1	11.1	9.4	14.1	10.2	18	18	38	-37	18
South Africa	12.9	14.8	14.9	11.2	17.7	13.4	-22	-23	69	-28	20
Hungary	12.1	11.7	15.0	9.4	14.9	10.6	7	-33	54	-36	22
Poland	11.2	13.7	16.8	10.3	16.7	12.4	-32	-54	74	-31	20
Russia	35.1	19.7	22.2	16.2	22.7	18.4	161	112	42	-22	13
Turkey	16.4	18.6	18.5	15.0	21.4	17.1	-21	-19	49	-22	16

Source: Goldman Sachs estimates.

In an optimistic scenario shown in Table 8, U.S. interest rates would decline from 6.4% currently to 5.4% in 12 months as inflation fears subside, Y2K fears pass, and movements in the U.S. dollar do not undermine falling interest rates. Declining risk aversion in the U.S. would lead to a 75bp decline in BB corporate bond spreads to 185bp over Treasuries, and the commodity price rally would continue, reflected in a 20% rise in the GSCI index to 225.

Emerging markets would appreciate 54% under our optimistic scenario, with Latin American markets the most leveraged, in part because of higher discount rates in the region and thus further potential for contraction in these rates. Latin America could increase 71%, while EMEA would rise 60% and emerging Asia would record a 24% return.

Table 9: Pessimistic Scenario

	Pessimistic	Current
Interest Rates		
3 Month Treasury Bill	6.20	5.01
10 Year Treasury Bond	7.00	6.41
T-Bill - T-Bond Spread	-0.80	-1.40
U.S. BB Corporate Spreads (bp)	335	259
GSCI	150	187

Source: Goldman Sachs.

Under our pessimistic scenario shown in Table 9, U.S. inflation fears would be realized, with the ten-year Treasury bond increasing to 7.00% and short-term rates rising to 6.2%. U.S. corporate bond spreads would expand 75bp to 335bp over Treasuries if investors become more risk averse in such an environment. Finally, we assume commodity prices decline 20% to 150. Emerging markets would fall 27% in this scenario. All three regions would fall in a range of 25%-29%.

Table 10: Current Global Forecasts

	GS Forecasts	Current
Interest Rates		
3 Month Treasury Bill	5.20	5.01
10 Year Treasury Bond	6.20	6.41
T-Bill - T-Bond Spread	-1.00	-1.40
U.S. BB Corporate Spreads (bp)	235	259
GSCI	209	187

Source: Goldman Sachs.

Finally, we examine the potential upside based on our current global scenario in Table 10. In this view, we see the Fed increasing short-term rates slightly in the next 12 months, although inflation should remain under control. The long-bond yield would fall to 6.2% from 6.4% currently, while the three-month Treasury rate would increase to 5.2% from 5.0%. Commodity prices would increase 12%, and U.S. corporate bond spreads would fall to 235bp over Treasuries.

We estimate that emerging markets would increase 16% under these assumptions. Similar to the optimistic scenario, Latin America would show the greatest appreciation of 22% compared with 19% for EMEA and 5% for emerging Asia.

Conclusions

In this piece we have further extended our previous work on cost of capital in emerging markets, and developed a model of country **discount rate determination based on fundamental domestic and international observable variables**. We have used this model to **recreate history for 23 emerging market countries over the last 25 years.** A high degree of (negative) correlation between the "fabricated" discount rates and the actual behavior of stocks markets suggest that our estimates are an adequate measure of historical risk. Our model permits the generation of **discount rates for any country in the world, even without the existence of a bond market**.

The availability of a long series of discount rates for emerging markets makes it possible to ascertain long-term trends in risk and the cost of capital. The comparison of the long-term with current discount rates provided by **our methodology bridges the gap between the investment decision in plant and equipment and portfolio investment.** Also, by providing a historical valuation benchmark for risk today, **our methodology flips the investment decision on its head**. Abnormally, high discount rates (relative to history) are a *buy* signal, while contemporaneous discount rates that appear too low relative to history are a *sell* signal. Finally, **by providing a decomposition of risk into fundamental domestic and global drivers, the model is useful in investment strategy applications.** We have illustrated this use in our section on alternative scenarios.

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