Risk, return and integration in Latin American equity markets

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RISK, RETURN AND INTEGRATION IN LATIN AMERICAN EQUITY MARKETS

A Dissertation

by

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RISK, RETURN AND INTEGRATION IN LATIN AMERICAN EQUITY MARKETS

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July 2001
ABSTRACT


There has been an increasing interest in studying the cross-sectional relationship between systematic risk (as measured by beta) and return due to the inability of unconditional models to explain this relationship and the empirical contradictions found for the Sharpe-Lintner-Black CAPM model. Extant research on developed stock markets shows a significant relationship between beta and return when it is conditional to up and down markets. However, whether these results apply to Latin American equity markets is an issue that has not been previously studied.

With this in mind, this dissertation pursues two main objectives: (1) to analyze whether unconditional or conditional CAPM models are better explanatory frameworks in explaining the cross-sectional relationship between systematic risk and return across a selected group of Latin American stock markets, namely Argentina, Brazil, Chile and Mexico, and (2) to study the degree of integration across these markets. Econometric techniques such as pooled OLS in conjunction with GARCH models are employed to achieve the objectives.

The results from this study suggest that conditional CAPM models dominate unconditional approaches in explaining the cross-sectional portfolio return variations.
across the selected Latin American stock markets. Moreover, the results are consistent under different specifications, currencies, subperiods and after controlling for additional risk factors such as portfolio size, leverage, book to market value equity ratio, price-earnings per share ratio and a January effect. The findings also show the presence of statistically significant asymmetries in the price of risk for the Brazilian and Argentinean stock markets. These results are consistent with pessimism about the prospect of high returns in these markets.

Furthermore, the findings show that the degree of integration differs across these markets. When Latin America’s market returns go up, the Chilean stock market rewards systematic risk more than the remaining stock markets, bringing better benefits in terms of portfolio diversification. Conversely, when Latin America’s market returns go down, the Mexican stock market exhibits a lower risk premium than the rest of the selected stock markets.

As a whole, the results show that there are asymmetries in the risk premium as well as incomplete integration across the Latin American stock markets. This has important implications for using adequate policies for stabilizing the financial sector in such markets. Financial policies (for instance, the creation of a center for free cross-listing and trading of Latin American stocks) that support an increase in the degree of integration across these markets are beneficial for Latin America as a whole. These policies can improve investors’ knowledge about the fundamentals of the Latin American stock markets, and thus, increase the efficiency of these markets. Moreover, under full stock market integration the cost of capital on average could fall, contributing to increase the economic growth in every Latin American country.
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CHAPTER I

INTRODUCTION

The foundations of the Capital Asset Pricing Model (CAPM) date back to Sharpe (1964), Lintner (1965) and Mossin (1966). Over the years, several asset pricing theories have been developed, but their predictions have been a matter of debate and controversy in the United States and other developed countries\(^1\). Among the most important factors that have motivated the development of asset pricing models are the rapid growth of equity markets in terms of market capitalization, variety of instruments, liquidity and efficiency. Moreover, researchers have recognized the importance of studying asset pricing models in order to investigate how the stock markets function as well as how the financial assets are priced.

During the last decade, there has been an increasing tendency to invest in the so-called emerging markets. Different economic and financial indicators confirm this tendency. Since 1990, foreign investment in emerging markets has been growing systematically. The net foreign capital flow to emerging equity markets was around $1 billion per year in the 1980s compared with $45 billion in 1993. Net portfolio investment totaled above $30 billion in every year up to 1998. Furthermore, the

\(^1\) Other relevant models of risk and return include the Arbitrage Pricing Theory (Ross, 1976), and different extensions of the CAPM model [e.g., the multi-beta CAPM (Merton, 1973), and the consumption CAPM (Breeden, 1979)].
capitalization of all emerging stock markets stood at 10% of the total world market capitalization at the end of 1997. In this scenario, the Latin American emerging stock markets of Brazil, Mexico, Chile and Argentina have become increasingly important because they have exhibited substantial growth in terms of volume, transactions, variety of instruments and liquidity. Altogether, these markets account for 90% of the total Latin American emerging stock markets’ equity capitalization.

Given the importance of Latin American emerging markets in the global financial context, this dissertation has two main objectives: (1) to analyze whether unconditional or conditional CAPM models are better explanatory frameworks in explaining the cross-sectional relationship between systematic risk and return across a selected group of Latin American stock markets, namely Argentina, Brazil, Chile and Mexico, and (2) to study the degree of integration across the above markets. Pricing models that explain the cross section return variation represent useful tools for evaluating different research questions associated with Latin American stock markets. For instance, are the Latin American stock markets fully or only partially integrated? In other words, is the price of risk not significantly different across the stock markets during ups and downs in the Latin American market returns? Is the price of risk symmetrical for each stock market when Latin American market returns go up or down? Are there additional risk factors, other than systematic risk (as measure by beta), which are significantly priced over time? Which Latin American stock market presents better opportunities (If they exist) for investor portfolio diversification in Latin America?

The main contribution of this study to the literature is to evaluate whether the CAPM models that have traditionally applied to developed stock markets represent valid
and reliable frameworks for evaluating the above issues.

This dissertation is organized as follows. Chapter II discusses the literature review of the CAPM models. Chapter III describes the background, history and the most important characteristics associated with the stock markets of emerging countries with an emphasis on Latin America. Chapter IV focuses on the description of the data and the sources of information. Chapter V presents the model specifications and econometric methodology. Chapter VI develops the hypotheses to be tested. Chapter VII presents and discusses the empirical results of the unconditional CAPM model. Chapter VIII reports and discusses the empirical results of the conditional version of the CAPM model. Chapter IX presents and also discusses the empirical results of the conditional version of the CAPM model after controlling for additional risk factors documented in the financial literature. Chapter X exhibits and discusses the empirical findings associated with stock market integration across the selected Latin America markets. Finally, Chapter XI summarizes the empirical findings and discusses the financial implications of the results and the areas for future research.
CHAPTER II

LITERATURE REVIEW

This chapter is divided into four sections. The first section begins with a review of the most important empirical studies based on domestic CAPM models. The next section continues by summarizing and discussing the main drawbacks associated with these studies. The third section discusses international studies about asset pricing models. Lastly, section four discusses Latin American asset pricing studies with emphasis on integration issues across the Latin American stock markets.

Capital Asset Pricing Models

Since Sharpe (1964), Lintner (1965) and Mossin (1966) developed the foundations of the CAPM model, many authors have empirically examined the relationship between beta and returns and, consequently, tested a positive linear relationship as postulated by the CAPM model. Despite the fact that this model emphasizes a positive tradeoff between risk (beta) and expected return, many researchers in this field have studied the realized returns of financial asset portfolios formed from rankings of betas. These studies have found a weak positive relationship between returns and beta over the selected sample periods, but the results are often inconsistent through different time periods and weaker than the relationship between returns and other variables (e.g., size). This evidence is generally interpreted as contrary to the validity of a positive relationship between beta and returns. The findings of the
main studies in this area are briefly described as follows.

Fama and MacBeth (1973), in their seminal study on the validity of the CAPM model, test for an unconditional relationship between realized portfolio returns and betas. Their methodology considers three stages. In the first stage, betas for individual securities are estimated using the zero-beta CAPM of Black (1972) over the first four years of their study. Then, individual securities are grouped into portfolios of at least 20 securities each according to the individual security beta rankings. In the second stage, these portfolios are taken into consideration in order to estimate portfolio betas for a subsequent time period of five years. In the final stage, using stock market data from a third time period, portfolio returns are regressed on portfolio betas in order to test whether there is a cross-sectional relationship between risk and return. Fama and MacBeth’s findings show that, on average, for the period 1935 through 1968 there exists a positive relationship between beta and monthly returns. Therefore, they conclude that the CAPM model describes the risk-return behavior observed in the U.S. capital market.

Following Fama and MacBeth, many researchers have conducted empirical studies that suggest that beta may not adequately measure a portfolio’s risk. Factors other than beta have been reported as successful in explaining that portion of portfolio returns not captured by beta.

Banz (1981) documents the importance of the firm size (market value of equity) for the period of 1931-1975. By regressing the returns against beta and firm size, his results show that the statistical association between returns and size is negative and very significant and the explanatory power of beta is very low. The NYSE firms in the bottom size quartile (ranked by the market value of equity) earn significantly positive
risk-adjusted excess returns. Based on this finding, this author concludes that market equity adds to the explanation of the cross-section of average returns provided by market betas and the CAPM is misspecified as a model of security returns.

Another contradiction of the CAPM model is the positive relationship between leverage and average returns documented by Bhandari (1988). It is possible that leverage is related with risk and expected return, but according to the CAPM model, leverage risk should be incorporated by market beta. By regressing returns against beta, size and leverage, Bhandari finds that leverage helps explain the cross-section variation of average returns.

Rosenberg, Reid and Lanstein (1985) also support the above findings. They show that two strategies for obtaining abnormal performance, the “book/price” (B/P) and “the specific-return-reversal” (SRR) strategies achieve significant abnormal returns. The B/P strategy buys stocks with a high ratio of book value of common equity per share to market price per share and sells stocks with a low book/price ratio. The SRR strategy selects on the basis of positive or negative monthly specific returns, which tend to reverse themselves. The sample of stocks consisted of 1,400 of the largest firms in the COMPUSTAT database for the period 1980-1984. Their results are consistent with the viewpoint that average returns on U.S. stocks are positively related to the ratio of a firm’s book value of common equity to its market value.

Chan, Hamao and Lakonishok (1991) find that book-to-market equity also has a strong role in explaining the cross-section of average returns of Japanese stocks. Their paper relates cross-sectional differences in returns on Japanese stocks to the underlying behavior of four variables: earnings yield, size, book to market ratio, and cash flow
yield. The sample includes companies from the Tokyo Stock Exchange for a high-quality data set that extends from 1971 to 1988. Their findings, mainly based on the Seemingly Unrelated Regression (SUR) estimation method, reveal a significant relationship between the previous variables and expected returns in the Japanese market. However, the book to market ratio has the most significant positive impact on expected returns.

Basu (1983) shows that price-earnings ratio (P/E) has more powerful explanatory power than the CAPM beta. He suggests that P/E ratios may explain the violations of the CAPM and concludes that there is a significant negative relationship between P/E and the excess returns predicted by the CAPM. Using the annual company rankings during the period 1957-1975, Basu points out that by buying the quintile of lowest P/E and selling short the highest P/E quintile, the average annual abnormal gross return would have been 6.75%. Consistent with these results, Ball (1978) argues that P/E is able to capture unnamed factors in expected returns; P/E is likely to be lower (prices are lower relative to earnings) for stocks with higher risks and expected returns, whatever the unnamed risk factors.

Tinic and West (1984) also reject the validity of the CAPM model based on intertemporal inconsistencies. Using monthly data, their findings show a positive and significant relationship between portfolio returns and portfolio betas when return data for the entire year are included. However, Tinic and West were unable to reject the null hypothesis of no difference in returns across portfolios if return data from the month of January are not considered. In addition, for several months of the year, a negative relationship between portfolio returns and portfolio betas was observed. This
inconsistent behavior for the CAPM model across months of the year led them to conclude that their results "... cast serious doubt on the validity of the two-parameter model ..." and "... to the extent that the risk-return tradeoff shows up only in January, much of what now constitutes the received version of modern finance is brought into question" (Tinic and West, 1984, 573).

Recent studies about the cross-sectional relationship between beta and average returns have used a more comprehensive data set and time period. Fama and French (1992), for instance, use all U.S. nonfinancial firms available in COMPUSTAT for the 1962-1989 period and find that the relationship between market beta and average return is flat. Moreover, only market capitalization and the ratio of book value to market value have significant explanatory power for portfolio returns. These results led them to state, "We are forced to conclude that the CAPM model does not describe the last 50 years of average stock returns" (p. 464).

Conversely, Pettengil et al. (1995) point out that previous tests of the CAPM model (based on unconditional versions to the stock market movements) use realized returns instead of expected returns and, therefore, the validity of the CAPM model is not directly tested. According to these authors, the need to modify previous CAPM tests results from two conditions (1) the expectation that, on average, the market return should be greater than the risk-free rate and (2) investors must perceive a nonzero probability that the realized market return will be less than the risk-free return. This second requirement suggests that the relationship between beta and realized returns varies from the relationship between beta and expected return required by the CAPM model. For all portfolios with a positive beta, the expected value for the return
distribution must be greater than the risk-free rate and the return distribution must contain a non-zero probability of realizing a return below the risk-free rate. In order to obtain testable implications, these authors extend their analysis to examine the differences in the return distributions of portfolios with different betas.

Portfolios with higher betas should have higher expected returns because of higher risks. For high beta portfolios to have higher risk, there must be some level of realized return for which the probability of exceeding that particular return is greater for the low beta portfolio than for the high beta portfolio. If this were not the case, no investor would hold the low beta portfolio. Thus, the CAPM model not only requires the expectation that realized returns for the market will, with some probability, be lower than the risk-free rate, but also requires the expectation that, with some probability, the realized returns for high beta portfolios will be lower than the realized returns for low beta portfolios. The model does not require a direct link between these two relationships. An inference, however, may be that returns for high beta portfolios are less than returns for low beta portfolios when the realized market return is less than the risk-free rate. Although previous tests of the CAPM model have not recognized these relationships when testing the validity of the CAPM model, the market model used to estimate beta does imply this relationship.

Summary and Critics to Unconditional CAPM Studies

The main drawback of the CAPM studies based on the unconditional relationship between return and beta relies on the lack of an appropriate statistical methodology to evaluate this relationship. An appropriate methodology requires adjustment to take into account that realized returns and not expected (ex-ante) returns have been used in the
tests. Pettengil et al. (1995) derive a conditional relationship between return and beta, which depends on whether the excess market return is positive or negative. In periods when the excess market return is positive (up market), there should be a positive relationship between beta and return. In periods when the market return is negative (down market), there should be a negative relationship between beta and return. This relationship is due to the fact that high beta portfolios are more sensitive to negative market excess returns and therefore will have a lower return than low beta portfolios.

The evidence presented by Pettengill et al. (1995) shows that for the period 1936-1990, there is strong support for beta in the U.S. stock market when the sample period is divided into up market and down market months. Moreover, international studies also support the findings of Pettengil et al. (1995). In the next section, these studies as well as those based on the unconditional CAPM model are briefly discussed.

**International CAPM Studies**

In an international setting, some studies have also examined the model of Pettengil et al. (1995). Fletcher (2000) finds strong support to this model when the conditional relationship between beta and return is tested on 18 developed stock markets for the period of January 1970 to July 1998. Moreover, consistent with previous research, he finds a flat unconditional relationship between beta and return.

The above issues are likely to also be relevant for emerging markets as well. This is the case for Latin American emerging stock markets, which have exhibited in the last decade a constant growth in terms of companies listed, volumes, and new instruments traded that collectively have contributed to increase their efficiency.

Indeed, as Ojah and Karemera (1999, 57) point out:
Documented evidence shows that equity prices in major Latin American emerging equity markets, Argentina, Brazil, Chile and Mexico, follow a random walk. This evidence suggests that international investors in these markets cannot use historical information to design systematically profitable trading schemes because future long-term returns are not dependent on past returns.

Furthermore, empirical studies for the previous stock markets are rather scarce. For example, in the case of Mexico there are only recent studies (e.g., Cervantes. 1999) that attempt to analyze what factors explain the stock market returns in this country. Cervantes (1999) points out that the CAPM model tested by Fama and MacBeth (1973) is rejected against a multifactor asset-pricing model. His work is mainly based on similar factors considered by Fama and French (1992). However, neither the conditional CAPM model tested by Pettengil et al. (1995) nor a multifactor conditional CAPM model (conditional on positive or negative excess market returns) is studied.

For the remaining Latin American stock markets, the empirical literature regarding the CAPM models tested by Fama and MacBeth (1973) and Pettengil et al. (1995) is also scarce and there is virtually no recent formal research on this topic. No formal articles can be located in ABI/INFORM, LEXIS NEXIS, and SCIENCE DIRECT when searching for key words associated with the above CAPM models across the emerging stock markets in the sample. A few alternative CAPM specifications can be found for some emerging Latin American stock markets, mainly Mexico. These international studies are discussed in the following section.
Latin American Asset Pricing Studies

Errunza (1983) investigated fifteen emergent markets, one of which was Mexico. He studied the 1976-1980 period and found that although these markets can be less efficient than markets in developed countries, high transaction costs do not allow for profitably trading rules. He points out that emerging markets have low correlation with developed markets, which is beneficial for global investors.

Errunza and Losq (1985) investigated ten emerging markets, including Mexico, from 1975 to 1981. They found that the Mexican stock market's returns follow a log-normal distribution similar to that shown for the 30 Dow Jones Industrial Average securities traded on the NYSE. They also found that the mean serial correlation was not significantly different from zero. They conclude that emerging markets are not as efficient as the developed markets, but they behave similar to the small European markets.

Haugen, Ortiz, and Arjona (1985) analyzed the efficiency of the U.S. market in comparison with the Mexican market. They investigated the 1975-1980 period by using weekly and quarterly data of 40 companies in 1975 and increasing to 75 by 1980. They compared the Mexican companies with 75 U.S. firms of similar size from CRSP files and found that earnings announcements had a more significant impact on Mexican than on U.S. stocks. The difference seems to be the result of more available means of information. They also found a large effect to earnings reports in the Mexican market. There exists a statistically significant trend fifteen weeks before the announcements and a stronger trend if the news is negative. This last trend also appears in the U.S. sample,
but it is much weaker. They conclude that the U.S. market is relatively more efficient than the Mexican market and opportunities may exist for abnormal returns.

Malkamaki, Martikainen and Pertunnen (1991) investigated risk and stock price behavior of 24 world stock market indexes, one of which was Mexico. They compared two asset pricing models: the CAPM and the APT. In the first stage, they studied the sensitivity of each of the stock market indexes to the fluctuations of the worldwide market portfolio by estimating the beta coefficient of each stock market index. In the second stage, they investigated which of the world stock markets fall into the same risk category by using a factor analysis technique based on the APT. They used the Financial Times Actuaries World Indexes published daily since March 1987. These indexes are available for 24 individual countries, ten regions of the world, and the world as a whole. The indexes were expressed in U.S. dollars with a base value of 100 on December 31, 1986. The world index daily mean return and standard deviation were 0.07% and 0.61%, respectively. Mexico had a daily mean return of 0.18%, which is 2.6 times the world index mean, and a standard deviation of 2.35%, which is 3.9 times larger than the world index. In both estimates, Mexico had the highest values. In kurtosis, Mexico was in fourth place after Belgium, Switzerland and the U.S. In skewness, Mexico was second after Belgium (with positive skewness). Malkamaki et al. (1991) found in a CAPM framework that Mexico had a beta of 0.08, the lowest of the 24 countries, indicating a very low correlation with the rest of the world.

In the APT framework they worked with factor analysis to estimate the global common factors that explain the returns of the world stock markets and also to estimate the systematic risk components of each individual stock market. They found that four
factors describe the cross-sectional variation. Most of the European stock exchanges are loaded to the first empirical factor. This indicates a strong positive empirical relationship between stock returns in these European countries. Japan is also loaded to this European factor. The second factor represents the Oceanic factor consisting of Australia, Hong Kong, Malaysia, Singapore and New Zealand. Japan has its second highest loading on this factor. The third factor can be seen to represent the North America stock exchanges, since both Canada and the U.S. have their highest loadings in this factor. The Netherlands and United Kingdom also loaded in the third factor. The fourth factor consists of the highest loadings of Finland and Mexico, both of which are relatively small stock markets. The authors conclude that the Mexican stock market seemed to show an independent price behavior.

The main interpretation that Malkamaki et al. (1991) assigned to the four-factor model is geographic influence. Economic trade and currency geographic areas seem to affect risk among various stock markets. However, this explanation is not consistent with Mexico, which is in North America but did not load on this factor. It is important to note that this investigation was conducted before NAFTA, and the correlation of Mexico with the U.S. and Canada after NAFTA has certainly increased.

Harvey (1995) provides further support to the previous result. He studied a conditional asset pricing model where the expected returns from emerging stock markets are functions of global and local information variables, the world risk premiums are dependent only on global information, and the conditional risk is a function of both global and local information. His findings point out that standard global asset pricing models, which assume complete integration of capital markets, fail to explain the cross
section of average returns in emerging markets. Moreover, his analysis of the
predictability of the returns reveals that emerging market returns are more likely than
developed countries to be affected by local information.

In contrast to Malkamaki et al. (1991) and Harvey (1995), Soydemir (1997)
studied the link between the stock markets of developed and emerging countries. The
growing flow of financial investments to emerging stock markets suggests that this is an
important issue for international portfolio diversification. Using weekly data, he
estimated a VAR model to analyze the extent of stock market interdependence between
the stock markets of developed and emerging countries and found evidence of links
among them. Although shocks are transmitted rapidly among industrialized markets, the
spillovers are longer lasting in emerging markets. The U.S. stock market is found to be
the most influential market affecting Latin American markets, with Mexico being the
most sensitive and Argentina the least responsive. The author suggests that these
findings are consistent with the trade patterns that exist between these markets. Finally,
he argues that stock market correlation increases over time and provides evidence in
favor of greater stock market integration. He points out that there is a slight decline in
expected gains from international diversification associated with the increase in
correlation. These results seem to be stronger when analyzing Latin American markets
and the U.S. relative to testing using the regional indexes. The findings suggest that
globalization in financial flows has made the Latin American and U.S. stock markets
more interdependent and less segmented.
CHAPTER III

LATIN AMERICAN EMERGING STOCK MARKETS

This chapter begins with some background information about emerging stocks markets. Then, it describes the most important characteristics of the Latin American emerging stock market development and reviews how these markets operate.

Background

Solnik (1999, 299) points out that investors have traditionally considered only developed markets in their international diversification strategies. These markets have operated for many years and their economies are considered highly developed. This portfolio selection has been supported by the importance of performance measurement in comparison to international benchmarks (such as the MSCI or FT/S&P international indexes) that include only developed markets.

Stock markets from developing countries have not been traditionally incorporated into these indexes. In spite of the lack of inclusion given by large indexes, investors now recognize the stock market development and the potential economic growth associated with them. The World Bank, which has been very involved in supporting developing countries for many years, made the decision to promote the stock markets of these countries by creating the International Finance Corporation (IFC). The IFC publishes monthly Emerging Stock Market Indexes, and this information has
allowed financial managers to measure and analyze the performance of their portfolios invested in developing countries. The data set collected by the IFC covers over 50 emerging markets. Other index providers, such as Morgan Stanley Capital International (MSCI) or INC Barings, seeing the importance of this information for domestic and foreign investors, have also begun to publish indexes for the main emerging stock markets. Since 1990, foreign investment in emerging markets has been growing significantly. The net foreign capital flow to emerging equity markets was around $1 billion per year in the 1980s; however it reached $45 billion in 1993. Net annual portfolio investments remained above $30 billion in every year until 1998, when new investments in emerging markets halted mainly because of the Asian financial crisis.

Previous literature states that the main economic criterion used for ranking a country's state of development is its level of income, measured by the gross national product (GNP) per capita. The World Bank, through the IFC, rejected using only the GNP per capita as a measure of economic development for several reasons. First, this measure exhibits high variability; for instance, the 1997 deep devaluation of the Korean Won cut the Korean GNP per capita ratio in half within weeks. This is not a desirable characteristic for a permanent benchmark of development. Second, many countries rapidly attain growth based on a GNP per capita basis, but their stock markets still remain undeveloped. Areas such as market efficiency and regulation, supervision and enforcement, accounting standards, transparency, and disclosures are all important in the conceptualization of a developed market.

With the above issues in mind, the IFC now follows an approach that considers—in addition to GNP per capita—a composite measure of the previous
elements. The IFC uses the World Bank classification and defines a country as emerging when it shows a low or middle income. The definition also maintains countries whose income has grown, but whose stock markets have not achieved a significant stage of development.

The stock market capitalization of emerging countries has grown rapidly in recent years. The capitalization of all emerging stock markets stood at 10% of the total world market capitalization (developed plus emerging markets) at the end of 1997 (Solnik 1999, 303). Latin American emerging stock markets such as Brazil, Mexico, Chile and Argentina ranked among the top 40 developed and emerging markets in the world at the end of 1998. Their rankings were 18th, 25th, 30th and 31st, respectively. Altogether, these countries accumulated around 90% of the total Latin American emerging stock market capitalization. Their shares were 43%, 26.3%, 12% and 10%, respectively (Solnik 1999, 302-304). Regarding other important macroeconomic variables for the 1990-1996 period, Chile shows the highest real growth rate (6.4%) and the lowest inflation rate (13.6%). Mexico exhibited the lowest real growth rate (-0.3%) and Brazil the highest inflation rate (675.4%).

One characteristic common to these Latin American emerging markets is their high stock market capitalization concentration, mostly because of the large size of some recently privatized companies. The top ten Argentinean, Mexican, Chilean and Brazilian companies represent around 74%, 51%, 46% and 31%, of each respective total national market capitalization (Solnik 1999, 305).
Argentinean Stock Market

The Argentinean stock market\textsuperscript{2} is mainly represented by the Mercado de Valores de Buenos Aires S.A. (Merval). The primary functions of Merval include the execution, settlement, surveillance and guarantee of exchange trades. This institution can also take disciplinary actions against individual brokers or brokerage firms that might violate the statutory rules in force, and/or the rules and regulations governing the Argentine stock exchange system under Public Offering Act 17811. Furthermore, Merval regulates, coordinates and implements each and every aspect connected with stock exchange trading, types of securities and trading mechanisms, terms and conditions of payment, and the like. It has also implemented a Stock-Watch facility to monitor all transactions in real time, focusing on those trades that for any reason call the attention of control experts.

The Mercado de Valores has a trading system applicable to corporate securities and government bonds called Concurrent Market, where trades are executed in an automated order-matching system or in the traditional open outcry mode on the floor of the Bolsa. All trades executed bear Merval's settlement guarantee. Trades in government and corporate bonds may also be executed through bilateral telephone execution, which is called the Continuous Trading System (with or without Merval's settlement guarantee). The kinds of trades available in the system are as follows: Cash Trades, Forward Trades, Forward-Forward, Carry-overs, Repurchase Agreements, Options, Securities Loans, Short Sales, Index and Government Bonds Futures. Among the Argentinean stock market indexes, the Merval Index is the most important. It is

\textsuperscript{2} Summary based on http://www.bcba.sba.com.ar. More details about the Argentinean stock market can be found on the previous web page.
based on the market value of an equity portfolio, selected according to market share, number of transactions, and quotation price on the Buenos Aires Stock Exchange. The date and base value are June 30, 1986 equal to $0.01. The Merval Index is reckoned on a continuous basis during any trading day and it is screened across the Market Data System terminals. Listed corporations and weighted prices are updated quarterly, consistent with market share for the last three months.

In addition to the Merval index, the performance of the Argentinean stock market is measured through two other indexes. The first is called the Burcap Index, which is essentially an equity portfolio composed of those securities included in the Merval Index. The contribution of each share of stock is in proportion to its market value as of base date. The index is adjusted in case of the start or withdrawal of quotation, equity reduction or subscription of new issues.

The other important stock market index, the Value Index, shows the evolution of the whole ordinary stocks with quotation on the Buenos Aires Stock Exchange. This index is also adjusted in case of the start or withdrawal of quotation, equity reduction or subscription of new issues.

Eun and Resnick (2001) report that the capitalization of the Argentinean equity market grew from 37 to 45 billion U.S. dollars from 1994 to 1997 (Eun and Resnick, 2001, 180). In 1998, the ten largest stocks represented 49% of the total market capitalization (Eun and Resnick, 2001, 183) even though 131 companies were listed on the Buenos Aires stock exchange. The turnover ratio, a measure of liquidity for a stock market represented by the ratio of stock market transactions over a one-year period.
divided by the year-end market capitalization, was 33 for the Argentinean stock markets in 1998 (Eun and Resnick, 2001, 182).

**Brazilian Stock Market**

The Brazilian Stock Market is mainly represented by the Sao Paulo Stock Exchange (Bovespa) and the Rio Stock Exchange\(^3\). Bovespa, the main stock exchange in Brazil, was founded on August 23, 1890 and it has a long history of services rendered to the capital market and to the Brazilian economy. The Rio Stock Exchange, the second most important Brazilian stock exchange, was founded in 1845. Up to the mid-1960s, Bovespa and the Rio Stock Exchanges were official entities linked to the finance departments of state governments, and brokers were appointed by the public sector. After the enactment of the Securities Act in 1965, the Brazilian financial system and capital market underwent a series of reforms, which provided the institutional character the Brazilian stock exchanges still have today. The Brazilian exchanges became non-profit self-regulating institutions, with administrative and financial autonomy. The traditional individual government securities broker was replaced by brokerage firms, which were established as joint stock companies or private limited liability companies.

Bovespa is a self-regulating entity that operates under the supervision of the Brazilian Securities and Exchange Commission (CVM). Since the 1960s, Bovespa has been improving its technology and the quality of services provided to investors, market intermediaries and listed companies. In 1972, Bovespa pioneered the implementation of automated trading sessions with information displayed on-line and in real-time via a computer terminal network. In the late 1970s, Bovespa was the first exchange to

introduce the options market in Brazil; in the 1980s, it implemented a Private Telephone Operations System (SPOT). At this time, Bovespa also developed a custody system and implemented on-line service networks for brokerage firms. In 1990, trading operations started being carried out through the Computer Assisted Trading System/CATS, which operated simultaneously with the traditional Open Outcry System. In 1997, Bovespa successfully implemented the Mega Bolsa, its new electronic trading system. Besides using highly advanced technology, Mega Bolsa expands the potential information processing volume and allows Bovespa to consolidate its position as the most important trading center in the Latin American market. Nowadays, Bovespa is the major stock-trading center in Latin America and it is composed of member firms that can operate through two trading systems: the open out-cry and the electronic trading system.

Bovespa trades company stocks, stock options, rights and stock dividends, subscription warrants and fund quotas regularly. Bovespa also trades depository receipts of stocks issued by companies from Mercosur member countries. Under the Brazilian Privatization Program, stock exchanges are authorized to auction stock lots representing the control of state companies to be privatized.

The Rio Stock Exchange was founded in 1845 by an imperial decree, which created the profession of public funds broker. From then on it has taken part in every important stage of Brazil’s economic development. After 1965 when the new Capital Markets Law was enacted, the Stock Exchange began to develop very rapidly. Professional management was introduced and the place of the public funds brokers was taken by stock brokering firms, which began to use new techniques for investing their clients’ funds.
The 1970s and 1980s were marked by the introduction of new telecommunications and information technology. Both transactions and participants also became more sophisticated and the Rio Stock Exchange was always at the forefront of these new developments. Derivative markets, an electronic trading system, and several different services offered by the network were introduced one after the other with great success. In the last ten years, foreign investors have entered the Brazilian stock markets and the Stock Exchange has played a decisive role in the privatization process, conducting over 80 successful federal auctions as well as nearly 30 auctions on behalf of state governments. In 1999, a market maker system was introduced in an entirely electronic trading environment. The Rio Stock Exchange is thus entering another era of history sponsoring the innovations, which are sweeping the Brazilian stock market.

Among the Brazilian stock market indexes, the Bovespa Index is the most representative indicator of the performance of the prices of the Brazilian stock market, since it clearly shows the behavior of the principal shares traded on the Sao Paulo Stock Exchange. The Bovespa Index is the most representative Brazilian indicator. It has not suffered any methodological changes since its implementation on January 2, 1968, and reflects 85% of the total business transactions carried out by all the Brazilian stock exchanges.

The Index is the current value, in Brazilian currency, of a portfolio made up on January 2, 1968, starting from a hypothetical investment. No additional investment is supposed to have been made, and only the reinvestment of the dividends received and of
the amount resulting from the sale of subscription rights, including the maintenance of
the portfolio shares received as bonus are considered.

The portfolio of the Index is composed of stocks, which jointly represent 80% of
the amount of cash transacted during the twelve months preceding the establishment of
the portfolio. As an additional criterion, it is required that a stock be at least present on
80% of the trading sessions of the period. The participation of each stock in the
portfolio has a direct relationship with the significance of this security on the cash
market—in terms of number of trades and their amount in Brazilian currency—adapted
to the size of the sample.

In order to maintain the representativeness of the Index, a four-month
reevaluation of the market is carried out, always based on the 12 preceding months. The
changes occurred in the relative participation of each stock are then identified. A new
portfolio is then formed and a new value is attributed to each paper, according to the
market distribution as assessed by the reevaluation study.

The Bovespa Index stands for the sum of the weights (theoretical amount of the
stock multiplied by its last price) of the stocks that compose the theoretical portfolio.
The mechanism of change is similar to the one used for the adjustment of the portfolio
as a whole; that is, one considers that the investor sold the shares for the last closing
price at the beginning of the distribution of benefits and used the resources in the
purchase of the same shares without the benefits distributed.

Bovespa is also involved in the development of stock profitability sector indexes,
which give economic agents and market participants the means to make inferences about
the segmented performance of the economy according to different activity sectors.
Bovespa chose the electric power sector to launch its first sector index. The IEE, Indice de Energia Eléctrica (Electric Power Index) is composed of the sector’s most important companies. At the moment, nine such companies are part of the Index, whose objective is to reflect the profitability of electric power generating, distributing and holding companies.

Another index created by Bovespa is the Brazil Index. It is a price index which measures the return of a theoretical portfolio composed of 100 stocks, selected among Bovespa’s most actively traded stocks in terms of number of trades and financial value, weighted according to their number of outstanding shares.

The capitalization of the Brazilian equity market grew from 189 to 256 billion U.S. dollars from 1994 to 1997 (Eun and Resnick, 2001, 180). In 1998, the ten largest stocks represented 25% of the total market capitalization (Eun and Resnick, 2001, 183) even though 1,118 companies were listed in total on the Rio and Bovespa stock exchanges. The turnover ratio was 91 for the Brazilian stock markets in 1998 (Eun and Resnick, 2001, 182).

**Chilean Stock Market**

The first steps taken to create a Stock Exchange in Chile occurred in 1840, but they were unsuccessful. In 1884 there were 180 companies, and this fact led to the creation of a specialized stock exchange where Chilean securities were officially traded. Thus, on November 27, 1983, the Santiago Stock Exchange (Bolsa de Comercio de Santiago) was founded. This represents the most important security exchange in Chile. In addition, Chile has two other stock exchanges: “La Bolsa de Valparaiso” and “La

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4 Summary based on [http://www.bolsantiaeo.cl](http://www.bolsantiaeo.cl). More details can be found on the previous web page.
Bolsa Electrónica.” The first one was initially created in 1915, subsequently closed in 1982, and reopened in April 1988. This exchange accounts for only a low percentage of the Chilean stock market total trading volume and listed securities. The second additional stock exchange, “La Bolsa Electrónica,” was created under the ownership of over-the-counter (OTC) dealers. This is a screen-based securities exchange and was founded in January 1989. “La Bolsa Electrónica” is the main competitor for the Santiago Stock Exchange and currently owns, due to its lower transaction costs, around a 33% market share of all Chilean stock market transactions. As of December 2000, there were approximately 300 companies listed on the Santiago Stock Exchange.

The performance of the Chilean stock market can be measured through the “Indice General de Precios de Acciones (IGPA)” and the “Indice de Precios Selectivo de Acciones (IPSA)”. IGPA, created in 1958, measures the stock market variations regarding all those securities registered in the Santiago Stock Exchange. This measure is based on the equity market value of Chilean companies. The companies are selected for the index according to the frequency of operations and volume.

IPSA, created in 1977, measures the price performance of the 40 most important Chilean stocks. The selection of the companies is made on a quarterly basis in March, June, September and December each year also according to the frequency of operations and volume.

The capitalization of the Chilean equity market grew from 28 to 52 billion U.S. dollars from 1991 to 1998 (Eun and Resnick, 2001, 180). In 1998, the ten largest stocks represented 43% of the total market capitalization (Eun and Resnick, 2001, 183) even though 287 companies were listed on the exchange. The turnover ratio was nine for the

**Mexican Stock Market**

The first organized security exchange in Mexico\(^5\), the “Bolsa Nacional de Mexico,” did not start its operations until 1894. Between the original and the current Bolsa Mexicana de Valores (BMV), different institutions have provided the mechanisms for trading securities, but interruptions occurred due to the Mexican revolution and the World War I. The current Mexican financial and securities system began its development with the first banking convention in 1924. However, this system was formally started in 1933 under the regime of the Credit Organization Law of 1932 and the Exchange Regulation Law. This legal framework was kept in place until the government of President Luis Echeverría in the 1970s. The Securities Market Act went into effect in 1975 and opened new alternatives of growth for the stock market. The “Bolsa de Valores de Mexico” changed its name to “Bolsa Mexicana de Valores” and concentrated the activities realized for several other exchange institutions (Mexico, Guadalajara and Monterrey).

In 1978, the government created the National Securities Depository (S.D. Indeval) and in 1980 The Mexican Securities Industry Association (AMIB). In 1990, authorities re-instituted what is called the “mixed regime” facilitating the way for the re-privatization of Mexico’s banks and the formation of financial groups under the Financial Group Law.

In November 1996, for the first time all securities listed on the exchange were traded through the electronic system BVM-SENTRA Capitales. In January 1997, the

BMV issued rules for the creation of an options and futures market in Mexico and S.D. Indeval implemented the securities lending program. In April 1997, trading of debt instruments issued abroad by the Mexican Federal Government began. On July 15, 1997, The International Quotation System (SIC) began operations by listing stock from four Argentinean issuers.

Currently, the BVM calculates and publishes several indexes. The Price Quotations Index (IPC) is the leading indicator of the performance of the stock market as a whole. It expresses an index based on a value-weighted representative sample of stocks traded on the BMV. The sample is reviewed once every two months and is composed of 34 issuers that participate in different sectors of the economy. The current structure has been used since 1978. Any change in the number of securities listed modifies the structure of the index because price and/or market capitalization is used as a weighting factor. This is why the value of issuers that declare dividends must be adjusted by applying an adjustment factor to the previous day’s market capitalization. If no adjustment is required, the factor is equal to one.

Besides the IPC, the BMV publishes sector indexes, which measure performance in certain areas or sectors of economic activity. The method used is the same as for the IPC, with the only difference being the size of the sample and the number of shares in each economic sector. The Mexico Index (INMEX) is used as an underlying value, which means that it serves as a base value for some derivative issues. The sample used to calculate this index includes the most representative and highest-marketable series of between 20 and 25 issuers. The weight of each issuer may not exceed 10% of the total and the sample is revised every six months. BMV also publishes a Medium Sized
Company Index (IP-MMEX), which is designed to reflect the performance of medium-sized companies. As of October 1997, the sample consisted of stocks from 18 issuers. The IP-MMEX sample is reviewed every two months and the equation is the same as the IPC's. Currently, there is the possibility or threat of the loss of medium-sized companies due to low trading volume. This probable disappearance could affect the overall development of the market by increasing the concentration of the market among a few large firms.

The capitalization of the Mexican equity market fell from 98 to 92 billion U.S. dollars from 1991 to 1998 (Eun and Resnick, 2001, 180). The total market capitalization represented by the ten largest stocks was approximately 41% in Mexico in 1998 (Eun and Resnick, 2001, 183). As in the case of the Chilean stock market, Mexico also exhibits a high degree of concentration on its stock exchange. Three sectors (communications, financial, and retail) of the economy make up close to 70% of total market capitalization. The turnover ratio was 37 for the Mexican stock markets in 1998 (Eun and Resnick, 2001, 182).
CHAPTER IV

DATA AND DESCRIPTIVE STATISTICS

This chapter begins with some important descriptive statistics related to each emerging stock market in the sample. Next, the risk and return characteristics associated with these markets are discussed within an international financial context. Then, the Latin American emerging stock markets' behavior, in terms of periods of positive and negative market excess returns, is analyzed and discussed.

Data

The sample period for this research begins the first week of January 1990 and finishes the last week of December 1999. Weekly returns for the securities included in the sample, stock market indexes, and government bond rates for each country were obtained from Economatica™, International Financial Statistics, and Datastream™ databases. The U.S. Treasury bill rates were collected from the Federal Reserve Bulletin. The number of companies considered in the sample varies according to the data available for each stock market. Argentina has 54 companies. Brazil exhibits 229 companies, Chile 80 and Mexico 70. Table 4.1 shows the distribution of Argentinean, Brazilian, Chilean and Mexican companies according to their industrial classification and market equity capitalization at the end of 1999.

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6 ECONOMATICA™ is a historical database, which tracks pricing, financial statements, company reports, and local news on Latin American countries.
Table 4.1
Descriptive Statistics for Latin American Companies in the Sample

<table>
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<tr>
<th>Sector</th>
<th>Argentina</th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
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<tr>
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</table>

*a* Number of companies in the stock market sample at the end of 1999.

*b* Percentage of companies on the total stock market sample at the end of 1999.

*c* Market equity capitalization (in millions of U.S. dollars) at the end of 1999.

*d* Percentage of equity capitalization on the total stock market sample at the end of 1999.

(Table continues)
Table 4.1 (Continued)
Descriptive Statistics for Latin American Companies in the Sample

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<sup>a</sup> Number of companies in the stock market sample at the end of 1999.
<sup>b</sup> Percentage of companies on the total stock market sample at the end of 1999.
<sup>c</sup> Market equity capitalization (in millions of U.S. dollars) at the end of 1999.
<sup>d</sup> Percentage of equity capitalization on the total stock market sample at the end of 1999.
Table 4.1 (Continued)
Descriptive Statistics for Latin American Companies in the Sample

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<td>%(b)</td>
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<tr>
<td>Mech.Industry</td>
<td>6</td>
<td>2.6</td>
<td>200</td>
<td>0.1</td>
<td></td>
<td>1</td>
<td>1.4</td>
<td>194</td>
<td>0.1</td>
<td></td>
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</tr>
<tr>
<td>Metallurgy</td>
<td>1</td>
<td>1.9</td>
<td>2</td>
<td>0.0</td>
<td></td>
<td>16</td>
<td>7.0</td>
<td>832</td>
<td>0.3</td>
<td></td>
<td>4</td>
<td>5.0</td>
<td>1,001</td>
<td>2.4</td>
<td></td>
<td>1</td>
<td>1.4</td>
<td>194</td>
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<tr>
<td>Mining</td>
<td>8</td>
<td>3.5</td>
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<td>7.0</td>
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<td>4</td>
<td>5.0</td>
<td>1,234</td>
<td>3.0</td>
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<td>2</td>
<td>2.9</td>
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<tr>
<td>Navigation</td>
<td></td>
<td>1.3</td>
<td>283</td>
<td>0.7</td>
<td></td>
<td>1</td>
<td>1.3</td>
<td>283</td>
<td>0.7</td>
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<td></td>
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<td></td>
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<tr>
<td>Paper Pulp</td>
<td>4</td>
<td>7.4</td>
<td>48</td>
<td>0.1</td>
<td></td>
<td>6</td>
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<td>5,917</td>
<td>1.9</td>
<td></td>
<td>2</td>
<td>2.5</td>
<td>2,323</td>
<td>5.7</td>
<td></td>
<td>1</td>
<td>1.4</td>
<td>5,160</td>
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<td>Pension Fund</td>
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<td>5</td>
<td>6.3</td>
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<tr>
<td>Petrol-Chemical</td>
<td>5</td>
<td>9.3</td>
<td>18,758</td>
<td>43.6</td>
<td></td>
<td>17</td>
<td>7.4</td>
<td>55,218</td>
<td>18.2</td>
<td></td>
<td>2</td>
<td>2.5</td>
<td>302</td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(a\) Number of companies in the stock market sample at the end of 1999.
\(b\) Percentage of companies on the total stock market sample at the end of 1999.
\(c\) Market equity capitalization (in millions of U.S. dollars) at the end of 1999.
\(d\) Percentage of equity capitalization on the total stock market sample at the end of 1999.

(Table continues)
Table 4.1 (Continued)
Descriptive Statistics for Latin American Companies in the Sample

<table>
<thead>
<tr>
<th>Sector</th>
<th>Argentina</th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Firms(^a)</td>
<td>%(^b)</td>
<td>Value(^c)</td>
<td>Firms(^a)</td>
</tr>
<tr>
<td>Steel Plants</td>
<td>2</td>
<td>3.7</td>
<td>2,472</td>
<td>5.7</td>
</tr>
<tr>
<td>Telecommunic.</td>
<td>2</td>
<td>3.7</td>
<td>13,345</td>
<td>31.0</td>
</tr>
<tr>
<td>Textile</td>
<td>1</td>
<td>1.9</td>
<td>36</td>
<td>0.1</td>
</tr>
<tr>
<td>Timber</td>
<td>1</td>
<td>1.9</td>
<td>4</td>
<td>0.0</td>
</tr>
<tr>
<td>Tobacco</td>
<td>2</td>
<td>3.7</td>
<td>721</td>
<td>1.7</td>
</tr>
<tr>
<td>Tourism-Hotel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toys</td>
<td></td>
<td>1</td>
<td>0.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Transportation</td>
<td>1</td>
<td>1.9</td>
<td>5</td>
<td>0.0</td>
</tr>
<tr>
<td>Various</td>
<td>6</td>
<td>11.2</td>
<td>784</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>100.0</td>
<td>43,056</td>
<td>100.0</td>
</tr>
</tbody>
</table>

\(^a\) Number of companies in the stock market sample at the end of 1999.
\(^b\) Percentage of companies on the total stock market sample at the end of 1999.
\(^c\) Market equity capitalization (in millions of U.S. dollars) at the end of 1999.
\(^d\) Percentage of equity capitalization on the total stock market sample at the end of 1999.
For the Argentinean stock market, the Food, Petroleum-Chemical, Holding and Paper Pulp sectors are the most important industries in terms of the number of companies. However, the ranking varies in terms of market-equity capitalization. In this case, the Petroleum-Chemical, Telecommunications and Holding sectors rank among the most relevant.

In the case of the Brazilian stock market, the Banking, Textile and Petroleum-Chemical sectors rank among the most important according to the number of companies in each industry. In terms of market equity capitalization, the ranking is led by the Telecommunications sector followed by the Banking and Petroleum-Chemical industries.

For the Chilean stock market, the Electric Power, Investment and Beverage sectors concentrate the highest number of companies. In terms of market-equity capitalization, the ranking is led by the Electric Power industry and then by the Commerce and Telecommunication sectors.

For the Mexican stock market, the Beverage, Commerce, Financial Group and Holding sectors account for the most relevant companies. In terms of the relative importance of market equity, the ranking is dominated by the Telecommunications industry followed by the Commerce and Cement sectors.

One of the main common features across the Latin American emerging stock markets in the sample is their high industrial concentration. The Argentinean and Mexican cases are the most concentrated stock markets in the region. Argentina has 11 companies that account for more than 80% of its total market-equity capitalization at the end of 1999. Mexico has 14 companies sharing 57% of the total market capitalization at
the end of the same year. This indicates that the size variable and, therefore, market concentration, might be an important factor in explaining the firm-specific cross-sectional return variations within each stock market.

**Risk and Return Characteristics of Latin American Stock Markets**

The risk and return characteristics of the Latin American emerging stock markets in the sample are summarized in Tables 4.2 and 4.3, which present the performance of these markets over the 1990-1994 and 1995-1999 subperiods, respectively.

It is important to separate the Latin American emerging stock market performance into the above subperiods because these markets have shown important differences over time in terms of risk and return mainly due to changes in currency, exchange rate regimes and inflation. A historical review of the main economic changes exhibited by these markets shows that Argentina until December 1991 used the austral as its official currency as well as a floating exchange rate regime. Since 1992 its official currency has been the peso under a practically fixed exchange rate regime. Thus, the variability of the U.S. dollar in Argentina in the 1990-1994 subperiod is mainly explained by the exchange rate variability exhibited in 1990 and 1991.

The historical analysis also shows that Brazil kept the cruzeiro as its official currency until June 1994. In July 1994, it was changed for the real under a floating exchange rate regime. The real was introduced as part of a successful anti-inflationary program and has been used as a device for trade policy since increases in import quotas and tariffs were introduced as an incentive for the domestic production and exports.

In the Chilean case, the analysis shows that this economy has exhibited a stable exchange rate regime. The Chilean exchange rate, which is adjusted frequently to a set
of economic indicators, has been one of the least variables across the Latin American markets in the sample.

Finally, the Mexican economy has kept the peso as its official currency under a floating exchange rate regime. A financial event that is important to mention is the Mexican peso crisis, which occurred at the end of 1994. The Mexican peso was depreciated by around 40% on that date, notoriously affecting the variability of the local exchange rate. After 1994, the variability of the Mexican peso against the U.S. dollar has been lower than in previous years.

The statistical analysis of the risk-return characteristics across the Latin American stock markets in the sample is as follows:

Table 4.2


<table>
<thead>
<tr>
<th>Country</th>
<th>Annual Return %</th>
<th>Capital Gain + Dividend Yield %</th>
<th>Currency Gain %</th>
<th>Total Risk %</th>
<th>Domestic Risk %</th>
<th>Correlation with Latin America</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>38.4</td>
<td>38.4</td>
<td>0.0</td>
<td>61.6</td>
<td>61.6</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Argentina</td>
<td>88.7</td>
<td>176.5</td>
<td>-87.8</td>
<td>180.4</td>
<td>337.7</td>
<td>0.90</td>
<td>2.63</td>
</tr>
<tr>
<td>Brazil</td>
<td>76.5</td>
<td>2027.3</td>
<td>-1950.9</td>
<td>136.8</td>
<td>2038.7</td>
<td>0.93</td>
<td>2.08</td>
</tr>
<tr>
<td>Chile</td>
<td>43.8</td>
<td>51.8</td>
<td>-8.0</td>
<td>30.3</td>
<td>37.8</td>
<td>0.68</td>
<td>0.33</td>
</tr>
<tr>
<td>Mexico</td>
<td>35.7</td>
<td>48.0</td>
<td>-12.2</td>
<td>59.2</td>
<td>50.5</td>
<td>0.86</td>
<td>0.83</td>
</tr>
</tbody>
</table>

The statistics shown in tables 4.2 and 4.3 are based on the Merval, Ibovespa, IGPA, IPC and the MSCI Emerging Latin America stock market indexes for Argentina, Brazil, Chile, Mexico and Latin America, respectively.
Table 4.3

December 1999, in U.S. Dollars

<table>
<thead>
<tr>
<th></th>
<th>Annual Return %</th>
<th>Capital Gain + Dividend Yield %</th>
<th>Currency Gain %</th>
<th>Total Risk %</th>
<th>Domestic Risk %</th>
<th>Correlation with Latin America</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America</td>
<td>5.8</td>
<td>5.8</td>
<td>0.0</td>
<td>31.6</td>
<td>31.6</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Argentina</td>
<td>7.2</td>
<td>6.9</td>
<td>0.3</td>
<td>26.5</td>
<td>26.4</td>
<td>0.79</td>
<td>0.66</td>
</tr>
<tr>
<td>Brazil</td>
<td>21.2</td>
<td>45.2</td>
<td>-24.0</td>
<td>45.8</td>
<td>70.9</td>
<td>0.96</td>
<td>1.40</td>
</tr>
<tr>
<td>Chile</td>
<td>-4.2</td>
<td>1.5</td>
<td>-5.7</td>
<td>22.6</td>
<td>26.4</td>
<td>0.62</td>
<td>0.44</td>
</tr>
<tr>
<td>Mexico</td>
<td>20.0</td>
<td>29.9</td>
<td>-9.9</td>
<td>51.5</td>
<td>39.9</td>
<td>0.95</td>
<td>1.55</td>
</tr>
</tbody>
</table>

The first column in Table 4.3 shows the total annual return measured in a
common currency, the U.S. dollar. The next two columns decompose this annual return
into capital gains plus dividend yield, and currency gains. The next three columns show
the risk (standard deviation) of these emerging markets measured in dollars (total risk),
local currency (domestic risk) and the correlation coefficient between each stock market
against the Latin American stock market index. The last column shows the beta
coefficient, which measures the degree of stock market sensitiveness to the general
movements in the Latin American index.

The high variability of the Latin American emerging stock markets during 1990
through 1994 is very clear. In U.S. dollar terms, these markets present volatility ranging
from 30% to 180%, compared to 62% for Latin America as a whole. The results are
more pronounced when volatility is measured in local currency. For instance, the
Brazilian stock market had a volatility of 2,039% in local currency, compared to 137%
in U.S. dollars. This difference is explained by hyperinflation. The Brazilian currency
depreciated by more than 1,950% relative to the U.S. dollar during the 1990-94 period.

The high return attained by some Latin American emerging stock markets seems
apparent. Argentina and Brazil had a mean dollar return of 89% and 77% per annum
during this period, compared to 38% for the Latin American Index. The relative high
correlation of these emerging stock markets with the Latin American index is shown
before the last column of Table 4.2. The high correlation achieved for some of these
markets seems to reflect a high degree of interdependence across the Latin American
stock markets in the sample. However, those economies that are regionally more
independent (e.g., Chile and Mexico) exhibit a lower correlation against the Latin
American index.

The last column of Table 4.2 shows the beta coefficient for each market, which
is estimated based on annual returns. Argentina and Brazil appear to be more than twice
as responsive, or risky, as the Latin American market index. Mexico appears to be
nearly as sensitive as Latin America, and Chile less than half as sensitive in comparison
to the other markets.

The analysis for 1995-1999 (see Table 4.3) presents some important differences
in comparison to the 1990-1994 period. First, there is a significant decrease in terms of
return variability across the Latin American emerging stock markets. In U.S. dollar
terms, these markets present volatilities ranging from 23% to 52%, compared to the 30%
to 180% range exhibited in the 1990-1994 period. The Latin America index also
presents a significant decrease from 62% to 32%. Moreover, the decreases are more
pronounced when volatility in U.S. dollars is compared to that estimated in local
currency. On average, the difference between these volatilities was 515% against 4.3% for the 1990-1994 and 1995-1999 periods, respectively. These results are consistent with a significant decrease in the exchange rate variability across the Latin American markets in the last five years. Moreover, exchange rate movements, on average, appear to be inversely related to the local stock market returns contributing to reduce the return variability when it is measured in U.S. dollars.

Tables 4.2 and 4.3 jointly show that the relatively high correlation between these emerging stock markets and the Latin American index would reflect a high degree of interdependence across the Latin American stock markets in the sample. It is important to note on the one hand, that the correlation coefficients by themselves do not imply anything about integration since it is possible to find segmented stock markets that are not correlated, and vice-versa. On the other hand, these coefficients might be important when the potential benefits of diversification are studied. The relatively lower correlation between the Chilean stock market and the Latin American Index suggests that the Chilean market might be partially segmented from the others, and thus, could provide some diversification benefits in comparison to a portfolio mainly invested on the remaining stock markets. Its contribution to long-run returns might be high, and the risk of the overall portfolio could be diminished.

However, the correlation remains generally positive. Therefore, it is not difficult to observe that in some periods, when Latin America falls, the previous emerging stock markets also fall, and some of them substantially, given their relative higher volatility. Two examples of this were the effects of the Mexican currency devaluation in 1994 and the Asian financial crisis in 1998. In dollar terms, while Latin America fell 16% in
1995, Brazil and Mexico fell 14% and 19%, respectively. In the same year, Argentina and Chile grew 14% and 5%, respectively. In 1998 while Latin America fell 38%, Argentina, Brazil, Chile and Mexico fell 37%, 39%, 30% and 39%, respectively. In other periods, an appreciation in Latin America can offset a domestic loss produced by investing mainly in an individual local stock market. An example of this was the year of 1996, in which Latin America grew 19% and Chile fell 18%.

Lastly, it is important to point out that a statement about stock market integration across the Latin American stock markets requires an asset pricing model that can be used to test whether the price of risk is not significantly different across markets. These issues will be addressed in Chapter X.

Positive and Negative Market Excess Return

Pettengil et al. (1995) point out that a systematic relationship must exist between beta and return for beta to be a useful measure of risk. The CAPM model shows an unconditional systematic and positive tradeoff between beta and expected return. However, according to the authors’ conditional version, it should reflect a segmented relationship between realized returns and beta (i.e., a positive relationship during positive market excess return periods and a negative relationship during negative market excess return periods). If realized market returns were barely less than the risk-free rate, this conditional relationship would have no significant impact on tests of the relationship between beta and returns. This relationship, however, occurs frequently. A month by month comparison of the CRSP equally-weighted index (as the proxy for market return) and the 90-day Treasury Bill rate (as the measure for the risk-free return) over the period

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1936 through 1990 indicates that the Treasury Bill rate exceeds the market return in 280 out of 660 total observations.

Latin American stock markets in the sample also present a similar situation to the U.S. stock market. A week-by-week comparison of each stock market index in the sample and each respective local risk free rate over the period 1995 through 1999 shows that the risk free rate exceeds the market return in 117 of 261 observations for Argentina, 124 of 261 for Brazil, 142 of 261 for Chile and 140 of 261 for the Mexican case. The presence of a large number of negative market excess return periods suggests that those studies that test for an unconditional positive association between beta and realized returns are biased in trying to find a systematic relationship.
CHAPTER V

MODEL SPECIFICATION AND ECONOMETRIC METHODOLOGY

This chapter describes the model specification and econometric methodology used in testing the CAPM models considered in this research.

The model specification is mainly based on the zero-beta CAPM of Black (1972), which predicts that:

\[ E(R_i) = \gamma_0 + \gamma_1 \beta_i \quad \text{for all } i = 1, \ldots, N \]

where \( E(R_i) \) is the expected return on asset \( i \), \( \beta_i \) is the beta of portfolio \( i \) where \( \beta_i = \frac{\text{Cov}(R_i, R_m)}{\text{var}(R_m)} \), \( \gamma_0 \) is the expected return on the portfolio, which has a zero covariance with the market portfolio, \( \gamma_1 \) is the expected risk premium of the market portfolio. This version of the CAPM model is based on the following assumptions (Copeland and Weston, 1988, 194):

1. Investors are risk-averse individuals who maximize the expected utility of their end-of-period wealth.
2. Investors are price takers and have homogeneous expectations about asset returns that have a joint normal distribution.

---

8 If a risk-free asset exists, \( \gamma_0 \) is the risk-free return, and this is the traditional form of the CAPM of Sharpe (1964).
3. The quantities of assets are fixed. Also, all assets are marketable and perfectly 
divisible.

4. Asset markets are frictionless and information is costless and simultaneously 
available to all investors.

5. There are no market imperfections such as taxes, regulations, or restrictions on short 
selling.

The main conclusion of the zero-beta CAPM of Black (1972) is that the results 
of this CAPM model do not require the existence of a pure riskless asset. Beta is still an 
appropriate measure of systematic risk for an asset, and the linearity of the model still 
holds. The zero-beta CAPM of Black (1972) is also usually called the two-factor model.

In order to analyze whether the CAPM model tested by Fama and MacBeth 
(1973) for U.S. portfolios (hereafter, the unconditional CAPM model [UCAPM]) 
exhibits a positive relationship between realized portfolio returns and betas for Latin 
American portfolios, the econometric tests are conducted in stages. In the first stage, $\beta_i$
 is estimated from the regression model (2) as follows,

$$R_{it} = \alpha_i + \beta_i R_{Mt} + e_{it}$$  \hspace{1cm} (2)$$

where $R_{it}$ is the return on asset $i$ in week $t$, $R_{Mt}$ is the return on the market portfolio 
proxy in week $t$, $e_{it}$ is a random error term and $\beta_i$ is the estimated beta of asset $i$. It is 
assumed that the error terms in equation (2) are independently and identically 
distributed with mean zero and stationary covariance matrix, and $R_{Mt}$ is assumed to 
come from a stationary distribution.

However, more efficient estimators can be obtained if heteroskedasticity in the 
errors is specified properly. Generalized Autoregressive Conditional Heteroskedasticity
(GARCH) models are specifically designed to model conditional variances. These models have been widely used in different branches of econometrics, especially in financial time series analysis where they have shown to be consistent with the volatility clustering often observed in financial returns data. In financial series, large changes in returns are commonly followed by further increasingly changes (Bollerslev, Chou, and Kroner, 1992 and Bollerslev, Engle and Nelson, 1994). The representation of the GARCH \((p,q)\) variance is

\[
\sigma_i^2 = \omega + \sum_{i=1}^{q} \alpha_i e_{i-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{i-j}^2
\]

where \(\sigma_i^2\) is the conditional variance of the error terms in equation (2), \(p\) is the order of the GARCH terms and \(q\) is the order of the ARCH terms. If equations (2) and (3) are correctly specified, the standardized residuals \((e_i/\sigma_i)\) should be independent, and identically distributed random variables with mean zero and variance one. If the standardized residuals are also normally distributed, then the estimates are maximum likelihood estimates, which are asymptotically efficient. However, even if the distribution of the residuals is not normal, the estimates are still consistent under quasi-maximum likelihood (QML) assumptions. To carry out valid inference with QML, the standard errors are estimated using the Heteroskedasticity Consistent Covariance method described by Bollerslev and Wooldridge (1992). The most important statistical issue behind equation (3) is to determine the adequate number of lags for \(p\) and \(q\). To solve this issue, The Akaike Information Criterion\(^9\) can be used to select the optimal

\(^9\) The Akaike information criterion has been widely used in time series analysis to determine the appropriate length of the distributed lag. Lutkepohl (1991, Chapter 4) presents a number of results regarding consistent lag order selection in time series models.
number of lags. Then, individual betas are estimated for each company's equity in the sample by jointly estimating equations (2) and (3) through the period of January 1990 to December 1992. After obtaining consistent estimates of individual betas, securities with the lowest betas are assigned to the first portfolio, and so on. The number of portfolio varies according to the number of available companies on each stock market under study. For Argentina, Brazil, Chile and Mexico there are 54, 229, 80 and 70 companies, respectively. As such, portfolios with five companies in each are considered for construction purposes. This procedure yields approximately 10, 45, 16 and 14 different portfolios for the Argentinean, Brazilian, Chilean and Mexican stock markets, respectively.

Betas for each portfolio are estimated in the second subsequent period from (January 1993 to December 1998) by again jointly estimating equations (2) and (3). This is the portfolio beta estimation period. In the last stage, the cross-sectional regression equation (4) is estimated for each week of two subsequent testing periods. These are 1995-99 and 1997-99. The regression equation (4), which is based on the CAPM of Black (1972), is specified as:

\[ R_{jt} = \gamma_0 t + \gamma_{1t} \beta_j + \mu_{jt} \]  

(4)

where \( R_{jt} \) is the return on portfolio \( j \) in week \( t \), \( \beta_j \) is the beta of portfolio \( j \), which is estimated from equations (2) and (3) in the portfolio beta estimation period and \( \mu_{jt} \) is a random error term. Equation (4) is estimated by cross-sectional OLS, which gives estimates \( \gamma_0 t \) and \( \gamma_{1t} \) for each week in the testing period. The average values of the

---

10 In order to incorporate the time-varying nature of portfolio betas, five portfolio beta estimation periods (1993-94, 94-95, 95-96, 96-97 and 97-98) are considered. The portfolio betas estimated for each pair of years are used as explanatory variables further in the immediate next year. For instance, the portfolio betas estimated based on the 1993-94 years, are used as predictors in 1995 and so on.
weekly coefficients are then estimated, and their average values can be tested to analyze whether they are significantly different from zero using t tests.

The main prediction obtained from equation (4) is that $\beta_j$ should be the only factor that explains the relationship between portfolio returns and risk. If other factors are included in order to explain return, these factors should have no explanatory power.

In order to assess the robustness of the results, the equations (2) through (4) are estimated under two scenarios in both the 1995-99 and 1997-99 test periods. The first scenario considers returns estimated in local currency and assumes that the Latin American stock markets are segmented. The second scenario assumes returns estimated in U.S. dollars and, thus, the above markets are supposed to be integrated.

To test the Pettengil et al. (1995) version of the CAPM (hereafter the conditional CAPM model [CCAPM]), the testing periods are split into up and down market weeks. If the realized market return is above the risk-free return (up market), portfolio betas and returns should be positively related, but if the realized market return is below the risk-free return (down market), portfolio betas and returns should be inversely related. Therefore, in order to study whether a systematic relationship between beta and returns exists, the regression coefficients from equation (5) are estimated,

$$R_{jt} = \alpha_0 t + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \varepsilon_{jt}$$

where $D = 1$, if $(R_{Mt} - R_f) > 0$, and $D = 0$, if $(R_{Mt} - R_f) < 0$. $R_f$ is the risk-free rate in week $t$. The predicted hypotheses in this case are:

$H_0$: $\alpha_1 = 0$ versus $H_a$: $\alpha_1 > 0$

$H_0$: $\alpha_2 = 0$ versus $H_a$: $\alpha_2 < 0$
where \( \alpha_1 \) and \( \alpha_2 \) are the average values of the coefficients \( \alpha_{1i} \) and \( \alpha_{2i} \) respectively. Using standard t tests, the statistical significance of these coefficients can be tested.

Pettengil et al. (1995) point out that the conditional relationship (equation [5]) does not imply a positive relationship between risk and return. According to them, in order to test for a positive tradeoff between risk and return, two conditions are necessary. Collectively, these are (1) the excess market return should be positive on average and (2) the risk premium in up markets and down markets should be symmetrical. The possibility of symmetry can be specified as follows:

\[
H_0: \alpha_1 - \alpha_2 = 0 \quad \text{versus} \quad H_a: \alpha_1 - \alpha_2 \neq 0
\]

These two previous hypotheses can be tested by a Wald test, which tests for an absolute significant difference between the \( \alpha_1 \) and \( \alpha_2 \) coefficients. Next, in order to test whether the results are sensitive to the dummy specification for up and down markets, the above procedures are repeated by using an alternative dummy specification into equation (5), where the dummy variable is redefined as \( D = 1 \), if \( R_{Mt} > 0 \), and \( D = 0 \), if \( R_{Mt} < 0 \). This dummy specification controls for the effect that a positive risk free rate would have on the results. Moreover, by using this specification, an alternative definition is tested for up and down markets. Up markets, defined by \( R_{Mt} > 0 \), require that \( P_{Mt} > P_{Mt-1} \). Thus, under this definition a stock market goes \textit{up} when its current realized value is \textit{greater} than its realized value in the previous week. Conversely, a stock market goes \textit{down} when its current realized value is \textit{lower} than its realized value in the previous week. The predicted hypotheses for this alternative specification remain the same as in Pettengil et al. (1995).
To assess again the robustness of the results, the equation (5) with the two specifications for the dummy variable is estimated under two scenarios in both the 1995-99 and 1997-99 test periods. The first scenario assumes local currency and segmented Latin American stock markets. The second scenario assumes returns estimated in U.S. dollars and integrated stock markets.

Next, in order to analyze whether the additional risk factors documented in the asset pricing literature contribute to explain the conditional cross-sectional return variations, equation (5) is expanded to include the following variables: size (Banz, 1981), leverage ratio (Bhandari, 1988; Rosenberg, Reid and Lanstein, 1985), book-to-market equity ratio (Chan, Hamao and Lakonishok, 1991), price-earnings ratio (Ball, 1978; Basu, 1983) and a January effect (Tinic and West, 1984). The effects of these variables are examined by testing whether the average value of the weekly coefficient on each of these covariates is significantly different from zero. The econometric specification to be tested is as follows:

$$R_{jt} = \delta_0 + \delta_1 D_f \beta_j + \delta_2 (1-D) \beta_j + \delta_3 \text{Size}_j + \delta_4 \text{Lev}_j + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j$$

where,

- $\text{Size}_j$ = The proxy is $\ln$ (Market value of equity) associated to each portfolio $j$.
- $\text{Lev}_j$ = Leverage. The proxy is $\ln$ (Total book assets/book value of common equity) ratio associated to each portfolio $j$.
- $\text{BME}_j$ = The proxy is $\ln$ (Book value of common equity/Market value of equity) ratio associated to each portfolio $j$.
- $\text{PE}_j$ = The proxy is $\ln$ (Stock price/[(Net Income/Shares outstanding)]) ratio associated to each portfolio $j$. 

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
\( J A N_j \) = Dummy variable which equals one if the week is within January and zero otherwise.

\( v_j \) = is a random error term.

An important observation, before continuing with methodological issues, is that the dummy variable that captures up and down markets in equation (6) will be defined later according to the results obtained in this research. The expectation is that both the Pettengil et al. (1995) specification and its alternative, which does not use the risk free as a benchmark, will produce similar results. Thus, if the results under both specifications do not vary significantly, then the dummy variable in equation (6) will be finally defined as \( D = 1 \), if \( R_{Ml} > 0 \), and \( D = 0 \), if \( R_{Ml} < 0 \), for domestic CCAPM and \( D = 1 \), if \( R_{LAlt} > 0 \) and \( D = 0 \), if \( R_{LAlt} < 0 \), for international CCAPM models. Here \( R_{Ml} \) is the return on a local stock market index and \( R_{LAlt} \) is the return on the MSCI Latin American stock market index, respectively. Lastly, to assess the robustness of the results, equation (6) with the selected specification for the dummy variable is estimated under two scenarios (domestic and international) in both the 1995-99 and 1997-99 test periods.

According to the CAPM literature (see Chapter II), it is possible to hypothesize that the average value of the weekly coefficients on each explanatory variable should be significantly negative for size, positive for leverage ratio, positive for the ratio of a portfolio's book value of common equity to its market value, negative for price-earnings ratio and positive for the January dummy. To ensure that the accounting variables are known before the returns they are used to explain, the accounting data for all fiscal yearends in calendar year \( t - 1 \) (1995-1998) is matched with the returns for July of year \( t \) to June of \( t + 1 \). The 6-month (minimum) gap between fiscal yearend and the return
tests is realistic for companies of emerging countries. Previous studies (e.g., Basu, 1983) assume that accounting data are available within three months of fiscal yearends. The U.S. firms are required to file their financial reports with the SEC within 90 days of their fiscal yearends, but on average 20% approximately do not comply. Furthermore, more than 40% of the December fiscal yearend firms that do comply with the 90-day rule file on March 31, and their reports are not made public until April (Alford, Jones, and Zmijewski, 1992).

The firm’s market equity at the end of December of year $t-1$ is used to estimate its book-to-market and price-earnings ratios for $t-1$, and its market equity for June of year $t$ is used to measure its size. The book value of assets and the common equity at the end of December of year $t-1$ are used to measure the firm’s leverage ratio for $t-1$. Since size, leverage, book-to-market equity ratio and the price-earnings ratio are measured for individual companies (stocks), it is necessary to group this information into portfolios in order to be consistent with the Fama-MacBeth regressions. In this dissertation, the average of the previous financial measures (based on individual firms in each portfolio) is used as an estimator of the financial variables for each portfolio.

Finally, in order to test whether the Latin American stock markets are integrated, two regression equations are estimated. First, equation (5) is extended (using the selected dummy specification for up and down markets) to incorporate all the stock markets studied into one single equation (7). Then, this equation is estimated to test whether the beta coefficients associated with up and down markets (the proxy for market portfolio to be used is the MSCI Latin America stock market index) are not statistically different across the markets. Then, equation (7) is extended in order to
control for those additional variables, other than up and down betas, that result significantly priced across periods for the Latin American stock markets in the sample.

Thus, equation (7) is defined as

\[ R_{jt} = \delta_1 D_{BRA} + \delta_2 D_{CH} + \delta_3 D_{MX} + \delta_4 D_{ARG} + \delta_5 D_{BRA} + \delta_6 (1-D) D_{BRA} + \delta_7 D_{CH} + \delta_8 (1-D) D_{CH} + \delta_9 D_{MX} + \delta_{10} (1-D) D_{MX} + \delta_1 D_{ARG} + \delta_2 (1-D) D_{ARG} + \eta_j \quad (7) \]

where

\[ D = 1, \text{ if } R_{LAit} > 0, \text{ and } D = 0, \text{ if } R_{LAit} < 0 \]

\[ D_{BRA} = 1, \text{ if portfolio } j \text{ belongs to the Brazilian Stock Market, and } D_{BRA} = 0, \text{ otherwise.} \]

\[ D_{CH} = 1, \text{ if portfolio } j \text{ belongs to the Chilean Stock Market, and } D_{CH} = 0, \text{ otherwise.} \]

\[ D_{MX} = 1, \text{ if portfolio } j \text{ belongs to the Mexican Stock Market, and } D_{MX} = 0, \text{ otherwise.} \]

\[ D_{ARG} = 1, \text{ if portfolio } j \text{ belongs to the Argentinean Stock Market, and } D_{ARG} = 0, \text{ otherwise.} \]

The working null hypotheses to be tested are:

A. Full Market Integration across Latin American stock markets. The null hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_7 = \delta_9 = \delta_{11} \text{ (up markets)} \]

\[ H_0: \delta_6 = \delta_8 = \delta_{10} = \delta_{12} \text{ (down markets)} \]

B. Partial Market Integration. Brazilian, Chilean and Mexican stock markets. The null hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_7 = \delta_9 \text{ (up markets)} \]

\[ H_0: \delta_6 = \delta_8 = \delta_{10} \text{ (down markets)} \]

C. Partial Market Integration. Brazilian, Chilean and Argentinean stock markets. The
null hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_7 = \delta_{11} \quad (up \, markets) \]

\[ H_0: \delta_6 = \delta_8 = \delta_{12} \quad (down \, markets) \]

D. Partial Market Integration. Brazilian, Mexican and Argentinean stock markets. The
null hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_9 = \delta_{11} \quad (up \, markets) \]

\[ H_0: \delta_6 = \delta_{10} = \delta_{12} \quad (down \, markets) \]

E. Partial Market Integration. Chilean, Mexican and Argentinean stock markets. The
null hypothesis in this case is given by

\[ H_0: \delta_7 = \delta_9 = \delta_{11} \quad (up \, markets) \]

\[ H_0: \delta_8 = \delta_{10} = \delta_{12} \quad (down \, markets) \]

F. Partial Market Integration. Brazilian and Chilean stock markets. The null
hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_7 \quad (up \, markets), \]

\[ H_0: \delta_6 = \delta_8 \quad (down \, markets) \]

G. Partial Market Integration. Brazilian and Mexican stock markets. The null
hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_9 \quad (up \, markets), \]

\[ H_0: \delta_6 = \delta_{10} \quad (down \, markets) \]

H. Partial Market Integration. Brazilian and Argentinean stock markets. The null
hypothesis in this case is given by

\[ H_0: \delta_5 = \delta_{11} \quad (up \, markets), \]

\[ H_0: \delta_6 = \delta_{12} \quad (down \, markets) \]
I. Partial Market Integration. Chilean and Mexican stock markets. The null hypothesis in this case is given by

\[ H_0: \delta_7 = \delta_9 \text{ (up markets)}, \]

\[ H_0: \delta_8 = \delta_{10} \text{ (down markets)} \]

J. Partial Market Integration. Chilean and Argentinean stock markets. The null hypothesis in this case is given by

\[ H_0: \delta_7 = \delta_{11} \text{ (up markets)}, \]

\[ H_0: \delta_8 = \delta_{12} \text{ (down markets)} \]

K. Partial Market Integration. Mexican and Argentinean stock markets. The null hypothesis in this case is given by

\[ H_0: \delta_9 = \delta_{11} \text{ (up markets)}, \]

\[ H_0: \delta_{10} = \delta_{12} \text{ (down markets)} \]

To test whether full or partial stock market integration exists across the Latin American stock markets, the estimated coefficients from equation (7) are used to test the null hypotheses A through K. It is important to point out that equation (7) does not include additional variables other than up and down betas for the Latin American stock markets in the sample. To assess the effect that other potential risk factors might have on portfolio returns across these markets, equation (7) is extended to take into account those variables that at the end happen to be priced.
CHAPTER VI

TEST OF HYPOTHESES

This chapter presents the main hypotheses that are addressed in this study. These are based on the literature review described in Chapter II.

Two cases are simultaneously analyzed across the selected Latin American stock markets. The first case considers the returns in domestic currency with the local stock market index used as proxy for the market portfolio. The weekly return on a domestic three-month government bond is used as a proxy for the risk-free asset. This viewpoint implicitly assumes that emerging stock markets in the sample are segmented from each other and may well demonstrate substantially different risk/return trade-off valuations.

The second case assumes that investors are concerned about obtaining returns in U.S. dollars. The MSCI Latin American emerging stock markets index is used as proxy for the market portfolio. The weekly return on the three-month U.S. Treasury bill is used as the risk-free asset. This second viewpoint assumes that the emerging stock markets in the sample are integrated and a single systematic risk premium may well be priced among them. Formally, the hypotheses are as follows:

\[ H_1: \text{Under the unconditional CAPM model (UCAPM), there is no significant cross-sectional relationship between portfolio systematic risk and return across the selected Latin American stock markets.} \]
This hypothesis is tested after estimating equations (2) through (4).

**H2:** Under the *conditional* CAPM model (CCAPM), there is a significant cross-sectional relationship between portfolio systematic risk and return across the selected Latin American stock markets.

**H2a:** In periods when the excess market return is positive (up markets), there is a significant positive relationship between portfolio systematic risk and return.

**H2b:** In periods when the excess market return is negative (down markets), there is a significant negative relationship between portfolio systematic risk and return.

These hypotheses are tested after estimating equations (2) through (5).

**H3:** The *conditional* cross-sectional relationship between portfolio systematic risk and return across the selected Latin American stock markets is not rejected even after controlling for additional factors such as size, leverage, book-to-market equity ratio, price-earnings ratio and a January effect.

This hypothesis is tested after estimating equations (2) through (6).

**H4:** Under the *conditional* CAPM model (CCAPM), there is a single systematic risk premium, which is not different across the selected Latin American stock markets even after controlling for additional factors such as size, leverage, book-to-market equity ratio, price-earnings ratio and a January effect.
**H₄a:** In periods when Latin American market returns go up, there is a significant and positive price of risk, which is not different across the selected Latin American stock markets.

**H₄b:** In periods when the Latin American market returns go down, there is a significant and negative price of risk, which is not different across the selected Latin American stock markets.

The hypotheses H₄, H₄a, and H₄b implicitly test for a full integration across the Latin American stock markets in the sample. These hypotheses are tested after estimating equations (2) through (7). Furthermore, the working hypotheses A through K discussed in the last section of Chapter V will complement the testing process of full and partial integration across the selected Latin American stock markets.
CHAPTER VII

RISK-RETURN IN LATIN AMERICAN EQUITY MARKETS: EMPIRICAL RESULTS OF THE UNCONDITIONAL CAPM MODEL (UCAPM)

This chapter presents the empirical results of estimating the unconditional cross-sectional relationship between portfolio betas and returns for the Argentinean, Brazilian, Chilean and Mexican equity markets.

First, I test whether the unconditional CAPM model (UCAPM) exhibits a positive relationship between realized portfolio returns and portfolio betas under the assumption that each country's stock market index is adequate proxy for the market portfolio of domestic investors. Thus, portfolio returns are estimated in local currency, which assumes segmented stock markets.

Second, I repeat the procedures discussed above but under the assumption that investors use the MSCI Latin American emerging stock market index as a proxy for their market portfolio. Thus, in this exercise, portfolio returns are estimated in U.S. dollars, which assumes integrated stock markets and investors that do not hedge their portfolio positions against exchange rate risk.

The econometric specifications to test the UCAPM model are conducted in three stages. In stage one, weekly data from the first week of 1990 through the last week of 1999 is separated into a series of subperiods: a portfolio formation period (1990-1992), five portfolio beta estimation periods (1993-94, 1994-95, 1995-96, 1996-97 and 1997-
98) and finally two test periods of five (1995-99) and three years (1997-99), respectively. In the portfolio formation period, betas are estimated for each stock by jointly regressing equations (2) and (3). Based on the relative rankings of the estimated betas, stocks are equally divided into portfolios, each of them composed of five securities. This process yields 46, 16, 14 and 11 portfolios for the Brazilian, Chilean, Mexican and Argentinean stock markets, respectively. Stocks with the lowest betas are allotted to the first portfolio, the next lowest in the second portfolio, and so on. In stage two, portfolio betas are estimated for each of the next five two-year periods. This procedure is adopted in order to capture the time-varying nature of portfolio betas and correlation structures across the Latin American stock markets. Portfolio betas are estimated by again jointly regressing equations (2) and (3). In the final stage, I test whether an unconditional positive cross-sectional relationship exists between portfolio betas and returns across the test periods of 1995-99 and 1997-99, respectively.

General Findings: Returns in Domestic Currency and the Local Stock Market Index as Proxy for the Market Portfolio

Tables 7.1.1 and 7.1.2 present the results of cross-sectional regressions between portfolio returns and betas for the stock markets in the sample. The findings show, with the exception of the Brazilian stock market, that there are no significant relationships between portfolio betas and returns. Indeed, the estimated risk premium on beta for Brazil is negative and significant, which suggests a downward sloping relationship between beta and return. However, this result is not consistent for the second test period.

---

\[11\] Several researchers have attempted to test asset pricing models that allow changes in the market beta, the equity risk premium, or both. For instance, Bollerslev, Engle, and Wooldridge (1988) develop and test a variant of the intertemporal CAPM allowing for time-varying conditional covariance between individual asset and overall market returns. Their model fits the data well, which suggests that a properly-specified CAPM is consistent with actual stock returns but the systematic risk/expected return relationship is complex and time-varying.
of 1997-99, where there is no significant relationship between portfolio risk and return for this market. With minor variations, the results reported in Table 7.1.2 are consistent with those reported in Table 7.1.1. There is no support of a significant positive risk premium over either sub-period. These findings are in line with previous studies of Fama and French (1992) for the U.S. stock market, Fletcher (1997) for the United Kingdom stock market and Hodoshima et al. (2000) for the Japanese stock market. The results imply either that there is no risk-return relationship or that systematic risk, as measured by beta, is not useful for measuring risk.\(^{12}\)

Table 7.1.1

Cross-Sectional Regression for the Relationship between Portfolio Returns and Betas. Results in Local Currency. Weekly Returns. 1995-1999 Period

\[
R_{jt} = \alpha_0 + \alpha_1 \beta_j + \epsilon_{jt}
\]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.00777***</td>
<td>0.00345</td>
<td>0.00247</td>
<td>0.00070</td>
</tr>
<tr>
<td></td>
<td>(0.00101)</td>
<td>(0.00154)</td>
<td>(0.00263)</td>
<td>(0.00164)</td>
</tr>
<tr>
<td>PORTFOLIO BETA</td>
<td>-0.00819***</td>
<td>-0.00283</td>
<td>0.00226</td>
<td>-0.00054</td>
</tr>
<tr>
<td></td>
<td>(0.00216)</td>
<td>(0.00189)</td>
<td>(0.00333)</td>
<td>(0.00260)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.00118</td>
<td>0.00061</td>
<td>0.00017</td>
<td>0.00002</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

Notes:
\(^{a}\) The dependent variable is Portfolio Return.
\(^{b}\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
\(^{c}\) *** indicates statistical significance at the 1% level.

\(^{12}\) Roll and Ross (1994) suggest that the observed flat association between risk and return can be explained by the possible mean-variance inefficiency associated with market portfolio proxies.
### Table 7.1.2

**Cross-Sectional Regression for the Relationship between Portfolio Returns and Betas.**

*Results in Local Currency. Weekly Returns. 1997-1999 Period*

\[
R_{jt} = \alpha_0 + \alpha_1 \beta_j + \varepsilon_{jt}
\]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>0.00685***</td>
<td>0.00499**</td>
<td>0.00285</td>
<td>-0.00033</td>
</tr>
<tr>
<td></td>
<td>(0.00121)</td>
<td>(0.00201)</td>
<td>(0.00389)</td>
<td>(0.00194)</td>
</tr>
<tr>
<td><strong>PORTFOLIO BETA</strong></td>
<td>0.00193</td>
<td>-0.00429*</td>
<td>0.00244</td>
<td>-0.00082</td>
</tr>
<tr>
<td></td>
<td>(0.00326)</td>
<td>(0.00260)</td>
<td>(0.00476)</td>
<td>(0.00315)</td>
</tr>
<tr>
<td><strong>R-squared</strong></td>
<td>0.00005</td>
<td>0.00133</td>
<td>0.00017</td>
<td>0.00004</td>
</tr>
<tr>
<td><strong>Total Panel Observations</strong></td>
<td>7,522</td>
<td>2,512</td>
<td>2,198</td>
<td>1.727</td>
</tr>
</tbody>
</table>

**Notes:**

a. The dependent variable is Portfolio Return.

b. Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).

c. *** indicates statistical significance at the 1% level.

**General Findings: Returns in U.S. Dollars and the MSCI Latin American Stock Market Index as Proxy for the Market Portfolio**

Tables 7.2.1 and 7.2.2 present the results of cross-sectional regressions between portfolio returns and betas for the selected Latin American equity markets. In this scenario, I assume that returns are estimated in U.S. dollars and investors who do not hedge their portfolio positions against exchange rate risk. Furthermore, I assume that investors use the Morgan Stanley Capital International (MSCI) Latin American stock market index as reference for their market portfolio. For the first test period the findings show, with the exception of the Brazilian stock market (which again exhibits a negative risk premium on betas), that there are no significant relationships between portfolio betas and returns. For the second test period, only the Chilean stock market exhibits a
positive and significant risk premium on portfolio betas. However, this relationship is weak given the low R-squares exhibited by the cross-sectional regression. This suggests that the model might be misspecified and, thus, additional risk factors other than beta might be required to explain the tradeoff between risk and return. With the minor variation of Chile, the results reported in Table 7.2.2 are consistent with those reported in Table 7.2.1. That is, there is no support to the hypothesis of a significant positive risk premium over either test periods.

**Table 7.2.1**

**Cross-Sectional Regression for the Relationship between Portfolio Returns and Betas. Results in U.S. Dollars. Weekly Returns. 1995-1999 Period**

\[ R_{jt} = \alpha_0 + \alpha_{1j} \beta_j + \epsilon_{jt} \]

<table>
<thead>
<tr>
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<th>Brazil</th>
<th>Chile</th>
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<th>Argentina</th>
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</thead>
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<td>Constant</td>
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<td>-0.00126</td>
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<td>0.00075</td>
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<tr>
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<td>(0.00104)</td>
<td>(0.00105)</td>
<td>(0.00372)</td>
<td>(0.00157)</td>
</tr>
<tr>
<td>PORTFOLIO BETA</td>
<td>-0.00533***</td>
<td>0.00479</td>
<td>0.00113</td>
<td>-0.00064</td>
</tr>
<tr>
<td></td>
<td>(0.00138)</td>
<td>(0.00356)</td>
<td>(0.00324)</td>
<td>(0.00239)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.00100</td>
<td>0.00004</td>
<td>0.00003</td>
<td>0.00002</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

**Notes:**

a The dependent variable is Portfolio Return.
b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
c *** indicates statistical significance at the 1% level.
Table 7.2.2


\[ R_{jt} = \alpha_0 + \alpha_1 \beta_j + \varepsilon_{jt} \]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
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<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.00394***</td>
<td>-0.00335***</td>
<td>-0.00077</td>
<td>-0.00134</td>
</tr>
<tr>
<td></td>
<td>(0.00138)</td>
<td>(0.00128)</td>
<td>(0.00515)</td>
<td>(0.00204)</td>
</tr>
<tr>
<td>PORTFOLIO BETA</td>
<td>0.00071</td>
<td>0.01261***</td>
<td>0.00490</td>
<td>0.00001</td>
</tr>
<tr>
<td></td>
<td>(0.00251)</td>
<td>(0.00446)</td>
<td>(0.00501)</td>
<td>(0.00286)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.00001</td>
<td>0.00257</td>
<td>0.00038</td>
<td>0.00000</td>
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<tr>
<td>Total Panel Observations</td>
<td>7,522</td>
<td>2,512</td>
<td>2,198</td>
<td>1,727</td>
</tr>
</tbody>
</table>

Notes:

a The dependent variable is Portfolio Return.
b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
c *** indicates statistical significance at the 1% level.

Summary

The results show that there are no statistically significant relationships between portfolio betas and returns under the unconditional CAPM model (UCAPM). With a few exceptions, the findings are consistent across the Latin American stock markets, the testing periods, the different assumptions about market portfolio proxies and the currencies used to estimate returns. Thus, the results support \( H_1 \) (see Chapter VI) and are in line with those reported by Fama and French (1992) and a number of other studies that show a flat relationship between betas and returns in the U.S. and in other stock markets. Ferson and Harvey (1994) also support a weak relationship between beta and return in international stock returns.
The above findings imply that there is no risk-return tradeoff or that beta does not capture risk adequately. Moreover, the results could be biased due to the conditional relationship between beta and realized returns documented by Pettengil et al. (1995).

According to the CAPM model, there should always be a positive relationship between beta and expected returns, but this relationship should be conditional on the market excess returns when realized instead of expected returns are employed in the statistical analysis. As such, the next chapter will empirically address this issue.
CHAPTER VIII

RISK-RETURN IN LATIN AMERICAN EQUITY MARKETS: EMPIRICAL RESULTS OF THE CONDITIONAL CAPM MODEL (CCAPM)

This chapter presents the empirical results of estimating the conditional cross-sectional relationship between portfolio betas and returns for the Argentinean, Brazilian, Chilean and Mexican equity markets, following two approaches for the dummy variable presented into equation (5) (See Chapter V). It is important to note that this dummy variable is incorporated in this equation in order to capture up and down markets. Under the first approach, I estimate equation (5) considering the dummy variable specification suggested by Pettengil et. al (1995). Under the second approach, I reestimate this equation under an alternative dummy variable to that suggested by the previous authors (See its specification further in this Chapter).

Pettengil et al. (1995) argue that the flat unconditional relationship between beta and return found in previous studies (including Chapter VII of this study) can be explained by the bias that is created due to the aggregation of positive and negative market excess return periods. The main prediction from the Pettengil et al. (1995) model is that if the realized market return is above the risk-free rate (up markets), portfolio betas and returns should be positively related, but if the realized market return is below the risk free rate (down markets), portfolio betas and returns should be inversely related.
This chapter is divided into four sections. In the first section, following the Pettengil et al. (1995) model, I test whether there is a significant positive relationship between portfolio betas and returns in up markets and whether there is a significant negative relationship between portfolio betas and returns in down markets. Moreover, I assume that investors have both the local stock market and a short-term domestic government bond as proxies for their market portfolio and the risk free rate, respectively. Thus, returns are estimated in local currency under the assumption of segmented stock markets. In the second section of this Chapter, I repeat the procedures and assumptions made in section I, but using an alternative dummy variable into equation (5). Thus, this equation and its alternative dummy variable are specified as follows:

\[ R_{jt} = \alpha_0 + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_j \]

where the dummy variable is redefined as \( D = 1 \), if \( R_{Mt} > 0 \), and \( D = 0 \), if \( R_{Mt} < 0 \). This dummy specification is incorporated to control for the effect that a positive risk free rate would have on the results. In addition, by using this specification I test an alternative definition for up and down markets. Up markets are defined by \( R_{Mt} > 0 \), which requires that \( P_{Mt} > P_{Mt-1} \). Thus, under this definition a stock market goes up when its current realized value is greater than its realized value in the previous week. Conversely, a stock market goes down when its current realized value is lower than its realized value in the previous week. The predicted hypotheses for this alternative specification remain the same as in Pettengil et al. (1995).

In the third section, I apply the same procedures indicated in the first section but assuming that returns are estimated in U.S. dollars. Lastly, in the fourth section, the
procedures applied in section II are again repeated but under returns in U.S. dollars. For the last two sections, I assume that the selected Latin American stock markets are integrated.

**General Findings: Conditional CAPM Model (CCAPM) as Applied to Latin American Stock Markets, Returns in Local Currency**

Tables 8.1.1 and 8.1.3 present the results of the conditional cross-sectional regressions between portfolio returns and betas as postulated by Pettengil et al. (1995) for the periods of 1995-99 and 1997-99, respectively. The results reported in these tables consider returns estimated in local currency and assume that investors have the local stock market and a short-term domestic government bond as proxies for their market portfolio and the risk free rate, respectively. Table 8.1.1 shows that the estimates for $\alpha_1$ and $\alpha_2$ are highly significant. These findings provide a strong support for a systematic but **conditional** relationship between portfolio betas and realized returns in each of the Latin American equity markets in the sample. The individual analysis for each stock market is as follows.

For the Brazilian stock market, $\alpha_1$ is estimated for each of the 137 weeks for which the local stock market return is above the domestic risk free rate. In these weeks, the high beta portfolios should present a realized return greater than the low beta portfolios. This prediction is confirmed by the average value of 2.66% for $\alpha_{1w}$, which is statistically significant at the 1% level. This finding shows that for the Brazilian stock market there is a significant positive risk premium during up markets. On the other hand, $\alpha_2$ is estimated for the 124 weeks in which the local stock market return is below the domestic risk free rate. In these weeks, the high beta portfolios should exhibit a
realized return lower than the high beta portfolios. This expectation is validated by the mean value of -4.14% for $\alpha_2$, which is statistically significant at the 1% level.

The qualitative results for the Chilean stock market are similar to those for the Brazilian market. $\alpha_1$ is estimated in each of the 119 weeks for which the domestic stock market excess return is positive. The mean value for $\alpha_1$ is 1.73%, which is statistically significant at the 1% level. This finding also shows that the Chilean stock market presents a significant positive risk premium during up markets. $\alpha_2$ is estimated for the 142 weeks in which the local stock market excess return is negative. In these weeks, the mean value for $\alpha_2$ is -1.69%, which is statistically significant at the 1% level.

For the Mexican stock market $\alpha_1$ is estimated in each of the 121 weeks for which the local stock market excess return is positive. The mean value for $\alpha_1$ is 3.51% and it is statistically significant at the 1% level. This finding also shows that the Mexican stock market exhibits a significant positive risk premium during up markets. $\alpha_2$ is estimated for the 140 weeks in which the local stock market excess return is negative. In these periods, the average value for $\alpha_2$ is -2.77%, which is significant at the 1% level.

Finally, $\alpha_1$ is estimated for the Argentinean stock market for each of the 144 weeks for which this stock market presents a positive excess return. The mean value for $\alpha_1$ is 2.90%, which is statistically significant at the 1% level. This finding also supports a significant positive risk premium during up weeks in the Argentinean stock market. $\alpha_2$ is estimated for the 117 weeks for which the local stock market excess return is negative. In these periods, the average value for $\alpha_2$ is -3.70%, which is statistically significant at the 1% level.
Table 8.1.1


\[
R_{jt} = \alpha_0 + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt}
\]

where \( D = 1, \text{ if } (R_{Mt} - R_{jt}) > 0, \text{ and } D = 0, \text{ if } (R_{Mt} - R_{jt}) < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \alpha_0 ))</td>
<td>0.00700*** (0.00907)</td>
<td>0.00231* (0.00136)</td>
<td>0.00301 (0.00225)</td>
<td>0.00075 (0.00155)</td>
</tr>
<tr>
<td>BETA Ups (( \alpha_1 ))</td>
<td>0.02663*** (0.00227)</td>
<td>0.01734*** (0.00180)</td>
<td>0.03510*** (0.00335)</td>
<td>0.02903*** (0.00244)</td>
</tr>
<tr>
<td>BETA Downs (( \alpha_2 ))</td>
<td>-0.04137*** (0.00211)</td>
<td>-0.01687*** (0.00160)</td>
<td>-0.02774*** (0.00301)</td>
<td>-0.03697*** (0.00254)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08340</td>
<td>0.26680</td>
<td>0.19710</td>
<td>0.27561</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.08330</td>
<td>0.26650</td>
<td>0.19670</td>
<td>0.27510</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

Notes:
* The dependent variable is Portfolio Return.
* Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
* * and *** indicate statistical significance at the 10% and 1% levels, respectively.

Pettengil et al. (1995) point out that the second condition required for a positive tradeoff is a consistent relationship between risk and return during up and down markets. This consistency is tested by comparing the average value for \( \alpha_1 \) and \( \alpha_2 \), from equation (5) for each Latin American stock market in the sample. Table 8.1.2 shows the Wald test, which is used to analyze whether the absolute difference on the average values of the coefficients for up and down markets are significantly different from zero.
Table 8.1.2


\[ R_{jt} = \alpha_0 + \alpha_{jt} D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt} \]

where \( D = 1, \text{ if } (R_{Mt} - R_{jt}) > 0, \text{ and } D = 0, \text{ if } (R_{Mt} - R_{jt}) < 0 \)

\[ H_0: \alpha_1 - \alpha_2 = 0 \text{ versus } H_a: \alpha_1 - \alpha_2 \neq 0 \]

<table>
<thead>
<tr>
<th>Absolute Difference((\alpha_1 - \alpha_2))</th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01474</td>
<td>0.00047</td>
<td>0.00736</td>
<td>0.00794</td>
<td></td>
</tr>
<tr>
<td>Wald Test</td>
<td>14.1777***</td>
<td>0.0203</td>
<td>1.4568</td>
<td>3.0394*</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0002</td>
<td>0.8869</td>
<td>0.2275</td>
<td>0.0814</td>
</tr>
</tbody>
</table>

Notes:
* * and *** indicate that the absolute difference is statistically significant at the 10% and 1% levels, respectively.

The values of the Wald test reported in Table 8.1.2 indicate that the null hypothesis of a symmetrical relationship between risk and return during periods of positive and negative stock market excess returns cannot be rejected at the 1% level for either the Chilean or Mexican stock markets. However, this hypothesis is rejected for the Brazilian and Argentinean stock markets at the 1% and 10% levels, respectively.

The previous results are not fully consistent in terms of symmetry with those reported for the U.S. market by Pettengil et al. (1995). For this market the absolute difference between up and down coefficients is close to zero. According to the findings reported in Tables 8.1.1 and 8.1.2, the Brazilian and Argentinean investors are more sensitive to down than to up markets. These results are consistent with the view that these investors have heterogeneous expectations about asset returns when the CAPM is
tested under the Pettengil et al. (1995) specification, which is conditional to the stock market movements.

To assess whether these findings are specific to the period selected, the test period is changed from 1995-99 to 1997-99, and the results are reported in Table 8.1.3. In addition, Table 8.1.4 shows the Wald statistics used to test for absolute differences between the coefficients for up and down markets.

Table 8.1.3


\[ R_{jt} = \alpha_0 + \alpha_1 D + \alpha_2 (1-D) + \epsilon_{jt} \]
where \( D = 1 \), if \((R_{Mt} - R_{ft}) > 0\), and \( D = 0 \), if \((R_{Mt} - R_{ft}) < 0\)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>México</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.00666***</td>
<td>0.00342*</td>
<td>0.00326</td>
<td>-0.00043</td>
</tr>
<tr>
<td></td>
<td>(0.00115)</td>
<td>(0.00178)</td>
<td>(0.00373)</td>
<td>(0.00185)</td>
</tr>
<tr>
<td>BETA Ups</td>
<td>0.04596***</td>
<td>0.01725***</td>
<td>0.03349***</td>
<td>0.02974***</td>
</tr>
<tr>
<td></td>
<td>(0.00338)</td>
<td>(0.00253)</td>
<td>(0.00479)</td>
<td>(0.00302)</td>
</tr>
<tr>
<td>BETA Downs</td>
<td>-0.04707***</td>
<td>-0.01923***</td>
<td>-0.03033***</td>
<td>-0.03623***</td>
</tr>
<tr>
<td></td>
<td>(0.00335)</td>
<td>(0.00216)</td>
<td>(0.00447)</td>
<td>(0.00313)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.09100</td>
<td>0.26330</td>
<td>0.16270</td>
<td>0.27920</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.09070</td>
<td>0.26270</td>
<td>0.16200</td>
<td>0.27830</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>7,222</td>
<td>2,512</td>
<td>2,198</td>
<td>1,727</td>
</tr>
</tbody>
</table>

Notes:
\(^a\) The dependent variable is Portfolio Return.
\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
\(^c\) * and *** indicate the statistical significance at the 10% and 1% levels, respectively.
Table 8.1.4

Pettengil et al. (1995) Dummy Specification

\[ R_{jt} = \alpha_{0j} + \alpha_{1j} D \beta_{j} + \alpha_{2j} (1-D) \beta_{j} + \epsilon_{jt} \]

where \( D = 1, \) if \( (R_{Mt} - R_{jt}) > 0, \) and \( D = 0, \) if \( (R_{Mt} - R_{jt}) < 0 \)

\[ H_0: \alpha_1 - \alpha_2 = 0 \text{ versus } H_a: \alpha_1 - \alpha_2 \neq 0 \]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Difference((\alpha_1 - \alpha_2))</td>
<td>0.00111</td>
<td>0.00198</td>
<td>0.00316</td>
<td>0.00649</td>
</tr>
<tr>
<td>Wald Test</td>
<td>0.0363</td>
<td>0.1922</td>
<td>0.1286</td>
<td>1.3454</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.8489</td>
<td>0.6612</td>
<td>0.7199</td>
<td>0.2463</td>
</tr>
</tbody>
</table>

The results reported in Tables 8.1.3 and 8.1.4 are partially consistent with those reported in Tables 8.1.1 and 8.1.2, respectively. The null hypothesis of symmetrical up and down coefficients is not rejected for each stock market in the sample. These results suggest that the Brazilian and Argentinean investors' expectations have experienced inter-temporal changes during the period analyzed. The results suggest that in recent years, the investors' expectations about asset returns have become more homogeneous.

General Findings: Conditional CAPM Model (CCAPM) as Applied to Latin American Stock Markets under an Alternative Dummy Specification. Returns in Local Currency

Tables 8.2.1 and 8.2.3 present the results of the conditional cross-sectional regressions between portfolio returns and betas as postulated by an alternative dummy specification to that of Pettengil et al. (1995) for the periods of 1995-99 and 1997-99, respectively. This specification is tested in order to analyze whether the results under the Pettengil et al. (1995) model are sensitive to an alternative definition of up and down markets. The specification of this dummy variable was already discussed in the...
introduction of this chapter. In order to compare the results across models, the findings reported below are again based on local currency and implicitly assume investors that have the local stock market and a short-term domestic government bond as proxies for their market portfolio and the risk free rate, respectively.

Table 8.2.1


\[ R_{jt} = \alpha_0 + \alpha_{1t} D \beta_j + \alpha_{2t} (1-D) \beta_j + \epsilon_{jt} \]

where \( D = 1, \) if \( R_M > 0, \) and \( D = 0, \) if \( R_M < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>México</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \alpha_0 ))</td>
<td>0.00731*** (0.00097)</td>
<td>0.00258* (0.00136)</td>
<td>0.00294 (0.00250)</td>
<td>0.00092 (0.00155)</td>
</tr>
<tr>
<td>BETA Ups (( \alpha_{1t} ))</td>
<td>0.02269*** (0.00221)</td>
<td>0.01573*** (0.00179)</td>
<td>0.02895*** (0.00324)</td>
<td>0.02935*** (0.00244)</td>
</tr>
<tr>
<td>BETA Downs (( \alpha_{2t} ))</td>
<td>-0.04528*** (0.00217)</td>
<td>-0.01786*** (0.00161)</td>
<td>-0.03397*** (0.00314)</td>
<td>-0.03700*** (0.00254)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08230</td>
<td>0.25970</td>
<td>0.19490</td>
<td>0.27920</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.08220</td>
<td>0.25940</td>
<td>0.19450</td>
<td>0.27870</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

Notes:

\(^a\) The dependent variable is Portfolio Return.
\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
\(^c\) * and *** indicate statistical significance at the 10% and 1% levels, respectively.

The results reported in Table 8.2.1 do not differ significantly from those shown in Table 8.1.1. The risk premiums associated with up and down stock market movements are again highly significant across the stock markets. The magnitudes of the coefficients are also very similar to those reported previously in Table 8.1.1. R-squares
and Adjusted R-squares remain almost at the same level, with a slightly higher value from those presented in Table 8.1.1.

Table 8.2.2


\[ R_{jt} = \alpha_{0t} + \alpha_{1t} D \beta_{j} + \alpha_{2t}(1-D)\beta_{j} + \epsilon_{jt} \]

where \( D = 1, \text{ if } R_{Mt} > 0, \text{ and } D = 0, \text{ if } R_{Mt} < 0 \)

\( H_{0}: \alpha_{1} - \alpha_{2} = 0 \) versus \( H_{a}: \alpha_{1} - \alpha_{2} \neq 0 \)

<table>
<thead>
<tr>
<th>Absolute Difference(( \alpha_{1} - \alpha_{2} ))</th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wald Test</td>
<td>33.2854***</td>
<td>0.4239</td>
<td>0.6829</td>
<td>2.8332*</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0000</td>
<td>0.5150</td>
<td>0.4086</td>
<td>0.0924</td>
</tr>
</tbody>
</table>

Notes:
* and *** indicate the statistical significance at the 10% and 1% levels, respectively.

The results in Table 8.2.2 are also consistent with those reported in Table 8.1.2. On the one hand, for the Brazilian and Argentinean stock markets the null hypothesis of a symmetrical relationship between risk and return during up and down markets is rejected at the 1% and 10% levels, respectively. On the other hand, this hypothesis is not rejected for the Chilean and Mexican stock markets.

The main conclusion derived from the results reported in Tables 8.2.1 and 8.2.2 is that the regression coefficients and the symmetry tests are not sensitive to alternative specifications of the dummy variable used in equation (5). Thus, local investors across the Latin American stock markets appear to be indifferent to the benchmark used as reference to determine when a domestic stock market goes up or down. The findings suggest that the risk premiums and their symmetries-asymmetries during up and down...
markets are not affected by using either a positive domestic risk free rate or a "zero"
interest rate as benchmarks.

Table 8.2.3


\[ R_{jt} = \alpha_0 + \alpha_{1t} D \beta_j + \alpha_2(1-D)\beta_j + \epsilon_{jt} \]
where \( D = 1 \), if \( R_{Mt} > 0 \), and \( D = 0 \), if \( R_{Mt} < 0 \)

<table>
<thead>
<tr>
<th>Country</th>
<th>Constant (( \alpha_0 ))</th>
<th>Beta Ups (( \alpha_1 ))</th>
<th>Beta Downs (( \alpha_2 ))</th>
<th>R-squared</th>
<th>Adjusted R-squared</th>
<th>Total Panel Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>0.00668***</td>
<td>0.04310***</td>
<td>-0.05041***</td>
<td>0.09080</td>
<td>0.09050</td>
<td>7,222</td>
</tr>
<tr>
<td>Chile</td>
<td>0.00354**</td>
<td>0.01636***</td>
<td>-0.01963***</td>
<td>0.25750</td>
<td>0.25690</td>
<td>2,512</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.00326</td>
<td>0.03349***</td>
<td>-0.03033***</td>
<td>0.16270</td>
<td>0.16200</td>
<td>2,198</td>
</tr>
<tr>
<td>Argentina</td>
<td>-0.00023</td>
<td>0.03048***</td>
<td>-0.03614***</td>
<td>0.28560</td>
<td>0.28470</td>
<td>1,727</td>
</tr>
</tbody>
</table>

Notes:
\(^a\) The dependent variable is Portfolio Return.
\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
\(^c\) * and *** indicate the statistical significance at the 10% and 1% levels, respectively.
Table 8.2.4


\[ R_{jt} = \alpha_{0t} + \alpha_{1t} D \beta_{j} + \alpha_{2t}(1-D) \beta_{j} + \epsilon_{jt} \]

where \( D = 1 \) if \( R_{Mt} > 0 \) and \( D = 0 \) if \( R_{Mt} < 0 \)

\[ H_0: \alpha_1 - \alpha_2 = 0 \text{ versus } H_a: \alpha_1 - \alpha_2 \neq 0 \]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Difference ((\alpha_1 - \alpha_2))</td>
<td>0.00731</td>
<td>0.00327</td>
<td>0.00505</td>
<td>0.00566</td>
</tr>
<tr>
<td>Wald Test</td>
<td>1.5778</td>
<td>0.5273</td>
<td>0.3310</td>
<td>1.0289</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.2091</td>
<td>0.4678</td>
<td>0.5651</td>
<td>0.3106</td>
</tr>
</tbody>
</table>

The findings reported in reported in Tables 8.2.3 and 8.2.4 do not differ significantly if the period of analysis is changed from 1995-99 to 1997-99. That is, the results are consistent with those reported in Table 8.1.3 and 8.1.4. The null hypothesis of symmetrical coefficients for up and down markets is not rejected for each stock market in the sample. These findings are in line with those suggested under the Pettengil at al. (1995) model. As conjectured previously, the expectations of Brazilian and Argentinean investors seem to have changed over time. In the last test period, their expectations about asset returns for up and down markets have become more homogeneous than those exhibited in the first and longer historical test period.

General Findings: Conditional CAPM Model (CCAPM) as Applied to Latin American Stock Markets, Returns in U.S. Dollars

Tables 8.3.1 and 8.3.3 show the results of the conditional cross-sectional regressions between portfolio returns and betas as postulated by Pettengil et al. (1995) for the periods of 1995-99 and 1997-99, respectively.
Table 8.3.1


\[ R_{jt} = \alpha_0 + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt} \]
\[ \text{where } D = 1, \text{if } (R_{LAlt} - R_{tf}) > 0, \text{and } D = 0, \text{if } (R_{LAlt} - R_{tf}) < 0 \]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ((\alpha_0))</td>
<td>0.00378***</td>
<td>-0.00056</td>
<td>0.00146</td>
<td>0.00179</td>
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<tr>
<td></td>
<td>(0.00101)</td>
<td>(0.00101)</td>
<td>(0.00353)</td>
<td>(0.00150)</td>
</tr>
<tr>
<td>BETA Ups ((\alpha_1))</td>
<td>0.02050***</td>
<td>0.03109***</td>
<td>0.02240***</td>
<td>0.02263***</td>
</tr>
<tr>
<td></td>
<td>(0.00155)</td>
<td>(0.00372)</td>
<td>(0.00308)</td>
<td>(0.00229)</td>
</tr>
<tr>
<td>BETA Downs ((\alpha_2))</td>
<td>-0.03165***</td>
<td>-0.03409***</td>
<td>-0.02558***</td>
<td>-0.03353***</td>
</tr>
<tr>
<td></td>
<td>(0.00151)</td>
<td>(0.00372)</td>
<td>(0.00327)</td>
<td>(0.00268)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.09130</td>
<td>0.10260</td>
<td>0.14750</td>
<td>0.19000</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.09120</td>
<td>0.10220</td>
<td>0.14710</td>
<td>0.18940</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

Notes:
\(^a\) The dependent variable is Portfolio Return.
\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
\(^c\) *** indicates statistical significance at the 1% level.

The results reported in these tables are based on returns estimated in U.S. dollars and assume that investors use the MSCI Latin American stock market index and the three-month U.S. Treasury bill as proxies for their market portfolio and the risk free rate, respectively. Table 8.3.1 shows that the estimates for \(\alpha_1\) and \(\alpha_2\) are highly significant. These findings provide a strong support for a systematic but conditional relationship between portfolio betas and realized returns in each of the Latin American equity markets. The analysis for each individual stock market is as follows. For each stock
market, \( \alpha_t \) is estimated for the 144 weeks during which the Latin American stock market return is above the U.S. Treasury bill return. In these weeks, the high beta portfolios should present a realized return greater than the low beta portfolios. On the other hand, \( \alpha_2 \) is estimated for the 117 weeks for which the Latin American stock market return is below the U.S. Treasury bill return. In these weeks, the high beta portfolios should exhibit a realized return lower than the high beta portfolios.

For the Brazilian stock market, these predictions are confirmed by the average value of 2.05\% for \( \alpha_{1t} \), and -3.17\% for \( \alpha_{2t} \), which are significant at the 1\% level. These findings show that the Brazilian stock market presents a significant positive risk premium during up markets and a significant negative risk premium during down markets.

The qualitative results for the Chilean stock market are similar to those for the Brazilian market. The mean value for \( \alpha_{1t} \) is 3.11\%, and -3.41\% for \( \alpha_{2t} \), which are significant at the 1\% level. These findings also show that the Chilean stock market exhibits a significant positive risk premium during up markets and a significant negative risk premium during down markets.

For the Mexican stock market, the average value for \( \alpha_{1t} \) is 2.24\%, and -2.56\% for \( \alpha_{2t} \), which are significant at the 1\% level. These results also point out that the Mexican stock market presents a significant positive risk premium during up markets and a significant negative risk premium during down markets.

Next, \( \alpha_t \) is estimated for the Argentinean stock market; the mean value for \( \alpha_{1t} \) is 2.26\%, which is significant at the 1\% level. This finding also supports a significant
positive risk premium during up weeks in the Argentinean stock market. On the other hand, the average value for $\alpha_2$ is $-3.35\%$, which is also significant at the 1% level.

Table 8.3.2


\[ R_{jt} = \alpha_{0t} + \alpha_{1t} D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt} \]

where \( D = 1 \), if \( (R_{Ljt} - R_{ft}) > 0 \), and \( D = 0 \), if \( (R_{Ljt} - R_{ft}) < 0 \)

H_0: $\alpha_1 - \alpha_2 = 0$ versus H_a: $\alpha_1 - \alpha_2 \neq 0$

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Difference ($\alpha_1 - \alpha_2$)</td>
<td>0.01115</td>
<td>0.00300</td>
<td>0.00318</td>
<td>0.01090</td>
</tr>
<tr>
<td>Wald Test</td>
<td>16.7020***</td>
<td>0.1959</td>
<td>0.2694</td>
<td>6.0466**</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0000</td>
<td>0.6581</td>
<td>0.6038</td>
<td>0.0140</td>
</tr>
</tbody>
</table>

Notes:

* ** and *** indicate the statistical significance at the 5% and 1% levels, respectively.

Table 8.3.2 shows the Wald test, which is again used to analyze whether the absolute difference on the average values for up and down market coefficients are significantly different from zero for each stock market in the sample. The values of this test reported in Table 8.3.2 show that the null hypothesis of a symmetrical relationship between risk and return during periods of positive and negative stock market excess returns cannot be rejected at the 1% level for the Chilean and Mexican stock markets. However, this hypothesis is rejected for the Brazilian and Argentinean markets at the 1% and 5% levels, respectively. The above results are consistent with the view that international investors in the Brazilian and Argentinean stock markets react more to
downs than to ups in the Latin American stock market index\textsuperscript{13}. These results are also in line with the view that investors have heterogeneous expectations about previous stock markets' asset returns when the CAPM is tested under its conditional model (CCAPM).

Finally, it is important to note that the stock market efficiency across the Latin American stock markets differs from that exhibited in the U.S. stock market. According to Pettengil et al. (1995) results, the regression equation (5) presents mean values of 3.36\% for $\alpha_1$ (t-statistic = 12.61) and -3.37\% for $\alpha_2$ (t-statistic = -13.82) within the 1936-1990 period. Moreover, a two-population t-test, which tests for absolute difference in previous coefficients, yields a result of 0.0001 (t-statistic = 0.029) with a p-value of 0.9769. These findings suggest that the U.S. stock market presents a more consistent symmetrical relationship between systematic risk and return during positive and negative excess market returns compared to that presented in Latin American stock markets. These results are also in line with a relatively higher level of efficiency in the U.S. market compared to that presented in Latin American stock markets. Stock prices in the U.S. market seem to reflect all available information more homogeneously than in Latin American stock markets.

\textsuperscript{13} Interestingly, studies analyzing market interconnectedness in Latin America have found that the reaction of Argentina, Brazil and Chile to changes in the Mexican stock market are more pronounced when the market is going down than up (Pagan and Soydemir, 2001). These results are consistent with pessimism about the prospect of high returns in these markets (Skinner and Sloan, 1999).
Table 8.3.3


\[ R_{jt} = \alpha_0 + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt} \]

where \( D = 1 \) if \((R_{LAjt} - R_{jt}) > 0\), and \( D = 0 \) if \((R_{LMjt} - R_{jt}) < 0\)

<table>
<thead>
<tr>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ((\alpha_0))</td>
<td>0.00329**</td>
<td>0.00260**</td>
<td>0.00342</td>
</tr>
<tr>
<td></td>
<td>(0.00131)</td>
<td>(0.00122)</td>
<td>(0.00501)</td>
</tr>
<tr>
<td>BETA Ups ((\alpha_1))</td>
<td>0.03731***</td>
<td>0.04061***</td>
<td>0.02420***</td>
</tr>
<tr>
<td></td>
<td>(0.00248)</td>
<td>(0.00460)</td>
<td>(0.00489)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.12140</td>
<td>0.11900</td>
<td>0.13240</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.12110</td>
<td>0.11830</td>
<td>0.13160</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>7,222</td>
<td>2,512</td>
<td>2,198</td>
</tr>
</tbody>
</table>

Notes:

a The dependent variable is Portfolio Return.
b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
c ** and *** indicate the statistical significance at the 5% and 1% levels, respectively.

To assess the robustness of these results, I test whether these findings are specific to the period studied. Table 8.3.3 presents the results for the 1997-99 testing period. Table 8.3.4 shows the Wald statistic employed to test for absolute differences between the coefficients of up and down markets for each equity market.
Table 8.3.4


\[ R_{jt} = \alpha_{0t} + \alpha_{1t} D \beta_j + \alpha_{2t} (1-D) \beta_j + e_{jt} \]

where \( D = 1 \), if \( (R_{LAMt} - R_{jt}) > 0 \), and \( D = 0 \), if \( (R_{LAMt} - R_{jt}) < 0 \)

\[ H_0: \alpha_1 - \alpha_2 = 0 \] versus \( H_a: \alpha_1 - \alpha_2 \neq 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Difference(( \alpha_1 - \alpha_2 ))</td>
<td>0.00738</td>
<td>0.00815</td>
<td>0.00826</td>
<td>0.01055</td>
</tr>
<tr>
<td>Wald Test</td>
<td>2.7378*</td>
<td>0.9422</td>
<td>0.7090</td>
<td>3.9490**</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0980</td>
<td>0.3318</td>
<td>0.3999</td>
<td>0.0471</td>
</tr>
</tbody>
</table>

Notes:
* and *** indicate the statistical significance at the 10% and 1% levels, respectively.

The results reported in Tables 8.3.3 and 8.3.4 are consistent with those reported in Tables 8.3.1 and 8.3.2, respectively. The null hypothesis of symmetrical up and down coefficients is again rejected for the Brazilian and Argentinean stock markets at the 10% and 5% levels, respectively. However, these results are not compatible with those reported in local currency. That is, international investors in the Brazilian and Argentinean stock markets have kept relatively more heterogeneous expectations about asset returns in this last period than in previous years.

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Tables 8.4.1 and 8.4.3 show the results of estimating the conditional cross-sectional regressions between portfolio returns and betas as postulated by an alternative dummy specification (see heading of Table 8.4.1) to that of Pettengil et al. (1995) for the periods of 1995-99 and 1997-99, respectively. In this scenario, the returns are again estimated in U.S. dollars with the MSCI Latin American stock market index and the three month U.S. Treasury Bill interest rate used as proxies for the investors' market portfolio and the risk free return, respectively. This model is again analyzed in order to test whether the results under the conditional CAPM (CCAPM) model are sensitive to an alternative definition for up and down markets.

The results reported in Table 8.4.1 do not differ significantly from those shown in Table 8.3.1. The risk premiums associated with up and down markets are again highly significant across the selected stock markets. The magnitudes of the coefficients are also very similar to those reported previously in Table 8.3.1. R-squares and Adjusted R-squares are only slightly lower to those presented in Table 8.3.1.

The results in Table 8.4.2 are also consistent with those reported in Table 8.3.2. First, for the Brazilian and Argentinean stock markets, the null hypothesis of a symmetrical relationship between risk and return during up and down markets is rejected at the 1% level. Second, this hypothesis is not rejected for the Chilean and Mexican stock markets.
Table 8.4.1


\[ R_{jt} = \alpha_0 + \alpha_1 D \beta_j + \alpha_2 (1-D) \beta_j + \epsilon_{jt} \]
where \( D = 1 \), if \( R_{La,t} > 0 \), and \( D = 0 \), if \( R_{La,t} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \alpha_0 ))</td>
<td>0.00361***</td>
<td>-0.00044</td>
<td>0.00160</td>
<td>0.00191</td>
</tr>
<tr>
<td></td>
<td>(0.00101)</td>
<td>(0.00102)</td>
<td>(0.00353)</td>
<td>(0.00149)</td>
</tr>
<tr>
<td>BETA Ups (( \alpha_1 ))</td>
<td>0.02045***</td>
<td>0.02998***</td>
<td>0.02192***</td>
<td>0.02228***</td>
</tr>
<tr>
<td></td>
<td>(0.00155)</td>
<td>(0.00370)</td>
<td>(0.00308)</td>
<td>(0.00228)</td>
</tr>
<tr>
<td>BETA Downs (( \alpha_2 ))</td>
<td>-0.03213***</td>
<td>-0.03552***</td>
<td>-0.02658***</td>
<td>-0.03507***</td>
</tr>
<tr>
<td></td>
<td>(0.00151)</td>
<td>(0.00376)</td>
<td>(0.00328)</td>
<td>(0.00269)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.09260</td>
<td>0.10280</td>
<td>0.14980</td>
<td>0.19670</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.09240</td>
<td>0.10230</td>
<td>0.14940</td>
<td>0.19610</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
<td>2,871</td>
</tr>
</tbody>
</table>

Notes:

\(^a\) The dependent variable is Portfolio Return.
\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
\(^c\) *** indicates statistical significance at the 1% level.
Table 8.4.2

Alternative Dummy Specification

\[ R_{jt} = \alpha_{jt} + \alpha_{1t} D \beta_{j} + \alpha_{2}(1-D) \beta_{j} + \epsilon_{jt} \]

where \( D = 1, \) if \( R_{LAlt} > 0, \) and \( D = 0, \) if \( R_{LAlt} < 0 \)

\[ H_{0}: \alpha_{1} - \alpha_{2} = 0 \text{ versus } H_{a}: \alpha_{1} - \alpha_{2} \neq 0 \]

<table>
<thead>
<tr>
<th>Absolute Difference ((\alpha_{1} - \alpha_{2}))</th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wald Test</td>
<td>18.3772***</td>
<td>0.6628</td>
<td>0.5808</td>
<td>8.3886***</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0000</td>
<td>0.4156</td>
<td>0.4460</td>
<td>0.0038</td>
</tr>
</tbody>
</table>

Notes:
*** indicates statistical significance at the 1% level.

The main findings derived from the results reported in Tables 8.4.1 and 8.4.2 are consistent with those previously found in local currency scenarios. The coefficients and the tests of symmetry are not sensitive to alternative specifications of the dummy variable in equation (5). Thus, investors across the Latin American stock markets appear to be indifferent to the benchmark used as reference to determine when a stock market goes up or down. The findings again suggest that the risk premiums and their symmetries-asymmetries for up and down markets do not change by using either a positive risk free rate or a “zero” interest rate for the U.S. Treasury bills as benchmarks.

The results reported in Tables 8.4.3 and 8.4.4 are consistent with those reported in Tables 8.4.1 and 8.4.2, respectively. The null hypothesis of symmetrical up and down coefficients is rejected again for the Brazilian and Argentinean stock markets at the 5% level. Thus, international investors in the Brazilian and Argentinean stock markets have kept heterogeneous expectations about asset returns across the test periods.
Table 8.4.3


\[ R_{jt} = \alpha_0 + \alpha_1 D\beta_j + \alpha_2 (1-D)\beta_j + \epsilon_{jt} \]

where \( D = 1 \), if \( R_{LAt} > 0 \), and \( D = 0 \), if \( R_{LAt} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.00319**</td>
<td>-0.00252**</td>
<td>0.00393</td>
<td>-0.00048</td>
</tr>
<tr>
<td></td>
<td>(0.00131)</td>
<td>(0.00123)</td>
<td>(0.00501)</td>
<td>(0.00193)</td>
</tr>
<tr>
<td>BETA Ups</td>
<td>0.03685***</td>
<td>0.03887***</td>
<td>0.02318***</td>
<td>0.02109***</td>
</tr>
<tr>
<td></td>
<td>(0.00247)</td>
<td>(0.00458)</td>
<td>(0.00487)</td>
<td>(0.00268)</td>
</tr>
<tr>
<td>BETA Downs</td>
<td>-0.04599***</td>
<td>-0.03316***</td>
<td>-0.03418***</td>
<td>-0.03342***</td>
</tr>
<tr>
<td></td>
<td>(0.00266)</td>
<td>(0.00483)</td>
<td>(0.00532)</td>
<td>(0.00323)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.12300</td>
<td>0.11440</td>
<td>0.13410</td>
<td>0.21920</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.12280</td>
<td>0.11370</td>
<td>0.13330</td>
<td>0.21830</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>7,222</td>
<td>2,512</td>
<td>2,198</td>
<td>1,727</td>
</tr>
</tbody>
</table>

Notes:

\( ^a \) The dependent variable is Portfolio Return.
\( ^b \) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
\( ^c \) ** and *** indicate the statistical significance at the 5% and 1% levels, respectively.
Table 8.4.4

\[ R_{jt} = \alpha_0t + \alpha_1t \, D \beta_j + \alpha_2t(1-D) \beta_j + \epsilon_{jt} \]
where \( D = 1 \), if \( R_{Un} > 0 \), and \( D = 0 \), if \( R_{Un} < 0 \)

\( H_0: \alpha_1 - \alpha_2 = 0 \) versus \( H_1: \alpha_1 - \alpha_2 \neq 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute</td>
<td>0.00914</td>
<td>0.00571</td>
<td>0.01100</td>
<td>0.01233</td>
</tr>
<tr>
<td>Difference (( \alpha_1 - \alpha_2 ))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald Test</td>
<td>4.1918**</td>
<td>0.4561</td>
<td>1.2560</td>
<td>5.4079**</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0407</td>
<td>0.4995</td>
<td>0.2625</td>
<td>0.0202</td>
</tr>
</tbody>
</table>

Notes:
** indicates statistical significance at the 5% level.

Summary

The results reported in Chapter VI show a weak and inconsistent relationship between portfolio risk (as measured by beta) and returns across the Latin American stock markets under study. One explanation for these results is that they are biased given the conditional relationship between beta and realized returns documented by Pettengil et al. (1995). According to the CAPM theory a direct relationship is always predicted between beta and expected returns. However, this relationship is conditional on whether the stock market return is above or under the risk free rate used as benchmark.

The results reported in this Chapter are partially consistent with Pettengil et al. (1995) and closer to those of Hodoshima et al. (2000) and Fletcher (2000). There is a significant positive relationship between beta and returns in up market weeks and a significant negative relationship between beta and return in down market weeks. These
findings are consistent across the Latin American stock markets, the test periods, and the different proxies for investors’ market portfolios. The results are also consistent with alternative specifications for up and down markets. Thus, there is a strong support to hypotheses: $H_2, H_{2a}$ and $H_{2b}$ (See Chapter VI).

With regard to the statistical hypothesis of a symmetrical relationship between risk and return during positive and negative market excess returns, the results are inconsistent under local currency but are consistent under U.S. dollars. On the one hand, when returns are estimated in local currency, which assumes segmented stock markets, this hypothesis is rejected for the Brazilian and Argentinean stock markets for the first test period of 1995-99 but it is not rejected for the second period of 1997-99. This inconsistency is compatible with the view that during the 1995-96 period the Brazilian and Argentinean investors reacted relatively more when they faced downs than ups associated with their local stock markets. In the last test period, their expectations about asset returns for up and down markets become more homogeneous than those exhibited in the first test period. On the other hand, when returns are estimated in U.S. dollars, which assumes that the stock markets are integrated, the symmetry hypothesis is rejected for the Brazilian and Argentinean stock markets in both test periods. Thus, these results are consistent with the view that investors, on average, are more sensitive to downturns than to upturns in the Latin American stock market index, when they invest in the Argentinean and Brazilian stock markets. Furthermore, these findings appear to be compatible with a relative partial degree of integration across the Latin American stock markets. Whether these stock markets are integrated or not requires formal tests, which are conducted in Chapter X.
CHAPTER IX

RISK-RETURN IN LATIN AMERICAN EQUITY MARKETS: EMPIRICAL RESULTS OF THE CONDITIONAL CAPM MODEL (CCAPM) AFTER CONTROLLING FOR ADDITIONAL RISK FACTORS

In this Chapter, I test whether additional risk factors documented in the asset pricing literature contribute to explain the conditional cross-sectional portfolio return variations for the Latin American stock markets in the sample. In Chapter VIII, I found that there are no significant differences in terms of results between alternative specifications for the dummy variable used in equation (5). As the last specification (the alternative to that used by Pettengil et al. [1995]) does not require a specification for the risk free rate, the tests presented in this Chapter are performed under this assumption.

In order to perform reliable tests, equation (5) is expanded to include size (Banz, 1981), leverage ratio (Bhandari, 1988; Rosenberg, Reid and Lanstein, 1985), book-to-market equity ratio (Chan, Hamao and Lakonishok, 1991), price-earnings ratio (Ball, 1978; Basu, 1983) and a January effect (Tinic and West, 1984). The effects of these variables are examined by testing whether the average value of the weekly coefficient on each of these covariates is significantly different from zero. The econometric model and proxies to be tested were already discussed in Chapter V.

This Chapter is divided into two sections. First, I estimate equation (6) and assume that investors use the local stock market as proxy for their market portfolio.
This approach assumes that Latin American stock markets are segmented. The returns in this case are estimated in local currency. Furthermore, in order to analyze whether the results are specific to time periods, I analyze the test periods of 1995-99 and 1997-99, respectively.

Second, I estimate equation (7). In this scenario, the returns are estimated in U.S. dollars under the assumption that the MSCI Latin American stock market index is the proxy for investors' market portfolio. This approach implicitly assumes that stock markets are integrated.


Table 9.1.1 presents the results of the conditional cross-sectional regression for the relationship between portfolio returns and portfolio betas after controlling for portfolio size, leverage, book to market value equity ratio, price-earnings per share ratio and a January effect. These results are obtained after applying the first set of assumptions, under local currency, and using the 1995-99 period for testing purposes. The analysis for each stock market is as follows. For the Brazilian stock market, the coefficients for size, leverage, book to market value equity ratio, and a January dummy are all positive and significant at the 1%, 1%, 1% and 5% levels, respectively. The positive sign for leverage, book to market value equity ratio and a January dummy are in line with those found in previous studies for the U.S. stock market. However, the sign for size is positive, which is inconsistent with the negative relationship between size and portfolio return documented by Fama and French (1992).
One possible explanation for this result is that put forth by Garcia and Bonomo (2001). According to these authors, large companies in Brazil offer the best insurance against inflation and, therefore, they yield adjusted risk returns that are relatively higher than those that can be obtained from small companies.

For the Chilean stock market, the results reported in Table 9.1.1 also show that in addition to the conditional betas (up and down betas) the coefficients for size and leverage are negative and positive as well as significant at the 5% and 10% levels, respectively. The coefficient for the January dummy is negative and significant at the 5% level. The negative sign for size and positive for leverage are consistent with those found in previous studies for the U.S. stock market. However, the negative sign for the January effect is inconsistent to the higher risk adjusted returns for this month that have been reported in previous studies.

One possible explanation for this phenomenon is that Chilean stocks in early January seem to be exploitable by a trading strategy that suggests short-selling these stocks in late December and then repurchasing them at the end of January. However, this phenomenon does not seem to be permanent because it does not appear in the second test period.

For the Mexican stock market, the results presented in Table 9.1.1 show that none of the coefficients associated with the additional explanatory factors incorporated in the regression equation is significant at any conventional level. As a whole the regression results reported in Table 9.1.1 are not superior in terms of Adjusted R-square to those reported previously in Table 8.2.1 when additional explanatory variables other than up and down betas are not included in the regression equation.
Finally, for the Argentinean stock market, the results reported in Table 9.1.1 indicate that, in addition to the conditional betas (up and down betas), only the coefficient for the book to market equity value ratio is positive and significant at the 5% level. In this case, this sign is consistent with the sign found in previous studies. As a whole, the regression results reported for the Argentinean stock market in Table 9.1.1 are very close in terms of Adjusted R-square to those reported previously in Table 8.2.1 when additional explanatory variables other than up and down betas are not included in the regression equation.

Table 9.1.1

**Conditional Cross-Sectional Regression Results for the Relationship between Portfolio Returns and Portfolio Betas after Controlling for Portfolio Size, Leverage, Book to Market Value Equity Ratio, Price-Earnings per Share Ratio and a January Effect. Weekly Returns in Local Currency. 1995-1999 Period**

\[
R_{jt} = \delta_0 + \delta_1 D \beta_j + \delta_2 (1-D) \beta_j + \delta_3 \text{Size}_j + \delta_4 \text{Lev}_j + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j
\]

where \( D = 1, \) if \( R_{m,t} > 0, \) and \( D = 0, \) if \( R_{m,t} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant (( \delta_0 ))</strong></td>
<td>0.00362</td>
<td>0.05506***</td>
<td>-0.00783</td>
<td>-0.03324*</td>
</tr>
<tr>
<td></td>
<td>(0.02140)</td>
<td>(0.02001)</td>
<td>(0.02476)</td>
<td>(0.01985)</td>
</tr>
<tr>
<td><strong>BETA Ups (( \delta_1 ))</strong></td>
<td>0.02114***</td>
<td>0.01959***</td>
<td>0.02938***</td>
<td>0.02905***</td>
</tr>
<tr>
<td></td>
<td>(0.00260)</td>
<td>(0.00235)</td>
<td>(0.00421)</td>
<td>(0.00310)</td>
</tr>
<tr>
<td><strong>BETA Downs (( \delta_2 ))</strong></td>
<td>-0.04670***</td>
<td>-0.01396***</td>
<td>-0.03373***</td>
<td>-0.03715***</td>
</tr>
<tr>
<td></td>
<td>(0.00252)</td>
<td>(0.00218)</td>
<td>(0.00413)</td>
<td>(0.00319)</td>
</tr>
<tr>
<td><strong>SIZE (( \delta_3 ))</strong></td>
<td>0.00188***</td>
<td>-0.00205**</td>
<td>-0.00060</td>
<td>0.00099</td>
</tr>
<tr>
<td></td>
<td>(0.00049)</td>
<td>(0.00085)</td>
<td>(0.00101)</td>
<td>(0.00086)</td>
</tr>
<tr>
<td><strong>LEV (( \delta_4 ))</strong></td>
<td>0.00430***</td>
<td>0.00339*</td>
<td>0.00430</td>
<td>-0.00050</td>
</tr>
<tr>
<td></td>
<td>(0.00083)</td>
<td>(0.00189)</td>
<td>(0.00483)</td>
<td>(0.00288)</td>
</tr>
</tbody>
</table>

(Table continues)
Table 9.1.2 shows the values of the Wald test for two independent null hypotheses. First, the null hypothesis of a symmetrical relationship between risk and return is tested during periods of positive and negative stock market excess returns after controlling for additional factors other than up and down betas. Then, the hypothesis of whether there is at least one additional risk factor (other than up and down betas) significantly different from zero is tested.

The results from table 9.1.2 show that the null hypothesis of a symmetrical relationship between portfolio beta and return for up and down markets cannot be rejected at the 1% level for the Chilean, Mexican and Argentinean stock markets. However, this hypothesis is rejected for the Brazilian stock market at the 1% level.

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME ($\delta_d$)</td>
<td>0.00373*** (0.00094)</td>
<td>-0.00038 (0.00090)</td>
<td>-0.00168 (0.00173)</td>
<td>0.00565** (0.00270)</td>
</tr>
<tr>
<td>PE ($\delta_d$)</td>
<td>-0.00551 (0.00444)</td>
<td>-0.00482 (0.00379)</td>
<td>0.00379 (0.00493)</td>
<td>0.00511 (0.00398)</td>
</tr>
<tr>
<td>JAN ($\delta_r$)</td>
<td>0.00458** (0.00195)</td>
<td>-0.00328** (0.00135)</td>
<td>-0.00317 (0.00595)</td>
<td>-0.00337 (0.00271)</td>
</tr>
</tbody>
</table>

| R-squared | 0.08570 | 0.26330 | 0.19590 | 0.28160 |
| Adjusted R-squared | 0.08520 | 0.26210 | 0.19430 | 0.27980 |
| Total Panel Observations | 12,006 | 4,176 | 3,654 | 2,871 |

Notes:

a The dependent variable is Portfolio Return.
b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).
c *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels, respectively.
Table 9.1.2

Wald Test for a Symmetrical Relationship between Risk and Return during Up and Down Markets. Results in Local Currency. Weekly Returns. 1995-1999 Period

\[ R_{jt} = \delta_t + \delta_t D \beta_3 + \delta_2 (1-D) \beta_3 + \delta_3 \text{Size} + \delta_4 \text{Lev} + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j \]

where \( D = 1, \text{ if } R_{M_t} > 0, \text{ and } D = 0, \text{ if } R_{M_t} < 0 \)

\( H_0: \delta_1 - \delta_2 = 0 \text{ versus } H_a: \delta_1 - \delta_2 \neq 0^b \)

\( H_0: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0 \text{ versus } H_a: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 \neq 0^c \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Difference (( \delta_1 - \delta_2 ))</td>
<td>0.02556</td>
<td>0.00563</td>
<td>0.00435</td>
<td>0.00810</td>
</tr>
<tr>
<td>Wald Test(^b)</td>
<td>29.1742***</td>
<td>1.6119</td>
<td>0.2898</td>
<td>1.8455</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0000</td>
<td>0.2043</td>
<td>0.5904</td>
<td>0.1744</td>
</tr>
<tr>
<td>Wald Test(^c)</td>
<td>8.7300***</td>
<td>3.4289***</td>
<td>0.4178</td>
<td>1.7007</td>
</tr>
<tr>
<td>P-Value</td>
<td>0.0000</td>
<td>0.0043</td>
<td>0.8366</td>
<td>0.1310</td>
</tr>
</tbody>
</table>

Notes:
\(^a\)*** indicates statistical significance at the 1% level.
\(^b\)*** Wald test for symmetry between up and down betas.
\(^c\)*** Wald test for statistical significance of risk factors, other than up and down betas.

The second Wald test in Table 9.1.2 shows that in the case of Brazil and Chile at least one of the control variables is significantly different from zero. Nonetheless, the increases in adjusted R-square for these stock markets (see Table 9.1.2 versus Table 8.2.1, respectively) are not substantive. Thus, including additional regressors does not improve substantially the explanatory power of the initial conditional CAPM (CCAPM) model when additional explanatory variables other than up and down betas are not included in the regression equation.
Table 9.1.3


\[ R_{jt} = \delta_0 + \delta_1 D \beta_j + \delta_2 (1-D) \beta_j + \delta_3 \text{Size} + \delta_4 \text{Lev}_j + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j \]

where \( D = 1 \), if \( R_{mt} > 0 \), and \( D = 0 \), if \( R_{mt} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \delta_0 ))</td>
<td>0.10407** (0.04722)</td>
<td>0.02752 (0.02778)</td>
<td>-0.02212 (0.03726)</td>
<td>-0.03274 (0.02404)</td>
</tr>
<tr>
<td>BETA Ups (( \delta_1 ))</td>
<td>0.04603*** (0.00500)</td>
<td>0.01795*** (0.00338)</td>
<td>0.03023*** (0.00523)</td>
<td>0.02953*** (0.00402)</td>
</tr>
<tr>
<td>BETA Downs (( \delta_2 ))</td>
<td>-0.04682*** (0.00500)</td>
<td>-0.01798*** (0.00302)</td>
<td>-0.03440*** (0.00501)</td>
<td>-0.03694*** (0.00404)</td>
</tr>
<tr>
<td>SIZE (( \delta_3 ))</td>
<td>0.00001 (0.00093)</td>
<td>-0.00106 (0.00124)</td>
<td>-0.00132 (0.00136)</td>
<td>0.00200* (0.00115)</td>
</tr>
<tr>
<td>LEV (( \delta_4 ))</td>
<td>0.00276** (0.00139)</td>
<td>0.00278 (0.00261)</td>
<td>0.00824 (0.00734)</td>
<td>0.00114 (0.00342)</td>
</tr>
<tr>
<td>BME (( \delta_5 ))</td>
<td>0.00270* (0.00154)</td>
<td>0.00029 (0.00121)</td>
<td>-0.00282 (0.00198)</td>
<td>0.00973*** (0.00337)</td>
</tr>
<tr>
<td>PE (( \delta_6 ))</td>
<td>-0.02263** (0.01021)</td>
<td>-0.00178 (0.00525)</td>
<td>0.00927 (0.00872)</td>
<td>0.00184 (0.00474)</td>
</tr>
<tr>
<td>JAN (( \delta_7 ))</td>
<td>0.00435* (0.00241)</td>
<td>-0.00128 (0.00135)</td>
<td>0.00439 (0.00878)</td>
<td>-0.00709 (0.00326)</td>
</tr>
</tbody>
</table>

(Table continues)

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### Table 9.1.4

**Wald Test for a Symmetrical Relationship between Risk and Return during Up and Down Markets. Results in Local Currency. Weekly Returns, 1997-1999 Period**

\[ R_{jt} = \delta_{0t} + \delta_{1t} D \beta_j + \delta_{2t}(1-D) \beta_j + \delta_{3t} Size_{t} + \delta_{4t} Lev_{t} + \delta_{5t} BME_{t} + \delta_{6t} PE_{t} + \delta_{7t} JAN_{t} + \epsilon_{jt} \]

where \( D = 1, \) if \( R_{Mt} > 0, \) and \( D = 0, \) if \( R_{Mt} < 0 \)

\[ H_0: \delta_1 - \delta_2 = 0 \quad \text{versus} \quad H_a: \delta_1 - \delta_2 \neq 0 \]

\[ H_0: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0 \quad \text{versus} \quad H_a: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 
eq 0 \]

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R-squared</strong></td>
<td>0.09310</td>
<td>0.25840</td>
<td>0.16530</td>
<td>0.29180</td>
</tr>
<tr>
<td><strong>Adjusted R-squared</strong></td>
<td>0.09220</td>
<td>0.25630</td>
<td>0.16260</td>
<td>0.28890</td>
</tr>
<tr>
<td><strong>Total Panel Observations</strong></td>
<td>7,222</td>
<td>2,512</td>
<td>2,198</td>
<td>1,727</td>
</tr>
</tbody>
</table>

**Notes:**

a The dependent variable is Portfolio Return.

b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).

c *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels, respectively.

The results reported in Tables 9.1.3 and 9.1.4 are only partially consistent with those reported in Tables 9.1.1 and 9.1.2, respectively. The main difference is that in this

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test period, the null hypothesis of symmetrical up and down markets is not rejected for any stock market in the sample after controlling for additional factors other than up and down betas. This result is consistent with the view that Brazilian investors, who exhibited historical asymmetries for risk premiums in up and down markets, have reduced significantly these asymmetries in recent years. In general, local investors in each Latin American stock market have kept more homogeneous expectations about asset returns in the last test period of 1997-99 than previously.

Furthermore, the second Wald test reported in Table 9.1.4 shows that in the case of Chile and Mexico any of the control variables is significant at any conventional level. However, in the case of Brazil and Argentina, at least one of the extra risk factors is significantly different from zero. It is important to note that the Brazilian stock market show in both sample periods additional risk factors that are statistically significant. These results suggest that the Brazilian market is relatively less efficient in comparison with the rest of Latin American stock markets in the sample. The presence of significant risk factors, other than up and down betas, is an indication of anomalies that can be exploited in terms of strategies that would allow investors to obtain abnormal returns. Nonetheless, as in the case of the sample period of 1995-99, the increases in adjusted R-squares are not substantive. This indicator of model fitness does not outperform substantially that reported previously in Table 8.2.3 when additional explanatory factors other than up and down betas are not included in the regression equation. The Adjusted R-squares presented in Table 8.2.3 are 0.0905, 0.2569, 0.1620 and 0.2847 for the Brazilian, Chilean, Mexican and Argentinean stock markets, respectively, which are very close to those reported in Table 9.1.3.


Table 9.2.1 presents the results of the conditional cross-sectional regression for the relationship between portfolio returns and portfolio betas after controlling for portfolio size, leverage, book to market value equity ratio, price-earnings per share ratio, and a January effect. The results reported are obtained after applying the second set of assumptions under U.S. dollars for the 1995-1999 period. The individual analysis for each stock market is as follows.

For the Brazilian stock market, the findings show that the coefficients of size, leverage, book to market value equity ratio, price-earnings ratio and the January dummy are significant at the 1%, 1%, 1%, 10% and 1% levels, respectively. The positive signs for leverage, book to market value equity ratio and the negative one for price-earnings ratio are consistent with those found in previous studies of the U.S. stock market. However, the signs for size and the January effect are inconsistent with those reported in previous literature. One possible explanation for a positive sign associated with size was discussed in the previous section. Large companies in Brazil offer the best insurance against inflation and, therefore, would yield adjusted risk returns that are relatively higher than those from small companies. The negative sign for the January dummy suggests that Brazilian stocks in early January seem to be exploitable by a trading strategy that would consist of short-selling these stocks in late December and then repurchasing them at the end of January. Somewhat surprisingly, the sign for the January effect differs with that reported in the previous section under local currency,
which suggests that this particular factor is sensible to the currency and stock market index used as benchmarks for the investors' market portfolio.

For the Chilean stock market, the results reported in Table 9.2.1 show that the coefficient for size is negative and significant at the 1% level. This finding is consistent with the view that smaller Chilean companies tend to have high abnormal rates of return. The coefficient for the January dummy is negative and significant at the 5% level. The negative sign for the January dummy suggests that Chilean securities, such as the case of the Brazilian stock markets, in early January might be exploitable by a trading strategy that would consist of short-selling these stocks in late December and then repurchasing them at the end of January.

For the Mexican stock market, the results reported in Table 9.2.1 show that none of the additional explanatory variables incorporated in the regression equation (other than up and down betas) are significant at any conventional level. As a whole, the regression results reported in Table 9.2.1 are not better in terms of Adjusted R-square (0.1492) than those presented in Table 8.4.1 (0.1494) when additional explanatory variables other than up and down betas are not included in the regression equation.

Finally, for the Argentinean stock market, the results reported in Table 9.2.1 are similar to those found for the Mexican stock market. No additional variables were found significant at any conventional level. As a whole, the regression results reported for the Argentinean stock market in Table 9.2.1 presents an Adjusted R-square of 0.1957, which is marginally lower than that reported in Table 8.4.1 (0.1961) when additional explanatory variables other than up and down betas are not included in the regression equation.
Table 9.2.1


\[ R_{jt} = \delta_0 + \delta_1 D \beta_j + \delta_2 (1 - D) \beta_j + \delta_3 \text{Size}_j + \delta_4 \text{Lev}_j + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j \]

where \( D = 1 \), if \( R_{LAlt} > 0 \), and \( D = 0 \), if \( R_{LAlt} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \delta_0 ))</td>
<td>0.00999</td>
<td>0.03721***</td>
<td>-0.00818</td>
<td>-0.02534</td>
</tr>
<tr>
<td></td>
<td>(0.01831)</td>
<td>(0.00377)</td>
<td>(0.02777)</td>
<td>(0.02413)</td>
</tr>
<tr>
<td>BETA Ups (( \delta_1 ))</td>
<td>0.01972***</td>
<td>0.03138***</td>
<td>0.02176***</td>
<td>0.01956***</td>
</tr>
<tr>
<td></td>
<td>(0.00187)</td>
<td>(0.00377)</td>
<td>(0.00308)</td>
<td>(0.00371)</td>
</tr>
<tr>
<td>BETA Downs (( \delta_2 ))</td>
<td>-0.03234***</td>
<td>-0.03398***</td>
<td>-0.02684***</td>
<td>-0.03782***</td>
</tr>
<tr>
<td></td>
<td>(0.00182)</td>
<td>(0.00381)</td>
<td>(0.00351)</td>
<td>(0.00403)</td>
</tr>
<tr>
<td>SIZE (( \delta_3 ))</td>
<td>0.00150***</td>
<td>-0.00420***</td>
<td>-0.00016</td>
<td>0.00115</td>
</tr>
<tr>
<td></td>
<td>(0.00049)</td>
<td>(0.00100)</td>
<td>(0.00126)</td>
<td>(0.00111)</td>
</tr>
<tr>
<td>LEV (( \delta_4 ))</td>
<td>0.00421***</td>
<td>-0.00132</td>
<td>0.00023</td>
<td>-0.00088</td>
</tr>
<tr>
<td></td>
<td>(0.00102)</td>
<td>(0.00294)</td>
<td>(0.00482)</td>
<td>(0.00282)</td>
</tr>
<tr>
<td>BME (( \delta_5 ))</td>
<td>0.00478***</td>
<td>0.00079</td>
<td>-0.00193</td>
<td>0.00089</td>
</tr>
<tr>
<td></td>
<td>(0.00104)</td>
<td>(0.00120)</td>
<td>(0.00257)</td>
<td>(0.00331)</td>
</tr>
<tr>
<td>PE (( \delta_6 ))</td>
<td>-0.00642*</td>
<td>0.00375</td>
<td>0.00262</td>
<td>0.00369</td>
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<tr>
<td></td>
<td>(0.00376)</td>
<td>(0.00348)</td>
<td>(0.00568)</td>
<td>(0.00483)</td>
</tr>
<tr>
<td>JAN (( \delta_7 ))</td>
<td>-0.01489***</td>
<td>-0.00371**</td>
<td>-0.00211</td>
<td>-0.00266</td>
</tr>
<tr>
<td></td>
<td>(0.00222)</td>
<td>(0.00178)</td>
<td>(0.00648)</td>
<td>(0.00249)</td>
</tr>
</tbody>
</table>

(Table continues)
### Table 9.2.2


\[
R_{jt} = \delta_0 + \delta_1 D \beta_j + \delta_2 (1-D) \beta_j + \delta_3 \text{Size} + \delta_4 \text{Lev}_j + \delta_5 \text{BME}_j + \delta_6 \text{PE}_j + \delta_7 \text{JAN}_j + \nu_j
\]

where \(D = 1\), if \(R_{LAlt} > 0\), and \(D = 0\), if \(R_{LAlt} < 0\)

\(H_0: \delta_1 - \delta_2 = 0\) versus \(H_a: \delta_1 - \delta_2 \neq 0^b\)

\(H_0: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0\) versus \(H_a: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 \neq 0^c\)

<table>
<thead>
<tr>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.09980</td>
<td>0.10840</td>
<td>0.15080</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.09930</td>
<td>0.10690</td>
<td>0.14920</td>
</tr>
<tr>
<td>Total Panel Observations</td>
<td>12,006</td>
<td>4,176</td>
<td>3,654</td>
</tr>
</tbody>
</table>

**Notes:**

\(^a\) The dependent variable is Portfolio Return.

\(^b\) Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White's method (1980).

\(^c\) *,**, and *** indicate the statistical significance at the 10%, 5% and 1% levels, respectively.

The results from table 9.2.2 show that the null hypothesis of a symmetrical relationship between portfolio beta and return for up and down markets cannot be...
rejected at the 1% level for the Chilean and Mexican stock markets. However, this hypothesis is rejected for the Brazilian and Argentinean stock markets at the 1% and 5% levels, respectively.

The second Wald test in Table 9.2.2 shows that in the case of Brazil and Chile at least one of the control variables is significantly different from zero. However, Brazil shows relatively higher stock market anomalies than the Chilean stock market. The presence of significant risk factors, in addition to up and down betas, might lead investors to obtain abnormal returns. However, the impact of these anomalies in terms of explaining the Brazilian portfolio return variations is not as substantial as up and down betas. As in the case of the results under local currency, the increases in adjusted R-square for these stock markets (see Table 9.2.1 versus Table 8.4.1, respectively) are not substantive. Thus, including additional regressors does not improve substantially the explanatory power of the initial conditional CAPM (CCAPM) model when additional explanatory variables other than up and down betas are not included in the regression equation.
Table 9.2.3


\[ R_{jt} = \delta_0 + \delta_1D\beta_j + \delta_2(1-D)\beta_j + \delta_3\text{Size}_j + \delta_4\text{Lev}_j + \delta_5\text{BME}_j + \delta_6\text{PE}_j + \delta_7\text{JAN}_j + \epsilon_j \]

where \( D = 1 \), if \( R_{LALT} > 0 \), and \( D = 0 \), if \( R_{LALT} < 0 \)

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Chile</th>
<th>Mexico</th>
<th>Argentina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (( \delta_0 ))</td>
<td>0.06198</td>
<td>0.02026</td>
<td>-0.06664</td>
<td>-0.00594</td>
</tr>
<tr>
<td></td>
<td>(0.0444)</td>
<td>(0.01929)</td>
<td>(0.05511)</td>
<td>(0.02982)</td>
</tr>
<tr>
<td>BETA Ups (( \delta_1 ))</td>
<td>0.04032***</td>
<td>0.03980***</td>
<td>0.02154***</td>
<td>0.01909***</td>
</tr>
<tr>
<td></td>
<td>(0.00354)</td>
<td>(0.00469)</td>
<td>(0.00450)</td>
<td>(0.00395)</td>
</tr>
<tr>
<td>BETA Downs (( \delta_2 ))</td>
<td>-0.04161***</td>
<td>-0.03242***</td>
<td>-0.03635***</td>
<td>-0.03539***</td>
</tr>
<tr>
<td></td>
<td>(0.00385)</td>
<td>(0.00488)</td>
<td>(0.00566)</td>
<td>(0.00440)</td>
</tr>
<tr>
<td>SIZE (( \delta_3 ))</td>
<td>-0.00039</td>
<td>-0.00287**</td>
<td>0.00032</td>
<td>0.00086</td>
</tr>
<tr>
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<td>(0.00088)</td>
<td>(0.00138)</td>
<td>(0.00180)</td>
<td>(0.00134)</td>
</tr>
<tr>
<td>LEV (( \delta_4 ))</td>
<td>0.00275*</td>
<td>0.00160</td>
<td>0.00028</td>
<td>0.00143</td>
</tr>
<tr>
<td></td>
<td>(0.00170)</td>
<td>(0.00428)</td>
<td>(0.00687)</td>
<td>(0.00324)</td>
</tr>
<tr>
<td>BME (( \delta_5 ))</td>
<td>0.00381**</td>
<td>0.00249</td>
<td>-0.00293</td>
<td>0.00090</td>
</tr>
<tr>
<td></td>
<td>(0.00169)</td>
<td>(0.00163)</td>
<td>(0.00294)</td>
<td>(0.00408)</td>
</tr>
<tr>
<td>PE (( \delta_6 ))</td>
<td>-0.01287</td>
<td>0.00304</td>
<td>0.01585</td>
<td>-0.00093</td>
</tr>
<tr>
<td></td>
<td>(0.00951)</td>
<td>(0.00419)</td>
<td>(0.01498)</td>
<td>(0.00578)</td>
</tr>
<tr>
<td>JAN (( \delta_7 ))</td>
<td>-0.02467***</td>
<td>-0.00186</td>
<td>0.00051</td>
<td>-0.00402</td>
</tr>
<tr>
<td></td>
<td>(0.00285)</td>
<td>(0.00243)</td>
<td>(0.00944)</td>
<td>(0.00301)</td>
</tr>
</tbody>
</table>

(Table continues)

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Notes:

a The dependent variable is Portfolio Return.
b Standard errors are reported in parentheses. The variance-covariance matrix has been corrected for heteroskedasticity using White’s method (1980).
c *, ** and *** indicate the statistical significance at the 10%, 5% and 1% levels, respectively.

Table 9.2.4


\[ R_{jt} = \delta_{t1} + \delta_{1j}D_{jt} + \delta_{2j}(1-D)_{jt} + \delta_{3j}S_{jt} + \delta_{4j}Lev_{jt} + \delta_{5j}BME_{jt} + \delta_{6j}PE_{jt} + \delta_{7j}JAN_{jt} + \nu_{jt} \]

where \( D = 1 \), if \( R_{LAjt} > 0 \), and \( D = 0 \), if \( R_{LAjt} < 0 \)

\[ H_0: \delta_1 - \delta_2 = 0 \] versus \( H_a: \delta_1 - \delta_2 \neq 0 \)

\[ H_0: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0 \] versus \( H_a: \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 \neq 0 \)

Notes:

** indicate the statistical significance at the 1% level.
*** Wald test for symmetry between up and down betas.
**** Wald test for statistical significance of risk factors, other than up and down betas.

The results reported in Tables 9.2.3 and 9.2.4 are only partially consistent with those reported in Tables 9.2.1 and 9.2.2, respectively. On the one hand, the coefficients
for the size and price-earnings ratios are not significant for the Brazilian stock market.

For the Chilean stock market, the size variable continues being negative and statistically
significant. The January effect disappears as a significant factor. The previous results
are consistent with the view that the Brazilian stock market prices more systematically
additional risk factors (other than up and down betas) than the remaining Latin
American stock markets. However, as in the case of previous regressions, these
anomalies are not as substantial as up and down betas in explaining the cross-sectional
portfolio return variations across the Latin American equity markets in the sample.

The main difference between test periods is that the null hypothesis of
symmetrical up and down markets is rejected only for the Argentinean stock market
after controlling for additional factors other than up and down betas. This result is
consistent with the view that investors (either domestic and international) who exhibited
historical asymmetries in terms of risk premiums in up and down markets have
significantly mitigated these differences in recent years. In general (with the exception
of Argentina), individuals who have invested in Latin American stock markets have
shown more homogeneous expectations about asset returns in the last test period (1997-
99) than in previous years.

Finally, it is important to note that the regression results reported in Table 9.2.3
do not substantially outperform those reported in Table 8.4.3 when additional
explanatory factors other than up and down betas are not included in the regression
equation. The Adjusted R-squares presented in Table 8.4.3 are 0.1228, 0.1137, 0.1333
and 0.2183 for the Brazilian, Chilean, Mexican and Argentinean stock markets,
respectively. These measures of model fitness are very close to those reported in Table 9.2.3.

**Summary**

One of the most important findings in this Chapter shows that the conditional relationship between beta and return is robust even after controlling for additional factors documented in previous studies. The significant positive relationship between beta and return in up market weeks and the significant negative relationship between beta and return in down market weeks are consistent for different currencies, proxies for the investors' market portfolio, time periods and across the Latin American stock markets under study. These results support hypothesis H3 (See Chapter VI).

With regard to the control variables, the results vary according to the currency used to estimate returns. Under the hypothesis of segmented stock markets (returns in local currency) the results show that, for the Brazilian stock market, the leverage, book to market equity ratio and the January dummy variables are all significant and positively related to portfolio returns. These findings are in line with previous studies. In addition, these variables are systematically priced across the test periods.

For the Argentinean stock market, only the book to market equity value ratio is positively and significantly priced across test periods. For the Chilean stock market those variables that were statistically significant in the first test period result to be insignificant in the second period. For the Mexican case, additional explanatory variables, other than up and down betas, are insignificant at any conventional level and across test periods.
The previous findings suggest that Latin American stock markets might have their own microstructure requiring different capital asset pricing specifications. However, the results also show that the additional factors documented in the financial literature do not contribute significantly to explain the cross-sectional return variation in portfolios. The adjusted R-squares are very similar in both the simple specification (i.e., up and down betas only) and the full specification (i.e., with the additional factors incorporated). Furthermore, the conditional betas are the main explanatory variables.

When the returns are estimated under the implicit assumption that stock markets are integrated (using U.S. currency), the results show that for the Brazilian stock market, the size, leverage, book to market equity ratio and a January dummy are all factors that are significant and positively related to portfolio returns. These variables also appear to be priced systematically across the test periods.

For the Chilean stock market, only the size variable is negatively and significantly priced across the test periods. For the remaining stock markets, additional explanatory variables other than up and down betas are not significant at any conventional level and across the test periods.

As previously found, the results also show that additional factors documented in the financial literature do not contribute significantly to explain the cross-sectional variation in portfolio returns. The adjusted R-squares are very close to those estimated when additional factors are not incorporated, and the conditional betas remain the main explanatory variables.

The earlier findings and the Wald tests reported for this second scenario (in U.S. dollars) also suggest that Latin American stock markets are relatively integrated.
Argentina and Brazil seem to be more integrated than segmented. In the next Chapter, I formally test whether there is evidence that these stock markets are either integrated or segmented.
CHAPTER X

STOCK MARKET INTEGRATION IN LATIN AMERICA:

EMPIRICAL RESULTS

The last Chapter concluded by stating that the conditional relationship between beta and return is robust even after controlling for additional factors documented in previous studies. The significant positive relationship between beta and return in up market weeks and the significant negative relationship between beta and return in down market weeks are consistent across different currencies, proxies for investors’ market portfolios, time periods and Latin American stock markets.

Chapter IX also shows that when the returns are estimated in U.S. dollars (assuming that stock markets are integrated) the Brazilian stock market exhibits additional risk factors, other than up and down betas, which are statistically significant and positively related to portfolio returns. The variables of size, leverage, book to market value ratio and January dummy were priced across both test periods.

For the Chilean stock market only, in addition to up and down betas, the size variable is statistically significant and negatively priced across test periods. For the remaining stock markets, any additional explanatory variables are not significant at any conventional level and across test periods. These results suggest that the econometric specifications presented in equations (5) and (6) might be useful in order to test whether
the stock markets under study are integrated or not. On the one hand, if these stock markets are regionally integrated, Latin American investors cannot capture diversification benefits by investing in the region. In this case, the market portfolio in the conditional CAPM (CCAPM) corresponds to an index representative of the group of Latin American stock markets as a whole. If the Latin American stock markets are integrated, the same future cash flows will be priced in the same way in any of the markets in the sample. On the other hand, if these stock markets are partially integrated then the Latin American investors can capture the benefits from regional diversification by choosing those stocks that are regionally cross listed and that are most highly correlated with their local market portfolios.

In this Chapter, I estimate two regression equations. First, equation (5) is extended using the alternative dummy specification to that suggested by Pettengil et al. (1995) to incorporate into a single equation (7) all the stock markets studied. (See specification in Chapter V). Then, by using this equation I test whether the beta coefficients associated with up and down markets (here the market portfolio is referred to the MSCI Latin America stock market index) are not statistically different across the selected stock markets in the sample. (See working hypotheses also in Chapter V). Second, I extend equation (7) in order to control for those additional variables, other than up and down betas, which were significantly priced across the test periods. Then, I repeat the testing procedures already explained by estimating equation (7) and compare the results.
Table 10.1


<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Wald Test Equation (7)(^a) (Up Markets)</th>
<th>Wald Test Equation (7)(^b) (Up Markets)</th>
<th>Wald Test Equation (7)(^a) (Down Markets)</th>
<th>Wald Test Equation (7)(^b) (Down Markets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.8982</td>
<td>2.6054**</td>
<td>1.6209</td>
<td>1.4584</td>
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<td>(0.1275)</td>
<td>(0.0500)</td>
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<td>(0.2237)</td>
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<tr>
<td>B</td>
<td>2.8353*</td>
<td>3.9022**</td>
<td>1.7811</td>
<td>1.5092</td>
</tr>
<tr>
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<td>(0.0587)</td>
<td>(0.0202)</td>
<td>(0.1685)</td>
<td>(0.2211)</td>
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<tr>
<td>C</td>
<td>2.8470*</td>
<td>3.9066**</td>
<td>0.6811</td>
<td>0.3691</td>
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<td>(0.0580)</td>
<td>(0.0201)</td>
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<tr>
<td>D</td>
<td>0.2581</td>
<td>0.4526</td>
<td>2.0257</td>
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</tr>
<tr>
<td></td>
<td>(0.7725)</td>
<td>(0.6360)</td>
<td>(0.1319)</td>
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<tr>
<td>E</td>
<td>1.8079</td>
<td>2.4455*</td>
<td>2.4150*</td>
<td>2.1860</td>
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<td>(0.1640)</td>
<td>(0.0867)</td>
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<tr>
<td>F</td>
<td>5.6703**</td>
<td>7.8038***</td>
<td>0.7018</td>
<td>0.1909</td>
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<tr>
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<td>(0.0173)</td>
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<td>G</td>
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<td>H</td>
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<td></td>
<td>(0.5051)</td>
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</tr>
<tr>
<td>I</td>
<td>2.8137*</td>
<td>3.7936*</td>
<td>3.2218*</td>
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<tr>
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<td>(0.0935)</td>
<td>(0.0515)</td>
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<tr>
<td>J</td>
<td>3.1501*</td>
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<td>0.0997</td>
<td>0.0327</td>
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<td>(0.0383)</td>
<td>(0.9215)</td>
<td>(0.8564)</td>
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<tr>
<td>K</td>
<td>0.0089</td>
<td>0.0089</td>
<td>4.0169**</td>
<td>4.0160**</td>
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<tr>
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<td>(0.9247)</td>
<td>(0.9245)</td>
<td>(0.0450)</td>
<td>(0.0451)</td>
</tr>
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</table>

Notes:
\(a\) Equation (7) alone.
\(b\) Equation (7) after controlling for significant additional risk factors for Brazil and Chile.
\(c\) * and ** indicate the statistical significance at the 10% and 5% levels, respectively.
\(d\) P-Values in parentheses.

Table 10.1 shows the results of Wald test coefficients after estimating equation (7) under two scenarios. First, the Wald test coefficients are reported after estimating equation (7) alone. This means that no additional variables other than up and down betas are taken into account when testing integration across the selected Latin American
stock markets. Second, the same tests are reported once equation (7) is extended to take into consideration variables such as size, leverage, book to market value equity ratio and the January dummy which were priced for the Brazilian stock market in both test periods, and size, which was also priced across those periods for the Chilean stock market. The Wald test is used to test whether the null hypotheses A through K of integration are rejected or not. (See hypotheses in Chapter V).

For upturns in the Latin American stock market index, the results reported in Table 10.1 (with minor variations) are consistent with a relative high degree of stock market integration across the Latin American stock markets, especially among the Brazilian, Mexican and Argentinean markets. The null hypothesis of market integration is not rejected for those cases where the selected stock markets appear together with the exception of the Chilean stock market (hypotheses D, G, H and K). The Chilean market is definitely the less integrated with the others for upturns in the Latin America stock market index. The null hypotheses of equal betas, before and after controlling for extra risk factors, is rejected in hypotheses B, C, F, and I where the Chilean stock market is present. Therefore, the Chilean market seems to be more segmented under this circumstance. Indeed, the Chilean stock market’s risk premium is 3% per week against 2.0%, 2.2% and 2.3% for the Brazilian, Mexican and Argentinean stock markets, respectively.

For downturns in the Latin American stock market index, the results reported in Table 10.1 with minor variations are consistent with a relative high degree of stock market integration, especially among the Brazilian, Chilean and Argentinean markets. The null hypothesis of market integration is not rejected for those cases where the
selected stock markets appear together with the exception of the Mexican stock market (hypotheses C, F, H and J). The Mexican market is relatively less integrated with the others markets when the Latin America stock market index goes down. The null hypotheses of equal betas before controlling for extra risk factors is rejected in hypotheses E, I and K where the Mexican stock market is present. More homogeneous results in favor of stock market integration are obtained after controlling for additional risk factors, with the exception of the Mexican and Argentinean stock markets. The Mexican stock market seems to be more segmented under this circumstance. For downturns in the Latin American stock market index, the Mexican market shows a negative risk premium of 2.7% per week against 3.2%, 3.5%, and 3.5% for the Brazilian, Chilean and Argentinean stock markets, respectively.

**Summary**

The results in this Chapter suggest that the Latin American stock markets are relatively more integrated than segmented. However, the degree of stock market integration varies according to up and down markets. These results partially support hypotheses $H_4$, $H_{4a}$ and $H_{4b}$ (See Chapter V).

On the one hand, the Chilean stock market is the least integrated with the other markets for upturns in the Latin America stock market index. The null hypotheses of equal risk premiums, before and after controlling for extra risk factors, is rejected in hypotheses B, C, F, and I where the Chilean market is a part of the combinations. The Chilean market is more segmented under this circumstance. Indeed, the Chilean stock market's risk premium is 3% per week against 2.0%, 2.2% and 2.3% for the Brazilian, Mexican and Argentinean stock markets, respectively.
On the other hand, the Mexican stock market is relatively less integrated with the other markets for downs in the Latin America stock market index. The null hypotheses of equal negative risk premiums before controlling for extra risk factors is rejected in hypotheses E, I and K where the Mexican stock market is present. More consistent results in favor of stock market integration are obtained after controlling for additional risk factors, with the exception of the Mexican and Argentinean combination. The Mexican stock market is more segmented under this situation. This stock market shows a negative risk premium of 2.7% per week against 3.2%, 3.5%, and 3.5% for the Brazilian, Chilean and Argentinean stock markets, respectively.
CHAPTER XI

CONCLUSIONS AND IMPLICATIONS

Assets pricing studies testing for an unconditional cross sectional relationship between portfolio risk (as measure by beta) and returns have found weak and inconsistent results under different time periods and markets. One possible explanation for these is that the above studies are biased given the conditional relationship between betas and realized returns documented by Pettengil et al. (1995). According to the CAPM theory a direct relationship is always predicted between portfolio betas and returns. However, this relationship is conditional on the market excess returns when realized returns instead of expected returns are used for testing objectives.

Since Pettengil et al. presented their results in 1995, several studies have empirically tested for a systematic conditional relationship between beta and realized returns. Briefly, these studies find a significant positive relationship between portfolios’ betas and returns during up markets and a significant but negative relationship during down markets.

In this dissertation, I study both the conditional and unconditional CAPM versions as applied to the most important emerging stock markets in Latin America, namely Argentina, Brazil, Chile and Mexico based on the 1990-1999 period. In addition, as extensions to the study of these CAPM versions, I also control for the effects that additional risk factors might have in explaining the conditional cross-
sectional portfolio return variation on each of the above stock markets, and test several hypotheses about regional integration.

First, the findings from the analysis support the hypothesis that there are no statistically significant relationships between portfolio betas and returns under the unconditional CAPM model (UCAPM). With the exception of Chile in the 1997-1999 subperiod, the results are consistent across Latin American stock markets, testing subperiods, different proxies for the market portfolio and currencies used to estimate returns. These findings are also consistent with those found by Fama and French (1992) and several other studies that show a flat relationship between betas and returns in the U.S. and in other stock markets. The above results would imply that either there is no risk-return tradeoff or that beta does not capture risk adequately. However, these findings could be biased due to the conditional relationship between beta and realized returns documented by Pettengil et al. (1995).

Second, when analyzing the conditional CAPM version, the results are partially consistent with Pettengil et al. (1995). On the one hand, there is strong support for the hypotheses of a significant positive relationship between portfolio beta and return in up market weeks and a significant negative relationship between portfolio beta and return in down market weeks. These findings are consistent across Latin American stock markets, subperiods, proxies for investors' market portfolio, and risk free rate. On the other hand, with regard to the statistical hypothesis of a symmetrical relationship between risk and return during positive and negative market excess returns, the results are inconsistent under local currency but are consistent under U.S. dollars. Under local currency, which assumes segmented stock markets, this hypothesis is rejected for the
Brazilian and Argentinean stock markets for the first test period of 1995-99 but it is not rejected for the second period of 1997-99. When the returns are estimated in U.S. dollars, which assumes that the stock markets are integrated, the symmetry hypothesis is rejected for the Brazilian and Argentinean stock markets in both test periods.

The findings also show that investors in Latin America, on average, are more sensitive to downturns than to upturns in the Latin American stock market index when they decide to invest in the Argentinean and Brazilian stock markets. Interestingly, studies analyzing market interdependencies in Latin America have found that the reaction of Argentina, Brazil and Chile to changes in the Mexican stock market are more pronounced when the market is going down than up (Pagan and Soydemir, 2001). These results are consistent with pessimism about the prospect of high returns in these markets (Skinner and Sloan, 1999). Furthermore, it is important to note that the stock market efficiency across the Latin American stock markets differs from that exhibited in the U.S. stock market. According to Pettengil et al. (1995) results, the regression equation (5) presents mean values of 3.36% for $\alpha_t$ and -3.37% for $\alpha_{2t}$ within the 1936-1990 period. Moreover, a two-population t-test, which tests for absolute difference in previous coefficients, yields a result of 0.0001 with a p-value of 0.9769. These findings suggest that the U.S. stock market presents a more consistent symmetrical relationship between systematic risk and return during positive and negative excess market returns compared to that presented in Latin American stock markets. These results are also in line with a relatively higher level of efficiency in the U.S. stock market compared to that presented in Latin American stock markets. Stock prices in the U.S. market reflect all available information more homogeneously than in Latin American stock markets.
Third, when analyzing the *conditional* relationship between beta and return, the findings show that this relationship is significant even after controlling for additional factors documented in previous studies. Up and down betas are the main explanatory variables after estimating the regression equations under different currencies, different proxies for the investors' market portfolio, different time periods and across the Latin American stock markets studied. With regard to the control variables, the results vary according to the local-international approach. Under the hypothesis of segmented stock markets, the results show that for the Brazilian stock market, the leverage, book to market equity ratio and January dummy variables are significant and positively related to portfolio returns across the test periods.

For the Argentinian stock market, only the book to market equity value ratio is positively and significantly priced across test periods. For the Chilean stock market, those variables that are statistically significant in the first test period are insignificant in the second period. For the Mexican case, additional explanatory variables other than up and down betas are insignificant at any conventional level and across test periods.

As a whole, the findings show that additional risk factors, other than up and down betas, do not contribute significantly to explain the cross-sectional return variation in portfolios. The adjusted R-squares are very similar in both the simple specification (i.e., up and down betas only) and the full specification (i.e., with the additional factors incorporated). Furthermore, the conditional betas are the main explanatory variables.

When the returns are estimated under the implicit assumption that stock markets are integrated, the results show that for the Brazilian stock market, factors such as size,
leverage, book to market equity ratio and a January dummy are significant and positively related to portfolio returns across the test periods.

For the Chilean stock market, only the size variable is negatively and significantly priced across test periods. For the remaining stock markets, additional explanatory variables, other than up and down betas, are not significant in both testing periods at any conventional level.

As in the case of the results under the assumption of segmented markets, the findings in this scenario also show that additional risk factors do not contribute significantly to explain the cross-sectional portfolio return variations. However, it is important to mention that the Brazilian stock market presents a relatively higher number of anomalies than the remaining Latin American stock markets due to factors such as size, leverage, book to market equity ratio and a January dummy are significant and positively related to portfolio returns across the test periods. Nonetheless, the increases in adjusted R-square are not substantial when these factors are included in the regression equation. Thus, including extra regressors does not improve significantly the explanatory power of the conditional CAPM model, which considers only up and down betas in the regression equation.

Finally, the findings reported in Chapter X suggest that the Latin American stock markets are relatively more integrated rather than segmented. However, the degree of stock market integration varies according to up and down markets. On the one hand, the Chilean stock market is the least integrated with the other markets for upturns in the Latin America stock market index. Indeed, the Chilean stock market's risk premium is 3.0% per week against 2.0%, 2.2% and 2.3% for the Brazilian, Mexican and
Argentinean stock markets, respectively. On the other hand, the Mexican stock market is relatively less integrated with the other markets for downs in the Latin America stock market index. More consistent results in favor of stock market integration are obtained after controlling for additional risk factors, with the exception of the Mexican and Argentinean combination. The Mexican stock market shows a negative risk premium of 2.7% per week against 3.2%, 3.5% and 3.5% for the Brazilian, Chilean and Argentinean stock markets, respectively.

In terms of implications, the results from this study provide a basic framework that contributes to a better understanding about how investors price portfolio stocks across the Latin American stock markets. The results may also help investors to develop certain financial strategies that can contribute to improve their results in terms of risk-return as well as portfolio diversification. In periods when Latin America’s market returns go up, the Chilean stock market rewards with a higher risk premium than the other Latin American stock markets. Investors feel relatively more optimistic when investing in risky Chilean stocks than when investing in similar securities in the rest of Latin America. However, when Latin America’s market returns go down, investors feel relatively more pessimistic when investing in risky Argentinean, Brazilian and Chilean stocks than when investing in similar securities in Mexico. Therefore, the Chilean and Mexican stock markets might offer benefits in terms of portfolio diversification conditional to the upturns or downturns experienced in Latin America’s market returns as a whole.

One financial recommendation derived from the previous results is that investors should invest relatively more in the Chilean securities than in the other Latin American
stock markets when Latin America’s market returns grow, and relatively more in the Mexican stocks than in the other Latin American stock markets when Latin America’s market returns fall. Of course, this active portfolio strategy assumes certain ability among investors in terms of market timing. If the market timing degree were high, a better strategy would be to invest relatively more in risky Chilean stocks when Latin America’s market returns go up and short sale all risky securities when Latin America’s market returns go down. However, these strategies are likely to lose their effectiveness if these markets become more integrated where the possibility to exploit abnormal returns decreases.

As a whole, the results show that the asymmetries in the risk premium and also the incomplete integration across the Latin American stock markets can have important implications for using adequate policies for stabilizing the financial sector in such markets. Financial policies (for instance, the creation of a center for free cross-listing and trading of Latin American stocks) that support an increase in the degree of integration across these markets are beneficial for Latin America as a whole. These policies can contribute to increase investors’ knowledge about the fundamentals of the Latin American stock markets and, therefore, their efficiency. Moreover, under full stock market integration, the cost of capital on average could fall, thereby contributing to an increase in Latin America’s economic growth.

It is important to point out that a potential extension for this study might include a broader sample with companies from diverse regions across the world. In addition to capturing the microeconomic information behind the companies, which is not captured when aggregate stock market indexes are used, this more ambitious study would allow
the analysis and test of international asset pricing models under the assumption of fully integrated markets across the world.

Lastly, the limitations associated with the study of Latin American emerging stock markets constrain the use of some techniques. The relatively fewer number of companies in these markets compared to developed markets and the limited historical data can affect the robustness of the results. In spite of these limitations, it is important that financial researchers and regulators in Latin American countries understand the risk-return generating process associated with these stock markets. This dissertation can contribute to a better understanding of these processes.
REFERENCES


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