THE EFFECT OF EXCHANGE RATE RISK ON THE CONDITIONAL RELATIONSHIP BETWEEN BETA RISK AND RETURN IN INTERNATIONAL EQUITY MARKETS

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ABSTRACT

The paper examines the effect of exchange rate risk on the conditional relationship between beta risk and return in international equity markets from January 1978 through September 2004. We use an extension of the model introduced by Pettengill, Sundaran, and Mathur (PSM Model, 1995) and adapted by several authors afterwards. The empirical results show evidence in international markets that are compatible with the PSM model and some international studies addressing returns that are unhedged against exchange rate risk. However, when this risk is controlled and hedged with forward contracts, the conditional relationship between beta risk and return appears asymmetric and presents a lower beta risk premium than the one takes place under unhedged returns in up-market months. A main business implication of the findings follows: international equity market administrators and portfolio managers can defend themselves against exchange risk by using forward contracts, particularly in world stock market conditions similar to those discussed throughout the paper.

JEL: G12, G15

INTRODUCTION

The effect of exchange rate risk on stock market returns has become an important issue for several economic agents, especially those interested in diversifying risks, when needed and feasible, by investing across different world stock markets. Simple observation of international stock markets shows that many investors spend substantial resources to control the foreign exchange risk, which is associated with their international stock market investments, under the belief that it is a source of risk to be hedged away. Thus, hedging foreign exchange rate risk will be a valuable financial strategy if investors price such risk in international stock markets. However and surprisingly, typical methods for testing whether the exchange rate risk is priced in the world stock market do not address the possibility that such risk could be differently priced under up and down world stock market periods. Currency exposure could lead to different stock market risk premiums depending on previous world stock market conditions. For instance, investors' optimism or pessimism may result in asymmetric responses under such conditions. This situation could generate differences on their portfolio returns' expectations due to the potential impact that changes in foreign exchange rate may have on foreign stock markets. Therefore, if investors price differently currency exposure in such world stock market conditions then this result may lead them to use financial hedging strategies in order to 1) protect their returns against exchange rate exposure and, thus, 2) eventually prevent financial portfolio problems or going bust.

Our main hypothesis is that if exchange rate risk were priced in an international context then there would be a positive and higher beta risk premium in up-market months and a negative and higher beta risk premium in down-market months. The above applies when investors do not hedge their international portfolio against exchange rate risk as compared to the situation when investors hedge their portfolios by using forward contracts. We assume that hedging may reduce both market (systematic) and non-market risk. We follow a methodology based on an extension of Pettengill, Sundaran, and Mathur (PSM Model, 1995). They are one of the first authors in examining the stock market risk premiums under up and down market periods. However, they also ignore both the effects that exchange rate risk and hedging strategies may have on stock market returns under such market conditions. Thus, the above issue constitutes the main objective in this study.

We start by examining the period from 1973 to 2003. This period includes the Bretton Woods (1973) and the Jamaica Agreements (1976). These agreements established a set of rules for the international monetary system, where flexible exchange rates were acceptable to the IMF members, and central banks could intervene in the exchange markets in order to control unwarranted volatilities. Despite the regulations, however, this period has not been exempt of exchange rate volatility. To achieve the stated objective, we use two approaches in order to isolate the effect of exchange rate risk. We follow the methodology of Pettengill, Sundaran, and Mathur (1995) in the first approach in order to estimate an international conditional relationship between market beta risk and return without controlling exchange rate risk. This approach assumes an unhedged estimation of security returns. Then, we control the exchange rate risk in the second approach by using forward currency contracts.

We organize the remainder of the paper as follows. Section 2 briefly discusses a review of the literature on this issue. Section 3 presents the methodology. Section 4 shows the empirical results and finally Section 5 discusses the paper conclusions and implications.

LITERATURE REVIEW

Several studies have considered the effects of exchange rate risk on asset returns when examining international asset pricing models assuming both unhedged returns and exchange rate risk as a pervasive independent explanatory factor (Solnik, 1974; Sercu, 1980; Stulz; 1981; Adler and Dumas, 1983; Solnik, 1997). Yet, the empirical evidence is twofold. On the one side, the results from testing unconditional asset pricing models are not conclusive. Early studies (e.g., Hamao, 1988; Jorion, 1991) found no evidence in favor of the effects of exchange risk pricing on the Japanese or the US stock markets. More recent studies (e.g., Carrieri and Majerbi, 2006), however, show significant unconditional exchange risk premium in emerging stock markets. On the other side, the results from testing time-varying conditional asset pricing models generally support the hypothesis that foreign exchange risk is priced in the stock markets of major developed countries (Dumas and Solnik, 1995; De Santis and Gerard, 1998; Choi et al., 1998; Doukas et al., 1999; Carrieri, 2001). Previous studies, however, do not asses the issue that exchange risk premia may eventually differ under up and down stock market periods when this risk is controlled on asset returns (dependent variable) by using forward contracts. The traditional approaches based on conditional time-varying and unconditional models do not consider previous possibility.

In the capital asset pricing literature, is also possible to find a variety of studies that address the issue of up and down beta risk premia. Wiggins (1992), Bhardwaj and Brooks (1993) and Pettengill, Sundaram, and Mathur (1995) suggested a potential explanation for the flat unconditional relationship between beta risk and security returns in the U.S. equity market. More recently, there has been an increasing flow of empirical research validating a conditional relationship rather than an unconditional relationship for these two variables, beta risk and return (Cheng, 2005; Conover, Friday, and Howton, 2000; Faff, 2001; Howton and Peterson, 1998; Hung and Shackelton, 2004; Jensen and Mercer, 2002; Pettengill, Sundaran, and Mathur, 2002; Tang and Shum, 2003). The work of Pettengill et al., (1995) is one of the first in recognizing that a conditional relationship between market beta risk and return may take place in up and down stock market periods and that a systematic relationship must exist between market beta risk and return for the further to be a useful measure of risk. They assumed that both variables depend on whether the excess market return is positive or negative. In fact, using 55 years of U.S monthly stock return data, Pettengill, Sundaran, and Mathur (1995) show that beta market risk is priced when sample period is divided into up and down market months. Granted, the CAPM indicates a systematic and positive tradeoff between market beta and expected return. Yet, in line with rational expectations and Pettengill et al. (1995), there should be a positive relationship between realized returns and market beta during positive market-excess return periods and a negative relationship during negative market-excess return periods.

More specifically, let's assume that the expected return for the portfolio is the mean of the distribution for all possible returns for that portfolio in a given period. Thus, the expected value for its return distribution must contain a non-zero probability of realizing a return below the risk-free rate for market portfolio or for any other portfolio with a positive market beta. Otherwise, no investor would hold risk free bonds. In addition, portfolios with higher market betas have higher expected returns because of higher risks, that is, there must be some level of realized return for which the probability of exceeding that particular return is greater for the low market beta portfolio than for the high market beta portfolio. This logic can help understand why some investors carry on low-market beta portfolios. Indeed, returns for high market beta portfolios are less than returns for low market beta portfolios when the realized market return is less than the risk free rate. Therefore, the main Pettengill et al's prediction works out: there should be a positive relationship between realized returns and market beta during positive market-excess return periods and a negative relationship during negative market-excess return periods.

In an international setting, the implication of this conditional relationship has also been a matter of study. Empirical support was found for a significant positive relationship between beta and return in up-market months and a significant but negative relationship in down market months in U.K.'s main international developed stock markets (Fletcher, 1997, 2000), Japan's equity markets (Hodoshima, Garza-Gomez, and Kunimura, 2000), and Latin American equity markets (Sandoval and Saens, 2004).

The main drawback of previous studies, however, is that they do not take into account the effect that exchange rate risk may have on such conditional relationship after controlling the exchange rate risk effect on asset returns, as dependent variable, by using forward currency contracts. In an international setting, currency exposure may lead to different stock market risk premiums during up and down world stock market periods. As previously mentioned, investors' optimism or pessimism may result in asymmetric responses under such conditions. This behavior could imply differences on their portfolio returns' expectations given the potential effect that the foreign exchange rate volatility may have on foreign stock markets. The study of this issue is the focus of this article.

METHODOLOGY

Exchange Rate Volatility and Unhedged Security Returns

This section presents the analysis of the effect of exchange rate variability on the total risk of foreign stock markets. The analysis takes the viewpoint of a U.S. investor investing in the U.S. and sixteen major foreign stock markets, i.e., Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland and the UK. The international portfolio strategy initially assumes uncovered returns against exchange rate risk, and uses Eun and Resnick's (1988) methodology, which includes six years of weekly data and the experience of seven countries. This study uses 32 years of monthly data from 17 major countries.

The Effect of Exchange Rate Variability

The dollar rate of return, $\widetilde{R}_{jUS\$}$, that an U.S. investor can make from an unhedged investment in the *j*th foreign stock market is given by

$$\widetilde{R}_{jUS\$} = (1 + \widetilde{R}_{j\$})(1 + \widetilde{e}_j) - 1 \tag{1}$$

$$\widetilde{R}_{jUS\$} = \widetilde{R}_{j\$} + \widetilde{e}_j + \widetilde{R}_{j\$}\widetilde{e}_j \tag{2}$$

where $\widetilde{R}_{j\$}$ is the local stock market return, which is measured in domestic currency, $\widetilde{e}_j$ is the rate of appreciation of the domestic currency against the dollar, and the symbol "~" indicates a stochastic variable. Note that the cross-product, $\widetilde{R}_{j\$}\widetilde{e}_j$, in equation (2) is close to zero in value, so $\widetilde{R}_{jUS\$}$ can be estimated by

$$\widetilde{R}_{jUS\$} \approx \widetilde{R}_{j\$} + \widetilde{e}_j \tag{3}$$

From equation (3), the variance of the dollar rate of return can be estimated by

$$Var(\widetilde{R}_{jus\$}) \approx Var(\widetilde{R}_{j\$}) + 2Cov(\widetilde{R}_{j\$}, \widetilde{e}_j) + Var(\widetilde{e}_j) \tag{4}$$

The previous analysis can be extended into a portfolio context. The variability of dollar portfolio returns, $Var(\widetilde{R}_{pUS\$})$, can be estimated as

$$Var(\widetilde{R}_{pUS\$}) = \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{jUS\$}, \widetilde{R}_{kUS\$}) \ \forall \ \mathrm{j, k} = 1, \ldots\ldots\ldots\ldots, \mathrm{n} \tag{5}$$

where w_j shows the percentage of wealth invested in the *j*th stock market. It is noted from equation (3) that

$$\begin{aligned} Cov(\widetilde{R}_{jUS\$}, \widetilde{R}_{kUS\$}) &\approx Cov\left[(\widetilde{R}_{j\$} + \widetilde{e}_j), (\widetilde{R}_{K\$} + \widetilde{e}_K\right] \\ &\approx Cov(\widetilde{R}_{j\$}, \widetilde{R}_{k\$}) + Cov(\widetilde{R}_{j\$}, \widetilde{e}_k) + Cov(\widetilde{R}_{k\$}, \widetilde{e}_j) + Cov(\widetilde{e}_j, \widetilde{e}_k) \end{aligned} \tag{6}$$

By merging equation (6) into equation (5), the former can be estimated as follows

$$Var(\widetilde{R}_{pUS\$}) \approx \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$}, \widetilde{R}_{k\$}) + 2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$}, \widetilde{e}_k) + \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{e}_j, \widetilde{e}_k) \tag{7}$$

Equation (7) shows that the total portfolio risk depends on (a) the covariances among the local stock market returns (local currency returns), (b) the cross-covariances among the local stock market returns and the exchange rate variations, and (c) the covariances among the exchange rate variations. The exchange rate variability contributes to the total portfolio risk through the second and third terms of equation (7). We can observe that if the second and the third terms are largely positive (negative), then the exchange rate variability will increase (decrease) the overall portfolio risk.

The effect of the exchange rate risk can be analyzed by forming an equally weighted portfolio from the seventeen stock markets under study. In order to study what has been the trend decomposition of the total portfolio risk, we examine 28 moving subperiods using monthly data from January 1973 to September 2004. Each subperiod includes 60 months (5 years). The first subperiod starts in January 1973 and ends in

December 1977. The second period covers from January 1974 through December 1978 and so on. The $Var(\widetilde{R}_{pUS\$})$ decomposition using equation (7) is shown in Table 1.

Table 1: Decomposition of Portfolio Risk (Absolute Contribution in Squared Percent)

Component/Period	73-77	74-78	75-79	76-80	77-81	78-82	79-83
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{R}_{k\$})$	15.755	14.384	10.039	6.998	6.770	7.494	8.364
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{e}_k)$	2.536	0.869	1.317	1.801	1.502	2.974	3.163
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{e}_j,\widetilde{e}_k)$	4.297	4.486	4.282	4.511	5.765	6.463	4.237
D. $Var(\widetilde{R}_{pUS\$})$	22.588	19.739	15.638	13.310	14.037	16.931	15.764
Component/Period	**80-84**	**81-85**	**82-86**	**83-87**	**84-88**	**85-89**	**86-90**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{R}_{k\$})$	9.698	8.569	9.284	19.752	19.590	19.319	25.359
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{e}_k)$	2.289	0.306	-0.121	-5.876	-5.341	-5.803	-5.222
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{e}_j,\widetilde{e}_k)$	4.480	5.847	6.538	6.564	7.307	7.418	5.792
D. $Var(\widetilde{R}_{pUS\$})$	16.467	14.722	15.701	20.440	21.556	20.934	25.929
Component/Period	**87-91**	**88-92**	**89-93**	**90-94**	**91-95**	**92-96**	**93-97**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{R}_{k\$})$	25.087	16.180	17.356	17.454	11.635	10.356	12.044
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{e}_k)$	-6.187	-5.519	-5.780	-6.219	-5.867	-5.998	-5.075
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{e}_j,\widetilde{e}_k)$	6.435	7.269	6.833	5.827	6.054	4.241	3.074
D. $Var(\widetilde{R}_{pUS\$})$	25.335	17.930	18.409	17.062	11.822	8.599	10.043
Component/Period	**94-98**	**95-99**	**96-00**	**97-01**	**98-02**	**99-03**	**00-04**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{R}_{k\$})$	17.125	16.447	19.234	23.476	24.807	22.010	22.958
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$},\widetilde{e}_k)$	-5.296	-4.183	-3.866	-2.038	0.932	1.456	0.737
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{e}_j,\widetilde{e}_k)$	3.015	2.775	2.252	2.069	1.389	0.889	0.909
D. $Var(\widetilde{R}_{pUS\$})$	14.844	15.039	17.620	23.507	27.128	24.355	24.604

Each entry in Table 1 shows the decomposition of total risk associated to an equally weighted portfolio according to its absolute contribution in squared percent. Row A shows the covariances among the local stock market returns (local currency returns). Row B shows cross-covariances among the local stock market returns and the exchange rate variations and row C shows the total portfolio risk measured by the variance of portfolio returns in US\$. The decomposition is presented for 28 sub-periods starting with the sub-period 1973-77 and finishing with the sub-period 2000-04.

Table 1 shows that the exchange rate risk (measured by the sum of component B and C) reinforces the portfolio risk during the first ten subperiods (from subperiod 1973-1977 to subperiod 1982-1986). During the first subperiod, exchange rate changes account for 19.0% of the risk of an equally weighted portfolio through its own covariance and for an extra 11.2% through its cross-covariances with the stock market returns. This trend is relatively stable up to subperiod 1982-1986 where exchange rate changes account for 41.7% of the risk of the portfolio through its own covariances and for a negative percentage (-0.8%) through its cross-covariances with the stock market returns. With no exchange rate risk, the portfolio variance would have been 15.755 and 9.284 squared percent for period 1973-1977 and 1982-1986, respectively, as compared to 22.588 and 15.701 squared percent, respectively, under the presence of exchange rate risk. This implies that, while the local stock market risk may be significantly diminished by constructing an international equally weighted portfolio, much of the exchange risk is nondiversifiable.

The results reported in Table 1 and Table 2 reveal important changes starting in period 1983-1987. It can be observed that components B and C almost offset each other in many cases during 18 subsequent subperiods. That is, the cross-covariances among the local stock market returns and the exchange rate variations behave with the opposite sign to the covariances among the exchange rate variations. Such trend implies that exchange rate risk did not have a significant effect on the total portfolio risk in many subperiods. The percentage of total portfolio risk explained by the cross-covariances among the local stock market returns ranges between 90.9% in the subperiod 1984-1988 and 120.4% in the subperiod 1992-1996. Surprisingly, however, exchange rate risk contributes to decrease the overall portfolio risk instead of increasing it in some subperiods as shown in Figure 1.

In summary, the subperiods between 1973 and 1986 are characterized by relatively higher exchange rate volatility where components B and C reinforce each other. Conversely, the subperiods between 1983 and 2004 show relatively lower exchange rate risk where components B and C offset each other. It should be noted that, important international economic agreements took place in order to stabilize the international monetary system during the subperiod 1983-2004. On the one hand, under the Plaza Agreement (New York, 1985) France, Japan, Germany the U.K. and the U.S. agreed that the dollar should depreciate against major currencies to solve a growing U.S. trade deficit, reason why they expressed their willingness to intervene in the exchange market to achieve this goal. On the other hand, under the Louvre Accord (Paris, 1987) Canada, France, Japan, Italy, Germany the U.K. and the U.S. agreed to cooperate in achieving greater exchange rate stability and to closely consult and coordinate their macroeconomic policies because of their concern that the dollar may fall too far. In fact, exchange rates have become more stable since the Louvre Accord.

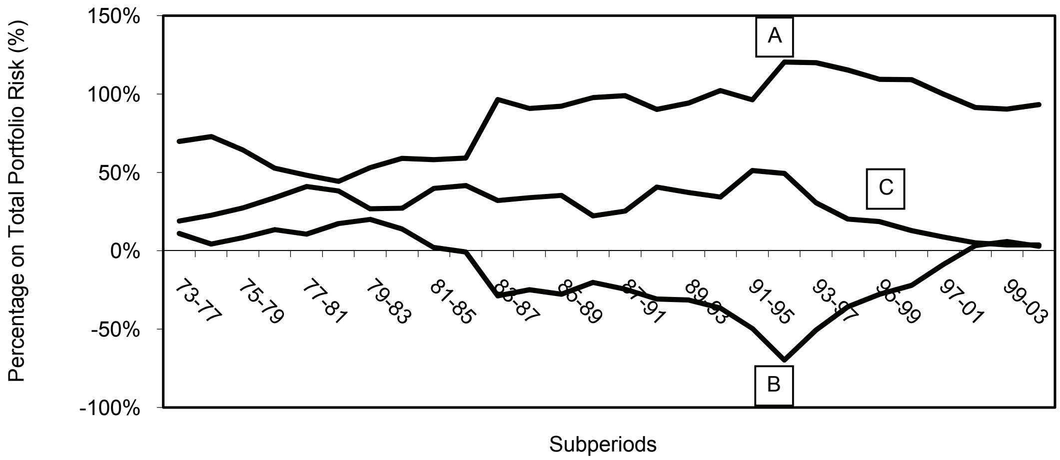
The previous analysis can serve as a good basis to formulate two hypotheses. 1) The exchange rate risk is a market risk from subperiods 1973-1977 to 1982-1986. Consequently, international equally weighted unhedged portfolios will have higher systematic risk premiums than those comparative hedging portfolio under the conditional relationship between beta risk and return applied by Pettengill, Sundaran, and Mathur (1995). 2) The exchange rate risk is neither a market nor a non-market risk from the subperiods 1983-1987 to 2000-2004. Consequently, there are not significant differences between hedging and not hedging portfolio returns against exchange rate risk. In practice, U.S. investors using forward contracts to control exchange risk in international equally weighted hedging portfolios, as implied in the previous hypothesis, will obtain no significant differences in terms of systematic risk and return compared to those comparative international equally weighted unhedged portfolio under the conditional relationship between beta risk and return applied by Pettengill, Sundaran, and Mathur (1995).

Table 2: Decomposition of Portfolio Risk (Relative Contribution in Percentage)

Component/Period	73-77	74-78	75-79	76-80	77-81	78-82	79-83
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{R}_{k\$})$	69.8%	72.9%	64.2%	52.6%	48.2%	44.3%	53.1%
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{e}_k)$	11.2%	4.4%	8.4%	13.5%	10.7%	17.5%	20.1%
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{e}_j,\tilde{e}_k)$	19.0%	22.7%	27.4%	33.9%	41.1%	38.2%	26.8%
D. $Var(\tilde{R}_{pUS\$})$	100%	100%	100%	100%	100%	100%	100%
Component/Period	**80-84**	**81-85**	**82-86**	**83-87**	**84-88**	**85-89**	**86-90**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{R}_{k\$})$	58.9%	58.2%	59.1%	96.6%	90.9%	92.3%	97.8%
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{e}_k)$	13.9%	2.1%	-0.8%	-28.7%	-24.8%	-27.7%	-20.1%
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{e}_j,\tilde{e}_k)$	27.2%	39.7%	41.7%	32.1%	33.9%	35.4%	22.3%
D. $Var(\tilde{R}_{pUS\$})$	100%	100%	100%	100%	100%	100%	100%
Component/Period	**87-91**	**88-92**	**89-93**	**90-94**	**91-95**	**92-96**	**93-97**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{R}_{k\$})$	99.0%	90.2%	94.3%	102.3%	96.4%	120.4%	119.9%
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{e}_k)$	-24.4%	-30.8%	-31.4%	-36.4%	-49.6%	-69.8%	-50.5%
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{e}_j,\tilde{e}_k)$	25.4%	40.5%	37.1%	34.2%	51.2%	49.3%	30.6%
D. $Var(\tilde{R}_{pUS\$})$	100%	100%	100%	100%	100%	100%	100%
Component/Period	**94-98**	**95-99**	**96-00**	**97-01**	**98-02**	**99-03**	**00-04**
A. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{R}_{k\$})$	115.4%	109.4%	109.2%	99.9%	91.4%	90.4%	93.3%
B. $2\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{R}_{j\$},\tilde{e}_k)$	-35.7%	-27.8%	-21.9%	-8.7%	3.4%	6.0%	3.0%
C. $\sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\tilde{e}_j,\tilde{e}_k)$	20.3%	18.5%	12.8%	8.8%	5.1%	3.7%	3.7%
D. $Var(\tilde{R}_{pUS\$})$	100%	100%	100%	100%	100%	100%	100%

Each entry in Table 2 shows the decomposition of total risk associated to an equally weighted portfolio according to its relative contribution in percentage. Row A shows the covariances among the local stock market returns (local currency returns). Row B shows cross-covariances among the local stock market returns and the exchange rate variations and row C shows the total portfolio risk measured by the variance of portfolio returns in US$. The decomposition is presented for 28 sub-periods starting with the sub-period 1973-77 and finishing with the sub-period 2000-04.

Figure 1: Decomposition of Portfolio Risk (%)



Line A shows covariances among the local stock market returns (local currency returns) on total portfolio risk. Line B shows cross-covariances among the local stock market returns and the exchange rate variations on total portfolio risk. Line C shows covariances among the exchange rate variations on total portfolio risk

Exchange Rate Volatility and Hedging Security Returns

The previous section showed that exchange rate risk could be nondiversifiable at least in some subperiods within the period under study. Such observation opens the possibility to consider the use of forward contracts as a choice to control exchange rate risk. Suppose that a U.S. investor sells the expected foreign currency proceeds forward. At the maturity of the forward contract, the U.S. investor will exchange the uncertain dollar return $(1+E(\tilde{R}_{j\$}))(1+\tilde{e}_j)-1$ for the dollar return $(1+E(\tilde{R}_{j\$}))(1+f_j)-1$, where $E(\tilde{R}_{j\$})$ is the expected rate of return on the *j*th foreign stock market (in foreign currency) and f_j is the forward exchange premium, which is defined as $(F_j/S_j)-1$, where F_j and S_j are the forward and spot exchange rates in U.S. dollar equivalents, respectively. F_j is estimated following the International Interest Rate Parity (IIRP) as $F_j = S_j(1+r_{US})/(1+r_j)$, where r_{US} and r_j are the risk-free interest rates in the U.S. and country *j*, respectively. However, the unexpected foreign currency proceeds $(\tilde{R}_{j\$}-E(\tilde{R}_j))$ will be exchanged for U.S. dollar at an uncertain future spot exchange rate. Therefore, the dollar rate of return for the hedging strategy, $\tilde{R}^H_{j\ US\$}$, is given by

$$\tilde{R}^H_{j\ US\$} = \{[1+E(\tilde{R}_{j\$})](1+f_j)+[\tilde{R}_{j\$}-E(\tilde{R}_{j\$})](1+\tilde{e}_j)\}-1 \tag{8}$$

$$\tilde{R}^H_{j\ US\$} = \tilde{R}_{j\$}+f_j+\tilde{R}_{j\$}\tilde{e}_j+E(\tilde{R}_{j\$})(f_j-\tilde{e}_j) \tag{9}$$

Because the third and fourth terms of equation (9) are small in value, this equation can be estimated by

$$\tilde{R}^H_{j\ US\$} \approx \tilde{R}_{j\$}+f_j \tag{10}$$

Therefore, the variance of the dollar hedged portfolio returns, $Var(\tilde{R}^H_{p\ US\$})$, can be estimated approximately as:

$$Var(\widetilde{R}^{H}_{p\ US\$}) \approx \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}^{H}_{j\ US\$}, \widetilde{R}^{H}_{k\ US\$}) \approx \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov[(\widetilde{R}_{j\$} + f_j), (\widetilde{R}_{k\$} + f_k)]$$
$$\approx \sum_{j=1}^{n}\sum_{k=1}^{n} w_j w_k Cov(\widetilde{R}_{j\$}, \widetilde{R}_{k\$}) \tag{11}$$

Equations (7) and (11) and the results presented in Table 1 and 2 show that the hedging strategy may result in a lower portfolio variance for subperiods from 1973-1977 to 1982-1986. That is because of presence of exchange risk (where components B and C reinforce each other) results in a higher risk under an international equally weighted unhedged portfolio, reason why this risk can be reduced by using a hedging strategy. The hedging strategy using forward contracts seems to be one of the cases where portfolio risk can be reduced without adversely affecting portfolio return because the forward exchange premium is an unbiased estimator of the future change of the exchange rate, i.e., $f_j \approx E(\widetilde{e}_j)$. However, it is not clear that the hedging strategy may result in a lower portfolio variance for subperiods from 1983-1987 to 2000-2004, mainly because the presence of exchange risk (where components B and C almost offset each other) does not affect significantly the international equally weighted undhedged portfolio risk. Therefore, similar results in terms of portfolio performance can be expected for these periods either for unhedged or hedging strategies.

Model Specification and Econometric Methodology

This section presents the model specification and the econometric methodology used to test the pricing models proposed. The model specification starts with the zero-beta CAPM used by Black (1972), which predicts that:

$$E(R_i) = \gamma_0 + \gamma_1 \beta_i \tag{12}$$

where $E(R_i)$ is the expected return on portfolio *i*, $\beta_i = Cov(R_i, R_m)/Var(R_m)$ is the beta of portfolio *i*, γ_0 is the expected return on the portfolio which has a zero covariance with the market portfolio, and γ_1 is the expected risk premium of the market portfolio. Yet, in an international setting, a CAPM extension requires some extra assumptions, such as that the capital markets are integrated and the international interest rate and purchasing power parities hold.

The next step relates to the estimation of the unconditional relationship between beta risk and return (URBRR). To accomplish this, the next analysis is performed in order to know if the CAPM model tested by Fama and MacBeth (1973) exhibits a positive relationship between realized portfolio returns and betas. The econometric tests are conducted in two stages. The first stage requires the stock market index beta estimation. Due to the documented presence of infrequent trading in many stock markets, individual betas are estimated using the aggregated coefficients method proposed by Dimson (1979) under two scenarios affecting the seventeen stock markets under analysis. The first scenario relates to unhedged stock market returns, which are estimated using equation (1). The second scenario considers hedged stock market returns, which are estimated using equation (10). Thus, the unhedged and hedged betas are estimated for each stock market index over the 5 years (60 months) moving subperiods, starting with the subperiod from January 1973 to December 1977. The consistent estimates of individual betas for the first subperiod are then used as predictors for the subsequent subperiods up to subperiod 1999-2003. The last estimates of betas are used as predictors for year 2004.

In the second stage, a pooled cross-sectional OLS regression for equation (13) is estimated for subperiods from 1978 through 1986 and from 1987 through 2004, using the CAPM specified by Black (1972):

$$R_{jt} = \gamma_{0t} + \gamma_{1t}\beta_j + \mu_{jt} \quad (13)$$

where R_{jt} is the return on portfolio *j* in month *t*, β_j is the beta of portfolio *j*, and μ_{jt} is a random error term. Both, individual stock markets returns and betas from the previous stage (under the two scenarios, hedged and unhedged returns) are used in this stage to estimate portfolio returns and portfolio betas through equation (13). Thus, equation (13) gives estimates of the average values of monthly coefficients γ_{0t} and γ_{1t} for the tested periods, coefficients that are then tested to see if they are significantly different from zero. The main prediction obtained from equation (13) is whether β_j is the only cross-sectional variable that explains the relationship between portfolio returns and risk.

There is some evidence that additional factors may also contribute to explain cross-sectional return variations. Jegadeesh and Titman (1993), Banz (1981) and Fama and French (1992, 1996) conclude that momentum, size and book-to-market (B/M), respectively, can contribute to explain cross-sectional return variations in U.S. samples. Rouwenhorst (1999) finds general evidence for the three previous factors in emerging markets using univariate analysis. Marshall and Walker (2000) add the size-effect in the Chilean stock market. Yet, the methodologies used in previous studies omit controlling for the sign of the market premium. In contrast, Hodoshima, Garza-Gomez, and Kunimura (2000) and Sandoval and Saens (2004) use multivariate approaches in an international context and find evidence that factors (such as momentum, size and B/M) have little effect in explaining international cross-sectional return variations after controlling their effects on the conditional relationship between beta risk and return, as applied by Pettengill, Sundaran and Mathur (1995).

Furthermore, to test the Pettengill, Sundaran, and Mathur's (1995) conditional relationship between beta risk and return, the tested periods are split into up and down market months. If the realized market portfolio return is above the risk-free return (up market), portfolio betas and returns are positively related. However, if the realized market return is below the risk-free return (down market), portfolio betas and returns are inversely related. Consequently, regression coefficients for equation (14) are estimated in order to know if a systematic conditional relationship between beta and returns exists.

$$R_{jt} = \gamma_{0t} + \gamma_{2t}D\beta_j + \gamma_{3t}(1-D)\beta_j + e_{it} \quad (14)$$

where $D = 1$ *if* $(R_{Mt} - R_{ft}) >= 0$, $D = 0$ *if* $(R_{Mt} - R_{ft}) < 0$. R_{Mt} is the market portfolio return, and R_{ft} is the risk-free rate, in week *t*. The derived hypotheses from this equation are: $H_0 : \gamma_2 = 0$ versus $H_A : \gamma_2 > 0$ and $H_0 : \gamma_3 = 0$ versus $H_A : \gamma_3 < 0$. Herein γ_2 and γ_3 are the average values of the coefficients γ_{2t} and γ_{3t}, respectively. The statistical significance of these coefficients can be tested using standard t-tests. It should be noted that Pettengill, Sundaran, and Mathur (1995) assume that the conditional relationship [equation (14)] does not imply a positive relationship between risk and return and that two conditions are necessary in order to test a positive relationship between risk and return. Those conditions are: (1) the excess market return are positive on average and (2) the beta risk premium in up markets and down markets are symmetrical. Because $\alpha_2 \leq 0$, the symmetry hypothesis can be specified as follows: $H_0 : \gamma_2 + \gamma_3 = 0$ versus $H_A : \gamma_2 + \gamma_3 \neq 0$. All the derived hypotheses can be tested using a Wald test, which accounts for an absolute significant difference between the γ_2 and the γ_3 coefficients.

Data and Descriptive Statistics for Stock Market Indices

The overall tested period begins in January 1978 and ends in September 2004. The following data sets are used: 1) Monthly returns in U.S. dollars for the seventeen equity indices under study from Morgan Stanley Capital International (MSCI). The seventeen equity indices are from Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, the UK and USA. 2) Treasury bills and government bonds rates for the countries included in the sample from the Federal Reserve Bank of Chicago, and 3) World equity index from the International Monetary Fund (IMF) databases available in electronic sources. All stock markets returns are calculated in local currency and U.S. dollars. The monthly return on the MSCI world index is used as a proxy for the market portfolio. The monthly return on a 3-month U.S. Treasury Bill is used as the risk-free asset chosen due to data availability.

Table 3 sets forth MSCI summary statistics for the 17 stock markets and the world index under the scenario of unhedged returns for the period from January 1978 to September 2004. These stock markets constitute a significant part and, thus, are representative of the world stock market as a whole. The statistics shown include the average monthly return, the standard deviation and Dimson's average beta risk from the 28 moving subperiods examined. Dimson's betas are estimates with respect to the MSCI World index.

The average monthly returns range between 0.80% for Spain and 1.38% for Sweden. The standard deviations range between 4.17% for the World Index and 7.77% for Singapore. Notably, the World Index exhibits the smallest returns standard deviation across the stock markets, which is consistent with the assertion that potential benefits are derived from international diversification. The Dimson's average betas range between 0.498 for Austria and 1.306 for Singapore, country that also shows the highest total risk and the highest systematic risk.

Table 3: Summary Statistics – Unhedged Returns

Stock Market	Mean Return %	Standard Deviation %	Dimson's Average Beta
Australia	0.87%	6.68%	1.148
Austria	0.81%	6.48%	0.498
Belgium	0.86%	5.74%	0.696
Canada	0.81%	5.62%	1.067
Denmark	0.98%	5.48%	0.538
France	1.08%	6.55%	1.009
Germany	0.81%	6.41%	0.658
Italy	1.13%	7.41%	1.052
Japan	0.85%	6.73%	1.285
Netherlands	0.91%	5.23%	0.829
Norway	1.07%	7.57%	0.760
Singapore	0.94%	7.77%	1.306
Spain	0.80%	6.64%	0.974
Sweden	1.38%	7.15%	1.174
Switzerland	0.93%	5.29%	0.836
UK	0.86%	5.42%	1.026
USA	0.84%	4.42%	0.851
World	0.80%	4.17%	

Table 3 sets forth the mean return %, standard deviation % and Dimson's average beta for the 17 stock markets and the world index under the scenario of unhedged returns for the period from January 1978 to September 2004. Source: MSCI Website (http://www.msci.com)

Table 4 shows similar MSCI summary statistics for the 17 stock markets and the world index under the scenario of hedged returns for the same period (from January 1978 to September 2004). The results are similar although slightly lower for hedged returns compared to those observed in Table 3 for unhedged returns. The average monthly returns range between 0.68% for Spain and 1.34% for Sweden. The standard deviations range between 4.17% for the World Index and 7.41% for Italy. The Dimson's average betas range between 0.440 for Austria and 1.217 for Singapore. The lower indices indicate the probability of achieving a better systematic risk-return trade off when using a hedging strategy for an internationally diversified portfolio. This assertion is tested in the next section.

Table 4: Summary Statistics – Hedged Returns

Stock Market	Mean Return %	Standard Deviation %	Dimson's Average Beta
Australia	0.70%	5.46%	1.015
Austria	1.00%	6.35%	0.440
Belgium	0.80%	5.69%	0.632
Canada	0.69%	4.98%	0.965
Denmark	0.69%	5.28%	0.500
France	1.00%	6.25%	0.922
Germany	0.83%	6.18%	0.613
Italy	0.95%	7.41%	0.933
Japan	0.88%	5.38%	0.833
Netherlands	0.80%	5.38%	0.775
Norway	0.91%	7.27%	0.715
Singapore	1.09%	7.22%	1.217
Spain	0.68%	6.57%	0.917
Sweden	1.34%	7.15%	1.077
Switzerland	0.93%	4.80%	0.754
UK	0.66%	4.81%	0.848
USA	0.84%	4.42%	0.851
World	0.80%	4.17%	

Table 4 sets forth the mean return %, standard deviation % and Dimson's average beta for the 17 stock markets and the world index under the scenario of hedged returns for the period from January 1978 to September 2004. Source: MSCI Website (http://www.msci.com)

EMPIRICAL RESULTS

This section presents the research results from testing each proposed model: URBRR-UR, URBRR-HR, CRBRR-UR, and CRBRR-HR.

<u>Unconditional Relationship between Beta Risk and Return Assuming Unhedged Returns (URBRR-UR)</u>

The analysis focuses on the unconditional relationship between beta risk and return for the entire tested period and two subperiods under the scenario of unhedged returns. The subperiods are from January 1978 to December 1986 and from January 1987 to September 2004. Table 5 shows the average of the monthly coefficients of the intercept γ_{0t} and the slope γ_{1t} and their respective t statistics after running a pooled cross-sectional OLS regression. The latter is estimated for unhedged equity index returns for the 17 countries on a constant and their respective predicted betas according to equation (13). The country betas are estimated according to the aggregated coefficients method proposed by Dimson (1979). The t statistics (in parentheses) indicate whether the average value of the coefficient equals zero. The t statistics are corrected for heteroskedasticity and autocorrelation effects using Newey and West's (1987) method.

Table 5: Unconditional Relationship Assuming Unhedged Returns

Coefficient	Jan 1978 – Sept 2004	Jan 1978- Dec 1986	Jan 1987- Sept 2004
γ_0	0.00873 (4.12)***	0.00908 (2.81)***	0.01024 (3.62)***
γ_1	0.00071 (0.33)	0.00419 (1.28)	-0.00289 (-0.98)

*Table 5 shows the estimated parameters after running a pooled cross-sectional OLS regression for equation (13), which is estimated assuming unhedged returns for the entire period from 1978 through September 2004 and also for those subperiods indicated in the table. T-statistics are reported in parenthesis. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

The results reported in Table 5 evidence that there is no a significant relationship between beta risk and return in international unhedged equity returns for the entire tested period and the two subperiods. The annualized estimated beta risk premium is only 0.85%, which is statistically no significant. These results are in line with those published by Fama and French (1992) and subsequent studies that find a flat association between beta risk and portfolio return in the U.S. and other stock markets. One possible explanation for the flat relationship, as suggested by Pettengill, Sundaran, and Mathur (1995), is the inclusion of realized returns (past returns) in the tests rather than expected returns.

Unconditional Relationship between Beta Risk and Return Assuming Hedged Returns (URBRR-HR)

A similar analysis is performed for the unconditional relationship between beta risk and return for the same tested period and two subperiods under the scenario of hedged returns. The same method applied to produce Table 5 is used to generate data for Table 6. This table shows that there is a significant but negative relationship between beta risk and return in international hedged equity returns for the entire tested period. The annualized estimated beta risk premium is -6.72%, which is statistically significant. Yet, the results are different in each subperiod. There is no significant relationship between beta risk and hedged stock returns in the first subperiod, whereas there is a significant but negative relationship in the second subperiod. These results suggest that systematic risk is negatively priced when U.S. investors use forward contracts to hedge exchange rate risk. However, it can also be said that the tests are biased because they use realized returns (past returns) instead of expected returns.

Table 6: Unconditional Relationship Assuming Hedged Returns

Coefficient	Jan 1978 – Sept 2004	Jan 1978- Dec 1986	Jan 1987- Sept 2004
γ_0	0.01333 (6.99)***	0.01519 (6.40)***	0.01233 (4.01)***
γ_1	-0.00560 (-2.62)***	-0.00219 (-0.77)	-0.00700 (-2.11)**

*Table 6 shows the estimated parameters after running a pooled cross-sectional OLS regression for equation (13), which is estimated assuming hedged returns for the entire period from 1978 through September 2004 and also for those subperiods indicated in the table. T-statistics are reported in parenthesis. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Conditional Relationship between Beta Risk and Return Assuming Unhedged Returns (CRBBR-UR)

A pooled cross sectional OLS regression is estimated for unhedged stock market index returns from 17 countries on a constant and their respective predicted betas under up and down markets according to equation (14) for the entire period and two subperiods. The betas for each country are estimated according to the aggregated coefficients method proposed by Dimson (1979). Table 7 includes the average of the monthly risk premiums in up market months γ_2 and in down market months γ_3. The Wald test is an indication of whether there is an absolute significant difference between γ_2 and γ_3 coefficients. The table also reports the included observations, the number of cross sections used, the total panel observations used in the tests, and the adjusted R^2. The t statistics (in parentheses) indicate whether the average value of γ_2 and γ_3 is significantly positive or negative. The t statistics have been corrected for heteroskedasticity and autocorrelation effects using Newey and West's (1987) method.

Results shown in Table 7 for the entire period are consistent with the results supporting the conditional relationship between beta risk and return. There exist a positive and significant relationship between return and beta risk in up market months and a significant but negative relationship in down market months. The annualized estimated beta risk premium is 30% in up market months and -38.1% in down market months, and both risk premiums result statistically significant at any significant level. In addition, the Wald test indicates that the hypothesis of a symmetric relationship between up market and down market months cannot be rejected at the 5% significance level.

The results for the two subperiods are consistent with those for the entire period in terms of a positive and significant relationship between return and beta risk in up market months and a significant but negative relationship in down market months. As Pettengill, Sundaran, and Mathur (1995) pointed out, the conditional relationship between beta risk and return implies that high beta risk equity countries like Singapore will show higher returns than low beta risk equity countries in up market months and lower returns in down market months. Yet, the hypothesis of a symmetric relationship between up and down market months is rejected in the second subperiod, because the evidence is less favorable in terms of symmetric risk premiums between up and down market months, even though there is support for a conditional relationship between beta risk and return for the entire period. These findings may be explained by the behavior of those investors who feel relatively pessimistic when facing business prospects under down world stock market months and, viceversa, optimistic when facing up world stock market months in the last subperiod. Thus, beta risk can be a useful indicator in international stock allocations, particularly when investors try to identify aggressive and defensive stock markets.

Table 7: Conditional Relationship Assuming Unhedged Returns

Coefficient	Jan 1978 – Sept 2004	Jan 1978- Dec 1986	Jan 1987- Sept 2004
γ_2	0.02500 (4.61)***	0.02565 (8.28)***	0.02288 ((7.94)***
γ_3	-0.03175 (-11.78)***	-0.02414 (-6.99)***	-0.03802 (-13.40)***
Wald test Ho: $\gamma_{2+}\gamma_3 = 0$	2.79187*	0.06439	7.86504***
p-value	0.09481	0.79971	0.00507
Included Observations	321 months	108 months	213 months
# of cross section used	17 countries	17 countries	17 countries
Total panel observations	5457 observations	1836 observations	3621 observations
Adjusted R^2	0.2021	0.1582	0.2315

*Table 7 shows the estimated parameters after running a pooled cross-sectional OLS regression for equation (14), which is estimated assuming unhedged returns for the entire period from 1978 through September 2004 and also for those subperiods indicated in the table. T-statistics are reported in parenthesis. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Conditional Relationship between Beta Risk and Return Assuming Hedged Returns (CRBRR-HR)

A similar analysis is performed for the conditional relationship between beta risk and return assuming hedged returns. Results reported in Table 8 for the entire period are also consistent with the conditional model applied by Pettengill, Sundaran, and Mathur (1995). There is a positive and significant relationship between return and beta risk in up market months and a significant but negative relationship in down market months. The annualized estimated beta risk premium is 20.8% in up market months and -39.4% in down market months, and both risk premiums result statistically significant at any significant level. However, the Wald test indicates that the hypothesis of a symmetric relationship between up market and down market months is rejected at the 5% significance level. It should be noted that the beta risk premium is lower in up market months and slightly similar in down market months under hedged returns against exchange rate risk compared to similar indices under unhedged returns (compare Table 8 with Table 7). Previous results just apply to the case of up market months.

In addition, it should be noted that the above findings are mainly explained by the influences brought into play in the first subperiod. In this subperiod, the beta risk premium (16.7% annual) in up market months is significantly lower to the same index under unhedged returns (30.8% annual), which offers partial support to our first hypothesis (see Section 2). In other words, there is support for up but not for down market months at least in the first subperiod. The remaining beta risk premiums are similar in both subperiods, which offer support to our second hypothesis (see Section 2). These results suggest that the potential benefits from a hedging strategy against exchange rate risk can be captured mainly in the first subperiod under up market months. These findings are in line with the arguments discussed in the first part of the paper.

Table 8: Conditional Relationship Assuming Hedged Returns

Coefficient	Jan 1978 – Sept 2004	Jan 1978- Dec 1986	Jan 1987- Sept 2004
γ_2	0.01736 (8.21)*	0.0139 (4.87)*	0.01965 (6.06)*
γ_3	-0.03287 (-14.65)*	-0.02190 (-6.58)*	-0.03741 (-11.76)*
Wald test Ho: $\gamma_2 + \gamma_3 = 0$	14.88451***	2.19180	8.44535***
p-value	0.00012	0.13892	0.00368
Included Observations	321 months	108 months	213 months
# of cross section used	17 countries	17 countries	17 countries
Total panel observations	5457 observations	1836 observations	3621 observations
Adjusted R^2	0.1481	0.0787	0.1865

*Table 8 shows the estimated parameters after running a pooled cross-sectional OLS regression for equation (14), which is estimated assuming hedged returns for the entire period from 1978 through September 2004 and also for those subperiods indicated in the table. T-statistics are reported in parenthesis. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

CONCLUSIONS AND IMPLICATIONS

This study examines the conditional relationship between beta risk and return in international equity markets from January 1978 to September 2004 and focuses on the effect of exchange rate risk on this conditional relationship. Consistent with previous studies, the paper finds that there exist a flat unconditional relationship between beta risk and return when returns are unhedged against exchange rate risk. Conversely, there is a negative relationship when the returns are hedged using forward contracts. However, a note of caution is suggested in Pettengill, Sundaran, and Mathur (1995). These results can be biased when realized returns are used in the tests rather than expected returns.

When the conditional relationship between beta risk and returns in international equity markets is examined, there is a significant positive relationship in up market months and a significant but negative relationship in down market months. Under unhedged returns, this evidence is consistent with those reported in Pettengill, Sundaran, and Mathur (1995), Fletcher (1997, 2000), Hodoshima, Garza-Gomez, and Kunimura (2000) and Sandoval and Saens (2004) that provide support for the conditional relationship between beta risk and return in the U.S., U.K., main international developed stock markets, Japan, and Latin American equity markets, respectively. This research also finds that the conditional relationship between beta risk and return appears symmetric for the entire period under unhedged returns but that it turns asymmetric when the returns are hedged against exchange rate risk. These results suggest that, on average, U.S. investors feel more “optimistic” by hedging their internationally diversified portfolio instead of maintaining their international investments without exchange rate risk control.

However, it is important to note that these findings are mainly influenced by the market conditions that prevailed on the first subperiod (1978-1986), in which the beta risk premium in up market months is significantly lower than similar indices under unhedged returns. The remaining beta risk premiums are similar in both subperiods. Such observations have important implications for controlling exchange rate volatility in an international portfolio context. Potential benefits from a hedging strategy against exchange rate risk were captured mainly in the first subperiod and under up market months.

Furthermore, in the first period, the stock and foreign currency markets exhibited cross-covariances among the local stock market returns and the exchange rate variations that reinforce each other. This trend is reversed in the second subperiod (1987-2004). Thus, markets conditions as those prevailing in the first subperiod offer a good opportunity to control and, therefore, diminish exchange rate risk without adversely affecting portfolio return by using forward contracts.

Overall, the paper suggests that forward contracts are useful tools for controlling exchange rate risk when it takes the form of market risk. Forward contracts allow firms to reduce this risk when using exchange rates in their operations and, thus, can transfer this benefit to the stock markets. These contracts represent useful mechanisms to hedge this risk, and thus, it would explain why they have already been used attempting to obtain better payoffs for internationally managed portfolios. Thus, an implication for business policy practices follows: international equity market administrators and portfolio managers can defend themselves against exchange risk (as a market risk) by using forward contracts, particularly in world stock market conditions that are similar to those discussed throughout the paper.

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