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### Recommended Citation

Bandopadhyaya, Arindam, "Bond and Stock Market Linkages: The Case of Mexico and Brazil" (2005). *Financial Services Forum Publications*. Paper 5.

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# **Bond and Stock Market Linkages: The Case of Mexico and Brazil**

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Financial Services Forum  
College of Management  
University of Massachusetts Boston  
January 2005

Working Paper 1002



*Financial Services Forum*

**Bond and Stock Market Linkages:  
The Case of Mexico and Brazil**

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Acknowledgements: I thank James Grant and Anne Jones for valuable comments and suggestions. Remaining errors are all mine.

## Abstract

This paper examines the Brady bond market of two largest Latin American economies, Mexico and Brazil. Results indicate that stripped yield of each market in the very near future is determined primarily by the past yields in the respective markets. However, over a longer-term horizon the interrelationships between the bond markets and the stock markets of the two countries become important. Future yields in the Mexican bond market are affected by the current returns in the Mexican stock market, and to a certain extent the yields in the Brazilian bond market. A significant portion of the future variation in the Brazilian bond market yield is explained by current variation of the yield in Mexican bond market and the returns in the Mexican stock market. The Brazilian stock market returns play a negligible role in either bond markets.

## Introduction

Research on emerging market bonds has been growing quickly (e.g., see Min (1998)).<sup>1</sup> This can be attributed to two main factors. First, while emerging market bond capitalization is relatively small compared to the size of the fixed-income market, it still has attracted the attention of investors. There are times (for example in the summer of 1997) the average performance of the Emerging Market Bond Index is better than that of the S&P 500 and is considerably better than the U.S. high-yield index. Among the debt instruments in the emerging markets Brady bonds are the most important. Overall, there are about \$200 billion of Brady bonds outstanding. According to Emerging Market Traders Association the secondary market turnover for Brady bonds represents the majority of all trading in emerging markets debt instruments. Secondly, the sovereign bond yield spreads over the yield of similar issues of the U.S Treasury has become a market-based measure of sovereign creditworthiness. It has been argued that the creditworthiness of economies as measured by agencies like *Institutional Investor*, Moody's and Standard and Poor's are only *ex post* indicators and may not be useful measures for those who are more interested in the future performance of an economy. As a result, recent literature on sovereign creditworthiness has focused on market-determined indicators, such as the Brady bond stripped yield spread, as the purest form of market based sovereign risk.

It has been documented that market based indicators of sovereign risk, including bond yield spreads, are highly correlated, with the correlation increasing in crisis periods (see, e.g.,

Figure 1 in which the Brady bond stripped yield spreads of Argentina, Brazil, Mexico,

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<sup>1</sup> Min (1998) finds that macroeconomic fundamentals, such as low domestic inflation rates, improved terms of trade and increased net foreign assets are associated with lower yield spreads. Weak liquidity variables of a country, such as high debt-to-GDP ratio, low foreign reserves to GDP ratio, low export growth, high import growth and high debt service ratio are associated with higher yields.

Philippines and Venezuela appear). When there is an adjustment in the market's perception of sovereign risk for one country due to country specific events then it results in a revision of the market based country risk measure for other countries as well, even though there is no apparent reason for the revision. This phenomenon is known as contagion, and has been the focus of many studies (see, e.g., Baig, Taimur and Goldfajn (1998, 2000)).

The literature on emerging bond markets has documented cross-sectional correlation across various bond markets in a number of ways.<sup>2</sup> Izvorski (1998) computes the default probabilities implicit in the prices of Brady bonds for seven developing countries and finds that there is high cross correlation in the estimated default probabilities with most correlation coefficients in excess of 90 percent. Barbone and Forni (1997) studied the effect of the Mexican crisis on the secondary market for Brady bonds and found that the crisis had a strong permanent effect on the risk assessment of Mexico as well as countries with similar pre-crisis means and volatilities.

A number of studies have focused on the association between bond and stock markets. Sarkar and Subrahmanayam, (2002) investigate the common determinants of bond and stock market liquidity. Fleming, Kirby and Ostdiek (1998) examine and find strong volatility linkages between stock, bond and money markets, and they also find an increase in the linkages since the crash of 1987. This paper examines the Brady bond market of the two largest Latin American economies, Mexico and Brazil, with the U.S. stock market being a common exogenous variable to each market. Results indicate that the stripped yields of each market in the very near future are determined primarily by the past yields of their respective markets. However, over a longer-

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<sup>2</sup> Contagion has been extensively studied in the context of stock and other asset markets (e.g., see Karolyi and Stulz (1996), and Hartmann, Straetmans and de Vries (2001)).

term horizon the interrelationships between the bond markets and the stock markets of the two countries become important. Future yields in the Mexican bond market are affected by current returns in the Mexican stock market, and to some extent by yields in the Brazilian bond market. A significant portion of the future variation in the Brazilian bond market yield is explained by current variation of the yield in the Mexican bond market and the returns in the Mexican stock market. The Brazilian stock market returns play a negligible role in both bond markets. The U.S. equity markets, after controlling for the bond and stock markets in Mexico and Brazil, play an insignificant role in any of the four markets studied.

The rest of the paper is organized as follows. Section 2 describes the data and the estimation equations. Section 3 discusses the results and the interpretation. Conclusions are in section 4.

## **2. The Estimation Equations and Data**

The primary variable of interest is the Brady bond stripped yield spreads of Mexico and Brazil. Brady bonds are securities that are issued by a sovereign in exchange for sovereign debts to commercial banks as a part of debt renegotiations. These bonds are denominated in US dollars and the principal and some of the interest are collateralized with US Treasury bonds. When evaluating a Brady bond, it is necessary to “strip” the principal and interest guarantees in order to extract the sovereign risk that is assessed by the investors on the issuing country. The Brady bond stripped yield spread is the difference between the Brady bond stripped yield and the US Treasury bond yield with a similar maturity.

The Brady bond stripped yields are estimated in a Vector Auto Regressive (VAR) framework. Specifically, the Brady bond yield of Mexico (BBYMEX) is postulated to be a

function of its own past values and the past values of the Brazilian Brady bond yield (BBYBRA), the past returns in the Mexican and the Brazilian stock markets (respectively, MEXRET and BRARET), and the past returns of the U.S. equity market (NDXRET). Similarly, BBYBRA is a function of its own past values and the past values of BBYMEX, BRARET, MEXRET, and NDXRET. As part of the VAR system the stock market returns in Mexico and Brazil are also postulated to be functions of their own past returns and the past values of the other endogenous variables in the system. The return of the U.S. equity market is exogenous to the system.

The VAR system takes the following form:

$$\text{BBYMEX}_t = \text{BBYMEX}_{t-1} + \text{BBYBRA}_{t-1} + \text{MEXRET}_{t-1} + \text{BRARET}_{t-1} + \text{NDXRET}_{t-1} + c_1 + \varepsilon_{1,t}$$

$$\text{BBYBRA}_t = \text{BBYBRA}_{t-1} + \text{BBYMEX}_{t-1} + \text{MEXRET}_{t-1} + \text{BRARET}_{t-1} + \text{NDXRET}_{t-1} + c_2 + \varepsilon_{2,t}$$

$$\text{MEXRET}_t = \text{MEXRET}_{t-1} + \text{BBYMEX}_{t-1} + \text{BBYBRA}_{t-1} + \text{BRARET}_{t-1} + \text{NDXRET}_{t-1} + c_3 + \varepsilon_{3,t}$$

$$\text{BRARET}_t = \text{BRARET}_{t-1} + \text{BBYMEX}_{t-1} + \text{BBYBRA}_{t-1} + \text{MEXRET}_{t-1} + \text{NDXRET}_{t-1} + c_4 + \varepsilon_{4,t}$$

It should be noted that results in the estimation of a VAR system are sensitive to the ordering in which the variables occur. However, in this study, the results described in the next section are not qualitatively different if the ordering of the variables is different from the one that appears in the above system.

Daily data from April 1993 to March 1998 are used in this study. The Brady bond stripped yield spreads are calculated using data provided by J.P. Morgan, and the stock market returns are daily returns using major market index of each economy (finance.yahoo.com). Stock market returns and levels in Mexico, Brazil and the US appear in Figures 2, 3 and 4, respectively. The Mexican and Brazilian Brady bond stripped yield spreads appear in Figure 5.



Descriptive statistics on the stock returns and bond yield spreads are in Table 1 and the correlation matrix on these variables is in Table 2.

### 3. Results

The variance decomposition of the Mexican stock market return, the Brazilian stock market return, the stripped Mexican Brady bond yield spread, and the stripped Brazilian Brady bond yield spread appear in Figures 6, 7, 8, and 9, respectively. All four figures show that the US stock market plays a negligible role in each of these markets.

From Figure 6 it is apparent that virtually all of the variation in the Mexican stock market return is explained by past returns in the Mexican stock market. The effect of past returns declines over time, but remains about eighty-four percent for a lagged value of 60-days. Similarly, Figure 7 indicates that Brazilian stock market returns are explained almost solely by returns in that market in the past, with over eighty percent of the current variability being explained by a lagged value of 60-days.

Figures 8 and 9 show that the Brady bond markets of both countries are related to each other and that the Mexican stock market plays a significant role in the Brady bond yield spread of each market. Specifically, for the immediate future the most important variable in both Brady bond markets are its own past yields. As one looks further into the future in the Mexican Brady bond market the influence of the Mexican stock return becomes increasingly important. While forty-six percent of the variability is still explained by a 60-day lagged value of the yield in this market, forty-one percent of the current variability is explained by a 60-day lagged value in the Mexican stock market. While the Brazilian markets increase in importance with the passage of time they remain relatively insignificant in the explanation of returns in the Mexican Brady bond

market. The Brazilian Brady bond market is slightly more influential than the Brazilian stock market. A 60-day lagged Brazilian Brady bond yield explains about seven percent of the current variability while a 60-day lagged return in the Brazilian stock market explains only about six percent of current returns.

The interdependence of the markets is the most pronounced in the Brazilian Brady bond market. The most important variable in the near term in this market is also its own past yields. Sixty three percent of current variability is explained by the yield a day ago. But, the Mexican Brady bond yields also have a significant role to play in the variation of current yields in this market. Thirty five percent of the current variability is due to the yield a day ago in the Mexican Brady bond market. What is quite noteworthy is that the effect of the own lagged values of yields in this market decreases dramatically. A 60-day lagged yield explains only fourteen percent of current variability. The effect of the Mexican stock market becomes most pronounced in this market as time goes by. Over forty two percent of the current variability is due to Mexican stock market returns 60-days ago. The Mexican Brady bond market maintains its strong influence in this market, increasing somewhat over time to explain forty two percent of the current variability with a 60-day lag.

The results are of significant importance to practitioners in general and bond traders in particular. The results support the hypothesis that the two stock markets examined are quite independent of each other. However, the Mexican stock market plays a significant role in the Brady bond market of each of these countries. In the Mexican Brady bond market the Mexican stock market plays a particularly important role especially over relatively longer periods of time. In the Brazilian Brady bond market contemporaneous yields are primarily a function of past

yields and past yields in the Mexican Brady bond market, but over a relatively longer period of time the Mexican bond and stock markets dominate the explanation of variations in this market.

#### **4. Conclusion**

This paper examines the relationship between the bond and stock markets of Mexico and Brazil, two of the main markets in Latin America. Results indicate that the stock markets of these two countries are independent of each other, with most of the variations in returns being explained by past returns of each respective market. The Mexican bond market is also independent of either the stock or the bond market in Brazil. However, the Mexican stock market affects yields in the Mexican bond market over a longer-term horizon. The Brazilian bond yields are closely tied to own yields in the past. But perhaps the most prominent finding of the paper is that the Brazilian bond yields are significantly affected by Mexican bond and stock market returns.

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**Table 1. Descriptive Statistics on Stock Market Returns and Bond Yield Spreads**

	<b>Average</b>	<b>Std. Dev.</b>	<b>High</b>	<b>Low</b>
<b>Mex.Ret.</b>	38.94005	626.4084	4207.979	-4801.37
<b>Bra. Ret</b>	200.583	1138.831	9224.337	-5388.31
<b>Ndx.Ret.</b>	38.70707	492.8731	2529.97	-2696.92
<b>BBYMEX</b>	666.3659	341.7765	2426	265
<b>BBYBRA</b>	757.5591	265.6788	1681	264

**Table 2. Correlation Matrix on Stock Market Returns and Bond Yield Spreads**

	<b>Mex.Ret.</b>	<b>Bra. Ret</b>	<b>Ndx.Ret.</b>	<b>BBYMEX</b>
<b>Mex.Ret.</b>				
<b>Bra. Ret</b>	0.108534			
<b>Ndx.Ret.</b>	0.072882	0.100373		
<b>BBYMEX</b>	-0.009228	-0.097391	0.018975	
<b>BBYBRA</b>	-0.00361	-0.0225	-0.00096	0.781324

**Figure 1. Brady Bond Stripped Yield Spread for Argentina, Brazil, Mexico, Philippines and Venezuela**

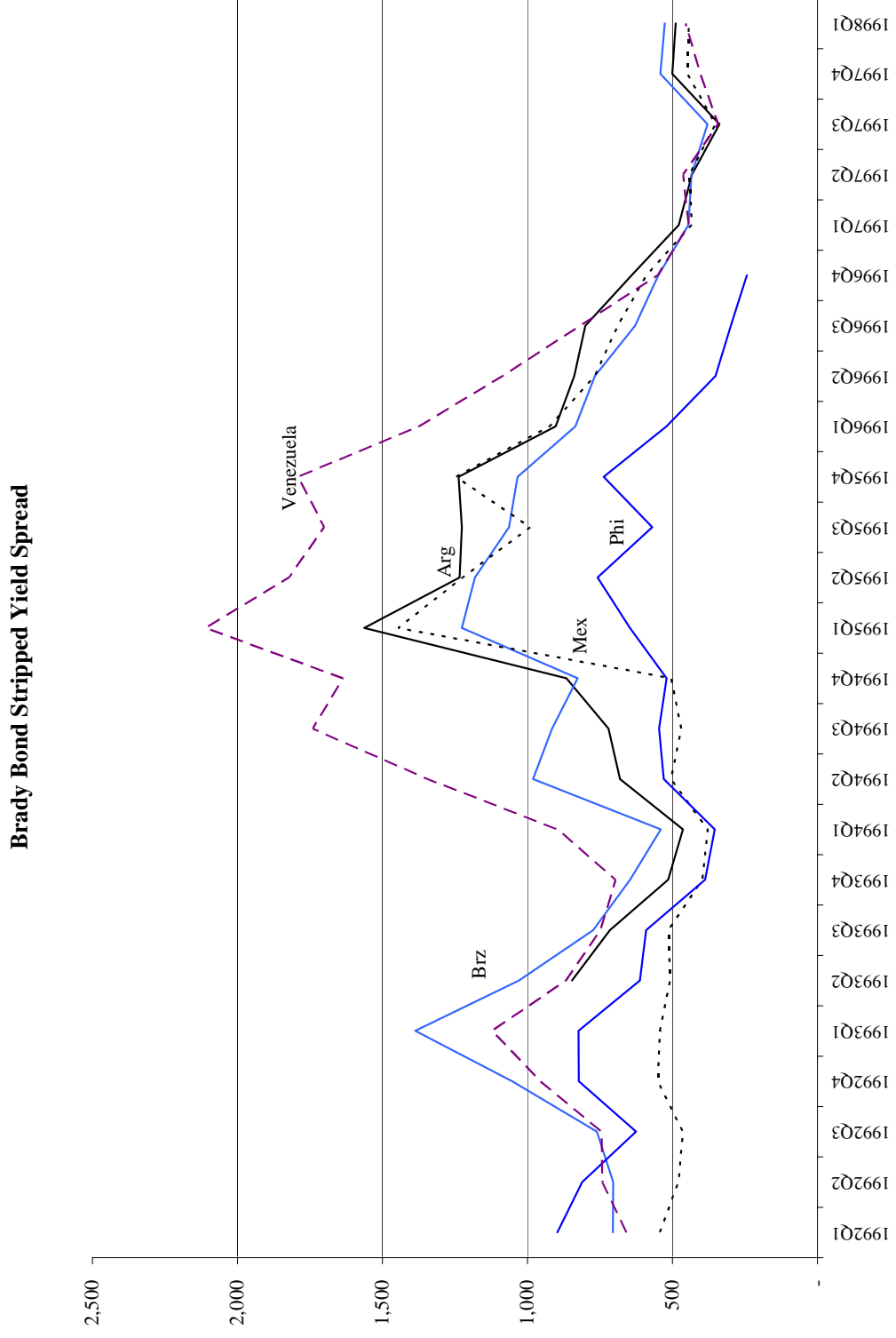


Figure 2. Mexican Stock Market Levels and Returns Between April 1993 and March 1998

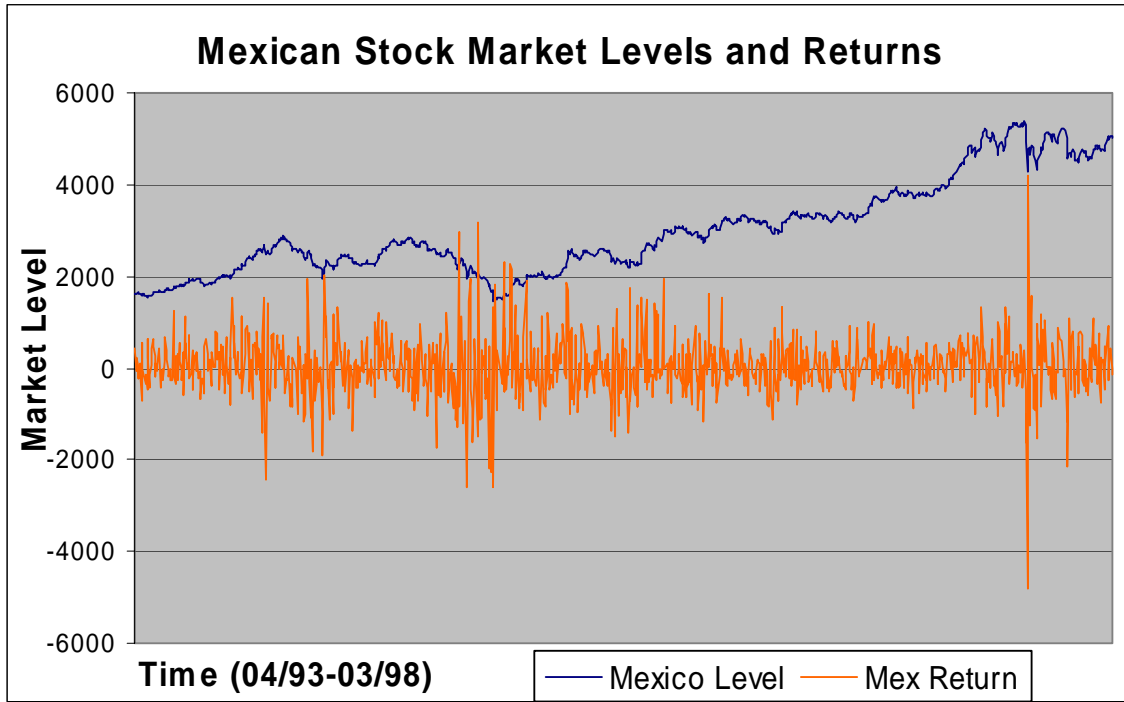


Figure 3. Brazilian Stock Market Levels and Returns Between April 1993 and March 1998

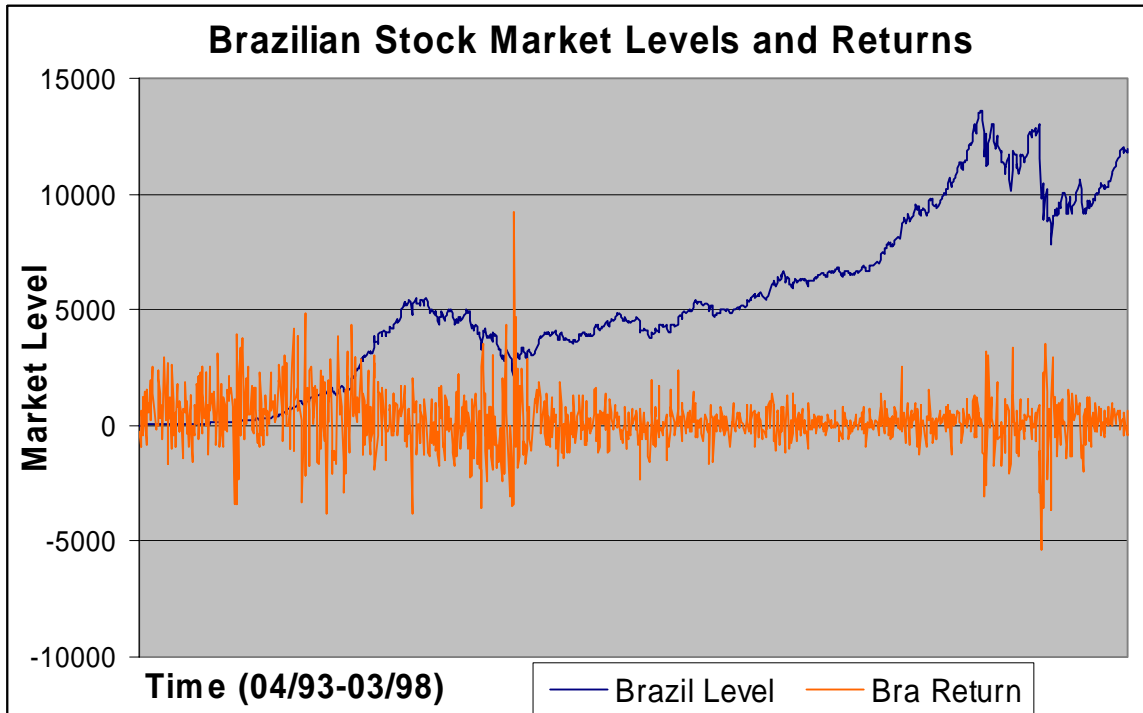


Figure 4. U.S. Stock Market Levels and Returns Between April 1993 and March 1998

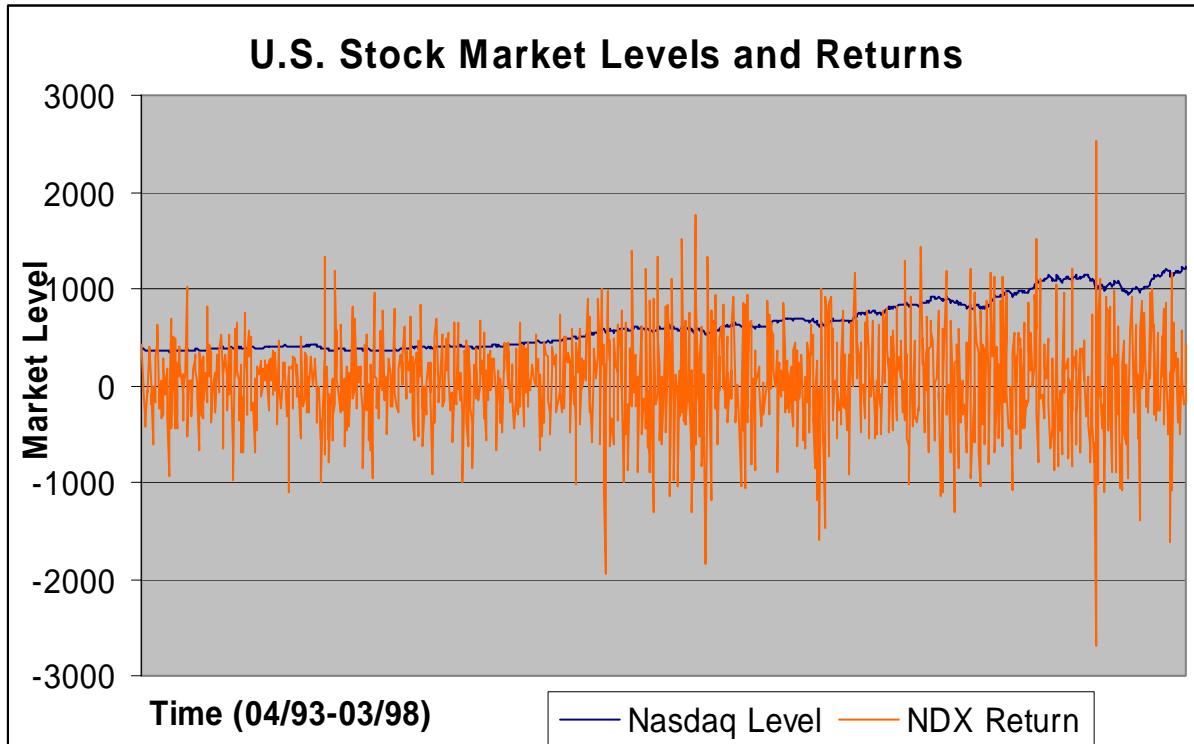
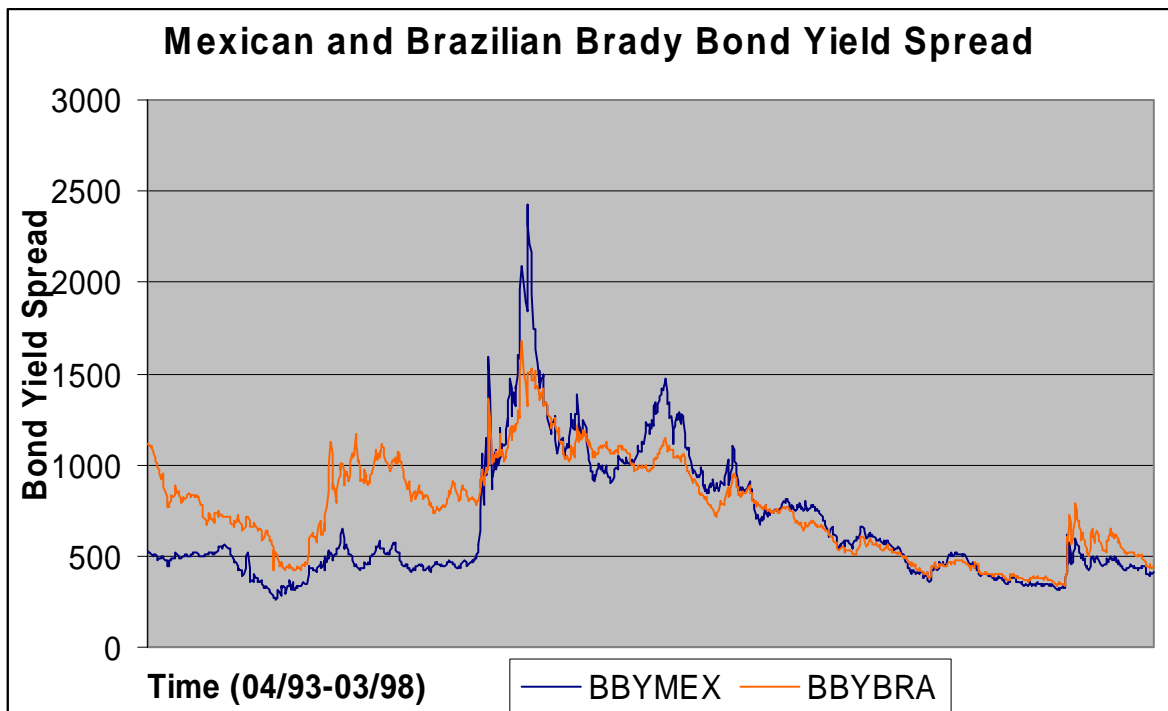
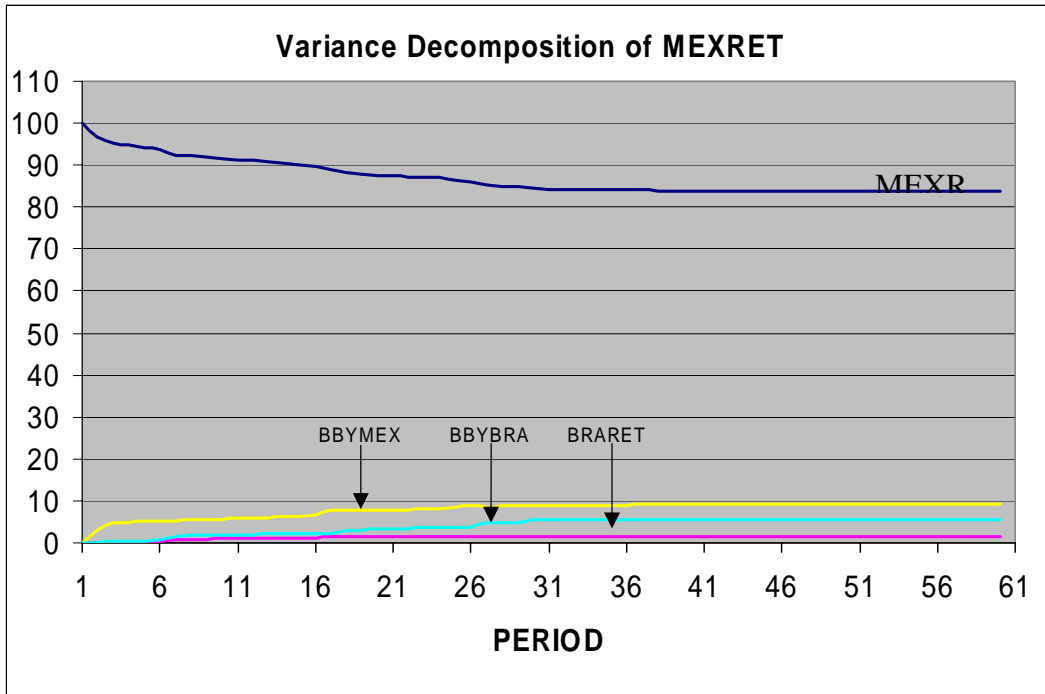


Figure 5. Mexican and Brazilian Brady Bond Yield Spread Between April 1993 and March 1998

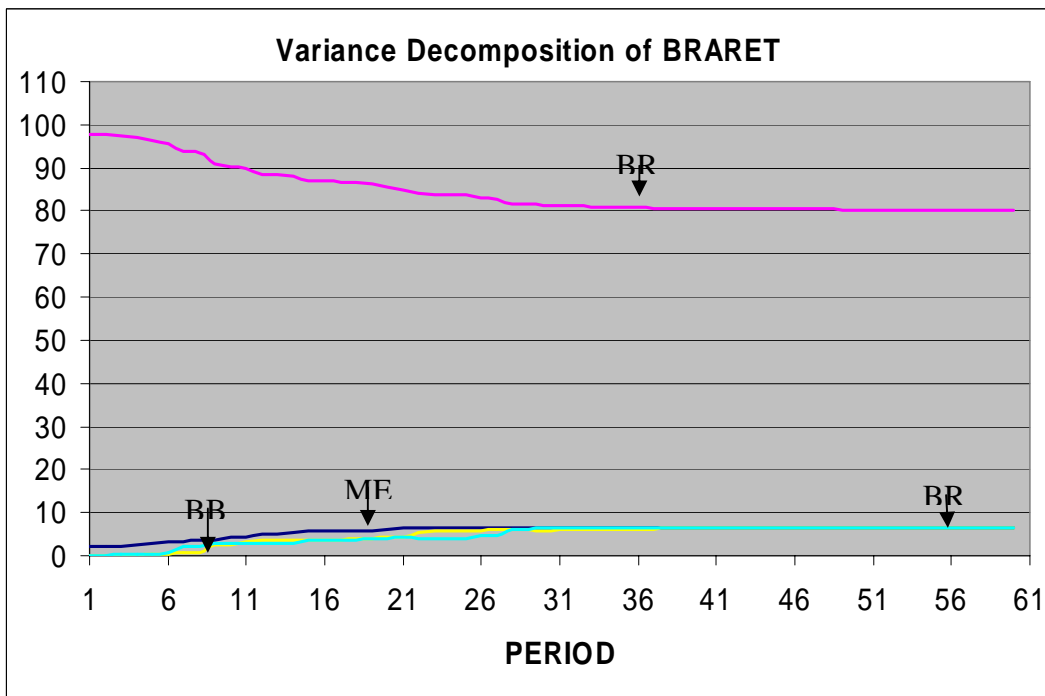




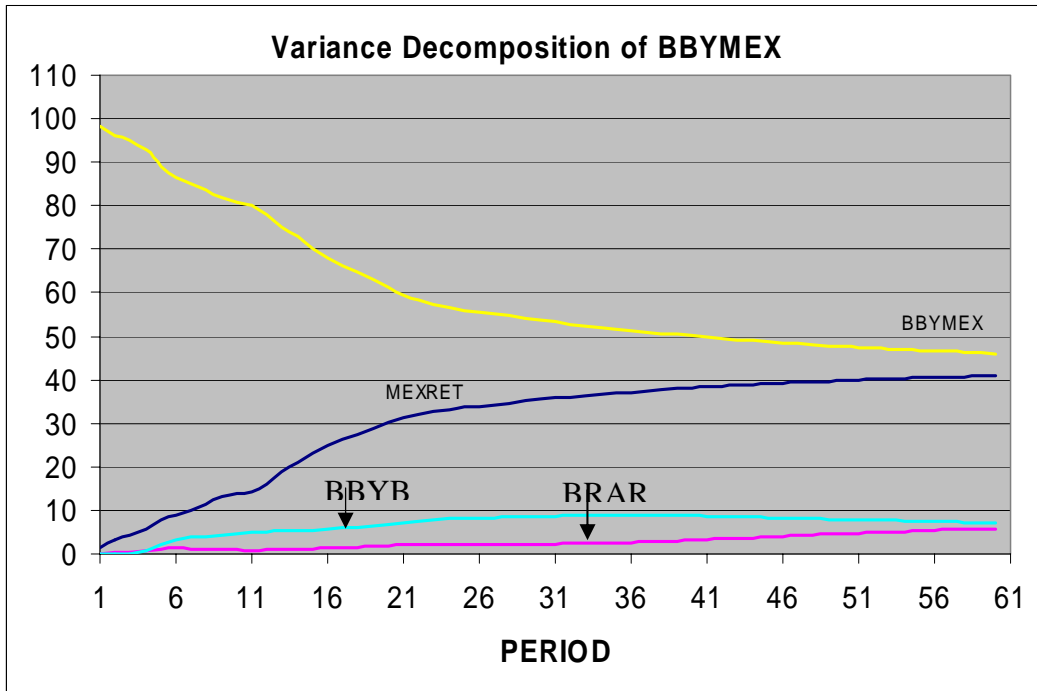
**Figure 6. Variance Decomposition of Mexican Stock Market Returns**



**Figure 7. Variance Decomposition of Brazilian Stock Market Returns**



**Figure 8. Variance Decomposition of Mexican Brady Bond Stripped Yield Spread**



**Figure 9. Variance Decomposition of Brazilian Brady Bond Stripped Yield Spread**

