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# Investment Research

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## The Valuation of Mexican Stocks:

*An Extension of the Capital  
Asset Pricing Model to  
Emerging Markets*

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### Our Methodology Provides:

- A Link Between Emerging Debt and Emerging Equity
- A Framework to Estimate Country Risk-Adjusted P/Es

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### Its Application Suggests:

- Mexican Stocks Provide a Good Diversification Option for U.S. Investors
  - Given Country Risk and Volatility, the Bolsa Is Significantly Undervalued
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Table of Contents	Introduction	1
	I. The Basic Capital Asset Pricing Model (CAPM) and the Dividend Discount Model (DDM)	2
	II. An Application of the Capital Asset Pricing Model to Mexico	4
	A. Mexican Sovereign Risk-Adjusted Rate	4
	B. The Equity-Risk Premium for Mexican Stocks	5
	Completely Integrated Market	5
	Completely Segmented Market	6
	Is the Mexican Market Segmented or Integrated?	7
	C. The CAPM Applied to Mexico	7
	III. Computations	8
	Standard Deviations and the Equity-Risk Premium	8
	The Current Valuation of the Mexican Market	9
	Effects of Volatility and Country-Risk on the P/E	10
	Double Counting	11
	Empirical Verification of the Model's Consistency:	11
	The Bolsa's Summer of 1992 Correction	
	Cetes Rates and the Bolsa	12
	A Word on the BETA of the Mexican Market	14
	Conclusion	15
	References	16

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- **Using Mexican Fixed Income Spreads and Stock Market Volatility, We Calculate Country Risk-Adjusted P/E Ratios**
- **Our Calculations Result in an Equity-Risk Premium for the Mexican Bolsa of 5.1%**
- **Using the Yield of the Mexican Par Bond, the Bolsa is Currently 27% Undervalued**
- **Our Methodology Can Be Applied to Any Country, Industry, or Individual Stock**

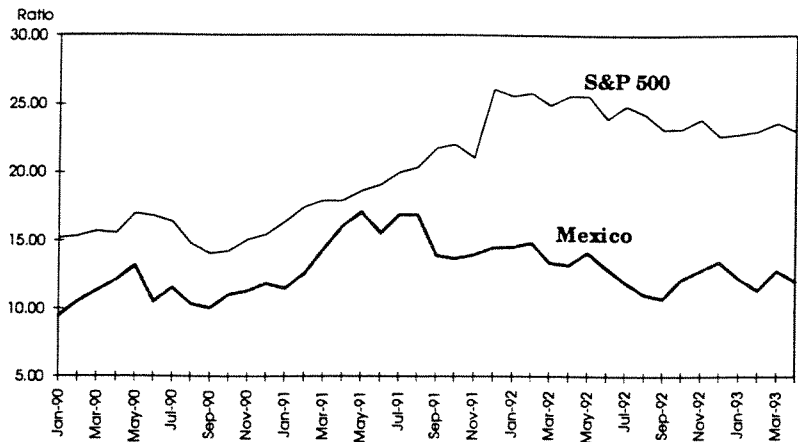
## Introduction

When compared with U.S. corporations, listed Mexican company stocks tend to exhibit faster earnings growth than their U.S. counterparts. Logic would suggest that, all other things being equal, Mexican stocks should trade at a premium to U.S. stocks. However, other things are not equal, and despite their superior earnings growth over the past few years, Mexican stock valuations have been considerably below those of U.S. stocks (see Figure 1). The significantly higher underlying risk typically associated with emerging markets like the Mexican Bolsa can be suggested as an explanation for this phenomenon. The additional underlying risk may be reflected in a greater degree of price volatility, which is the consequence of lower levels of market liquidity as well as more unstable economic and political environments. Accounting differences between the United States and Mexico play a relatively minor role.

The difficulty in assessing the appropriate discount rate for these "emerging market risks" precludes an answer to the following question: Given the Mexican market's expected trend earnings growth rate and the current level of interest rates of alternative Mexican fixed income instruments, are Mexican equities undervalued or overvalued? In this report, we develop a methodology that may be used to systematically measure an emerging market's valuation from the point of view of a U.S. investor. The proposed methodology involves a simple extension of the concepts of the traditional capital asset pricing model (CAPM) and the dividend discount model (DDM). While we have chosen to apply it to the Mexican market, this methodology could be extended to any international market, industry, or particular stock.

Figure 1

**Price-Earnings Ratio: Mexico IPC versus S&P 500(a)**



(a) Based on reported earnings per share.

**I. The Basic Capital Asset Pricing Model (CAPM) and the Dividend Discount Model (DDM)**

In determining the appropriate discount rate for an equity investment, the CAPM employs two main concepts: (1) a proxy for the risk-free rate of return (for example, a five-year U.S. Treasury Bond) and (2) an equities market risk premium. The basic expression of the CAPM relation can be seen in equation 1, which defines the minimum return, R, required by an equity investor to purchase equities instead of safer (relatively riskless) debt investments.

Equation 1

$$R = R_f + \beta (R_m - R_f)$$

Above, R is the required rate of return,  $R_f$  is the risk-free rate,  $\beta$  is the beta of a stock,  $R_m$  is the historical total return of the market (e.g., the S&P 500 index). The difference between the historical total return of the market,  $R_m$ , and the risk-free rate, according to the CAPM theory, is justified by the additional risk incurred in buying stocks (equity-risk premium).

In its most basic form, the DDM defines the price of a stock as a function of a company's expected dividends, expected trend earnings/dividends growth rate, and a risk-adjusted discount rate. A basic DDM is shown in equation 2, where we have divided both sides of the equation by the prospective 1993

earnings per share "E" in order to calculate a "fair value" P/E. In this analysis, we use a five-year time horizon model.

Equation 2

$$P/E = \left\{ \frac{D}{(1+R)} + \frac{D(1+g)}{(1+R)^2} + \frac{D(1+g)^2}{(1+R)^3} + \frac{D(1+g)^3}{(1+R)^4} + \frac{D(1+g)^4}{(1+R)^5} + \frac{P_5}{(1+R)^5} \right\} (1/E)$$

$$\text{where, } P_5 = \frac{D_5}{R} + \frac{\frac{ROE}{R} (RE_5)}{\frac{R}{(1+g)}}$$

and  $ROE = \frac{g}{1 - PO}$  represents the sustainable rate of return on equity; P/E is the justifiable price earnings multiple on prospective 1993 earnings; E is the prospective 1993 earnings in nominal dollar terms; D is the estimated trend dividend per share in 1993; ( $D = E * PO$ ), where PO is the estimated five-year average payout ratio;  $D_5$  is the estimated dividend per share five years forward; R is the required rate (risk-free rate plus equity-risk premium); g is the five-year trend earnings growth rate (nominal dollar terms);  $P_5$  is the theoretical share price five years forward;  $RE_5$  is the estimated retained earnings per share five years forward.

The expression for  $P_5$ , above, states that the price five years forward ( $t=5$ ) is a function of (1) the contribution to price from the current dividends capitalized by the investor's required rate of return, and (2) the contribution to price deriving from the profitable retention of earnings that will generate future dividend payments. (see the January 1978 *Risk, Return, and Equity Valuation*).<sup>1</sup>

Substituting  $P_5$  into the equation for P/E, and expressing the equation in the form of an "n-year" time horizon, we obtain the basic DDM as reproduced in equation 2a on the next page.

<sup>1</sup> The expression for  $P_5$  is obtained by evaluating the following integral between  $t = 5$  and infinity, and by then dividing the second term by  $(1+g)$  to express the level of estimated retained earnings in terms of the sixth year rather than the fifth year.

$$P_5 = \int_5^{\infty} (D_5)(e^{-rt}) dt + (ROE)(RE_5) \int_5^{\infty} (t)(e^{-rt}) dt$$

Equation 2a

$$P/E = \left\{ \sum_{i=1}^n D_i / (1 + R_{mex})^i + \left[ (D_0 / R_{mex}) + \frac{\left( \frac{ROE}{R_{mex}} \right) (RE_0)}{(1 + g)} \right] / (1 + R_{mex})^n \right\} / E$$

## II. An Application of the Capital Asset Pricing Model to Mexico

Extending the above concepts to the Mexican stock market requires the assessment of two key variables: the Mexican risk-free rate (in nominal dollar terms) and the equity-risk premium of Mexican stocks.

### A. Mexican Sovereign Risk-Adjusted Rate

Mexican fixed income instruments, even those with minimal default risk, have historically carried a greater dollar yield (or have sold at a greater discount) than U.S. debt instruments of equivalent maturities. The yield spread between dollar-denominated Mexican debt securities and analogous U.S. government instruments provides a "crude" measure of the notion of country or sovereign risk. We regard this as a "crude" measure because the yield differential between the two countries is also likely to be influenced by other exogenous factors (e.g., market liquidity, seasonality, and differences in legal frameworks). The spread between the yields of the U.S. 30-year Treasury bond and the Mexican 30-year (Brady) dollar-denominated par bond has averaged about 300 basis points over the past three years (see Figure 2). There are other types of fixed income Mexican instruments that could be used as viable candidates for a risk-free rate. For example, dollar-denominated bonds, such as so-called Yankee bonds, are the full obligation of the Mexican government and therefore can be considered the "safest" Mexican debt investments.

The selection of an appropriate Mexican risk-free rate is key to our analysis. We believe that government bonds provide the closest approximation to Mexican sovereign risk, even if some bonds issued by Mexican companies could, in theory, represent safer investments. Under both Moody's and Standard and Poor's credit rating systems, the sovereign credit rating of a country is used as the ceiling for corporate ratings in that country. For example, Moody's Investors Services rates Mexican sovereign Eurobonds as BA2 and Brady bonds as BA3. Standard and Poor's rates all Mexican sovereign debt as BB+. No corporate bond of Mexico, denominated in currencies other than pesos, has received a better credit rating than Mexican sovereign debt.

If we define the Mexican risk-free rate as the sum of the U.S. risk-free rate plus an appropriate country-risk spread, we obtain

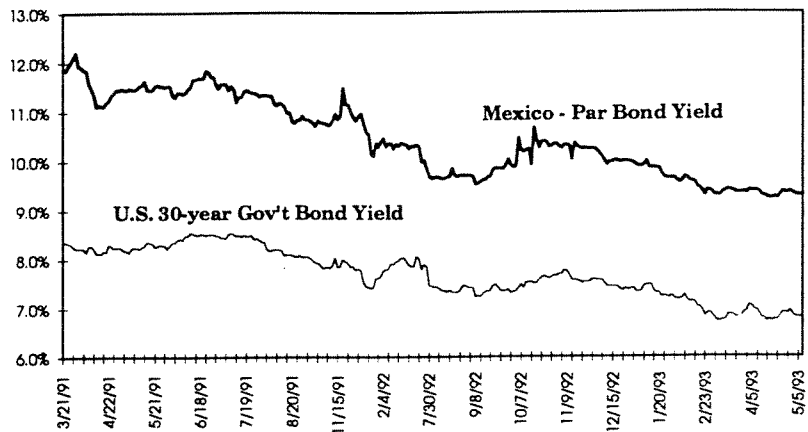
Equation 3

$$R_{f,mex} = R_{f,usa} + C_s$$

where  $R_{f,mex}$  is the Mexican risk-free rate,  $R_{f,usa}$  is the U.S. risk-free rate, and  $C_s$  is the country-risk spread.

Figure 2

**Yield Spread Between the United States and Mexico**



Applying the basic definition of the CAPM (from equation 1), we define the total required rate of return for Mexico,  $R_{mex}$ , as the sum of the Mexican risk-free rate,  $R_{f,mex}$ , plus the Mexican equity-risk premium,  $R_{p,mex}$ , as shown below:

Equation 4

$$R_{mex} = R_{f,mex} + R_{p,mex}$$

**B. The Equity-Risk Premium for Mexican Stocks**

The assessment of a Mexican equity-risk premium depends on the determination of whether the Mexican market is fully integrated or fully segmented in relation to the U.S. market.

*Completely Integrated Market*

In a fully integrated world setting, each national market is assumed to be part of a single world capital market. In the U.S./Mexico case, we interpret the world market as consisting of two countries. In this context, the Bolsa is not conceptually different from any stock in the U.S./Mexico world market, and its equity-risk premium can be measured by the product of the

Bolsa 2.3% of  
USD Stock Exchange  
Market Capitalization.

Mexican market beta (relative to the two-country market) and the equity-risk premium of this two-country world portfolio. However, given that the market capitalization of the Mexican Bolsa is only 2%-3% of the U.S. market capitalization, the U.S. market can be used as a good approximation for this two-country world market. (see equation 5). The beta can be estimated, for example, by regressing the index of the Mexican stock market against the S&P 500 index. A discussion on beta and some estimates for the Mexican market is presented on pages 14 and 15.

Equation 5

$$R_{p,mex} = [ (\beta_{mex})(R_{p,usa}) ],$$

where  $R_{p,usa}$  is the S&P 500 equity-risk premium. Substituting equations 3 and 5 into equation 4 results in a CAPM for Mexico, under the assumption of full integration, as shown in equation 6:

Equation 6

$$R_{mex} = R_{f,usa} + C_s + [ (\beta_{mex})(R_{p,usa}) ]$$

Under the assumption of full integration, equation 6 defines the required rate of return for Mexico,  $R_{mex}$ , as the sum of the U.S. risk-free rate,  $R_{f,usa}$ , a country-risk spread,  $C_s$ , plus the U.S. equity-risk premium,  $R_{p,usa}$ , adjusted by the Mexican market beta, represented by  $\beta_{mex}$ .

Completely Segmented Market

Under the segmented market assumption, expected market returns mostly reflect domestic factors inherent to that market. Segmentation implies that investors (individuals and institutions) in each national market are largely different from those of other countries. In other words, investors do not have sizable cross-border exposures and tend to exhibit a "home-bias."<sup>2</sup> If segmentation exists, there is likely to be a large component of the volatility of one country that is diversifiable from the point of view of the other country. In this case, the adjustment factor for the risk of the Mexican market is better captured by the ratio of the standard deviations of the Mexican market over the U.S. market, as shown in equation 7, where  $R_{p,mex}$  is the Mexican equity-risk premium,  $S_{mex}$  is the standard deviation of the Mexican market,  $S_{usa}$  is the standard deviation of the U.S. market and  $R_{p,usa}$  is the U.S. equity-risk premium.

Equation 7

$$R_{p,mex} = [ (S_{mex}/S_{usa})(R_{p,usa}) ]$$

<sup>2</sup> For a discussion on the "home-bias" effect found in international asset allocation, see Fischer Black, "Global Reach", *Risk Magazine* (December 1992).



By substituting equations 3 and 7 into equation 4, we obtain a CAPM for Mexico as shown by equation 8.

Equation 8

$$R_{\text{mex}} = R_{f,\text{usa}} + C_s + [(S_{\text{mex}}/S_{\text{usa}}) (R_{p,\text{usa}})]$$

Under the assumption of full segmentation, equation 8 defines the required rate of return for Mexico,  $R_{\text{mex}}$ , as the sum of the U.S. risk-free rate,  $R_{f,\text{usa}}$ , a country-risk spread,  $C_s$ , and the U.S. equity-risk premium,  $R_{p,\text{usa}}$ , adjusted by the relative standard deviations of the two markets,  $S_{\text{mex}}/S_{\text{usa}}$ .

*Is the Mexican Market  
Segmented or Integrated?*

In reality, most international stock markets exhibit characteristics of both integration and segmentation. More "isolated" markets tend to possess segmentation properties and other markets, particularly those forming part of an economic bloc, tend to exhibit integration traits. While there exists no true way of testing markets for segmentation and integration traits, there are some "crude" tests which can be performed. We applied several such tests on the Mexican Bolsa. Unfortunately, our results proved inconclusive.<sup>3</sup>

However, intuition and common sense support our view that the Mexican market more reflects features of a segmented market rather than an integrated market since most U.S. investors tend to invest in U.S. equities, while most Mexicans tend to invest a large portion of their holdings domestically (home-bias). Currently, of the Mexican market's total capitalization of \$130 billion, only about \$30 billion worth of Mexican equities is held by foreign investors (mostly from the United States). On the other hand, Mexican investors hold an insignificant portion of their portfolios in U.S. stocks at the present time.

*Mexican Market Total  
Capitalization of \$130 billion*

C. The CAPM  
Applied to Mexico

Assuming for the purposes of the remainder of this analysis that the Mexican market is fundamentally segmented, the P/E valuation model for the Mexican market is summarized by equations 2a and 8, reproduced on the next page.

<sup>3</sup>We tested the Mexican market for integration and segmentation properties during two periods: (1) January 2, 1991 to May 31, 1993 (daily data) and (2) January 1986 to May 1993 (monthly data). We used a method suggested by Sushil Wadhvani. For these two periods, we ran regression models to test for the statistical significance of the coefficients of the beta (indicative of an integrated market) and of a volatility measure such as the 30-day moving average of the variance of daily returns (representative of domestic risk for segmented markets). In an integrated market, beta is the "sole" risk factor. On the other hand, domestic risk factors (e.g., volatility) are more important in segmented markets. Unfortunately, for both time periods, our statistical tests proved inconclusive. The lack of reliable data for long periods of time may have biased our results.

Equation 2a

$$P/E = \left\{ \sum_{t=1}^n D_t / (1+R_{mex})^t + \left[ \left( \frac{D_n}{R_{mex}} + \frac{\left( \frac{ROE}{R_{mex}} \right) (RE_n)}{R_{mex}} \right) / (1+R_{mex})^n \right] \right\} / E$$

Equation 8

$$R_{mex} = R_{f,usa} + C_s + [(S_{mex}/S_{usa}) (R_{p,usa})]$$

The above two expressions represent the basic framework for assessing the market's valuation. In the following section, we estimate and provide values for the parameters of the above equations in order to calculate the Mexican market "fair value" P/E under different Mexican country-risk assumptions.

### III. Computations

Standard Deviations  
and the Equity-Risk Premium

The relative volatility between the Mexican and U.S. stock markets can be approximated by the ratio of the standard deviation of the daily dollar returns for Mexico relative to that of the S&P 500, expressed as  $S_{mex}/S_{usa}$ , multiplied by our Portfolio Strategy Group's equity-risk premium estimate of 3% for the U.S. market (See Table 1).

Table 1

#### Standard Deviations and Equity-Risk Premiums<sup>4</sup>

	1/2/91 to 5/31/93	1/2/93 to 5/31/93	1992	1991
<b>Standard Deviations</b>				
Mexican IPC Index ( $S_{mex}$ )	2.43	2.38	2.60	2.31
S&P 500 Index ( $S_{usa}$ )	1.43	1.10	1.24	1.61
( $S_{mex}/S_{usa}$ )	1.70	2.15	2.10	1.40
<b>Mexican Equity-Risk Premium(a)</b>				
$R_{p,mex} = (S_{mex}/S_{usa})(R_{p,usa})$	5.10	6.50	6.30	4.20

(a) Assuming an equity-risk premium of 3% for the S&P 500.

<sup>4</sup>As proposed to us by Fischer Black, we calculated the standard deviations of the Mexican market " $S_{mex}$ " and those of the S&P 500 " $S_{usa}$ " for the above periods by adjusting for serial correlations in the daily returns. Under this methodology, the "true" one-day variance,  $\sigma^2$ , is defined as  $\sigma^2 = \sigma_{11} + 2\sum \sigma_{1i}$  where  $\sigma_{11}$  is the one-day variance,  $\sigma_{1i}$  is the serial covariance between the market return and the return lagged "i-1" times. The standard deviation is the square-root of  $\sigma^2$ . For our calculations,  $i=2$ , which indicates that we used a one-day lag for the daily returns.

The Current Valuation  
of the Mexican Market

Using the Mexican equity-risk premium of 5.1% obtained for the 1991-1993 period, we calculate the market's "fair value" P/E based on an estimated 1993 dividend payout ratio of 25%, different earnings growth rate assumptions, and alternative nominal Mexican interest rates (in dollars) as approximations for the Mexican risk-free rate. Our results are shown below in Table 2. The range of earnings growth rates employed is built around our current five-year nominal growth rate for Mexican corporate earnings of 17.5%.<sup>5</sup> The 6.50% equity-risk premium obtained for the 1993 year-to-date period was not used in our calculations because we believe this volatile period does not accurately reflect the Bolsa's behavior over the last few years.

To provide a clearer idea of the basic workings of our methodology, consider that if we assume that the 9.3% yield (in dollars) of the Mexican par bond is an appropriate benchmark for a Mexican risk-free rate, and given that the U.S. 30-year Treasury Bond yields 6.9%, if we apply our calculated Mexican equity-risk premium of 5.1%, a U.S. investor would require about 750 basis points in extra compensation for investing in Mexican stocks rather than in the 30-year U.S., currently yielding 6.9%. Of the 750-basis-point differential, about 240 basis points come from the additional country risk (measured by the spread between the Mexican par bond and the 30-year U.S. bond) and 510 basis points come from the Mexican equity-risk premium.

Table 2

**Fair Value P/Es under Alternative  
Interest Rate and EPS Growth Scenarios**

(assuming the Mexican market is completely segmented)

Five-Year Trend EPS Growth	Risk - Free Rate			
	8.30 (a)	8.60 (b)	9.30 (c)	11.80 (d)
15.5%	12.7X	12.1X	10.8X	7.6X
16.5	13.9	13.2	11.8	8.3
17.5	15.1	14.4	12.9	9.0
18.5	16.5	15.7	14.0	9.7
19.5	17.9	17.0	15.1	10.5

(a) Grupo Televisa 5-year dollar bond yield.

(b) 10-year Mexican Yankee dollar bond yield.

(c) 30-year Mexican par bond yield in dollars.

(d) one-year CETES peso rate adjusted for an estimated 4.6% peso devaluation in 1993.

<sup>5</sup> The use of a nominal dollar growth rate in earnings as opposed to a real peso growth rate is required to maintain internal consistency in our five-year model.

We compare the resulting "fair value" P/E's calculated under different interest rate assumptions, as shown in Table 2, with the current estimated 1993 P/E for the Mexican bolsa of 9.4 (assumptions on EPS growth and dividend payout ratios used are shown below in Table 3). Using our current five-year trend earnings growth rate of 17.5% (in nominal dollar terms) for Mexican stocks, the Bolsa appears to be undervalued by as much as 38% (the fair value P/E obtained by using a yield of 8.3% paid by Grupo Televisa Eurobonds and an EPS growth of 17.5%, is 15.1 times). The exception occurs under the one-year Mexican Treasury bill (Cetes) rate adjusted for expected currency devaluation, where a slight 4.4% overvaluation occurs. If we use the 30-year Mexican par bond yield, the Mexican Bolsa is currently 27% undervalued.

**Table 3****Current Estimates for the Mexican Market (5/31/93):**

P/E	
1993	9.4X
1994	7.5
5-Year Trend in Earnings Growth	17.5%
5-Year Average Dividend Payout Ratio	25
Equity-Risk Premium	5.1

**Effects of Volatility and  
Country Risk on the P/E**

Given that the Mexican market's additional country risk and volatility imply a discount to its P/E, we now attempt to separate that portion of the discount that is related to a higher risk-free rate (country risk) from that portion associated with greater price volatility. In Table 4, column III, we compute the "fair value" P/E by keeping the Mexican risk-free rate of 9.3% constant, while first using the U.S. equity-risk premium and then the Mexican equity-risk premium. This analysis suggests that the additional volatility of the Mexican market results in approximately a 30% discount (the value of the difference, 5.5 times, divided by 18.4 times) from the P/E multiple that would exist if, other things being equal, the Mexican Bolsa had an equity-risk premium equal to that of the U.S. market. Alternatively, in Table 4, Row II, we compute "fair value" P/E's by holding constant the Mexican market equity-risk premium and varying the risk-free rate. This computation suggests that Mexico's sovereign risk implies a market multiple discount of about 34% (6.5/19.4) from the fair value P/E that would prevail in Mexico if the market's risk-free rate were that of the U.S. market's.

Table 4

**Effects of Volatility and Sovereign Risk on the P/E(a)**

	I Equity-Risk Premium	II U.S. risk-free rate (6.9%)	III Mexican risk- free rate (9.3%)	IV Difference
I	U.S. (3%)	29.9X	18.4X	--
II	Mexico (5.1%)	19.4	12.9	6.5X
III	Difference	-	5.5X	

(a) Based on a five-year trend earnings growth rate of 17.5% (nominal dollar terms), average dividend payout ratio of 25%, and the nominal yield of the Mexican par-bond yield as the Mexican risk-free rate. The U.S. risk-free rate used is the 30-year government bond yield.

*Double Counting*

In the course of this discussion, we have assumed that country risk and volatility are separate and exclusive factors that explain the inherent P/E discount found in the Mexican market. However, it is likely that the country-risk spread for Mexico partially reflects events or factors that cause some volatility in the equities market. Likewise, it is likely that the market's equity-risk premium encompasses a measure of country risk, and not just the volatility caused by low market liquidity and other technical factors. In Table 4, evidence of double counting in our methodology surfaces since the sum of the two *separate* effects, volatility and country risk, is less than the effect of the two factors *combined* (17 times is the difference obtained from subtracting the "fair value" Mexican P/E of 12.9 from the P/E ratio of 29.9 obtained using the U.S. risk-free rate and the U.S. equity-risk premium). This amount is 5 points more than 12 times (obtained by the sum of the separate contribution to discount by country risk, 5.5, and the volatility, 6.5). Even though we acknowledge that the DDM is a non-linear relationship, we believe part of the discrepancy stems from pure "double counting". This double counting can be measured by the covariance of the country risk-adjusted risk-free rate and the equity-risk premium (this subject will be explored in a later report). The acknowledgment of a measure of double counting in our methodology suggests that we are overestimating the required rate of return for Mexico and, thus, underestimating its "fair-value" P/E, which implies that our methodology is somewhat conservative.

Empirical Verification  
of the Model's Consistency:  
*The Bolsa's Summer of 1992  
Correction*

A true empirical application of our methodology would require adjustments to the model in several areas. For instance, the equity-risk premium is not constant or static over time and has been shown to have an inverse relationship with the level of real interest rates (see the March 1990 *The Perplexing Issue of Valuation*). We do not test the accuracy of the model

empirically in this paper but, instead, opt to test its structural consistency by applying it to an actual event, such as the Bolsa's 1992 summer correction.

The 1992 peak of the Bolsa Mexicana de Valores occurred on June 1, 1992, when the IPC Index closed at 1,907. However, this level proved to be unsustainable as stock prices came under pressure when uncertainty regarding NAFTA escalated under the attacks of then-presidential candidate Ross Perot and as the popularity of Bill Clinton rose against that of George Bush. In an attempt to prevent a shortage of foreign capital flows into Mexico, the Mexican government promoted a policy of high interest rates.

Table 5

### Relative Mexican Market Valuations for Selected Periods in 1992 and Currently

Critical Date	Bolsa Index	91-Day Cetes Rate in U.S. \$ (a)	Critical Date P/E (b)	Fair-Value P/E (c)	Valuation	Ensuing Market Response (d)
Jun-1-92	1,907	14.9% (Sep-21-92)	13.7X	7.9X	Over (73%)	34% drop
Sep-25-92	1,252	11.9 (Dec-10-92)	9.0	12.0	Under (25%)	46% rally
Jan-6-93	1,836	13.7 (Feb-18-93)	10.7	6.8	Over (57%)	18% drop
Feb-25-93	1,504	11.7 (Apr-1-93)	8.7	9.1	Under (4%)	13% rally
Apr-12-93	1,701	11.9 (Apr-22-93)	10.4	8.5	Over (22%)	7% drop
May-31-93	1,575	9.0E (Dec-31-93)	9.4	13.4	Under (30%)	? % rally

(a) Based on the estimated peso devaluation at that time.

(b) Based on the 12-month prospective earnings at that time.

(c) Assumptions for 1992: Mexican Equity-Risk Premium of 5.1%, trend earnings growth rate (nominal dollar terms) of 21%, and average payout ratio of 25%. Assumptions for 1993: Mexican Equity-Risk Premium of 5.1%, trend earnings growth rate of 17.5% in nominal dollar terms, and average payout ratio of 25%.

(d) Performance of the market from the current critical date to the next critical date.

#### *Cetes Rates and the Bolsa*

To test the structural validity of the model, we calculate "fair valuation" P/Es at relative peaks and troughs of the Mexican market around the correction registered during the summer of 1992. The risk-free rates used at each critical date are the next highs and lows of the 91-day Cetes rates that followed each relative peak and relative trough, respectively, but which occurred before the next critical date. We use the Cetes rate to illustrate the basic properties of the methodology. However, the use of a short-term peso-denominated instrument as a benchmark for country risk renders the valuation highly volatile whereas the use of a longer-term fixed income instrument would result in more stable valuations. Our method is better explained by Table 5 and by Figures 3 and 4.

Figure 3

**Mexican Market Valuations for Selected Periods between January 1992 and May 1993**  
(Mexican Bolsa Index)

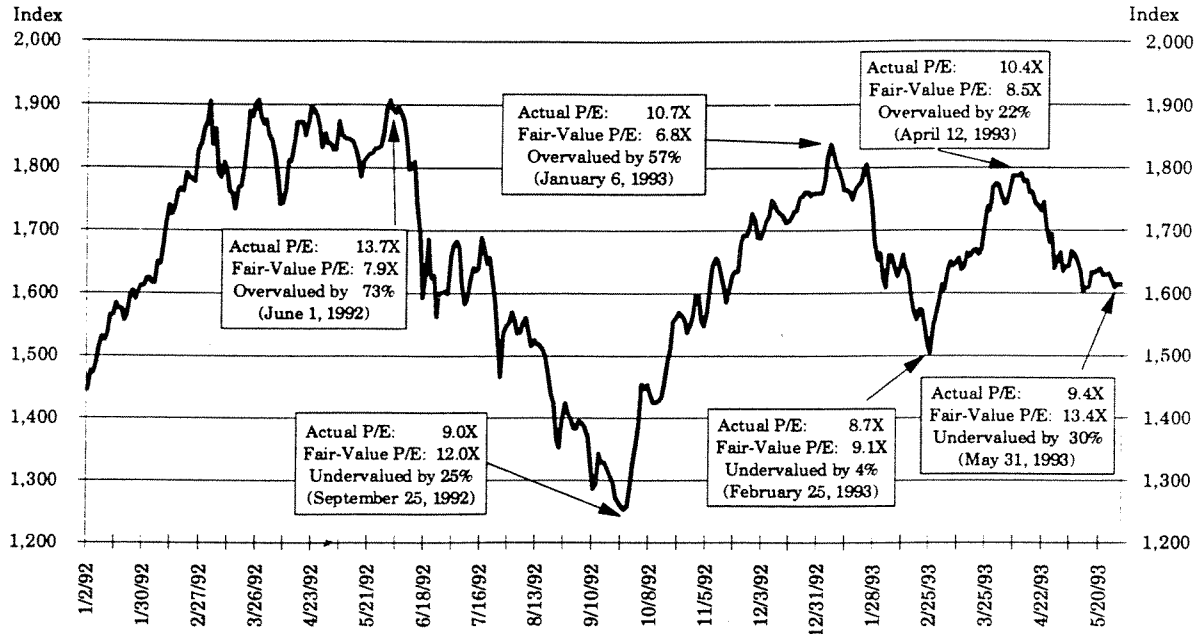
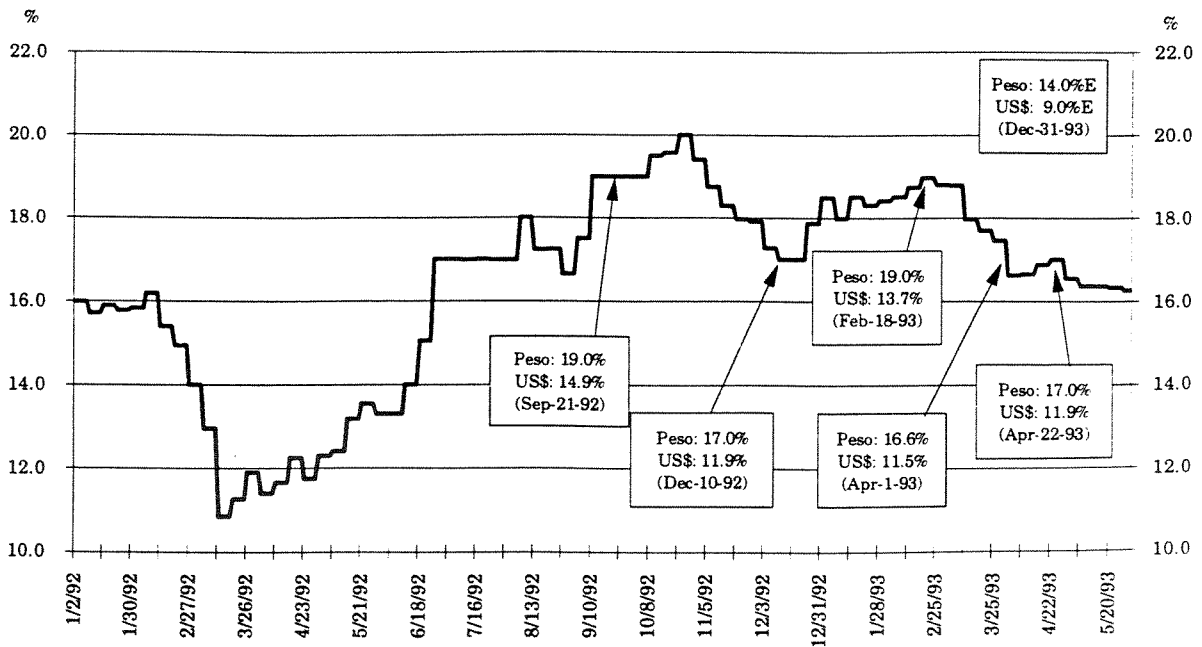


Figure 4

**Nominal Interest Rates (91-day Cetes) in Nuevos Pesos and U.S. Dollars**



For example, to assess the valuation of the market at its peak on June 1, 1992, we used the next high of the 91-day Cetes rate, 19% (14.9% when adjusted for the expected devaluation of the peso versus the dollar at that time), which occurred on September 21, 1992. According to our calculations, the market was overvalued on June 1, 1992.

In order to value the market at its trough on September 25 last year, we used the next low of interest rates, 17% (11.9% in dollar terms), which occurred on December 10. Our model results in undervaluation for the Mexican Bolsa for September 25, 1992. Finally, if we assume that 91-day Cetes rates, currently around 16%, will be 14% (9% in dollars) by yearend 1993, the market is currently undervalued. The exercise suggests that, disregarding the exact amounts of over and undervaluation, our model appears directionally correct.

#### A Word on the BETA of the Mexican Market

While use of the segmentation assumption precludes the application of the Mexican market beta in the calculation of the Mexican equity-risk premium, in this section, we provide some estimations for the beta parameter that investors may find somewhat surprising. We calculated the Mexican market beta for several periods using different techniques.<sup>6</sup> (see Table 6). As can be seen in all three time periods tested, a beta close in value to "one" was obtained. This may seem counterintuitive when one considers the greater volatility displayed by the Bolsa vis-à-vis the U.S. market.

<sup>6</sup> For daily data, the model used was:

$$\text{Mex}\%(t) = \beta_0 \text{SP500}\%(t) + \beta_1 \text{SP500}\%(t-1) + \dots + \beta_n \text{SP500}\%(t-n)$$

where the Mexican market beta is defined as " $\beta$ " =  $\sum \beta_i$ , for  $i = 0$  to  $n$ , and " $n$ " is the number of lagged days. We found that a lag of one day ( $t-1$ ) was statistically significant. The above regression method, which adjusts daily data for serial correlation biases, was suggested to us by Fischer Black.

**Note:** We also calculated the beta for the period between January 1986 and May 1993, using monthly data and the following regression model:

$$[\log \text{IPC}(t) - \log \text{IPC}(t-1)] = \alpha + \beta [\log \text{SP500}(t) - \log \text{SP500}(t-1)]$$

In the monthly case, we obtained a Mexican Market beta of 1.60 (U.S. stock market beta = 1.0). Here, we used monthly dollar index values for the Mexican Bolsa Index (IPC). However, a great deal of structural change in that longer period makes us question the validity of the beta estimate in this case. It also must be noted that the computation of beta was done using a dollar conversion of the index. While the peso/dollar rate has been very stable during the period we are analyzing, it has historically been subject to wider fluctuations. This fact may contribute to explain the different results obtained for the longer period.



Table 6

**The Mexican Market Beta Over Different Periods**  
(Using Daily Data)

Period	Beta	R-Square	t-statistics		Durbin-Watson
	( $\beta$ )		$\beta_1$	$\beta_2$	
1/2/91 to 5/31/93	0.96	16%	10.0	3.2	1.6
1992	1.10	11	5.6	1.5	1.6
1991	0.96	23	8.1	3.0	1.7

These results suggest, however, that a beta value close to "one", in conjunction with greater price volatility, is explained by the fact that a good portion of the additional Mexican risk is diversifiable risk from the point of view of a U.S. investor. The relatively low values of the R-squares imply that common factors between the United States and Mexico contribute to a small percentage of the Bolsa's volatility, and that residual factors (other than those affecting the S&P 500; i.e., domestic factors) explain a large portion of the variability present in the returns of the Mexican stock market.

**Conclusion**

We have developed a methodology which is an extension and application of the Capital Asset Pricing Model and the Dividend Discount Model to measure valuations of emerging markets from the point of view of a U.S. investor. This methodology allows us to link the emerging debt market (sovereign or corporate) with the emerging equities market, and provides a framework for calculating country-risk adjusted P/Es with readily available data. Our methodology, which could supplement traditional fundamental securities analysis, can also be extended to any international market, as well as other industries and specific companies.

We applied the methodology to measure the impact of volatility and country-risk encountered in the Mexican equities market and, therefore, to assess the additional "risk discount" attached to Mexican equities. The valuations obtained, as could have been expected, are highly sensitive to the choice of the "Mexican risk-free rate" used. If we use the Mexican 30-year par bond yield, we conclude that the Mexican market is currently about 27% undervalued. Using the one-year Cetes dollar rate results in a slight 4% overvaluation for the Bolsa. If we assume, however, that by yearend 1993, the one-year Cetes rate will drop to around 14% (9% in dollar terms), the market would be currently 30% undervalued.

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