Contribution of Turkish Stock Market to Global Portfolios

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ABSTRACT

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In this research, the long term international diversification benefit of Turkish Stock market is investigated among globally and regionally constructed portfolios. The global portfolios are Developed Markets, Emerging Markets and World portfolios. The regional portfolios are Developed Europe, Emerging Europe, Asia, North America, Latin America, Pacific Rim, Middle East and G7 portfolios.

In the research, mean-variance portfolio theory is employed using the dollar denominated monthly MSCI country stock index data and diversification benefit is explored in the full period as well as in the crises periods. Furthermore, due to the limitations of the mean-variance framework, Stein estimation is used to verify the findings of the study free of estimation bias. Under each optimization, the statistical significance of the findings are explored with the asset set spanning and asset set intersection tests of the Jobson and Korkie, respectively for the efficient portfolios constructed in the absence and in the presence of a riskless asset.

This study specifically focused on the diversification potential of Turkish stock market. In this respect, the findings of the study reveal whether or not investment in it had been beneficial for an international investor for risk reduction purposes. It is found that despite its relatively lower correlations, over the investigation period Turkish stock market's contribution to reduce the risk of a global portfolio is negligible.

KISA ÖZET

Türkiye Borsası'nın Global Portföylere Katkısı

Ceylan Onay

Bu araştırmada Türkiye Borsası'nın kurulan global ve bölgesel portföyler içerisindeki uzun dönem uluslararası portföy çeşitlendirmeye katkısı aranmıştır. Kurulan global portföyler Gelişmiş Piyasalar, Gelişen Piyasalar ve Dünya portföyleridir. Kurulan bölgesel portföyler ise Gelişmiş Avrupa, Gelişen Avrupa, Asya, Kuzey Amerika, Latin Amerika, Pasifik Rim, Orta Doğu ve G7 portföyleridir.

Araştırmada aylık dolar bazındaki MSCI ülke hisse senedi endeks verileri kullanılarak ortalama-varyans portföy teorisi uygulanmış ve Türkiye Borsası'nın uluslararası portföy çeşitlendirmeye faydası hem uzun dönemde hem de kriz dönemlerinde aranmıştır. Bunun ötesinde ortalama-varyans çerçevesindeki kısıtlamaları gidermek ve bulguları tahmin hatasından arınmış bir şekilde sunabilmek için Stein tahmin metodu kullanılmıştır. Her eniyileme altında bulguların istatistiki önemi sırasıyla, risksiz varlık dahilinde ve yokluğunda kurulan portföylerde Jobson ve Korkie'nin varlık seti içerme ve varlık seti kesişme testleri ile araştırılmıştır.

Bu çalışma özellikle Türkiye Borsası'nın uluslararası portföy çeşitlendirme potansiyeli üzerine odaklanmıştır. Bu doğrultuda, bulgular Türkiye Borsası'na yatırımın riski azaltma amacındaki uluslararası bir yatırımcı için faydalı olup olmadığını ortaya çıkarmıştır. Göreceli olarak düşük korelasyonlarına rağmen, incelenen süreçte Türkiye Borsası'nın riski azaltma yönünde uluslararası portföy çeşitlendirmeye katkısının ihmal edilebilir olduğu bulunmuştur.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS

DM : Developed Markets Portfolio

DM+T : Developed Markets including Turkey Portfolio

EM : Emerging Markets excluding Turkey Portfolio

EM+T : Emerging Markets including Turkey Portfolio

W : World excluding Turkey Portfolio

W+T : World including Turkey Portfolio

DE : Developed Europe Portfolio

DE+T : Developed Europe including Turkey Portfolio

EM : Emerging Europe excluding Turkey Portfolio

EM+T : Emerging Europe including Turkey Portfolio

A : Asia Portfolio

A+T : Asia including Turkey Portfolio

NA : North America Portfolio

NA+T : North America including Turkey Portfolio

LA : Latin America Portfolio

LA+T : Latin America including Turkey Portfolio

PR : Pacific Rim Portfolio

PR+T : Pacific Rim including Turkey Portfolio

ME : Middle East Portfolio

ME+T : Middle East including Turkey Portfolio

G7 : G7 Portfolio

$G7+T$: G7 including Turkey Portfolio

R_{tl} DM : Developed Markets Portfolio with Turkish R_f

R_{tl} DM+T : Developed Markets including Turkey Portfolio with Turkish R_f

R_{us} DM+T : Developed Markets including Turkey Portfolio with US R_f

R_{tl} EM : Emerging Markets excluding Turkey Portfolio with Turkish R_f

R_{tl} EM+T : Emerging Markets including Turkey Portfolio with Turkish R_f

R_{us} EM+T : Emerging Markets including Turkey Portfolio with US R_f

R_{tl} W : World excluding Turkey Portfolio with Turkish R_f

R_{tl} W+T : World including Turkey Portfolio with Turkish R_f

R_{us} W+T : World including Turkey Portfolio with US R_f

R_{tl} DE : Developed Europe Portfolio with Turkish R_f

R_{tl} DE+T : Developed Europe including Turkey Portfolio with Turkish R_f

R_{us} DE+T : Developed Europe including Turkey Portfolio with US R_f

R_{tl} EM : Emerging Europe excluding Turkey Portfolio with Turkish R_f

R_{tl} EM+T : Emerging Europe including Turkey Portfolio with Turkish R_f

R_{us} EM+T : Emerging Europe including Turkey Portfolio with US R_f

R_{tl} A : Asia Portfolio with Turkish R_f

R_{tl} A+T : Asia including Turkey Portfolio with Turkish R_f

R_{us} A+T : Asia including Turkey Portfolio with US R_f

R_{tl} NA : North America Portfolio with Turkish R_f

R_{tl} NA+T : North America including Turkey Portfolio with Turkish R_f

R_{us} NA+T : North America including Turkey Portfolio with US R_f

R_{tl} LA : Latin America Portfolio with Turkish R_f

R_{tl} LA+T : Latin America including Turkey Portfolio with Turkish R_f

R_{us} LA+T : Latin America including Turkey Portfolio with US R_f

R_{tl} PR : Pacific Rim Portfolio with Turkish R_f

R_{tl} PR+T : Pacific Rim including Turkey Portfolio with Turkish R_f

R_{us} PR+T : Pacific Rim including Turkey Portfolio with US R_f

R_{tl} ME : Middle East Portfolio with Turkish R_f

R_{tl} ME+T : Middle East including Turkey Portfolio with Turkish R_f

R_{us} ME+T : Middle East including Turkey Portfolio with US R_f

R_{tl} G7 : G7 Portfolio with Turkish R_f

R_{tl} G7+T : G7 including Turkey Portfolio with Turkish R_f

R_{us} G7+T : G7 including Turkey Portfolio with US R_f

1. INTRODUCTION

The objective of this research is to explore if investment in Turkish equity market, which seems to have low statistical correlation with other country markets, can help reduce the overall risk in international portfolios. The long term international diversification benefits of the Turkish stock market are investigated in various globally and regionally constructed portfolios. The "global portfolios" include portfolios of Developed Markets, portfolios of Emerging Markets, and the World portfolio. The "regional portfolios" include Developed Europe, Emerging Europe, Asia, North America, Latin America, Pacific Rim, Middle East, and G7 portfolios. In the study, the standard mean-variance portfolio analysis is employed using the dollar denominated monthly MSCI country stock index data and diversification benefit is explored in the full period from 1988 to 2003 as well as selected crises times in this period. Furthermore, due to some limitations of the mean-variance framework, Stein estimation is used to further verify the findings of the study. For every calculation of the portfolio frontier, the statistical significance of the findings is measured with the asset set spanning and asset set intersection tests of Jobson and Korkie (1989). All of the tests are conducted with and also without a tradable risk – free asset.

Many studies have been conducted on the diversification benefits of emerging markets as an asset set. However, there seems to be no published study specifically examining the diversification potential of the Turkish stock market as a single emerging market. In this respect, the findings of the study are expected to reveal valuable information about Turkish stock markets and how it can be utilized in a global portfolio for risk reduction purposes. It is seen that emerging markets still preserve their low correlation advantage despite the liberalization of financial markets, market integration, and contagion factors. Thus, it would be beneficial to study the Turkish stock market for the international diversification opportunities it may provide.

Emerging markets are characterized by high expected returns, high volatility and low correlation with developed markets and within themselves. This relatively lower correlation with developed markets stems from these markets' more local nature. Their economies are found to be less integrated with the business cycles of developed countries and consequently country specific factors are found to be more dominant in their equity returns than global factors. It is also evident that capital restrictions, government regulations, technological sophistication, independent fiscal and monetary policies all play a role in the independence of stock markets and determine the correlation and integration level of emerging markets. Most emerging markets are considered to lie between complete market segmentation and complete market integration. However, their correlation with developed markets has been less than perfect leaving ample opportunities for risk reduction. Thus, emerging markets may be seen as a natural hedge to the losses in developed markets.

On the other hand, liberalizations and capital market reforms have changed the integration degree of emerging markets with the developed markets. As a result, emerging markets have become more correlated with the developed markets and more volatile after liberalizations. Nonetheless, correlations are found to remain still much lower than correlations of developed markets with each other. Spanning tests evince that, even after liberalizations, adding emerging market assets to the international portfolios pushes the efficient frontier leftward.

Several instruments are available for investing in emerging markets. These instruments vary according to the openness of the emerging markets to the international investors. Portfolio investment in emerging markets can be done via international indexes, ADRs, open-end funds, closed-end funds, and also direct purchase of shares. All vehicles have been found to provide significant diversification benefits.

Then again, it is evinced that empirical distributions of emerging market returns significantly depart from normality. These distributions are observed to possess skewness and excess kurtosis making it problematic to use in a mean-variance framework, which assumes (at least approximately) normally distributed returns. Although these markets are favored as natural hedges due to their low correlations, they also pose a great challenge for the investors assumed to prefer positively skewed returns to negatively skewed returns. The extreme volatility of emerging market returns also makes it harder to estimate the average returns of the assets with sufficient statistical significance. This fact leads to major estimation errors in asset allocation decisions.

Contagion is another important fact. The correlations of emerging markets with developed markets and within themselves are observed to increase during periods of high volatility such as the recent global crises. Emerging markets economies are found to be much more sensitive to such negative shocks. It is found that during crises emerging markets exhibit extreme volatility accompanied with increased correlation. However, extreme volatility is not the only source of risk for global investors. During such shocks, the currency risk embedded in international portfolio investments doubles for emerging markets, as these markets experience severe currency devaluations during the crises. Paradoxically, it means that international diversification fails when it is most needed. However, in the long run, emerging market correlations are observed to revert to their long run averages and still remain less than developed markets' correlations. Recovery in emerging markets is also evinced to be faster compared to developed markets. Although correlations are found to be time-varying and increasing in time, due to stronger economic linkages and liberalizations, their levels remain still lower than developed market correlations, providing diversification benefit for a global investor.

On the other hand, it is shown that increased stock market correlations cannot be attributed to industrial similarity of the indices. Country factors are still found to dominate the equity returns. However, economic and trade linkages affect the correlation structure of the countries. In fact, correlation structures can be estimated with models, which parameterize the economic determinants of correlation structure.

Considering all of the issues mentioned above and the development of the Turkish stock market, this study aims to see whether or not the Turkish stock market has been beneficial for international diversification purposes, since as a case of emerging markets, it had higher returns and lower correlations than most of the developed and a majority of emerging markets. The study continues with section 2, which gives a detailed literature review on the evolvement of emerging markets. Section 3 presents the research design and methodology, while section 4 provides the data analyses. Section 5, 6, 7 and 8 elaborate on the findings respectively in the absence and in the presence of the riskless asset, and, finally, conclusions and suggestions for future research are presented in section 9.

2. LITERATURE REVIEW

The purpose of this research is to investigate the contribution of the Turkish stock market to a global portfolio. Accordingly, research will be based on the analysis of correlation between respective portfolios. The findings of this study are expected to reveal valuable information on the integration degree and related diversification benefits of The Turkish stock market in a global portfolio. As Turkey is an emerging market, it has been found necessary to investigate the emerging markets literature and analyze the evolution of these markets. Therefore, the following articles are examined under the main headings of asset pricing, market integration, financial liberalizations, volatility, correlation, emerging markets data, diversification benefits, country risk & contagion, industrial structure and economic modeling of correlation structure. All these headings are important in evaluating the diversification benefits of emerging markets in a global portfolio. Furthermore, the implications of these studies to the research proposal are considered. Primarily, asset pricing issue is elaborated. It is known that asset pricing theories' common assumption has been perfect capital markets, meaning that same risk asset commands the same return. Therefore, considering the emerging markets case, it is seen necessary to evaluate if emerging markets are actually segmented or not, and does capital asset pricing models explain the asset returns in these markets.

2.1 Asset Pricing in Emerging Markets

The traditional asset pricing framework assumes that investors like higher rather than lower expected returns, they dislike risk and hold well-diversified portfolios. Following the CAPM of Sharpe (1964) and Lintner (1965), in international finance a world version of CAPM is used, where what matters is the covariance with the world portfolio. Assets within a particular country are rewarded in terms of their contribution to a well-diversified portfolio. However, emerging markets challenges the assumption of perfect capital markets, which in an international setting means markets are perfectly integrated. Perfectly integrated markets mean that the same risk asset commands the same expected return irrespective of the market. Risk refers to some common world factor. This fact requires no effective barriers to make portfolio investment across borders. Harvey (1991) in his study to measure world price of covariance risk, tests world CAPM for developed markets and provides sufficient evidence that it works. However, when applied to emerging markets Harvey (1995) finds striking results. Harvey (1995) first studies the average risk of emerging market equity returns, then in the framework of asset pricing theory he explores the reasons of high expected returns associated with emerging markets, finally offering evidence on the time variation of emerging market returns. Over the 1970:02 to 1989:05 sample periods the average cross-country correlation of 17 developed markets is reported to be 41 percent while the average cross-country correlation of the emerging country returns had been only 12 percent. More interestingly, the overall average correlation between emerging markets and developed markets and the correlation between emerging markets and the world market portfolio were only 0.14 and 0.15, respectively. The efficient frontier analysis of the respective developed markets and emerging markets reveal that adding emerging markets to the portfolio of developed markets shift the frontier leftward in both cases where short-selling is allowed and restricted. To test the significance of this shift Harvey employs the spanning test of Jobson and Korkie (1989) letting "$r = \{r_1, r_2\}$ where r_1 is the matrix of returns in 18 developed markets and r_2 represents the returns in 18 emerging markets. The test is whether one set of assets (developed returns) spans the frontier of both developed and emerging markets by estimating the following moment condition:

$$\eta_t = r_{2t} - \alpha - \beta r_{1t} - \delta r_{0t}$$

where r_0 is the return on the minimum variance portfolio constructed from r assets (all 36 assets), α and δ are 1×18 parameter vectors, β is a 18×18 parameter matrix, η defines the disturbances and $E[\eta | 1, r_1, r_2] = 0$. Let the set of minimum-variance portfolios generated by r_1 be efficient with respect to assets r. From Roll (1977), we know that a regression of r_2 on r_1 and the global minimum variance portfolio return should yield zero intercepts if r_2 intersects the efficient set. The slope coefficients should also sum to unity". Harvey finds evidence that addition of emerging market assets significantly enhances portfolio opportunities, which means emerging market returns are not spanned by the developed market returns. Harvey then studies the level of integration of emerging markets with developed markets. As the factors such as taxes and barriers to entry challenges the complete integration of capital markets assumption of asset pricing models, he investigates whether or not CAPM fully characterizes the emerging market returns' behavior. He employs a single factor model (Sharpe-Lintner) and a two-factor model (Adler-Dumas). In the Sharpe-Lintner model the null hypothesis is that this portfolio is the SL tangency portfolio while in the second specification the world portfolio is augmented with the excess return on a trade-weighted portfolio of ten currency deposits. However, Harvey aggregates the foreign exchange factor for econometrical purposes and calculates the excess return on the trade-weighted currency portfolio instead. The results of the tests enable Harvey to reject the null hypothesis of the single factor Sharpe-Lintner model. He also reports that in contrast to developed markets world market portfolio beta has little influence on emerging market expected returns. Finally, Harvey investigates the predictability of emerging market returns. He studies a conditional asset pricing model where the expected returns 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. He reports that (i) the degree of predictability of emerging market returns is not associated with emerging markets' correlation with the US portfolio, (ii) compared to developed markets the predictability of expected returns is much more pronounced for emerging markets and (iii) the predictability of expected returns is strongly influenced by local information variables, which is consistent with the fact that most emerging markets are segmented from world capital markets.

Harvey shows that (i) emerging markets push the efficient frontier leftward due to their low correlation with developed markets, (ii) international CAPM fails in emerging markets, thus in contrast to general theory not all markets are perfectly integrated. Indeed emerging markets are segmented and that local country-specific factors are dominant in equity returns. These findings encourage the intended research on the contribution of the Turkish stock market to a global portfolio. These results bring us to the discussion of market integration.

2.2 Market Integration

Following the debate of "emerging markets are segmented" many research has been made on the degree of integration among international markets. Especially for emerging markets it has been hard to measure if they are integrated or not. The aim in these studies had been to measure the integration degree of emerging markets, examine how their relationship with developed markets had grown in time and whether it had a time-varying nature. Three different views of market integration are evident in the literature: completely integrated, completely segmented and mild segmentation. Bekeart and Harvey (1995) present these three views as

(i) "markets are completely integrated; the risk that investors face is the covariance of the country portfolio with the world return,

$$E_{t-1}\left[r_{i,t}^{A}\right]=\lambda_{t-1}\operatorname{cov}_{t-1}\left[r_{i,t}^{A},r_{w,t}\right]$$

where $E_{t-1}\left[r_{i,t}^{A}\right]$ is the conditionally expected excess return on security A's equity (in country i), r_w is the return on the value-weighted world portfolio, cov_{t-1} is the conditional covariance operator and λ_{t-1} is the conditionally expected world price of covariance risk for time t.

(ii) markets are completely segmented; the risk that investors face is the variance of the country portfolio,

$$E_{t-1}\left[r_{i,t}^{A}\right]=\lambda_{i,t-1}\operatorname{cov}_{t-1}\left[r_{i,t}^{A},r_{i,t}\right]$$

where $E_{t-1}\left[r_{i,t}^{A}\right]$ is the price of security A with respect to its covariance with the return on the market portfolio in country i, r_i and λ_i is the local price of risk. Aggregating at the national level,

$$E_{t-1}\left[r_{i,t}\right] = \lambda_{i,t-1} \operatorname{var}_{t-1}\left[r_{i,t}\right]$$

(iii) markets are partially integrated [mild segmentation model of Errunza, Losq (1985) and Padmanabhan (1992)] ; expected returns reflect reward for both covariance with world return and market's own variance".

The main disadvantage of mild segmentation model is that the degree of segmentation is fixed through time. In this respect the liberalization processes that emerging markets go through are not evaluated in the model, thus degree of segmentation is not allowed to change. Bekaert and Harvey (1995) parameterize and estimate a regime-switching model that allows for time-varying market integration. To incorporate the liberalization processes of countries, conditionally expected return in a country is designed to be a function of its covariance with a world benchmark portfolio and the variance of the local return. In a perfectly integrated market, covariance is the measure of risk whereas in a segmented market only variance counts. In the model the time-varying weight that is applied to covariance and the variance is the integration measure. The price of variance risk across countries is assumed to depend on country-specific information whereas the world price of covariance risk is assumed to be effected only by global information. "The conditional mean return is

$$E_{t-1}\left[r_{i,t}\right] = \phi_{i,t-1}\lambda_{t-1} \operatorname{cov}_{t-1}\left[r_{i,t}, r_{w,t}\right] + (1-\phi_{i,t-1})\lambda_{i,t-1} \operatorname{var}_{t-1}\left[r_{i,t}\right]$$

where the parameter, $\phi_{i,t-1}$, which falls in the interval $[0,1]$, is the econometrician's time-varying assessment of the likelihood that the market is integrated with information set Z_{t-1}". In the model, the information set is composed of local and global components. The global information variables are a constant, the world market dividend yield in of the 30-day Eurodollar rate, the default spread, the change in term structure spread and the change in the 30-day Eurodollar rate. The set of local variables include a constant, local equity returns, local exchange rate changes, local dividend yields and the ratio of equity market capitalization to GDP. Authors study two different regime-switching models to infer $\phi_{i,t-1}$ from the data. First is the standard Hamilton model where S_t^i, unobserved state variable that takes the value of one when markets are integrated and a value of two when markets are segmented, follows a Markov process with constant transition probabilities. "Then the regime probability is

$$\phi_{t-1} = (1-Q) + (P+Q-1)\left[\frac{f_{1,t-1}\phi_{t-2}}{f_{1,t-1}\phi_{t-2} + f_{2,t-1}(1-\phi_{t-2})}\right]$$

where the country i has been suppressed and

$$P = prob[S_t = 1 | S_{t-1} = 1]$$
$$Q = prob[S_t = 2 | S_{t-1} = 2]$$

and $f_{j,t}$ is the likelihood at time t conditional on being in regime j and time $t-1$ information, Z_{t-1}. In the second formulation authors allow the transition probabilities P and Q to be time-varying, modeling them as logistic functions of Z_{t-1}^*:

$$P_t = \frac{\exp(\beta_1' Z_{t-1}^*)}{1+\exp(\beta_1' Z_{t-1}^*)}$$
$$Q_t = \frac{\exp(\beta_2' Z_{t-1}^*)}{1+\exp(\beta_2' Z_{t-1}^*)}$$

where β_j, $j = 1,2$, are vectors of parameters. To complete the model a series of bivariate models are estimated on the movement of expected returns on the world equity portfolio:

$$R_{i,t} = \left[r_{i,t}, r_{w,t}\right]$$

$$r_{i,t} = \phi_{i,t-1}\lambda_{t-1} \operatorname{cov}_{t-1}\left[r_{i,t}, r_{w,t}\right] + (1-\phi_{i,t-1})\lambda_{i,t-1} \operatorname{var}_{t-1}\left[r_{i,t}\right] + e_{i,t}$$

$$r_{w,t} = \lambda_{t-1} \operatorname{var}_{t-1}\left[r_{w,t}\right] + e_{w,t}\text{''}$$

In this paper return data is used to measure the degree of .integration. The size of the trade sector and the capitalization of the local equity market are used as proxy variables for the openness of the market. It is found that a number of emerging markets exhibit time varying integration. The results of the study show that variation in the integration measure coincides with capital market reforms and in contrast to general perception that world markets have become more integrated; some countries have become less integrated over time.

This leaves an open door for future research as it says that despite the general perception, some emerging markets have become less integrated. With respect to the intended research, it may be necessary to evaluate the effect of capital market reforms on the correlation structure to better analyze the contribution of Turkish stock market to a global portfolio and interpret the risk reduction properties of this relationship.

2.3 Financial Liberalizations

As mentioned above, capital market reforms have been determinants of the market integration between emerging markets and developed markets. Thus, the influence of financial liberalizations on emerging markets is investigated in this section. The following articles examine the influence of liberalizations on the equity-return generating process, behavior of expected returns, volatility, correlation and capital flows in emerging markets. Liberalization of emerging markets is an important turning point as these markets become more integrated to the world capital markets afterwards. As markets liberalize, foreign capital flows freely to the country, taking advantage of low correlation and high expected returns of these emerging market assets. With liberalization increased trading volume decreases the information asymmetry. As a result markets become more integrated and expected returns decrease leading to a decrease in the cost of capital. Bekaert and Harvey (2000) measure the effect of liberalization on the equity return-generating process in 20 emerging markets focusing primarily on the cost of equity. The time period investigated starts from 1976 and extends to December 1995. Three types of events are examined to assess the effect of liberalizations: the introduction of a country mutual fund, the introduction of ADR and changes in government regulations. They focus on the behavior of expected returns, volatility and correlations with the world before and after liberalizations. To measure the cost of capital, dividend yields are used as proxy. They find that correlations with world market increase and dividends yields decline that after liberalizations expected returns decrease. However, the effect is always less than 1 percent on average and the post-liberalization correlations are still much lower compared to developed countries. Thus, diversification benefits have not disappeared. On the other hand, Harvey and Bekaert attribute some of the decrease in dividend yields to improved growth opportunities liberalizations provide. In terms of volatility, they do not find evidence that liberalization leads to increases in volatility. Bekaert, Harvey and Lumsdaine (2001a) explore the interrelationship between capital flows, returns, dividend yields and world interest rates in 20 emerging markets. The effect of lower interest rates on capital flows and on cost of capital is explored by a vector autoregression. Furthermore, endogenous break points in variables are traced to the liberalization of emerging equity markets. Thus, in the study joint dynamics of returns and net U.S. equity flows that accompany liberalizations are investigated. They conduct their empirical analysis in the context of vector autoregressions (VARs). Previously mentioned four variables are included in the primary VAR; the world interest rate i_t, the net equity capital divided by market capitalization nf_t, the log-dividend yield dy_t and the logged equity return r_t. To perform tests of the main hypotheses, impulse response analysis based on a structural interpretation of the VAR is employed. "Consider, without loss of generality, a first-order VAR, suppressing the constant:

$$\mathrm{Y}_t = \mathrm{A}\mathrm{Y}_{t-1} + \varepsilon_t$$

where all eigenvalues of A having moduli less than one so that the VAR is stationary. Impulse responses, $IR(i, j, k) = \partial e_i' \mathrm{Y}_{t+k} / \partial \varepsilon^*_{t,j}$ where $\varepsilon^*_{t,j}$ are the "structural" shocks and e_i is an indicator variable selecting the i^{th} variable, are computed. They look at one standard deviation shocks. The structural shocks are determined by the ordering in the VAR, that is $\varepsilon_t = \mathrm{P}'\varepsilon^*_t$ where P is an upper triangle matrix and ε^*_t are uncorrelated structural shocks". Then they apply novel structural break tests to financial and economic series whose behavior is likely to change due to market integration. These series include net equity flows as a proportion of local market capitalization, log returns and the log dividend yield. The liberalization events are defined as a major regulatory reform liberalizing foreign equity investments, the announcement of the first ADR issue, the first country fund launching and a large increase in capital flows. Allowing all parameters to change after the capital market liberalizations, multivariate break tests are examined. They find that capital flows to emerging markets increase rapidly after liberalizations and representing an effective liberalization. After liberalizations, they find that equity flows increase by 1.4% of market capitalization. Finally, their analysis of the transition dynamics from pre-liberalization to post-liberalization suggests that when capital leaves, it leaves faster than it came in. Bekaert, Harvey and Lundblad (2001) study how liberalizations affect the real economic growth prospects in emerging markets. The time-series component of growth in addition to the cross-sectional relation is emphasized in the study. The empirical design seeks the relation between real per capita GDP growth over various horizons and an indicator of official financial liberalization. Macroeconomic influences, banking development, and equity market development are the set of control variables for variation in economic growth rates across countries. Government consumption divided by GDP, the size of the trade sector divided by GDP, and the annual rate of inflation proxy the condition and stability of macro economy. The size of the trade sector as imports plus exports divided by GDP is also employed as a measure of the openness of the particular economy to trade. Secondary school enrollment is also included to proxy the human capital. Private credit divided by gross domestic product is included as a control variable for the relationship between development in the banking sector and economic growth. To proxy for the more general development of the equity market: a measure of equity market size, the log of the number of domestic companies, and equity market turnover as a measure of market liquidity variables are explored. "The regression model is as follows:

$$Y_{i,t+k,k} = \beta' x_{i,t} + \varepsilon_{i,t+k,k} \qquad i = 1,\ldots,N \text{ and } t = 1,\ldots,T$$

where $y_{i,t+k,k}$ represents the annual, k-year compounded growth rate of real per capita GDP. The independent right-hand side variables as mentioned above are denoted as $x_{i,t}$. While the error terms are serially correlated for $k > 1$,

$E\left[\varepsilon_{i,t+k,k} \cdot x_{i,t}\right] = 0$ ". Their results evidence higher real growth, in the range of 1% per annum, associated with financial market liberalizations. The impact of financial market liberalizations is found to be robust to the inclusion of the usual set of control variables representing the macroeconomic environment, banking development and stock market development. They also point out that that effect of financial liberalization is larger for countries with higher education levels. On the other hand, Bekaert, Harvey and Lumsdaine (2001) to measure the world capital markets integration, specify a reduced-form model for a number of financial time-series and search for a common, endogenous, break in the process generating the data. They evidence that these endogenous break dates are accurately estimated but do not always correspond closely to dates of official capital market reforms. Indeed, the endogenous dates are shown to be usually later than official dates pointing towards the important distinction between market liberalization and market integration.

The results of these studies show that financial liberalizations decrease the expected returns while no increase in volatility is observed against the general insight. However, while these results are consistent with the time period Harvey and Bekeart (2000) had investigated, the recent crises suggest the reverse. Higher real growth rates and higher capital flows are also proven to be two other important results of liberalizations. On the other hand, correlations are found to increase. However, this increase is slight and still much lower compared to the developed markets.

2.4 Volatility

High volatility is one of the main characteristics of emerging markets. On the other hand, theory suggests that increased volatility is one of the expected consequences of liberalization of financial markets and related increased integration. However, it is evident that no increase in volatility is observed in emerging markets as a result of liberalization. Thus, the following articles are examined. Bekaert and Harvey (1997, 2000) elaborate on this issue. They investigate (i) the relation of a number of macro economic and micro structural variables with the cross-sectional dispersion in volatility and (ii) the effect of capital market liberalizations on volatility. The time period investigated in the study starts from 1976 and extends to the end of 1992. First they estimate a world factor model of conditional variances. "Letting $r_{i,t}$ represent the arithmetic excess return on the national equity index of country i in U.S. dollars, the general model is

$$r_{i,t} = \mu_{i,t-1} + \varepsilon_{i,t}$$

$$\varepsilon_{i,t} = \upsilon_{i,t-1}\varepsilon_{w,t} + e_{i,t}$$

$$\left(\sigma'_{i,t}\right)^2 = E\left[e^2_{i,t}\middle|\mathrm{I}_{t-1}\right] = c_i + \alpha_i\left(\sigma'_{i,t-1}\right)^2 + \beta_i e^2_{i,t-1} + \gamma_i S_{i,t} e^2_{i,t-1}$$

$$e_{i,t} = \sigma'_{i,t} z_{i,t}$$

where I_{t-1} is the information variable at time $t-1$. The conditional mean return for country i is given by $\mu_{i,t-1}$. The unexpected portion of country i's return, $\varepsilon_{i,t}$, is driven in part by world shocks, $\varepsilon_{w,t}$, as well as a purely idiosyncratic shock $e_{i,t}$. The dependence of local shocks on world shocks is determined by $\upsilon_{i,t-1}$. The local idiosyncratic standard deviation is $\sigma'_{i,t}$ and $z_{i,t}$ is a standardized residual with zero mean and unit variance. Finally, $S_{i,t}$ is an indicator variable that takes on the value of one when idiosyncratic shock is negative and zero otherwise. The model that describes the world market return and variances is a special case of these equations with $i = w$, $\sigma'_{i,t} = \sigma_{w,t}$, $\upsilon_{w,t-1} = 0$ and $\mu_{w,t-1} = \delta'_w X_{t-1}$ where X_{t-1} represents a set of world information variables including a constant, the world market dividend yield in excess of 30-day Eurodollar rate, the default spread, the change in the term structure spread, and the change in the 30-day Eurodollar rate". To examine the effect of both local and world factors on the mean and the variance, two parameterizations are explored for $\mu_{i,t-1}$ and $\upsilon_{i,t-1}$. The effect on volatility as a function of the local variables, which measure the country's financial and economic integration with world markets, is allowed to change through time in both cases. In the first parameterization $\mu_{i,t-1}$ and $\upsilon_{i,t-1}$ are assumed to be linear in the information variables whereas they are assumed to be nonlinear in the second. Furthermore, authors focus on conditional correlations. First correlation of the emerging market return with the world market return is examined. "The world market correlation in the model is given by

$$\rho_{it} = \upsilon_{i,t-1} \frac{\sigma_{w,t}}{\sigma_{i,t}}$$

Hence, correlations increase when markets become more integrated or when world market volatility is high relative to local volatility. Second, the proportion of variance accounted for by world factors is examined. The variance ratio is

$$VR_{i,t} = \frac{\upsilon_{i,t-1}\sigma_{iw,t}}{\sigma_{i,t}^2}$$

It is further decomposed into three pieces representing the degree of integration, the correlation and the volatility ratio, respectively,

$$\xi_i \psi_{i,t-1}, \frac{\sigma_{iw,t}}{\sigma_{i,t}\sigma_{w,t}}, \frac{\sigma_{w,t}}{\sigma_{i,t}}"$$

In all but four countries, the linear model is accepted. Wald tests provided for the linear model suggest that global factors do influence the mean but the hypothesis that there is a significant world factor in the variance is rejected. However, the Wald test on the coefficients of trade and size variables in the $\upsilon_{i,t-1}$ function indicates time variation in the world factor dependence for the sample countries' variances. Next, independence assumption of country shocks from both the world shocks and the other country shocks is explored. Although there is some evidence that country shocks are correlated, the hypothesis of world residuals being independent of the country shocks is accepted. Authors also investigated the proportion of variance caused by world factors and the behavior of conditional correlations with the world equity benchmark. Three sub-periods are used; post-October crash period, pre-liberalization and post-liberalization. The average proportions of variance attributable to world factors are generally found to be very small. However average conditional correlations with world increased after capital market liberalizations suggesting that after capital market liberalizations the influence of world factors increase. Thus evidence suggests that after liberalizations world factors have become more important. Harvey (1993) shows that the unconditional volatilities in developed markets have ranged from high to low 18% (from high to low) whereas in emerging markets it has been 86%. Bekaert and Harvey (1997) furthermore explore cross-section of volatility in emerging markets and investigate four sources of volatility: asset concentration, stock market development / economic integration, microstructure effects and macroeconomic influences and political risk. The time-series estimate of conditional volatility is used as the raw material for the cross-sectional analysis. "A pooled time-series cross-sectional regression is estimated

$$\ln\left(\sigma_i^2\right) = \alpha_i + \beta' X_i + u_i \quad i = 1, \ldots, N$$

There are N countries and σ_i^2 is a $T_i \times 1$ vector of pre-estimated conditional variances, where T_i is the number of observations for country i, X_i is a matrix of L explanatory variables for country i, the α_i are intercept coefficients and β is a $L \times 1$ coefficient vector". The explanatory variables are the number of firms in each index, asset concentration ratio for each country, ratio of equity capitalization to GDP, ratio of exports plus imports to GDP, turnover ratios, foreign exchange rate volatility and country credit ratings. They find that market volatility is a function of the openness of the economy. More open economies have less volatile equity markets. They evidence that capital market liberalizations increase correlations between local market returns and world market but do not drive up local market volatility. In fact a significant decrease in volatility of emerging markets is observed after capital market liberalizations. Erb, Harvey and Viskanta (1997) link market volatility and country demographics. They argue that population reveals information about risk. They focus on three demographic variables: average age, life expectancy growth and population. Average age increase variable is found to reveal information about future returns especially on long horizon returns whereas life expectancy and population variables do not. They evidence that the many of the countries with the highest average age increase are the poorest emerging markets carrying the most volatility risk. They also find that market volatility is high when inflation risk is high, which is typically the case in many emerging countries.

The results of these studies reveal that after liberalizations the effect of world factors on the mean had increased but no significant effect had been observed on the volatility of emerging markets. In fact, liberalizations are found to decrease the local volatility in emerging markets. However, it is very important to mention that these studies' investigation period do not include the recent financial crises of 1992-93, 1994-95 and 1997-98 during which emerging market volatilities are observed to be extremely high and increased. On the other hand, conditional correlation of emerging markets with the world is observed to increase due to liberalizations. However, this increase is still lower than developed markets and there exists substantial diversification benefits in investing emerging markets in this respect. These findings support the research proposal as they show that emerging markets are still beneficiary for international diversification purposes. Aiming to analyze the contribution of Turkey to a global portfolio, it is also important to identify the proportion of the change in correlation structure that can be attributed to the financial liberalizations.

2.5 Correlation

Seeing that liberalizations and related changes in the degree of market integration had increased the emerging markets correlations with the world, it is necessary to identify the characteristics and nature of this correlation structure. In terms of correlation of emerging markets with world markets, Erb, Harvey and Viskanta (1994) examine the correlation structure of equity returns. They find that correlations change over time. They suggest that the relation between business cycles of G7 countries determine the equity cross-correlations. Since expected stock returns are linked to the business cycle correlation is linked to it as well. In the study a semi-correlation analysis that measures equity co-movements in common up, common down and mixed markets, is implemented. The methodology differentiates equity co-movements in bull and bear markets and enables forecasting of multi period equity correlations. Recent evidence on emerging markets suggests that return distributions are not symmetric. Especially in down markets correlations are higher. Thus, it is important to know how stocks co-move in different market scenarios. Portfolios constructed assuming that correlations are symmetric may perform worse in down markets. Conditioning the correlation on realized return, positive and negative semi correlations are calculated which involves of up-up, down-down, up-down and down-up markets. The average negative semi-correlation of G-7 countries with U.S. returns is found to be nearly double the positive semi-correlation. Later, correlations were examined under three business cycle peroiods: recession-recession, growth-growth and out of phase. They find evidence that international cross-correlations are higher during recessions than during growth periods and when the business cycles between the countries are out of phase. A significant asymmetry of correlation is evidenced. In bear markets, correlations are higher and in bull markets correlations are lower. In the case of emerging markets, pattern of asymmetric correlation is evident if the emerging market is more integrated with world capital markets. On the other hand, liberalization is found to increase correlation of emerging and world markets as business cycles of these markets become more integrated. Authors had further explored the stochastic properties of correlation measure. They had studied a multivariate forecasting model, which uses instrumental variables to represent stability in correlation and business-cycle patterns. Rolling multiperiod correlations is used as the dependent variable. The instrumental variables include the lagged correlation for 60 months lag over five-year correlations, and variables representing mean reversion in expected returns. Lagged multiperiod returns in countries and both local and U.S. dividend yields were added to the forecasting equation. The final set of variables designed to capture business cycle effects included measures of term structure of interest rates for each country. Their estimates evidence the predictability of the variability in the correlations through time. Longin and Solnik (1995) investigate the international equity return correlations over 1960-1990 period to test for the stability of conditional correlation matrix. Their sample consist of the monthly excess returns for seven major countries. They employ a bivariate GARCH (1,1) model, put forward in Bollerslev (1990), to each pair of markets to model the asset return dynamics that assume constant conditional correlation. "The multivariate process for asset returns is written as

$$R_t = m_{t-1} + e_t$$
$$m_{t-1} = E(R_t | F_{t-1})$$
$$e_t | F_{t-1} \sim N(0, H_t)$$

where R_t is a vector of asset excess returns (denoted R_t^i for country i), m_{t-1} is the vector of expected returns conditioned on the information set F_{t-1}, e_t is the vector of innovations or unexpected returns assumed to be conditionally normal with a conditional covariance matrix H_t. Elements of H_t are denoted $h_t^{i,j}$ for the off-diagonal terms and h_t^i for the diagonal terms (variances). The expected excess return for market i (its national risk premium) is conditioned on a set of information variables Z_{t-1}^i. A linear relationship is assumed between expected excess returns and the vector of information variables:

$$R_t^i = b^i Z_{t-1}^i + e_t^i \text{"}$$

In the information set of country i the national dividend yield, short-term and long-term interest rates and a January seasonal is included. "The variance term for each market is assumed to be a function of the past innovation and conditional variance of this market, as well as some national information variables. However the conditional correlation between the two markets is assumed to be constant over time:

$h_t^i = a^i + b^i e_{t-1}^i e_{t-1}^i + c^i h_{t-1}^i + d^i Z_{t-1}^i$ and $h_t^{i,us} = r^{i,us} \sqrt{h_t^i} \sqrt{h_t^{us}}$

where h_t^i is the conditional variance of market i and $h_t^{i,us}$ is the conditional covariance between market i and the US dividend yield, short-term interest rate, long-term interest rate of country i observed in $t-1$ and a January dummy that takes the value of one if t is the month January and zero otherwise". To simplify the GARCH estimation process, only correlation of US market with foreign markets is estimated. While positive tendation is observed in dividend yield and January seasonal coefficients, coefficients of Short-term interest rates tend negative. Significant GARCH effects are observed for all countries in variance equations. However the coefficient of dividend yield had mixed signs whereas interest rates had positive coefficients in all equations. The hypotheses of constant expected return and constant variances are both rejected at 1% and 5% level in all cases. Rejecting the constant expected returns and variance, authors investigate the possible sources of deviation from their base model of constant conditional correlation. A time trend, the presence of threshold and asymmetry, and the influence of economic variables are examined as sources of deviation. To detect a progressive increase in correlation over the past 30 years as a result of increased integration of capital markets, a linear time-trend is augmented in the correlation specification and the null hypothesis is set to test that coefficient is zero. The covariance term is defined as

$$h_t^{i,us} = \left(r_0^{i,us} + r_1^{i,us} t\right) \sqrt{h_t^i} \sqrt{h_t^{us}}$$

The coefficients for the variances are found to be small and insignificant and no secular increase in expected market volatility. However, a positive time-trend in conditional correlation is evident for all countries. Correlation increase over 30 years is found as 0.36. "The constant correlation GARCH model assumes that the conditional covariance, $h_t^{i,us}$, estimated from information variable at time $t-1$, is equal to a constant correlation times the product of the two conditional standard deviations $\sqrt{h_t^i}\sqrt{h_t^{us}}$ following a first order GARCH process. To test the hypothesis of higher international correlation during turbulent periods, authors introduce a threshold effect in their bivariate constant correlation GARCH specification. With this threshold on correlation, covariance term is now written as

$$h_t^{i,us} = \left(r_0^{i,us} + r_1^{i,us} S_{t-1}\right)\sqrt{h_t^i}\sqrt{h_t^{us}}$$

where S_{t-1} is a dummy variable that takes on value of one if the estimated conditional variance of the US market is greater than its unconditional value and zero otherwise. The time-t international correlation is conditional on the time-t volatility of the US market. The coefficient r_1 will be positive if the correlation increases when the conditional US variance is high; it will be zero if there is no threshold effect". The estimated coefficient r_1 is found to be positive for all countries, meaning that correlation increases in turbulent periods and in fact the magnitude is quite large. 27% increase is observed in correlation coefficient during volatile periods. To test whether negative and positive shocks (e_{t-1}) have a different impact on the conditional correlation (asymmetry), the correlation is conditioned on both the sign and magnitude of past shocks $\left(e_{t-1}^{us}\right)$. "This threshold, asymmetric correlation GARCH specification is written as

$$h_t^{i,us} = \left(r_1^{i,us} S_{1,t-1} + r_2^{i,us} S_{2,t-1} + r_3^{i,us} S_{3,t-1} + r_4^{i,us} S_{4,t-1}\right)\sqrt{h_t^i}\sqrt{h_t^{us}}$$

where $S_{k,t-1}$ are dummy variables that take the values:

$S_{1,t-1} = 1$ if $\left(e_{t-1}^{us}\right)$ is less than $-\sigma^{us}$,

$S_{2,t-1} = 1$ if $\left(e_{t-1}^{us}\right)$ is less than 0,

$S_{3,t-1} = 1$ if $\left(e_{t-1}^{us}\right)$ is greater than 0,

$S_{4,t-1} = 1$ if $\left(e_{t-1}^{us}\right)$ is greater than $+\sigma^{us}$,

and zero otherwise. If the impact of the small and large shocks are similar, then the two coefficients r_1 and r_4 should equal to zero". The results evidence that large shocks tend to increase the conditional correlation as coefficients r_1 and r_4 are found to be significantly positive. However, asymmetry is weakly evident. Though the correlation is more sensitive to negative than to positive shocks and seems to increase in periods of high turbulence. Finally to test the influence of information variables on the correlation and covariance, the following equation is developed. The hypothesis is that the past values of the information variables can be used to predict the conditional correlation itself. The covariance equation is defined as

$$h_t^{i,us} = \left(r' + g_1^{i,us} DIV_{t-1}^{us} + g_2^{i,us} ST_{t-1}^{US}\right)\sqrt{h_t^i}\sqrt{h_t^{us}}$$

The US dividend yield and interest rate are the information set. During periods of low dividend yield and high interest rates the conditional correlation is predicted to increase. This result is consistent with the previous finding of that the conditional variance increases with the level of interest rates and that the correlation increases in periods of high volatility. It is confirmed here that higher conditional correlation is associated with higher interest rates. In brief authors find that the international covariance and correlation matrices are not constant over time. Solnik, Boucrelle and Le Fur (1996) explored the effect of growth in international capital flows and market integration on the general level of correlation and the behavior of correlation during periods of high volatility. They had used six developed markets and EAFE index as their sample, covering 37 years of monthly data. They had fitted a simple least squares line on the total period. Unlike the developed markets' slopes that are mostly positive, emerging markets had negative slopes, tending to be less correlated with the rest of the world. To obtain the econometric estimation of the link between correlation and market volatilities, authors regressed the innovations (shocks) in correlation, which are uncorrelated over time, on a constant and on the innovations in each market's volatility. All volatility coefficients are found statistically significant. However, depending on the country considered the major influence is either national or U.S. volatility. But US volatility is dominant over national volatility. Although there is evidence of volatility contagion across markets and increased correlation during turbulent periods, international correlation levels are still at opportunistic levels for diversification purposes. Considering the emerging markets Bekaert and Harvey (1997, 2000) find evidence that correlations of emerging markets with world markets increase after liberalization while diversification benefit is still present as it is well below from the correlation levels of developed countries. They propose evidence that average response of these conditional correlations to liberalizations in 17 emerging markets is a small but statistically significant increase of 0.08 at most. So, low correlation means that adding emerging market assets to a world portfolio reduces risk for a given level of expected return thus provides diversification benefits.

The results of the studies show that correlation:

- is linked to the business cycle of the related countries,
- is asymmetric in nature, that it increases more during crisis,

- is unstable (not constant),
- has a positive time trend and
- increases in periods of high volatility, when it is needed the most for diversification purposes.

These findings have serious implications for the proposed research topic. First of all, they encourage the examination of the correlation structure of Turkish stock market for possible diversification benefits. These results show that Turkey, as a case of emerging markets, may have unstable conditional correlation with world markets and its degree of change may hold valuable information for risk reduction purposes that will be explored within extreme value context.

2.6 Emerging Markets Data

The data used in the researches made on the emerging markets usually consist of international benchmark indexes or the direct returns data of these countries. The indexes differ in certain aspects such as construction and coverage. However, they are used as the benchmarks for asset allocation decisions. On the other hand, the distribution of the emerging market data is found to be highly non-normal. The following articles are studied to get familiar with the emerging market data before making any examinations for the proposed research.

To measure diversification benefits, investors use emerging market indexes as benchmark portfolios. The benchmarks used are mainly IFC Emerging Markets Data Base, Morgan Stanley Capital International Emerging Markets and ING Barings Emerging Markets Index (BEMI). IFC and MSCI each offer two emerging market indexes; global and free (investable). IFC global and MSCI Global are both weighted by total market capitalization and target to cover 60% of the total capitalization and 60% of the trading volume in each emerging country. Stocks are selected for inclusion in the index based on size, liquidity and industry. IFC Investable and MSCI EMF are weighted by the proportion of market capitalization accessible to foreigners. BEMI is by definition an investable index. Most empirical research relies on these indexes. However, there are certain problems with these indexes in terms of representativeness as they suggest conflicting results on allocation of wealth on emerging markets. Masters (1998) examine the differences in construction of these indexes. IFC takes into consideration the market capitalization while MSCI stresses industry representation and BEMI focuses on liquidity. Furthermore, the country weights in these indexes change dramatically through time. He provides evidence that emerging market indexes are inefficient portfolios that lie beneath the efficient frontier and links this fact to the high turnover, high transaction costs, unstable country weights that increase risk and risk drag. He also suggests that a risk-weighted portfolio offers the best long-term growth and the lowest risk and in emerging markets efficient portfolios can be built from the ground up independent of the index's structure by buying low and selling high taking advantage of emerging market volatility. Masters provide evidence that the ideal portfolio consists of at least 6% allocated to emerging markets. On the other hand, Harvey (1995) mentions a number of potential survivorship biases in the construction of these indices. He especially points out the methodology used to construct the indices and shows that the data were backfilled, which leads to look-back bias, that raise the portfolio's observed mean and performance. More importantly he provides evidence that the distribution of the data is highly non-normal. "To test for normality, the following system of equations is estimated for each asset i

$$e_{1it} = r_{it} - \mu_i$$
$$e_{2it} = (r_{it} - \mu_i)^2 - v_i$$
$$e_{3it} = \left[(r_{it} - \mu_i)^3\right] / v_i^{3/2} - sk_i$$
$$e_{4it} = \left[\left((r_{it} - \mu_i)^4\right)\right] / v_i^2 - 3 - xku_i$$

where μ is the mean, v is the variance, sk is the skewness, xku is the excess kurtosis and $e_t = \{e_{1it}, e_{2it}, e_{3it}, e_{4it}\}$ represents the disturbances where $E[e_t] = 0$. There are two parameters and four orthogonality conditions leaving a χ^2 test with two degrees of freedom. The test statistic results from setting the coefficient of skewness and kurtosis equal to zero in the third and fourth equations. This forms a joint test of whether these higher moments are equal to zero". In 14 of the 20 emerging markets used in the analysis the null hypothesis of normality is rejected at the 5% level. Bekaert and Harvey (1997) besides GMM also present Bera-Jargue and Kolmogorov-Smirnov tests for normality. Tests provide evidence against the hypothesis of normality in 18 and 15 of 20 emerging countries, respectively. Bekaert, Erb, Harvey and Viskanta (1998) show that distribution of emerging market equity return data is highly non-normal. As mean-variance theory assumes normally distributed returns the significant skewness and kurtosis in the data makes it problematic to use in a mean-variance framework, produces biased asset allocation. Furthermore, skewness and kurtosis change over time, which is expected in markets that are in a transformation from segmented to integrated state. Bekaert and Harvey (1995, 1997, 2000) argue that this fact is expected in this transformation stages. Bekaert, Erb et al. show that over the 04:1987 – 03:1997 period, 17 of the 20 emerging countries had positive skewness and 19 of them exhibited excess kurtosis. For the same period analysis of MSCI-all countries and MSCI world indexes are also provided. Both indexes are found to exhibit negative skewness and stronger excess kurtosis compared to IFC indexes. A comparison of 1980's with 1990's shows that in most countries while positive skewness has increased in 1990's, the degree of kurtosis has been reduced. Authors employ a Chow test to estimate the change in mean between 80's and 90's and test whether the change is statistically significant. In only four of nineteen countries the Chow tests evidence a significant shift in skewness at the 10% level of significance. The Chow test for kurtosis evidences a significant change in only three of nineteen countries. Finally, a joint test is employed which simultaneously considers the mean, variance, skewness, and kurtosis to analyze the shift in distribution in 90's. Authors fail to accept the hypothesis that the distribution is the same at the 5% level in ten of the nineteen countries. The evidence suggests that distribution of emerging market returns is non-normal and is unstable in time. To explore the deviations from normality, certain country fundamentals' relation with skewness and kurtosis are examined. The fundamentals explored are country risk ratings, inflation, trade-to-GDP, market capitalization-to-GDP. The financial variables are market capitalization, volatility, beta vs. MSCI world index, earnings-to-price, book value-to-price, and dividend yield. Skewness is found to be negatively related to most of ICRG ratings, market capitalization, GDP growth whereas it is strongly positively related to inflation, book-to-price, and beta vs. MSCI world index. Kurtosis is negatively related to ICRG country ratings, market capitalization and GDP growth whereas it has positive correlations with inflation, book-to-price and beta similar to skewness. Authors also suggest that a Markowitz optimization fails to take into account that investors prefer positively skewed returns to negatively skewed returns. In terms of asset allocation, they employ a portfolio optimization simulation and show that the asset with positive skewness gets higher weight holding kurtosis constant. They also find that holding skewness positive and constant, higher kurtosis lead to higher investment weights in emerging markets. Finally, authors evidence that distribution of emerging market returns are non-normal and that distribution has changed over time due to the liberalization of these markets and relatively changing degrees of integration. Harvey and Siddique (2000) present tests of an asset pricing model which incorporates a dynamic measure of skewness. In this model investors prefer positive skewness and what matters is the contribution of the asset to the portfolio's skewness: Coskewness. They succeed in explaining cross-section of US equity returns. Harvey (2000) has examined 18 measures of risk in 47 international markets. The idea is to determine if the same risk factors explain expected returns in developed and emerging markets. 28 emerging markets and 19 developed markets are included in the sample. "Using a world version of a single factor model, where R_{mt} denotes the return on the MSCI world index, the following regression is estimated:

$$R_{it} - r_{ft} = \alpha_i + \beta_i \left[R_{mt} - r_{ft}\right] + e_{it}$$

where r_{ft} is the U.S. 30-day Treasury bill rate, and e_{it} is the residual. Also, $e_{mt} = R_{mt} - Avg(R_{mt})$ is used later. SR (systematic risk) is the beta β_i. TR (total risk) is the standard deviation of country return σ_i. IR (idiosyncratic risk) is the standard deviation of the residual e_{it}. For size variable natural log of average market capitalization over the relevant period for each country is taken. Semi-standard deviation is given as:

$$Semi\text{-}B = \sqrt{(1/T)\sum_{t=1}^{T}(R_t - B)^2} \quad \text{for all } R_t < B$$

Semi-mean is the semi-standard deviation with B = average returns for the market. Semi-r_f is the semi-standard deviation with B = U.S. risk free rate. Semi-o is the semi-standard deviation with B = 0. Downside Beta measures are (i) $Down - \beta_{iw}$ which is the β coefficient from the market model using observations when country returns and world returns are simultaneously negative and (ii) $Down - \beta_{w}$ which is the β coefficient from the market model using observations when world returns are negative. VaR is a value at risk measure, which is the simple average of returns below the 5^{th} percentile level. Skewness variables: Skew is defined as the unconditional skewness of returns which is calculated by taking the Mean(e_i^3) divided by the [Standard deviation of $(e_i)^3$]. Skew 5% is calculated as [(Return at the 95^{th} percentile level-mean return)-(Return at the 5^{th} percentile level-Mean return)]-1. Coskew1 represents the coskewness definition 1, which is calculated by (sum up e_i x e_m^2)/T and divide by [square root of (sum of (e_i^2)/T] x [(sum of (e_i^2)/T)]. Coskew2 represents the coskewness definition 2, which is calculated by (sum up e_i x e_m^2)/T and divide by [standard deviation of $(e_m)]^3$. Spread variable: Kurt is the kurtosis of the return distribution. Political and Country risk variables: ICRGGC is the log of the average monthly ICRG's country risk composite. CCR is the log of the average semiannual country risk rating published by Institutional investor. ICRGP is the log of the average monthly ICRG political risk ratings". The findings evidence that emerging markets exhibit higher volatility and risk on the downside compared to developed markets. It is also found that due to more negative coskewness these markets have, inclusion of these assets to the diversified portfolio increases the negative skewness. The results of the bivariate regression suggest that CAPM works reasonably well for emerging markets in this analysis, which is practically due to the time period of the analysis 1988-1999 during which emerging markets become more integrated with the world. It is seen that total variance accounts for 52% of the variation in the emerging market returns whereas it fails to explain any of the developed markets. Similar results are found for idiosyncratic risk. A weak relation is found between international returns and size for both emerging and developed markets. Semivariance explains a substantial part of the variation in emerging markets while fails to account for the variation of developed markets. Downside betas and the emerging market returns are found to be related while no relation is found for the developed market returns. High negative VaR is observed for emerging markets implying a higher expected return in emerging markets. Particular attention is paid to coskewness. This risk measure captures the contribution that an asset makes to a well-diversified portfolio's total skewness. In this sense an asset with negative coskewness decreases the skewness of the portfolio. Given that investors like positive not negative skewness, this asset would have to have a high expected return to get investors to purchase it. A positive relation is found between the two total skewness measures for emerging markets but not developed markets. A negative relation is found for the coskewness measures for both markets. Consistent with theory a more negative coskewness gets a higher expected return. A positive relation is found between kurtosis and returns in emerging markets but not in developed markets. For the ICRG composite and IICCR a negative relation is found for both markets. The political risk measure evidences that higher political risk is associated with lower expected returns. Furthermore, multivariate regressions are run. It is found that a world CAPM with coskewness account for the average returns in both developed and emerging markets. The systematic risks fail to be complete measures of emerging markets risk. Adding total risks to the regression enables extra variation to be explained. Harvey finds evidence that world beta and coskewness succeed in explaining the cross-section of average returns in world markets. Many emerging markets are found to be impacted by total risk measures like variance and skewness due to their less-than-complete integration with world markets.

The results of the articles, evidence that the distribution of the emerging market data is non-normal and significant skewness and kurtosis exist. It is also seen that the distribution of the data has changed in time as a result of liberalizations and that investors prefer positively skewed returns. These findings suggest that Turkish stock market may have a non-normal distribution and even it may be positively skewed. Therefore, precaution must be given to the skewness and kurtosis properties of the dataset before any further analysis that may be assuming normal distribution, is employed. It is also seen that co-skewness plays an important role in portfolio allocation decisions in the sense that negative co-skewness decrease the skewness of the total portfolio. Turkish data's skewness properties may be important to examine in this respect.

2.7 Diversification Benefits

Emerging markets offer substantial diversification benefits due to their low correlation with developed markets. It is evident in the literature that these diversification benefits are still present despite the liberalizations and increased integration. This section elaborate on the diversification benefits of emerging markets with respect to different investment vehicles that are international indexes, ADRs, open and closed end funds, WEBS and direct exposure to these markets.

Aiello and Chieffe (1999) explore the diversification benefits of international index funds (both developed and emerging funds) and measure returns against

S&P500. They investigate whether international indexes outperform domestic indexes and if international index funds are beneficial for diversification purposes. To test whether international indexes outperform S&P500 benchmark in a risk-adjusted basis, Sharpe ratio, Treynor measure and Jensen measures are used. "The Sharpe measure is the ratio of average risk premium to the total risk the portfolio faces during the evaluation period:

$$S_i = \frac{\overline{R}_i - \overline{R}_F}{\sigma_i}$$

where S_i is the Sharpe Measure for index i, $\overline{R}_i$ is the average return on index i, $\overline{R}_F$ is the average risk free rate, and σ_i is the standard deviation of returns on the index. The Treynor measure uses systematic risk and allows the investor to compare the individual index returns to the market return, disregarding diversification:

$$T_i = \frac{\overline{R}_i - \overline{R}_F}{\beta_i}$$

where T_i is the Treynor measure for index i , β_i is the beta or systematic risk for index i . For the Jensen measure excess portfolio returns are regressed against excess domestic market returns. The intercept represents the Jensen measure. A positive and statistically significant intercept means superior performance.

$$\alpha_i = \left(\overline{R}_i - \overline{R}_F\right) - \left[\beta_i\left(\overline{R}_M - \overline{R}_F\right)\right]$$

where α_i is the Jensen measure and $\overline{R}_M$ is the average return on market". All measures fail to reject the null hypothesis that average performance of international indexes is equal to or less than that of S&P500 index, except for the emerging market indexes. Emerging market indexes are found to outperform the S&P500 index.

Before investigating the diversification benefits of other ways of investing in emerging markets other than index funds, which are direct purchase of foreign shares, foreign-listed shares (ADRs), closed-end country funds and open-end funds (WEBS- world equity benchmark shares), some information is provided here on the pros and cons of these vehicles. Compared to other instruments foreign direct investment carries high transaction costs and foreign exchange risk. In bullish markets appreciation of the local currency amplifies the returns to the foreign investor. However, in bearish markets depreciation of the local currency magnifies the loss. In the case of ADRs the problems of settlement and transaction costs are minimized. Dividends are paid in the foreign currency and more information is available about the underlying stocks but they are still exposed to FX risk. However, FX risk can be hedged by options, forwards or futures contracts. The correlation of ADRs and the underlying stock are in general close to one. ADRs are also a good way to invest in emerging markets where foreign ownership is restricted. Closed-end country funds issue a fixed number of shares that trade on exchange and are never liquidated. Portfolio managers are released from trading to meet net redemptions or net purchases of shares. The premium on the fund is the difference between the fund value and the NAV, which is the difference of fund's price from the assets it consisted of. The fund is subject to price fluctuations caused by the supply and demand of the fund itself. Net asset value reflects this volatility in the same way it reflects the currency risk. The advantages of a closed-end format are especially relevant for funds investing in illiquid or volatile markets. The main disadvantage of these funds is the uncertainty in the premium. Foreign investment restriction also make emerging country-funds attractive despite their high volatility. They trade at a premium when the assets are invested in closed or restricted markets or at a discount when the foreign market has unusual political risk. When pricing of country-funds are examined, it is seen that the fund's value is strongly correlated with the market it is traded and reacts slowly to the changes in the fundamentals. On the other hand open-end funds are listed whose shares can be purchased and sold at the NAV of the assets owned by the fund. The advantage of the open-end fund is that there is no premium. WEBS, which represent an equity portfolio of a specific foreign market that is intended to track the performance of the corresponding MSCI country index, are introduced in 1996. The degree of correlation between the returns of WEBS and the corresponding foreign indices has been very near to the value 1.0. Khorana and Nelling (1998) examine the effectiveness of World Equity Benchmark Shares (WEBS) as an international indexing instrument. They find evidence that WEBS tend to exhibit low correlations with the S&P 500, suggesting that they provide useful diversification opportunities for U.S. investors. The introduction of WEBS was accompanied by a decrease in trading volume and a widening of discounts for closed-end country funds as well.

In perspective of the proposed research, it may be beneficial to explore the correlation of these investment vehicles to enter the Turkish stock market other than its index. It may be also interesting to compare and even correlate these investment vehicles' returns to stock market index return in terms of diversification debate. Many recent researches on the diversification benefits of emerging markets have been measured using one of the investment vehicles mentioned above. Studies that used index funds often identified emerging markets as free lunch but this identification is biased as high transaction costs, investment restrictions and low liquidity in emerging markets are not taken into consideration. Bekaert and Urias

(1996) explore the diversification benefits from emerging markets using data on closed-end funds, open-end funds and ADRs. They suggest that a set of assets have diversification benefits if adding these to the benchmark shift the mean-variance frontier leftward. In the study a new class of unconditional and conditional mean-variance spanning tests are employed to exploit the duality between Hansen-Jagannathan bounds (1991) and mean-standard deviation frontiers. Diversification benefits are measured in relation to a set of mature market benchmark returns. In the study emerging markets are accepted to provide diversification benefit if adding emerging market assets to a number of different benchmark portfolios from mature markets leads to a statistically significant leftward shift in the efficient frontier. To measure the economic significance of a shift, Sharpe Ratio was used in the study. Diversification benefits of closed-end funds and IFC Investables indices of emerging markets are compared in the study. In particular US and UK traded closed-end funds are used. Authors find that investors give up a substantial part of diversification benefits by holding closed-end funds instead of the underlying portfolios. Investors do so to the point that the benefits from investing in US traded closed-end funds are not statistically significant relative to an internationally diversified portfolio benchmark. Emerging market closed-end funds represent exposure to emerging markets that is actually attainable by foreign investors, whereas the IFC investables ignore all effective investment costs or restrictions. Open-end funds are found to be tracking the IFC indexes much better than the other investment vehicles and prove to be the best diversification instrument in the study. Bekaert (1999) elaborates on the free lunch doctrine and focus on the benefits from holding closed-end funds, ADRs and open-end mutual funds in a global portfolio. While these vehicles provide emerging market returns that are actually attainable, they may sacrifice some of the benefits of direct access to the local markets they represent. However, they are more realistic. The results indicate that the US and UK closed-end funds have higher expected returns than the open-end funds, ADRs and IFC Investable composite index at all allocation levels. At least 10% invested in emerging markets the expected excess return for the emerging market assets exceeds the developed world equity market index. Mean-variance spanning test, developed by Hansen and Jagannathan, is employed which examines whether the frontiers intersect at two pre-specified points along the benchmark frontier. "The main intuition for the test is:

$$R_e(t) = a + w_1 R_b(t,1) + \ldots + w_L R_b(t,K) + Nu(t)$$

where $R_e(t)$ represent an emerging market asset return or "test" asset return, $R_b(t,j)$ represent the return on the j^{th} benchmark asset, where j is indexed from 1 to K. Then $R_e(t)$ is spanned by the K benchmark returns if it can be written as a portfolio of the benchmark returns with the weights summing to one, plus an uncorrelated, mean-zero error term, $N_u(t)$". The emerging market return is concluded to be spanned by the benchmark if benchmark returns can mimic the return on the emerging market fund. If that is the case then emerging market return does not offer a real diversification benefit and hence the hypothesis that the frontier of benchmark plus emerging market return is the same as the frontier generated by only the benchmark returns cannot be rejected. At the 95% confidence level spanning is rejected that is emerging markets offer diversification benefits. It is concluded that direct exposure to emerging market indexes perform as strong as those from managed funds or ADR portfolios. However, Closed-end funds, open-end funds and ADRs are found to provide statistically significant diversification benefits in the 1993-1996 test period. Alaganar and Bhar (2001) investigate the diversification benefit of ADRs, the underlying Australian stocks and the Australian equity index for a US investor seeking international diversification. Three hypothesis are developed in the study; "H1: ADRs are priced efficiently in line with the underlying stocks and that risk-return characteristic of the ADR portfolio is similar to that of foreign stocks, H2: Correlation coefficient between the US equity market and the ADR portfolio is similar to that between the US equity market and the underlying stocks, H3: there is a uni-directional causality and transfer of pricing information from the domestic market to the ADR market". To test hypothesis 1 close-to-close daily returns differences are analyzed using matched pair t-tests. To test hypothesis 2 authors use monthly returns to examine the effect of shocks, defined as the absolute difference between two consecutive monthly returns of the representative index, on the correlations between the US index return and the ADR portfolio return and that between the US index return and the underlying stock returns. The time-series data is divided into two sub-samples and then the correlations for the both samples are calculated. This way correlations between high-state and low-state shocks are compared. To test hypothesis 3 VaR framework is adopted. Authors used a four variable system return known as "innovation accounting" on daily returns where variables were the ADR portfolio, the underlying stock portfolio, the Australian index and the US index. They find evidence that law of one price holds for ADRs. In the mean-variance context an ADR portfolio is cost-effective and superior measured by the risk-to-reward ratio. Although the underlying stock portfolio in foreign currency outperforms the ADR, the high transaction costs and hedging costs for the foreign exchange risk change the picture. They also suggest that ADR portfolio has a low correlation with the US index under high external shock states and detect a uni-directional information transmission from the underlying stocks to the ADRs. Hanna, McCormack and Perdue (1999) investigate whether S&P500 portfolio dominates a portfolio of G7 indexes. The market indexes under study are S&P500, Toronto Stock Exchange 300 Composite Index, London FTSE, Paris CAC40, Frankfurt DAX, Milan MIBtel and Tokyo Nikkei 225. First correlation coefficients are examined to define the relationship between each foreign market index and S&P500. Then to test for a linear relationship between S&P500 and each of the market indexes individually regression analysis is made. Furthermore, sample portfolios are developed where the S&P500 is paired with each of the other markets under different weighting schemes. All correlation coefficients are found to be positive. The R-squares of regressions are also found to be statistically significant and strong except Milan. It is evidenced that a portfolio consisting solely of S&P500 dominates any portfolio that can be constructed from the S&P500 and the major market index of the G-7 countries. This fact is due to the statistically significant positive correlations between developed countries. There is a diversification benefit only when foreign country index is increasing while S&P500 is decreasing. In this respect, emerging markets are the future for international diversification. Erb, Harvey and Viskanta (1995) examine the influence of U.S. capital markets and U.S. economy on the foreign capital markets in terms of international diversification argument. They suggest that correlation should be dependent on the state of the market and the state of the economy in general. Correlations are observed to be different in up markets and down markets. They may also differ according to the stage of the business cycle. In emerging markets they find that correlations are higher when U.S. market is down but still lower compared to developed countries. The average correlation in down markets is 18% and in up markets it is 9%. They also find evidence that poor economic conditions in U.S. cause lower equity returns, higher volatility and higher correlation of returns. While the average correlation of emerging markets with U.S.

markets during recessions is average 22.8%, the average correlation in recovery is 10.2%. One interesting result of their research is that currency hedging increases the correlation. Unhedged portfolios are found to be less correlated with U.S. markets. The answer to their research question "do world markets still serve as a hedge?" is affirmative especially for emerging markets as their covariance and correlation is found to be less relative to developed markets. Gilmore and McManus (2002) study the short and the long term relationships between the U.S. stock market and the three Central European markets. Authors employ the methodology of cointegration to explore the potential diversification benefits these markets offer for U.S. investors. Bivariate and multivariate cointegration tests are employed to investigate if a long-term common trend exist between the U.S. and the three Central European stock markets namely, Czech Republic, Hungary and Poland. The data consist of weekly closing price indices for the mentioned stock markets covering the period 07:1995 to 08:2001. Before cointegration test of Johansen is employed, a generalization of the Dickey-Fuller test is employed to test whether index series are non-stationary which is a precondition for cointegration. The null hypothesis of a unit root is accepted at the 5% confidence level while the first difference series reject the null hypothesis indicating that they are stationary. Consequently, all series are integrated I(1). "The Johansen approach circumvents the use of two-step estimators and estimates as well as tests for the presence of multiple cointegrating vectors. This method relies on the relationship between the rank of a matrix and its characteristic roots, or eigenvalues. Letting X_t be a vector of n times series variables, each of which is integrated of order (1) and assume that X_t can be modeled by a vector autoregression:

$$X_t = A_1 X_{t-1} + \ldots + A_p X_{t-p} + \varepsilon_t$$

Rewriting the VAR as

$$\Delta x_t = \Pi x_{t-1} + \sum \Gamma \Delta x_{t-i} + \varepsilon_t$$

where $\Pi = \sum A_i - I$, $\Gamma_i = -\sum A$. If the coefficient matrix Π has reduced rank $r < k$, there exists $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' x_t$ is stationary. The number of cointegrating relations is given by r, and each column of β is a cointegrating vector. If the rank of $\Pi = 0$, then there are no combinations that are stationary and there are no cointegrating vectors". Two versions of the Johansen procedure were implemented: one with intercept in the cointegrating equation and the other without. The results of both versions confirm the same finding that none of the Central European equity markets are cointegrated with the U.S. equity market. Authors fail to reject the null hypothesis that the rank of the coefficient matrix is equal to zero, indicating that there are no stationary combinations and no cointegrating vectors. Although there is no evidence of cointegration on bilateral basis, multilateral Johansen was applied to test whether there is cointegration as a group. No evidence for multilateral cointegration is found for these markets as well. Despite low short-term correlations are found between the U.S. stock market and the three Central European markets, application of Johansen cointegration procedure indicates that there is no long-term relationship. Thus, in the long-term these markets offer diversification benefits.

Analysis of the diversification benefits of emerging markets reveal that these markets indeed offer, significant diversification benefits and that adding these assets to an international portfolio push the efficient frontier leftward. Especially direct exposure to emerging market indexes is found to give diversification benefits as strong as those from managed funds and ADRs. On the other hand, developed market indexes have diversification potential only when they are increasing and U.S. stock market is decreasing, due to their high correlation. However, emerging markets' correlations are also higher when U.S. market is down but still lower compared to developed markets. Therefore, these results support not only the diversification potential of emerging markets but also the proposed research. From international diversification perspective, the way the correlation of Turkish stock market behaves when developed markets go up or down constitutes the base of risk reduction benefit of Turkish stock market.

2.8 Country Risk and Contagion

The economic and financial policies of governments have substantial effect on the integration level of a market. In this sense foreign ownership restrictions often observed in emerging markets are a very effective barrier to entry. Bekaert (1995) show that the presence of country funds or cross-listed securities might effectively integrate markets with world capital markets despite restrictions. There are also indirect barriers arising from differences in available information, accounting standards and investor protection. Barriers arising from emerging-market specific risks are liquidity risk, political risk, economic policy risk and currency risk. Bekaert (1995) finds that indirect barriers are strongly related cross-sectionally with the integration measure. Erb, Harvey and Viskanta (1996) examine the economic content of five different measures of country risk and explored whether any contained information about future expected returns. Their strategy was to form two portfolios: upgrades and downgrades based on the ICRG political risk measures. The portfolios were subject to rebalancing every six month. Under this strategy if the rating remains the same, the country stays in its respective portfolio. The upgrade portfolios were found to have higher average returns than the downgrade portfolios. Then a time-series/cross-sectional regression analysis is employed to investigate further the link between expected returns and country-risk measures. "The regression is

$$R_t = c_0 + c_1 A_{t-1} + \varepsilon_t$$

where R represents a vector of six-month returns for all the countries in the sample and A represents the risk attribute that is lagged and matched to the country". Univariate and multivariate regressions are made. Each of the five risk attributes is found to have significant negative coefficients, implying that lower rating (higher risk) is associated with higher expected returns. Finally, the results suggest that country risk measures are correlated with future equity returns. International Country Risk Guide composite, financial and economic ratings contain considerable information. In particular economic and financial risk measures are found to forecast the cross-section of returns especially in developed markets. Change in political rating also has some marginal explanatory power in emerging markets but not in developed markets. Erb, Harvey, Viskanta and Bekaert (1997) find that political risk is priced in emerging markets. Bailey and Chung (1995) also suggest that exchange rate and political risks may be significantly priced factors in equity markets. They succeed in evidencing time-varying premiums for each exchange rate and political risk by using free market dollar premium and sovereign default risk as proxies.

Contagion factor is another important criterion in deciding to invest in emerging countries despite their diversification benefits. The low correlation of these markets with developed markets is seen as a natural hedge for the global investor. However, contagion defined as the regional market's response to regional crises, complicate the diversification argument. Erb, Harvey and Viskanta (1998) show that IFCI emerging markets composite index have outperformed the MSCI world index and the correlation between EAFE (Europe, Australia and Far East) index and the world is 94% whereas correlation between IFCI emerging markets composite investables and world has been a modest 53%. On the other hand, developed markets are found to be highly correlated with the world index and diversification fails when markets are bearish due to the increased correlations during crises. Analyses of country risk ratings suggest that average level of country risk is sharply higher in emerging markets. When the effect of Latin American and Asian crisis on correlations is examined, it is interesting to see that in the post-crisis period correlations are much higher. However, the unconditional three-year rolling correlation analysis provide conflicting findings with the idea of contagion as correlations are found to be increasing well before the crisis and continued to increase afterwards. Furthermore, cross-sectional correlations are investigated in the study Erb, Harvey and Viskanta show that intra-regional correlations in both Latin America and Asia have been increasing through time and relate it to the increase in economic and trade linkages of these economies and increasing level of integration. On the other hand, to analyze the effect of crisis on the risk premium that investors demand for investing Latin America and Asia, a regression analysis is done. To derive the expected premium, the average country returns in U.S. dollars in excess of a U.S. Treasury bill return is regressed on the natural logarithm of the Institutional Investor country credit rating and the contemporaneous change in the Institutional Investor credit rating. The change in the rating provides information about the change in the risk premiums. The results of the regression suggest that as country risk increases, expected returns and volatility increase. Masters (1999) examine the decline of emerging markets from 1997 to 1998. He points out to the fact that these recent financial crisis have led to massive corrections in the current accounts of these countries. He states that although the downturns are very severe in these countries, it is known that historically individual markets rise 10% or more in a calendar month 15.4% of the time, almost twice the frequency of comparable gains in developed countries. He also suggests that focusing on short-term correlations could be misleading. He shows that during the 97-98 period while S&P500 gained 71%, Emerging Markets index plunged 34%. Actually they had moved in opposite direction despite the general argument that correlations increased after crisis. Masters claims that short-term correlations are sensitive to the level of volatility. Whenever crisis occurs, it causes a jump in emerging market volatility and correlations go up. However, Masters suggest that emerging markets remain essentially local in character. He finds evidence that only 15% of emerging markets' equity capitalization and just 10% of their trading volume comes from developed market investors. As crisis pass, he claims that fundamentals reassert themselves and correlations revert to long-term average. In terms of asset allocation, he suggests that the optimum in terms of return enhancement and volatility reduction is achieved when 5% to 10% of the equity is committed to emerging markets. However, portfolio rebalancing is necessary.

The results of these studies show that country risk and political risk is priced in emerging markets. Studies also evidence that correlations have been increasing before the crisis and continued to do so afterwards. Especially intra-regional correlations had increased possibly due to increased economic and trade linkages among the region countries. On the other hand, it is shown that as country risk increases, expected return and volatility increases. With respect to the debate of contagion, studies also reveal that emerging markets are local in nature and despite correlations increase during the crisis, they revert to their long-term averages in time. Also recovery in emerging markets is faster than developed markets. These findings have serious implications for emerging markets. First, they suggest that there is still room for diversification despite crisis, especially within countries that have less common economic and trade linkages and are from different regions, which is the typical case for Turkey vs. developed markets. Second, the economic and trade linkages effect correlations; therefore it is necessary to analyze economic determinants of the correlation structure. Third, correlations revert to long-term average, that in the long run it is a win-win situation to invest in emerging markets.

2.9 Industrial Structure

In analyzing the correlation of emerging markets with developed markets, it is important to identify why cross-market correlation is so low. Recent research had tried to reveal the effect of industrial structure on both the correlation and cross-sectional volatility. The studies usually focused on decomposing the stock returns into country and industry components in an attempt to figure out if the low correlation is due to differing industrial structures of market indices, whether country factors are dominating equity return behaviors and their implications for international portfolio selection. Studies made tried to measure not only the proportion of variance explained by each but also the influence of these factors on correlation matrices.

Lessard (1976) analyzes the world, country and industry relationships in equity returns. He presents evidence concerning the covariance structure of equity returns in international markets and discusses some of its implications for portfolio selection. The main question he asks is do world, country or industry factors dominate? He first reports the average proportion of variance of individual security returns explained by national market indexes and shows that smaller less diverse economies display greater proportions of national systematic risk in stock returns. Then he reports the proportion of variance of national indexes explained by world indexes where the proportion of variance explained is equal to the R^2 of

$$R_j = \alpha_j + \beta_j R_w + e_j$$

where R_j is the monthly percentage change in the national market index for country j and R_w is the monthly percentage change in the world market factor. He shows that relatively low average proportion of variance is explained by world factors. "In order to test for industry elements, returns on individual stocks are regressed against (i) a world index and (ii) the residuals of the country or industry indexes obtained by regressing these on the world index. Four alternative relationships were estimated using two different surrogates for the world factor - market value weighted average of the country indexes and equally weighted average of the country indexes – and the residual of either of the country or the industry index on the world index used.

$$R_{it} = \alpha_i + \beta_i (MWI)_t + \gamma_i RC_j (MWI)_t + \varepsilon_t \qquad i \text{ included in } j,\ j=1,\text{J}$$

$$R_{it} = \alpha_i + \beta_i (MWI)_t + \gamma_i RI_k (MWI)_t + \varepsilon_t \qquad i \text{ included in } k,\ k=1,\text{K}$$

$$R_{it} = \alpha_i + \beta_i (EWI)_t + \gamma_i RC_j (EWI)_t + \varepsilon_t \qquad i \text{ included in } j,\ j=1,\text{J}$$

$$R_{it} = \alpha_i + \beta_i (EWI)_t + \gamma_i RI_k (EWI)_t + \varepsilon_t \qquad i \text{ included in } k,\ k=1,\text{K}$$

where R_i is the return on the stock i, member of country j and industry k in period t, MWI is the market value weighted world index, EWI is the equally weighted world index, $RC_j(\ )$ is the residual series remaining after the country j index is regressed on the world index specified in parentheses, and $RI_k(\ )$ is the residual of the industry k index on the particular world index". The regressions evidence a world factor in returns. Nonetheless, significant country effects and relatively weaker industry effects are also found to have explanatory power. Thus, Lessard provide evidence that country factors are dominant in the covariance structure. Grinold, Rudd and Stefek (1989) ask the question: are country factors more prominent than industry factors? In the model portfolio return decomposed into currency return and excess return in the local markets. Then local systematic returns, industry returns and returns related to volatility, size or yield, which authors refer to as common factor returns, are separated. "The model for local excess return on asset n, $rle(n)$, over a single period is

$$rle(n) = \sum_k b(n,k)h(k) + \sum_j y(n,j)g(j) + \sum_i x(n,i)f(i) + u(n)$$

where $b(n,k)$, $y(n,j)$ and $x(n,i)$ are predetermined variables describing the relevant asset characteristics: namely, the beta, industry assignment, and common factor exposures. Variables $h(k)$, $g(j)$ and $f(i)$ represent returns attributable to the various components, namely countries, industries and common factors". The terms respectively give the aggregate country return, the industry return and the return attributed to common factors. Then factor returns are estimated which represent the local market factors net of other factors. Industry factors are found to work best in identifying the pure industry returns. The proportion of the variance of the monthly returns that could be explained by industry and local market is examined under three specifications; only industry factors, only local market factors and both industry and local market factors. The results show that each industry-only and local-only models have R-squares over 20%, however the combined models R-square is 34% indicating that industry explains a significant portion of variance local markets fail to explain alone. Furthermore, the monthly R-squares are normalized to see how the explanatory power of industry and local market factors varies in time. It is seen that local market factors succeed 90% of the time in explaining the variance than industry factors do. To measure the degree of segmentation, correlation of local market returns with market indexes is analyzed. The correlations are quite high. Authors interpret this fact as the higher the correlation the more segmented the market assuming countries that have many multinational companies to have relatively smaller correlations between the local market factor and the local market index. The authors also find that industry factors are significant determinants of asset returns and the influence of global industries is more evident in countries with less significant country factors. Roll (1992) examines the behavior of stock price indices. Technical aspect of index construction, each country's industrial structure, and exchange rate behavior are examined as explanatory factors. "To ascertain whether the observed volatility of national stock market indexes could be due to the technical aspects of the index construction, a set of cross-country regressions were fit in the following form:

$$\log_e(S_j) = b_0 + b_1 C_j \quad , \quad j = 1,\ldots,24$$

where C_j is a measure of index concentration for country j at the beginning of the month and S_j is the calculated standard deviation of daily returns during the month". Three concentration measures were employed: (i) the number of individual stocks in the country's index, (ii) "Herfindahl" measure of industry concentration within the index which is given by $H_j = \sum_i (w_{ij})^2$ where w_{ij} is the market value proportion of country j's index represented by stocks in three-digit industry i, and (iii) Herfindahl measure computed with the weights of individual stocks in the index where w_{ij} is now the weight of stock i in the index of country j. Return volatility is found to be related across countries inversely to the number of stocks in the index and positively to a "Herfindahl" measure of three-digit industry concentration within the index. The country's index is more volatile when it is more concentrated. In explaining the time series behavior of national stock market indices by industry structure and exchange rates, "a basic time series regression model is used:

$$R_{jt} = b_{1j}I_{j1t} + \ldots + b_{7j}I_{j7t} + b_8 D_{Mt} + b_{9j}Z(j/\$)_t + e_{jt}\ ,\ t = 1,\ldots,T$$

where R_{jt} is the dollar-denominated daily return on a given country's national stock market, I_{jit} is the Industry index return for sector i (according to seven broad Global Industry sectors used by FT Actuaries/Goldman Sachs), D_{Mt} is the Monday seasonal dummy, $Z(j/\$)$ is the relative change in the exchange rate, and T is the total number of trading days in the time series sample. The I 's has a subscript j which indicates that returns from country j are not used in I 's calculation when R_{jt} is the dependent variable, that R_{jt} is never regressed on itself". The results show a higher R-square for industry factors in 17 of 23 countries. The average R-square is 0,39 for the industry factors alone and 0,231 for the exchange rate alone over the 23 countries where the exchange rate is a possible explanatory factor. It is evidenced that global industry indexes computed strictly from returns in other countries explain a sizeable part of the variations in a given country's national stock market. To investigate whether the international pattern of return correlations can be partly ascribable to the industrial structures of countries, "portfolio returns were constructed for each country by weighting the global industry factors with the country's industry weights as follows:

$$R_{pjt} = W_{1j} f_{1t} + \ldots + W_{7j} f_{7t}$$

where W_{ij} is the weight of industry i in country j at the beginning of a month and f_{it} is the global industry i factor return for day t during the month". Then correlations were computed on pairwise basis. A significant relation should exist between the correlations computed directly from the actual index returns of each country and the correlations computed from the country specific industry-weighted portfolios if industry factors played a role. Correlations are found higher for industry-weighted portfolios rater than from the raw indexes, which is expected by authors as only about 45% of the daily raw index volatility is explained by industry factors. To conclude that a significant portion of the international pattern of correlations is due to the industrial structures of countries, extent of the similarity in the correlation matrices is examined by cross-sectional (Pearson) correlation of the sample correlation coefficients. Empirical evidence shows that industry compositions of the national stock market indices can explain a significant part of the international structure of country correlations. Countries with similar industries tend to be more correlated than countries with dissimilar industries. Heston and Rouwenhorst (1994) examine whether industrial structure has an effect on the cross-sectional volatility and correlation structure of country index funds for 12 European countries. Search for a relationship between the relative performance of countries and their industrial structure and investigate the role of industrial diversification in international diversification. They employ an empirical estimation strategy for decomposing stock returns into industry and country effects. "The following model is postulated for the return on the ith security that belongs to industry j and country k:

$$R_{it} = \alpha_t + \beta_{jt} + \gamma_{kt} + e_{it}$$

where α_t is a base level of return in period t, β_{jt} is the industry effect, γ_{kt} is the country effect and e_{it} is a firm-specific disturbance. This formulation allows separate influences of industry and country effects but rules out any interaction between these effects. This formulation is rewritten as

$$R_i = \alpha + \beta_1 I_{i1} + \beta_2 I_{i2} + \ldots + \beta_7 I_{i7} + \gamma_1 C_{i1} + \gamma_2 C_{i2} + \ldots + \gamma_{12} C_{i12} + e_i$$

where I_{ij} is an industry dummy that is equal to one if security i belongs to industry j and C_{ik} is a country dummy that is equal to one if security i belongs to country k and zero otherwise". However, due to perfect multicollinearity, industry and country effects are measured relative to a benchmark, which is chosen as the European equally weighted market in the study. "To implement this definition, following restrictions are imposed:

$$\sum_{j=1}^{7} n_j \beta_j = 0 \quad \text{and} \quad \sum_{k=1}^{12} m_k \gamma_k = 0$$

where n_j and m_k denote the number of assets in industry j and country k, respectively. Since the sum of industry and country effects is zero for the European index by definition, the least-squares estimate of α is equal to the return on the European equally weighted market. The pure industry return $\hat{\alpha} + \hat{\beta}_j$ is the least-squares estimate of the return on a geographically diversified portfolio of firms in the j th industry. In this context, a geographically diversified portfolio is a portfolio that has the same country composition as the European equally weighted index and is therefore free of country effects. By similar reasoning $\hat{\alpha} + \hat{\gamma}_k$ is an estimate of the pure return on the country portfolio k. This portfolio is industrially diversified in the sense that it has the same industry composition as the European equally weighted index and therefore has no incremental industry effect. This estimation procedure allows a decomposition of R_k^{EW}, the actual equally weighted index of country k, into a component that is common to all countries $\hat{\alpha}$, the average of the industry effects of the securities that make up its index and a country-specific component $\hat{\gamma}_k$,

$$R_k^{EW} = \hat{\alpha} + \frac{1}{m_k} \sum_i \sum_{j=1}^{7} \hat{\beta}_j I_{ij} + \hat{\gamma}_k$$

where the i-summation is taken over firms in country k. Similarly each equally weighted industry index return R_j^{EW} can be decomposed into a component that is common to all industries, $\hat{\alpha}$, the weighted average of several country components, and an industry-specific component, $\hat{\beta}_j$,

$$R_j^{EW} = \hat{\alpha} + \hat{\beta}_j + \frac{1}{n_j}\sum_i \sum_{k=1}^{12} \hat{\gamma}_k C_{ik}$$

where the i-summation is taken over firms in industry j". The results of these decompositions show that most of the variance of excess equally weighted country returns is explained by country-specific effects. It is also found that most of the variation in excess industry returns is due to industry effects. However, the average variance of the pure industry effects is 5.43% squared quite smaller than the average variance of the pure country effects. Country effects in industry indices are generally larger than industry effects in country indices. Pure country effects are on average larger than pure industry effects. The results for the estimated country returns corrected for industry composition, $\hat{\alpha} + \hat{\gamma}_k$, and the estimated industry returns corrected for the country effects, $\hat{\alpha} + \hat{\beta}_j$, evidence that industry composition and industry effects are not important in explaining cross-sectional volatility and country correlations, respectively. Similar results are found for the value weighted indices as well. Authors conclude that country diversification is a more effective tool for achieving risk reduction than industry diversification. Heston and Rouwenhorst (1995) elaborate on the industry and country effects in asset allocation decisions. In their previous study mentioned above, they had shown that stocks from the same industry but from different countries are more beneficial for international diversification. In this study they build on their previous research and by comparing three different investment strategies they show that when building portfolios it is more important to be geographically diversified than to be industrially diversified. In the first strategy, the portfolio is well diversified industrially within a country and as the number of stocks in the portfolio becomes large the portfolio variance becomes 38% of the average variance of the securities in the portfolio. The second strategy chooses stocks from a single industry across countries and for large portfolios the average portfolio variance is approximately 20% of the variance of the typical stock in the portfolio. The final strategy in which a large portfolio diversifies over industries as well as countries has a variance of 18% of the typical security variance. Consequently they suggest that in terms of asset allocation, fund managers should pay more attention to the geographical decomposition of their portfolios. Solnik (1995) shows that increasing a portfolio size beyond 20 stocks provides limited risk reduction while an international portfolio of the same size provides substantial risk reduction. He mentions three different asset selection procedures, which are geographical diversification, industrial diversification and simultaneous geographical and industrial diversification. Clearly, inter-country diversification performs better in terms of risk reduction except for large portfolios where both portfolios would pick the same stocks. The combined procedure with both industrial and geographical diversification gives slightly better results. Solnik also compares unhedged and hedged portfolios against exchange risk. He shows that the risk of an unhedged portfolio is larger than a covered portfolio. However, its total risk is still much smaller for a comparable domestic portfolio. Solnik links this fact to devaluation of US dollar during the period 1966-71. Thus, he claims that an uncovered international portfolio is certainly a good hedge against devaluation of the dollar. Beckers, Connor and Curds (1996) examine the effect of global and national influences on the common movements of equity returns. Following same factor modeling approach of

Heston and Rouwenhorst, they estimate and compare a set of factor models with the same basic structure but varying degrees of national versus international focus. They use simple factor models with zero/one exposures to the explanatory variables. "In the model, called countries + global industries model, the local excess return to each equity in a given month is divided into a global market return, a country factor return, and an asset-specific return; that is,

$$r_i = f^G + \sum_{h=1}^{M} \delta_{ih}^I f_h^I + \sum_{j=1}^{L} \delta_{ij}^C f_j^C + \varepsilon_i$$

where

r_i = excess return to security i, $i = 1,...,N$

f^G = return to the global market factor

f_h^I = return to industry factor h, $h = 1,...,M$

f_j^C = return to country factor j, $j = 1,...,L$

ε_i = asset-specific return to security i

δ_{ih}^I = 1 if security i is in industry h, 0 otherwise

δ_{ij}^C = 1 if security i is in country j, 0 otherwise

The factor returns for each month are estimated by applying ordinary least squares to the cross-section of returns using the above equation subject to two linear constraints. That is, estimated factors are found to minimize $\sum_{i=1}^{N} \hat{\varepsilon}_i^2$ subject to $\sum_{i=1}^{N} \sum_{h=1}^{M} \hat{\delta}_{ih}^I \hat{f}_h^I = 0$ and $\sum_{i=1}^{N} \sum_{j=1}^{L} \hat{\delta}_{ij}^C \hat{f}_j^C = 0$. Adding these restrictions implies that the country factor returns are measured net of the global market return". In addition to countries and global industries model, a set of alternative factor models with varying degrees of national versus international focus is estimated. "Global industries only" and "countries only" models are estimated by respectively dropping country and industry dummies from the model. The returns to be explained are local currency denominated excess returns to individual equities in 19 developed countries. The results confirm that national influences dominate global industry influences. The countries only model display significantly higher average R-square than the global industries only model. Adding countries to the global industries only model increases the average R-square by 16.67%. The global factor explains 21% of the typical equity return variance, country factor explains an additional 14% and global industry factors an additional 4%. Global factor is even more powerful than the country factor. The best model in terms of explanatory power is composed of a global market factor, country factors and nation-specific industry factors. When the sample is restricted to only European Union countries, the global market and global industry factors are found to be more important than country factors. Authors interpret this finding as EU to be more integrated than the world overall. Griffin and Karolyi (1998) examine the role of industrial structure of countries in international diversification by employing Dow Jones World Stock Index database, which has daily index prices for 66 industry classifications and over 25 countries. Stock returns are decomposed into industry and country components using a dummy-variable regression model. Inter-industry differences in the relative importance of industry and country factors in stock returns are also investigated. Traded and non-traded goods industries are distinguished and that industry effects explain a larger fraction of the variation in industry index returns than country effects for traded-goods industries is hypothesized. The dummy variable regression analysis for value weighted index returns of individual securities is applied. "The following equation is estimated weekly for each country and industry index:

$$R_{ic} = \alpha + \beta_1 I_{i1} + \beta_2 I_{i2} + \ldots + \beta_n I_{i66} + \gamma_1 C_{i1} + \gamma_2 C_{i2} + \ldots + \gamma_{i25} C_{i25} + e_i$$

where R_{ic} is the return on the industry value weighted index i in country c. Weighted least squares estimates are computed for every week subject to the restrictions

$\sum_{j=1}^{66} w_j \beta_j = 0$ and $\sum_{k=1}^{25} v_k \gamma_k = 0$ where w_j and v_k denote the value weights of industry j and country k in the world market portfolio. Then the estimated intercept represents the return on the world market portfolio. The weekly cross-sectional regressions yield a time series of the intercept and the country and industry coefficients. The coefficient $\hat{\beta}$ is interpreted as the estimated "pure" industry effect relative to the value-weighted world market portfolio and $\hat{\gamma}$ as the estimated "pure" country effect". The average variance of the country effects is found as 8.042%-squared while the average variance of industry effects is 0.704%-squared, which is very low. Thus, it is concluded that the country effects are the main determinants of variation in international returns. Authors link these high values to the inclusion of emerging markets to their sample. On the other hand, traded-goods industries are found to have the higher industry effects and a lower proportion of the variance is explained by country effects. Authors comment that this variation could reflect important differences in the underlying economic factors that influence international stock return correlations. Serra (2000) explores the importance of industry and country factors in explaining the structure of emerging market returns. She examines different industry classifications in various regions. She first analyzes the correlation of returns between portfolios of stocks within a particular industry across markets. Cross-country returns within a particular industry are found to correlate less than market indices and for some industries the correlation is evidenced to be even lower that it is better to diversify across countries within a particular industry. She then examines the cross-industry correlations at the aggregate level, and evidences that cross-industry correlation is always higher than cross-market correlation. She also finds that within a single country cross-industry correlation is also very high indicating the dominance of national factors. She uses the methodology of Heston and Rouwenhorst (1994) in decomposing individual stock returns into industry and country components. A cross-sectional regression of individual security returns on industry and country dummies for each month is run from where time series estimate of "pure" industry and country effects are derived. Then the power of these effects in explaining the variation of emerging markets' aggregate returns is measured. The country effects are found to account for almost all the variance of market indices' returns. On average the variance of pure industry effects is found to be much smaller than pure market effects. The ratio of 18:1 evidences that pure country effects dominate market indices. The pure industry effects account for 52% of the industry indices' variance. The relatively lower explanatory power of industry effects stems from larger variances in the returns of emerging market indices and dominant country effects. The examination of the variance of the intercept of the cross-sectional regressions over the sample period relative to the total variance of the indices reveals that there exists a small common factor. The common factor and the country and industry factors are found to account for as much as 38% of the variability of the time-series cross-sectional returns. The correlation matrix is computed using the estimated market returns adjusted for their industrial structure and is compared to the statistics provided for raw market indices' returns. No difference is found between raw and adjusted indices that cross-market correlations for adjusted returns remained the same. However, the overall industry indices showed lower standard deviations after the adjustments. The average cross-industry correlation increases from 0.54 to 0.72. Thus cross-industry correlation is on aggregate basis, higher than cross-market correlation. Serra furthermore compares four different portfolios to get a better understanding of the diversification benefits of different diversification strategies. First one is "no diversification" portfolio where variance is obtained as the average of the individual stocks: $\sigma_{ND}^2 = \frac{\sum_{i=1}^{N} \sigma_i^2}{N}$. The second is "maximum diversification" portfolio, which invests in all emerging market indices, and where variance is obtained as the variance of equally weighted portfolio: $\sigma_{MD}^2 = \sigma_{EW}^2$. The third portfolio is "industry diversification" portfolio, which diversifies across industries within a country, and variance is given by the weighted average of the variances of the 26 emerging markets' indices: $\sigma_{ID}^2 = \sum_{k=1}^{K} \frac{m_k}{M} \sigma_k^2$ where the weights are given by the ratio of the number of companies in a market relative to the total number of firms in the sample. The fourth portfolio is "geographical diversification" portfolio, which diversifies across countries within an industry, and variance is given by the weighted average of the variances of the nine emerging markets' industry indices: $\sigma_{GD}^2 = \sum_{l=1}^{L} \frac{n_l}{M} \sigma_l^2$ where the weights are given by the average ratio of the number of companies in an industry relative to the total number of firms in the sample. The latter three portfolios are compared to the first portfolio in terms of variance. The MD portfolio is found to eliminate risk to 6% of the average individual risk. ID and GD portfolios can reduce to, respectively, 43% and 8% of the ND strategy. It is better to diversify across countries in terms of risk reduction. Emerging markets offer much more substantial diversification than the one observed for the developed markets due to the more idiosyncratic character of each of these markets and the lower importance of common factors in these markets. For the emerging markets, country specific effects are dominant and industry composition fails to explain the low cross-market correlation. When a finer industry classification is used, the country factors still dominate industry factors. It is also found that even within a region, local factors dominate regional effects, that it is better to diversify geographically rather than industrially.

The studies reveal that country factors are dominant in explaining the equity returns in both developed and emerging markets. It is always better to diversify geographically rather than industrially. However, it is also mentioned that a combined strategy of both geographical and industrial diversification performs slightly better than geographical diversification. On the other hand, when EU countries consist the sample, it is found that global factors play an important role due to higher integration. One other interesting finding is that in traded-goods industries, effect of industrial factors is higher. In emerging markets, evidence show that country specific factors are stronger due to their more local nature. In this framework, it may be suggested that Turkey as a case of emerging markets, shows the same characteristics and that country factors are dominant in explaining in equity return correlations and cross-volatility.

2.10 Economic Modeling of Correlation Structure

Bracker and Koch (1999) study the change in correlations across international equity markets. The hypothesis is that greater economic integration across countries is associated with greater capital market integration. Investors' valuation decisions are assumed to be interdependent through trade and capital flows across national equity markets. In this respect, authors maintain that greater economic integration should bring greater co-movement in respective national markets. In the study the stability of the correlation matrix is tested over different periods and potential economic determinants of the correlation structure is modeled. The daily returns on ten national stock market indexes, from 1972 to 1993, are employed to construct a quarterly time series of the correlation matrix. The stability of the correlation matrixes is checked by Jenrich test for the equality of two correlation matrices. The Jenrich test is applied to investigate the equality of (i) consecutive quarterly correlation matrices, (ii) nonconsecutive quarterly correlation matrices (one, two, and three quarters apart), and (iii) consecutive correlation matrices estimated over time intervals longer than one quarter. Stability of correlation matrices is rejected in all time periods. Next, Augmented Dickey-Fuller test is employed to check for unit root on time series of quarterly pairwise correlations and results indicate that the time series have no unit root. "The regression model is as follows:

$$\begin{aligned} r_{ijt} &= \beta_0 + \beta_1 \left|IND_i - IND_j\right|_t + \beta_2 \left|INFL_i - INFL_j\right|_t + \beta_3 \left|INT_i - INT_j\right|_t + \beta_4 \left|LOSH_i - LOSH_j\right|_t \\ &+ \beta_5 \left|SIZE_i - SIZE_j\right|_t + \beta_6 GAP_{ijt} + \beta_7 TRADE_{ijt} + \beta_8 \left|XRCH_{ij}\right|_t + \beta_9 XRSD_{ijt} + \beta_{10} WLDVOL_t \\ &+ \beta_{11} WLDMKT_t + \beta_{12} TREND + \beta_{13} OCT87 + \beta_{14} OCT89 + \beta_{15} Q1 + \beta_{16} Q2 + \beta_{17} Q3 + \varepsilon ijt \end{aligned}$$

where i = country 1 to 6, j = country $(i+1)$ to 7, t = quarter 1 to 88,

r_{ijt} = estimated correlation between daily returns in countries i and j during quarter t,

IND_{it} = growth in industrial production in country i during quarter t,

$INFL_{it}$ = inflation rate in country i during quarter t,

INT_{it} = real interest rate during quarter t,

$LOSH_{it}$ = spread between long and short term bond rates in market i during quarter t,

$SIZE_{it}$ = percent of world equity market share in market i during quarter t,

GAP_{ijt} $= \left(\left|X_{ij} - M_{ij}\right|_t\right)/GDP_{it} + \left(\left|X_{ij} - M_{ij}\right|_t\right)/GDP_{jt}$

$TRADE_{ijt}$ $= \left(\left|X_{ij} + M_{ij}\right|_t\right)/GDP_{it} + \left(\left|X_{ij} + M_{ij}\right|_t\right)/GDP_{jt}$

$XRCH_{ijt}$ = percent change in bilateral exchange rate during quarter t,

$XRSD_{ijt}$ = standard deviation in daily bilateral exchange rate during quarter t,

$WLDVOL_t$ = standard deviation of daily world stock market index during quarter t,

$WLDMKT_t$ = percent change in daily world stock market index during quarter t,

$TREND$ = nonlinear trend, $\ln(t)$,

$OCT87(89)$ = dummy variable equal to 1 in fourth quarter of 1987(1989)

$Q1, Q2, Q3$ = seasonal dummy variables for the first three quarters."

The country's macroeconomic performance that affect expected cash flows in that national market is measured by the first four variables. Size variable measures the effect of the size of national stock market on that country's equity returns. Gap variable incorporates the potential influence of trade gap on r_{ijt}. As X-M (exports-imports) constitutes a greater proportion of GDP, a greater response would be expected in r_{ijt}. Trade variable accounts for the total amount of trade across two countries. XRCH incorporates a potential negative effect on the correlation due to increased trade gap. XRSD accounts for the negative effect of higher volatility of exchange rates on the correlation between different pairs of national equity market returns denominated in US dollars. WLDVOL incorporates the effect of discount rates on the correlations. On the other hand, due to the asymmetric nature of correlation, WLDMKT may exhibit a negative association with the correlation structure overtime. Nevertheless, authors state that correlation of national equity markets are observed to increase due to factors such as greater interdependence across economies, improved telecommunications, global deregulation of markets, cross-listing of securities, growth in multinational activities and increased international diversification. Thus, a Trend variable is entered into regression. Furthermore, two dummies are entered to account for the erratic behavior of correlations during crisis of October 87 and 89. Finally, seasonal dummy variables are incorporated to the model to account for the seasonal patterns in market activity. Pooled and SUR approaches are utilized in the estimation of regressions. The findings evidence that

- world market volatility is a positive function of correlation,
- a positive trend in the correlation appears during 1972-82 period but disappears afterwards,
- exchange rate volatility and correlation is negatively associated.

In addition, to a lesser extent, for U.S. dollar returns,

- term structure differential is a negative function of correlation,

while for home currency returns,

- real interest rate differential is a negative function of correlation,
- the world market return is negatively associated with the correlation.

Authors also compare the forecasting ability of their economic model with four atheoretical models namely; no change, historical average, empirical Bayes, and ARIMA. The forecast performance of the economic model outperforms the alternative models. This fact confirms the forecasting ability of the theoretical economic model and enables improving portfolio performance. Pretorius (2002) investigates the fundamental factors that influence the correlation and how correlations between emerging stock markets evolve. Industrial composition, bilateral trade, size differential, physical distance, regional effects, market volatility, exchange rate volatility, term structure differentials, real interest differentials and the return on the world market index are evidenced factors that effect correlation of emerging markets. This study examines the influence of these and other factors on the correlation of emerging markets. In the first part of the analysis a cross-sectional analysis is done, in which 1995:01-2000:03 period pairwise simple are pooled across all the country pairs and regressed on the averages of the possible explanatory variables on quarterly intervals. This analysis is expected to explain why stock markets are correlated and how much is due to contagion. In the second part a time-series approach is employed to explore the instability of correlations thorugh time, in which quarterly coefficients is regressed on the average values of the dependent variables for each quarter. Unit root tests evidence that all the series are stationary. In the model the dependent variable is the correlation between daily rate of return of countries i and j. The independent variables consist of trade, inflation differential, industrial production growth, interest rates, size, volatility, region variables and dummies for trend, quarterly effect and stock market crisis of 1998. With the expectation that the stronger the trade relationship between two countries, the more correlated their stock markets should be; sum of the value of the bilateral trade as a proportion of each country's total trade is incorporated into the model. With the expectation that inflation differential of two countries to negatively influence the extent of interdependence, absolute value of the inflation differential is incorporated into the model. Assuming a negative correlation between difference in industrial growth rates and stock market correlation; absolute value of difference in industrial growth rates is incorporated into the model. Assuming a negative correlation between interest rate differential and stock market correlation; absolute value of interest rate differential is incorporated into the model. Assuming a negative correlation between size differential stock market correlation; absolute value of size difference is incorporated into the model. Assuming convergence of countries' stock markets leads to convergence of prices, correlation is expected to be negatively correlated to the ratio of volatility. Ratio of the variances of returns of countries i and j is incorporated into the model. Expecting the correlation of two countries that are in the same region, to be higher than that of two countries in different regions, four dummies are incorporated into the model to account for the regions; same region, Latin America, Africa or Europe and Asia. To proxy the increasing correlations over time, trend dummy is included to the model. A dummy variable is incorporated into the model to test whether correlations have a quarterly component. Stock Market Crisis of 1998 are incorporated into the model with two dummy variables to test whether correlations change during crisis and whether a structural break occurs at the time of crisis.

In the cross-sectional model only bilateral trade, industrial production growth differentials and regional effect dummy were significant in explaining the pairwise correlation coefficients. The signs of the variables confirmed the expectations of the author. The model succeeds in explaining 37% of the variation in the correlation coefficients. Results of the time series regression of pairwise correlation coefficients show that only the extent of bilateral trade, industrial production growth rates differential, crisis and region variables were significant. The signs of the variables also confirm the expectations. The R-square is 39%. In the study also the forecasting ability of the economic model is explored by comparing the model to three atheoretical models of no change, historical average and ARIMA. It was found to be doing pretty well compared to other models.

The articles describe the economic determinants of correlation structure and that it can be forecasted with economic models. Although these findings may be valuable in terms of explaining the structure of correlation, there may be a discussion of causality.

3. RESEARCH DESIGN AND METHODOLOGY

The research design involves construction of various global and regional portfolios excluding Turkey and comparison of these portfolios with portfolios including Turkey. The comparisons are made on the basis of risk-return attributes and diversification potential of Turkey in Mean-variance framework. In the beginning six global portfolios are constructed in the absence of risk free asset. These portfolios include developed markets portfolio, emerging markets excluding Turkey portfolio, world excluding Turkey portfolio, developed markets including Turkey portfolio, emerging markets including Turkey portfolio and world including Turkey portfolio:

P_1 : Developed Markets Portfolio

P_2 : Developed Markets including Turkey Portfolio

P_3 : Emerging Markets excluding Turkey Portfolio

P_4 : Emerging Markets including Turkey Portfolio

P_5 : World excluding Turkey Portfolio

P_6 : World including Turkey Portfolio

The portfolios constructed by the classic efficient frontier optimization are examined for their risk-return characteristics under the null hypothesis that Turkish stock market provides significant risk reduction. The statistical significance of the findings is explored by the spanning test statistic of Jobson and Korkie. The contribution of Turkish stock market in smaller portfolios is also found necessary since important information could be lost in these quite crowded portfolios. As a more detailed analysis is aimed regional portfolios are constructed again in the absence of risk free asset. These portfolios include Developed Europe, Emerging Europe, Asia, North America, Latin America, Middle East, Pacific Rim and G7 countries. Then the diversification benefit of Turkey is investigated by including Turkey into these regional portfolios. The constructed portfolios are:

P_1 : Developed Europe Portfolio

P_2 : Developed Europe including Turkey Portfolio

P_3 : Emerging Europe excluding Turkey Portfolio

P_4 : Emerging Europe including Turkey Portfolio

P_5 : Asia Portfolio

P_6 : Asia including Turkey Portfolio

P_7 : North America Portfolio

P_8 : North America including Turkey Portfolio

P_9 : Latin America Portfolio

P_{10} : Latin America including Turkey Portfolio

P_{11} : Pacific Rim Portfolio

P_{12} : Pacific Rim including Turkey Portfolio

P_{13} : Middle East Portfolio

P_{14} : Middle East including Turkey Portfolio

P_{15} : G7 Portfolio

P_{16} : G7 including Turkey Portfolio

The hypothesis that Turkish stock market provides significant risk reduction is investigated under various time periods for each regional portfolio. The analyses start with Classic mean-variance analysis and proceed with Stein estimated mean-variance analyses. The objective of Stein analysis is to minimize the estimation bias of the Classic Mean-Variance analysis by smoothing the country means. Smoothing aims to shrink the sample means towards a common mean. The common mean is defined as the minimum variance portfolio mean of respective portfolios. By this estimation Turkey's contribution to regional portfolios is aimed to be stated more clearly and free of estimation error. The statistical significance of the findings of the classic and Stein estimated portfolios are both tested by the Spanning test. Finally, short-selling restricted analyses of all portfolios are provided for all periods. The periods under investigation include full period analysis, and recent global crises periods namely ERM crisis, Latin Crisis, Asian and Russian crises. The crises periods are defined to include the pre-crisis, crisis and post-crisis periods in order to observe the emerging markets behavior more clearly. Then sections one and two are repeated in the presence of a riskless asset. In the study the 3 month Turkish T-bill rate is assumed as the risk-free rate for the global investor. The objective of this assumption is to evidence how higher rates evident in Turkey can be beneficial for a global investor in a portfolio setting.

3.1 Mean-Variance Portfolio Theory

Mean – variance portfolio model is a two-parameter model, where the probability distribution of the return on a portfolio can be fully characterized and described by the knowledge of its mean and variance, assuming normally distributed returns. The basic idea behind the theory is investors prefer higher expected return for a given level of risk or lower risk for a given level of expected return. Thus, investors need a rational ranking of the possible set of investment alternatives in order to maximize their utility functions. Under the assumption of normally distributed returns, Mean-Variance theory provides investors a tool to allocate their funds rationally. The main assumptions of the theory are

- The probability distribution of the returns is normal.
- Investors are rational and risk averse, that they dislike risk and prefer the lowest variance for a given level of expected return.

The investor chooses from a set of alternative portfolios the one that maximizes his wealth, which is called the efficient portfolio. The efficient portfolio is the portfolio that no other portfolio has lower standard deviation for a given level of expected return. Thus the portfolio with the highest expected return for a given level of risk or the portfolio with the lowest standard deviation for a given level of expected return is called the efficient portfolio. The set of these efficient portfolios is called the efficient set.

In MV model the return of a portfolio is simply the weighted average of the returns on the individual securities in the portfolio where the proportion of the portfolio funds invested in the security determines the weight of that security in the portfolio. The expected return on a portfolio is measured by its mean:

$$E(R_p) = E\left(\sum_{i=1}^{n} x_i E(R_i)\right) = \sum_{i=1}^{n} x_i E(R_i)$$

$$R_p = \sum_{i=1}^{n} x_i R_i = \mu_p$$

where x_i denotes the weight of security i invested in the portfolio, R_i is the return on security i and R_p is the return on portfolio composed of N assets.

In the same manner, the risk of a portfolio is measured by its variance. The variance of a portfolio is composed of two parts. The first part is the individual variances of securities and the second part is the co-variation of securities in the portfolio. The latter part is the concern of the diversification debate as it is the primary source of risk reduction in a portfolio. The variance of a portfolio is measured as:

$$\sigma^2(R_p) = E\{[R_p - E(R_p)]^2\}$$

$$\sigma^2(R_p) = E\left[\left(\sum_{i=1}^{n} x_i (R_i - E(R_i))\right)^2\right]$$

$$\sigma^2(R_p) = E\left[\left(\sum_{i=1}^{n}\sum_{j=1}^{n} x_i x_j (R_i - E(R_i))(R_j - E(R_j))\right)\right]$$

$$\sigma^2(R_p) = \sum_{i=1}^{n}\sum_{j=1}^{n} x_i x_j \sigma_{ij}$$

where there are n securities and σ_{ij} is the covariance between the return on security i and the return on security j in the portfolio p. Covariance measures the degree of dependence between R_i and R_j, to see whether their deviations from their respective means tend to move in the same direction or not. When the number of assets in a portfolio is too large, then the importance of covariance in determining the risk of a portfolio increases compared to variances of securities. In that case lower covariance between the securities in the portfolio leads to higher diversification of risk. Furthermore, the contribution of security to the risk of a portfolio can be described by its covariance with the portfolio return:

$$\operatorname{cov}(R_i, R_p) = \sum_{j=1}^{n} x_j \sigma_{ij}$$

Another important tool to examine the co-movement of securities is the correlation coefficient computed as

$$corr(R_i, R_j) = \frac{\operatorname{cov}(R_i, R_j)}{\sigma(R_i)\sigma(R_j)} = \rho_{ij}$$

Considering a portfolio of two risky assets, the mean and the variance of the portfolio are computed as

$$\mu_p = x_i R_i + (1 - x_i) R_j$$
$$\sigma_p^2 = x_i \sigma_i^2 + x_j \sigma_j^2 + 2 x_i x_j \rho_{ij} \sigma_i \sigma_j$$

It can be seen from the above equations that correlation coefficient has no effect on the mean of the portfolio. However, it significantly effects the portfolio variance. Given that

$0 < x < 1$ (no short-selling) and $(-1 \leq \rho \leq +1)$, the portfolio variance would have the largest value when R_i and R_j were perfectly positively correlated that is $\rho = 1$. Then there would be no opportunity for diversification. However, when $\rho < 1$, the standard deviation of the portfolio decreases. Thus, the lower the $corr(R_i, R_j)$, the smaller the portfolio variance that diversification works. As long as $\rho < 1$, there is room for diversification and risk reduction. It is also important to mention that when $corr(R_i, R_j) = -1$ (perfect negative correlation), the portfolio variance has the possible smallest value. Furthermore, assuming that there is no risk-free asset, a point where $\sigma_p^2 = 0$ can be achieved by varying the value of x.

When short-selling is allowed, the standard deviation of the portfolio is larger when the correlation of return of security i and the return of security j is perfectly negatively correlated then when they are perfectly positively correlated. This is because holding a security short and the other long reverses the sign of the correlation between them when they were both held long. Again assuming that there is no risk-free asset, there can still be a point where $\sigma_p^2 = 0$ but this time the securities should be perfectly positively correlated. However, short-selling extends the opportunity set; the efficient frontier.

When there is a risk-free asset with a certain return of R_f and $\sigma(R_f) = 0$, investors can do riskless lending and borrowing at the risk-free rate R_f. Then the efficient portfolios would be composed of the risk-free asset and a risky asset g. With $x \leq 1$ the expected return and the standard deviation of a portfolio of a risk-free and a risky asset would be

$$E(R_p) = x_i R_f + (1 - x_i) R_g$$
$$\sigma_p = (1 - x_i)\sigma_g$$

Then the efficient frontier portfolios with risk-free lending and borrowing would be the line from R_f through g.

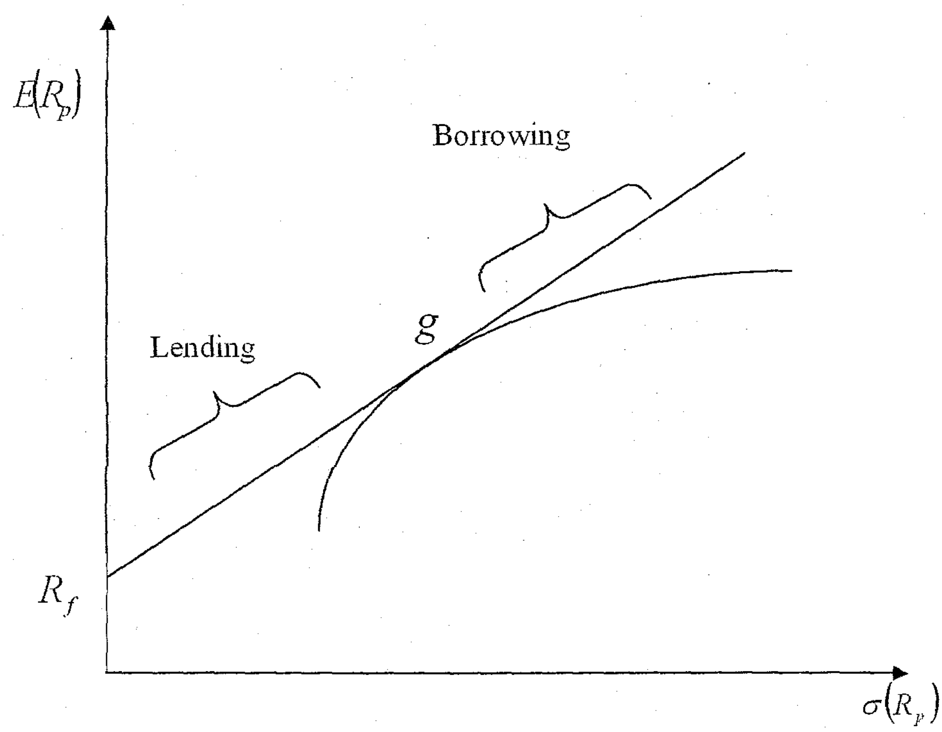

Figure 3.1 Efficient Frontier with riskless lending and borrowing

Derivation of the efficient frontier requires the solution of the following optimization problem of Markowitz. In the universe of $N \geq 2$ assets, define the following :

$$x = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_N \end{pmatrix}, \quad \mu = \begin{pmatrix} \mu_1 \\ \mu_2 \\ \vdots \\ \mu_N \end{pmatrix}, \quad 1 = \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix}, \quad \varnothing = \begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix}, \quad V = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \cdots & \sigma_{1N} \\ \vdots & \sigma_2^2 & \cdots & \sigma_{2N} \\ \vdots & & \ddots & \vdots \\ \sigma_{N1} & \cdots & \cdots & \sigma_N^2 \end{pmatrix}$$

where μ is the expected rate of return whose at least one element is non-zero and V is the symmetric NxN variance-covariance matrix which is positive definite. The expected rate of return and variance of a portfolio are

$$\mu_p = \sum_i x_i \mu_i = x'\mu \quad \text{and} \quad \sigma_p^2 = \sum_i \sum_j x_i x_j \sigma_{ij} = x'Vx$$

The quadratic problem is then

$$\min_{\{x\}} imize \frac{1}{2} x'Vx$$

subject to $\quad x'\mu = \overline{\mu}_p \quad$ (given expected return)

$\quad x'1 = 1 \quad$ (budget constraint)

Forming the Lagrangian $L(x, \lambda_1, \lambda_2)$ with $\lambda_1 > 0$ and $\lambda_2 > 0$, $\overline{x}_p$ is the solution to:

$$\min_{\{x, \lambda_1, \lambda_2\}} imize \quad L = \frac{1}{2} x'Vx + \lambda_1 \left(\overline{\mu}_p - x'\mu\right) + \lambda_2 \left(1 - x'1\right)$$

The solution to λ_1 and λ_2 are

$$\lambda_1 = \frac{\left(C\overline{\mu}_p - A\right)}{D} \qquad \text{and} \qquad \lambda_2 = \frac{\left(B - A\overline{\mu}_p\right)}{D}$$

where $A = 1'V^{-1}\mu$, $B = \mu'V^{-1}\mu$, $C = 1'V^{-1}1$ and $D = BC - A^2$.

Substituting λ_1 and λ_2 in the expression for x^*,

$$x^* = \left(\frac{\left(C\overline{\mu}_p - A\right)}{D}\right)V^{-1}\mu + \left(\frac{\left(B - A\overline{\mu}_p\right)}{D}\right)V^{-1}1$$

gives the unique set of portfolio weights $\{x_1^*,\ldots,x_N^*\}$ for the frontier portfolio having an expected rate of return equaling $\overline{\mu}_p$. Then in the $\sigma_p - \mu_p$ space, the following expression gives the standard deviation of the frontier portfolio

$$\sigma_p = \left[\frac{1}{D}\left(C\mu_p^2 - 2A\mu_p + B\right)\right]^{1/2}$$

When there exists a riskless asset, R_f, the optimization problem becomes

$$\underset{\{x\}}{\min imize}\,\frac{1}{2}x'Vx$$

$$\text{subject to} \qquad x'\mu + \left(1 - x'1\right)R_f = \overline{\mu}_p$$

with no budget constraint.

The solution to x^* is then obtained by the following Lagrangian solution.

$$\underset{\{x,\lambda\}}{\min imize} \qquad L = \frac{1}{2}x'Vx + \lambda\left(\overline{\mu}_p - x'\mu - R_f\left(1 - x'1\right)\right)$$

$$x^* = V^{-1}\left(\mu - R_f\right)\frac{\overline{\mu}_p - R_f}{H}$$

where $H = B - 2AR_f + CR_f^2 > 0$. The standard deviation of this portfolio in the $\sigma_p - \mu_p$ space is then

$$\sigma_p = \left|\left(\mu_p - R_f\right)/\sqrt{H}\right|$$

The tangency portfolio mean and standard deviation are then

$$\mu_t = \frac{B - A\mu_f}{A - C\mu_f} \qquad \sigma_t = \sqrt{H}/\left(A - C\mu_f\right)$$

The Sharpe Ratio, which suggests the reward to risk ratio of the efficient portfolios, is also provided in the analyses as a portfolio performance measure and computed for the tangency portfolios as

$$SR = \frac{\mu_t - \mu_f}{\sigma_t}$$

3.2 Limitations of Mean Variance Portfolio Theory

The Mean-variance theory has been traditionally criticized for its instability and ambiguity. The main limitation comes from its estimation error maximizing nature. A small change in the sample may lead to totally different optimal portfolio solutions.

Depending on statistically estimated information, optimization is up to maximize estimation error. This is because optimization tends to overweight assets with higher expected mean, negative correlation or small variances. Jobson and Korkie (1981) elaborate on this issue. It is also criticized for representitiveness of mean and standard deviation for the investor utility as well as its forecasting ability for financial planning being a one-period estimation framework.

3.3 Stein Estimators

The mentioned limitations have led academics to work on the issue and find ways to minimize the estimation bias inherit in Mean-variance optimization. The main approach involves re-estimation of sample means. Since expected returns and variances have time-varying nature previously evidenced by many researchers, sample means fail to be efficient estimators of the expected returns. In terms of international diversification estimation risk is an important issue as possible gains from international diversification is quite overestimated by the classic optimization. The idea of shrinking sample means towards a common mean, first proposed by Stein , aims to minimize the estimation error in means and improve out-of-sample performance of the optimal portfolios. Then developed by Jorion (1985, 1986) The Stein Estimator enables smoothing of sample means by the minimum variance portfolio mean. The minimum variance portfolio mean is used as the common or grand mean in the estimation since its optimal weights depend on the sample covariance matrix and estimation bias is less pronounced for it. The Stein estimator is then defined as

$$\mu_p = (1-\omega)\mu + \omega \underline{1}\mu_0$$

where μ_p is the expected portfolio return, μ is the sample mean returns, μ_0 is the minimum variance portfolio mean and ω is the shrinkage factor defined as $\omega = \lambda/(T+\lambda)$. The precision parameter lambda is then derived from the data:

$$\lambda = \frac{(N+2)(T-1)}{(\mu-\mu_0\underline{1})^T V^{-1}(\mu-\mu_0\underline{1})(T-N-2)}$$

where T is the sample size, N is the number of assets and V^{-1} is the sample variance-covariance matrix. A high lambda indicates less reliance or confidence on the past data to make an estimate, since then ϖ would get closer to 1 and expected return would tend toward the minimum variance portfolio mean.

3.4 Asset Set Spanning, Intersection and Potential Performance

Jobson and Korkie (1989) introduce an F-test for spanning for financial asset sets and subsets. Spanning test statistic answers the question of mean-variance equivalence of two respective asset sets and the selection of the dominant portfolio among them. An asset subset is said to span the larger asset set if it provides all the mean-variance portfolio opportunities of the larger set. In that case the hyperbolas of the respective asset sets are identical. On the other hand, the marginal potential performance measures the marginal benefit provided by an asset set relative to a subset of it,

$$\Delta P_0 = P_0 - P_{01}$$

where $P_0 = bc - a^2$ is the N asset set potential performance and $P_{01} = b_1 c_1 - a_1^2$ is the N_1 asset subset's potential performance calculated with respect to its minimum variance portfolio. The null hypothesis of the spanning test is zero marginal potential performance $H_0 : P_0 = P_{01}$. The spanning test statistic is an exact F distribution with $2(N - N_1)$ and $2(T - N)$ d.f. if the N_1 asset subset completely spans the N asset set in the mean variance space.

$$\phi_s = \left(\frac{T-N}{N-N_1}\right)\frac{\sqrt{\hat{c}\left(1+\hat{b}_0\right)}-\sqrt{\hat{c}_1\left(1+\hat{b}_{01}\right)}}{\sqrt{\sqrt{\hat{c}_1\left(1+\hat{b}_{01}\right)}}} = \left(\frac{T-N}{N-N_1}\right)\frac{\sqrt{\hat{c}+\hat{P}_0}-\sqrt{\hat{c}_1+\hat{P}_{01}}}{\sqrt{\hat{c}_1+\hat{P}_{01}}}$$

where

$$\begin{aligned}
&\hat{b}_0 = \left(\bar{r}-\bar{r}_0 e\right)' S^{-1}\left(\bar{r}-\bar{r}_0 e\right)\\
&\hat{b}_{01} = \left(\bar{r}_1-\bar{r}_{01} e_1\right)' S_{11}^{-1}\left(\bar{r}_1-\bar{r}_{01} e_1\right)\\
&\textit{and}\\
&\bar{r}_0 = \hat{a}/\hat{c}\\
&\bar{r}_{01} = \hat{a}_1/\hat{c}_1\\
&\hat{P}_0 = \hat{b}\hat{c} - \hat{a}^2\\
&\hat{P}_{01} = \hat{b}_1\hat{c}_1 - \hat{a}_1^{\,2}\\
&\Delta\hat{P}_0 = \hat{P}_0 - \hat{P}_{01}
\end{aligned}$$

In this study the global/regional portfolio including Turkey is defined as N asset set and the global/regional portfolio is defined as N_1, subset of N. The measure investigates whether the N_1 subset of assets span the N set of assets. If the calculated statistic is found to be greater than the required F-value, then the hypothesis of zero marginal potential performance is rejected. Accordingly, it is concluded that inclusion of Turkey improves the performance of the global/regional portfolio.

Asset set intersection in the presence of a riskless asset suggest the slopes of the tangent lines of two asset sets to be equal if the efficient set of the complete asset set and efficient set of the subset had been equal. Given

$$\hat{b}_f = \left(\bar{r} - e\mu_f\right)' S^{-1}\left(\bar{r} - e\mu_f\right)$$
$$\hat{b}_{f1} = \left(\bar{r}_1 - e_1\mu_f\right)' S_{11}^{-1}\left(\bar{r} - e_1\mu_f\right)$$

Two hyperbola should intersect if $\hat{b}_f$ equals $\hat{b}_{f1}$. In this setting the asset set intersection test is an exact F distribution with $(N - N_1)$ and $(T - N)$ d.f. if the N_1 asset subset intersects the N asset set at the same tangency point given μ_f,

$$\phi_f = \left(\frac{T-N}{N-N_1}\right)\frac{\hat{b}_f - \hat{b}_{f1}}{1+\hat{b}_{f1}} = \left(\frac{T-N}{N-N_1}\right)\frac{\hat{P}\Delta_f}{1+\hat{b}_{f1}}$$

where $\hat{P}\Delta_f = \Delta\hat{b} - 2\Delta\hat{a}\mu_f + \Delta\hat{c}\mu_f^2$ gives the implied marginal potential performance. Then the null hypothesis is zero implied marginal potential performance $H_0 : P\Delta_f = 0$. In this study the global/regional portfolio including Turkey is defined as N asset set and the global/regional portfolio is defined as N_1, subset of N. The measure investigates whether the N asset set and the N_1 asset subset intersect the tangency line at the same point. If the calculated statistic is found to be greater than the required F-value, then the hypothesis of zero implied marginal potential performance is rejected. Accordingly, it is concluded that inclusion of Turkey improves the performance of the global/regional portfolio in the presence of the riskless asset.

4. DATA ANALYSIS

The data of this study is collected from MSCI (Morgan Stanley Capital International) website and consists of the monthly return data of MSCI global country indexes for both the developed and the emerging countries. MSCI indexes are chosen for their longer time series history and consistent and up to date index methodology. MSCI country indexes are constructed to represent the 60% of market capitalization of each country and targets 85% industry representation within each sector within each country. MSCI follows a four step index construction methodology. First it lists all the listed equities in a given country and then adjusts market capitalization to reflect the free float available to a non-domiciled investor. The securities are then classified according to their industry after which they are analyzed for their size, liquidity and level of market concentration for inclusion in the index. In the study MSCI global country indexes are preferred not only to maximize the number of countries included but also to present the diversification benefit of Turkish stock market for both local and international investors. The time period of the monthly data under investigation extends from 02:1983 to 02:2003 covering the last 20 years history of stock markets with 240 observations. However, to achieve comparable time series of countries included in the portfolios constructed the full period analyses are started from a closer date whenever needed. There are 22 developed and 26 emerging country stock indexes; a total of 48 country stock indexes in the dataset. The developed countries data consist of the following countries' stock indexes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, and US stock indexes tracked by Morgan Stanley Capital International. The emerging markets data consist of the following countries' stock indexes: Argentina, Brazil, Chile, China, Colombia, Czech, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey, and Venezuela stock indexes tracked by MSCI. All the index values are denominated in US$ and retrieved as raw values which are converted into return values by the following equation

$$\Delta y_t = \frac{y_t - y_{t-1}}{y_{t-1}}$$

Since all indexes used in the analyses are dollar denominated, the currency risk international investors face is already reflected in the returns.

The statistical analysis of time series is done under three headings: stationarity, normality and independence. The full period analyses of the monthly data are respectively given at sections 4.1, 4.2 and 4.3. However, the major part of the crises had relatively short periods on monthly basis for stationarity, and independence tests (maximum monthly 24 observations and 12 observations on average). The findings for crises periods might have been affected by the insufficient number of observations for calculus of the available dataset based on monthly observations. Thus, for crises periods "time series" are assumed to be stationary and not serially correlated.

The descriptive statistics of the monthly and the daily data set are provided below. These statistics include Mean, Median, Maximum, Minimum and Standard Deviation of the individual time series.

Table 4.1 Descriptive Statistics of Developed Markets Data

Developed Markets	*Starting* Date	*# of* Cases	Mean	Median	Max	Min	*Std.* Dev.
Australia	Feb-83	240	0.0077	0.0080	0.1761	-0.4471	0.0669
Austria	Feb-83	240	0.0093	0.0053	0.2791	-0.2341	0.0710
Belgium	Feb-83	240	0.0103	0.0110	0.2621	-0.1920	0.0574
Canada	Feb-83	240	0.0060	0.0084	0.1713	-0.2223	0.0526
Denmark	Feb-83	240	0.0094	0.0090	0.2108	-0.1412	0.0572
Finland	Feb-83	240	0.0171	0.0106	0.3832	-0.2452	0.0958
France	Feb-83	240	0.0115	0.0129	0.2080	-0.1856	0.0618
Germany	Feb-83	240	0.0091	0.0129	0.2005	-0.1781	0.0668
Hong Kong	Feb-83	240	0.0122	0.0069	0.3334	-0.4364	0.0897
Ireland	Feb-88	181	0.0063	0.0092	0.1816	-0.1782	0.0604
Italy	Feb-83	240	0.0093	0.0062	0.3081	-0.1891	0.0734
Japan	Feb-83	240	0.0072	0.0067	0.2418	-0.1942	0.0728
Netherlands	Feb-83	240	0.0103	0.0094	0.1619	-0.1778	0.0530
New Zealand	*Feb-83*	*240*	*0.0077*	*0.0081*	*0.2723*	*-0.3811*	*0.0811*
Norway	Feb-83	240	0.0093	0.0119	0.2174	-0.2993	0.0733
Portugal	Feb-88	181	0.0013	0.0002	0.2841	-0.1624	0.0689
Singapore	Feb-88	181	0.0068	0.0076	0.3986	-0.2179	0.0847
Spain	Feb-83	240	0.0115	0.0091	0.2607	-0.2085	0.0704
Sweden	Feb-83	240	0.0119	0.0140	0.1991	-0.2496	0.0777
Switzerland	Feb-83	240	0.0107	0.0098	0.2295	-0.1780	0.0548
UK	Feb-83	240	0.0082	0.0054	0.1551	-0.2174	0.0535
USA	Feb-83	240	0.0084	0.0115	0.1309	-0.2146	0.0455
Average			0.0092	0.0088	0.2393	-0.2341	0.0677
Max			0.0171		0.3986		0.0958
Min			0.0013			-0.4471	0.0455

Table 4.2 Descriptive Statistics of Emerging Markets Data

Emerging Markets	Starting Date	# of Cases	Mean	Median	Max	Min	Std. Dev.
Argentina	Feb-88	181	0.0238	0.0039	1.0397	-0.4324	0.1837
Brazil	Feb-88	181	0.0232	0.0019	0.7481	-0.6464	0.1772
Chile	*Feb-88*	*181*	*0.0113*	*0.0075*	*0.2058*	*-0.2968*	*0.0797*
China	Feb-93	121	-0.0093	-0.0299	0.4272	-0.2356	0.1151
Colombia	Feb-93	121	0.0016	-0.0041	0.3525	-0.3476	0.1007
Czech	Feb-95	97	0.0053	0.0139	0.2209	-0.2300	0.0895
Egypt	Feb-95	97	0.0016	-0.0033	0.3413	-0.1827	0.0876
Hungary	Feb-95	97	0.0164	0.0146	0.4505	-0.3684	0.1154
India	Feb-93	121	0.0029	-0.0081	0.2362	-0.2249	0.0840
Indonesia	Feb-88	181	0.0116	-0.0018	0.9986	-0.4124	0.1680
Israel	Feb-93	121	0.0027	0.0066	0.2443	-0.2409	0.0845
Jordan	Feb-88	181	-0.0007	-0.0037	0.1260	-0.2343	0.0452
Korea	Feb-88	181	0.0074	-0.0095	0.5908	-0.3413	0.1175
Malaysia	*Feb-88*	*181*	*0.0071*	*0.0105*	*0.2943*	*-0.3621*	*0.0912*
Mexico	Feb-88	181	0.0201	0.0223	0.3346	-0.3699	0.1041
Morocco	Feb-95	97	0.0038	0.0047	0.2023	-0.1259	0.0515
Pakistan	Feb-93	121	0.0026	-0.0121	0.3992	-0.3732	0.1202
Peru	Feb-93	121	0.0093	0.0053	0.3088	-0.2985	0.0872
Philippines	Feb-95	181	0.0044	-0.0005	0.6251	-0.3311	0.1059
Poland	Feb-93	121	0.0220	0.0094	0.8982	-0.3268	0.1634
Russia	Feb-95	97	0.0337	0.0206	1.0064	-0.6053	0.2225
South Africa	Feb-93	121	0.0068	0.0116	0.2826	-0.2715	0.0819
Taiwan	Feb-88	181	0.0105	-0.0017	0.4509	-0.3281	0.1240
Thailand	Feb-88	181	0.0064	0.0018	0.6282	-0.3452	0.1268
Turkey	Feb-88	181	0.0195	-0.0080	0.9923	-0.4541	0.2034
Venezuela	Feb-93	121	0.0053	-0.0096	0.3715	-0.4428	0.1384
Average			0.0096	0.0016	0.4914	-0.3396	0.1180
Max			0.0337		1.0397		0.2225
Min			*-0.0093*			*-0.6464*	*0.0452*

The descriptive statistics of the monthly data reveal that consistent with the theory emerging markets have provided higher return at the expense of higher volatility. On average emerging markets have had a higher return of 0.96% and a higher volatility of 11.8% compared to developed markets, which have had on average a return of 0.91% and a volatility of 6.74%. The monthly means for the developed markets, range from 1.3% rate of return for Portugal to 1.71% for Finland, while the standard deviations range from 4.55% for US to 9.58% for Finland. It can be said that Finland's higher return is associated with higher volatility. However, among the developed markets US has the lowest standard deviation despite its higher return compared to Portugal. This fact may be attributed to the size, depth and the longer history of the US stock market. Finland, Hong Kong, Italy and Singapore had respectively extreme positive returns of 38.32%, 33.34%, 30.81% and 33.81% while Australia, Hong Kong and Singapore had extreme negative returns of -44.71%, -43.64%, and -41.43%, respectively. On the other hand, the monthly means of the emerging markets range from -0.93% for China to 3.37% for Russia, while the standard deviations range from 4.52% for Jordan to 22.25% for Russia. Argentina, Russia, Indonesia and Turkey had positive extreme returns of respectively 103.97%, 100.64%, 99.86% and 99.23% while Brazil and Russia had negative extreme returns of -64.64% and -60.53% respectively. Turkey on average had a 1.95% rate of return and 20.34% standard deviation, while it had positive and negative extreme returns of 99.86% and -45.41%, respectively. These statistics provide sufficient evidence that emerging markets compared to developed markets display extraordinary returns, extraordinary volatility and thus extraordinary risk.

4.1 Stationarity Assumption:

A series y_t is said to be a time series when it displays a discrete time continuous process and the random variable y is associated with the value that it takes at time t. Time series may be composed of both stochastic and deterministic components.

Considering a series with a deterministic trend and a stochastic white noise component as follows

$$y_t = \alpha + \beta t + \varepsilon_t$$

the series is called covariance-stationary if $|\beta| < 1$. Then the expectation and variance of the series will be constant at every date t and autocovariance will depend only on the lag.

When a series is said to be 'stationary', it is meant weak form stationarity, which is also called covariance-stationarity. Strict stationarity is a stronger form of stationarity, where the whole joint distribution is independent of the date, which it is measured and depends only on the lag.

Autoregressive model of order 1, the AR(1) model is a simple example of a stationary time series. Considering an AR(1) model with a constant term,

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t$$

where $\varepsilon_t \sim i.i.d.(0, \sigma^2)$, the model will have constant mean and variance only if $|\beta| < 1$, and then it will define a stationary process. When $\beta = 1$, the AR(1) process will be having a unit root and the equation becomes

$$y_t = \alpha + y_{t-1} + \varepsilon_t$$

which is called a *random walk with a drift*. When there is unit root, y no more has unconditional mean and variance and thus y series is then said to be nonstationary. Finally when $\beta > 1$, the series are said to be explosive series.

The efficient market hypothesis implies that the best forecast of the price on any future date is simply the price today. So the efficient markets hypothesis assume prices to random walk. As random walk processes are nonstationary processes, testing the value of β in the equation $y_t - \beta y_{t-1} = \varepsilon_t$ would show if the time series, y_t follows a random walk.

4.1.1 Unit Root Tests

In the unit root tests the null hypothesis that a time series is non-stationary is tested against the alternative that it is stationary. So null hypothesis is $H_0 : \beta = 1$ that there is unit root and y_t is a random walk, while the alternative hypothesis is $H_1 : \beta < 1$ that the series are stationary and y_t is not a random walk. The main test used in the literature to test for unit root is the Dickey-Fuller test. In this test y_{t-1} is subtracted from both sides of the equation and the following equation is estimated

$$\Delta y_t = \alpha + \gamma y_{t-1} + \varepsilon_t$$

where ε_t is assumed to be white noise and $\gamma = \beta - 1$. Thus the null hypothesis is $H_0 : \gamma = 0$ that y_t is a random walk, while the alternative is the $H_1 : \gamma < 0$. The null hypothesis will be rejected if the t statistics is greater than the critical value, calculated by McKinnon (1990). The DF test can be estimated to test unit root in three ways, which are (i) y_t is a random walk, (ii) y_t is a random walk with a drift and (iii) y_t is a random walk with a drift and a trend.

However, if the series are correlated of higher order than AR(1), then DF test will not be valid as the assumption of white noise disturbance will be violated. The Augmented Dickey-Fuller test overcomes this problem via assuming that y series follows an AR(p) process. Thus ADF makes a parametric correction by adding lagged differenced dependent variables to the equation in order to remove the autocorrelation in the error terms. The equation becomes

$$\Delta y_t = \alpha + \gamma y_{t-1} + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

where p denotes the number of lags. The ADF is then tested for the same hypotheses of DF and the null hypothesis is rejected if the t statistics is smaller than the critical McKinnon values.

4.1.2 Interpretation of the Findings

The dataset is analyzed for its time series properties via Dickey-Fuller and Augmented Dickey-Fuller test. Primarily the Dickey-Fuller test is employed to the monthly data of 48 stock market indexes in the dataset. The Dickey-Fuller test results show that all time series are stationary at the 1% critical value as they all have significantly smaller t-values from their respective required critical values. Thus, the null hypothesis of random walk is rejected for all the 48 stock markets in the dataset. None of the markets have unit root.

The Durbin-Watson test, which looks for the autocorrelation in the residuals, is also calculated. The statistics evidence that there is no serial correlation in the residuals as all the statistic scores is either 2 or very close to 2. Tables below provide the Dickey-Fuller Test results and Durbin-Watson test statistics for the monthly data.

Table 4.3 Unit root tests of developed markets data - Dickey-Fuller

Developed Markets	ADF Test Statistic	1% Critical Value*	Durbin-Watson Statistic
Australia	-16.4884	-3.4592	2.0164
Austria	-13.9300	-3.4592	1.9930
Belgium	-14.9814	-3.4592	1.9870
Canada	-14.1985	-3.4592	1.9913
Denmark	-17.3046	-3.4592	2.0031
Finland	-13.5241	-3.4592	1.9917
France	-15.6200	-3.4592	1.9960
Germany	-15.7690	-3.4592	1.9942
Hong Kong	-15.5039	-3.4592	1.9898
Ireland	-13.9582	-3.4678	1.9989
Italy	-14.8533	-3.4592	2.0016
Japan	-14.8247	-3.4592	1.9978
Netherlands	-17.2268	-3.4592	1.9591
New Zealand	-15.1307	-3.4592	1.9934
Norway	-15.1631	-3.4592	1.9929
Portugal	-13.1224	-3.4678	1.9533
Singapore	-13.3653	-3.4678	1.9970
Spain	-14.4176	-3.4592	1.9827
Sweden	-14.9032	-3.4592	1.9874
Switzerland	-15.2546	-3.4592	1.9910
UK	-16.1447	-3.4592	2.0006
USA	-15.6662	-3.4592	1.9926

Table 4.4 Unit root tests of emerging markets data - Dickey-Fuller

Emerging Markets	ADF Test Statistic	1% Critical Value*	Durbin-Watson Statistic
Argentina	-13.0384	-3.4678	1.9981
Brazil	-16.1400	-3.4678	1.9854
Chile	-11.4724	-3.4678	1.9639
China	-9.9575	-3.4856	1.9825
Colombia	-10.0811	-3.4856	1.9904
Czech	-10.1574	-3.4993	2.0099
Egypt	-8.2097	-3.4993	2.0329
Hungary	-10.1941	-3.4993	2.0162
India	-9.9925	-3.4856	2.0140
Indonesia	-11.5078	-3.4678	1.9681
Israel	-10.8077	-3.4856	1.9733
Jordan	-12.8581	-3.4678	2.0007
Korea	-12.4223	-3.4678	1.9770
Malaysia	-10.7072	-3.4678	2.0362
Mexico	-12.3070	-3.4678	2.0165
Morocco	-8.7843	-3.4993	1.9950
Pakistan	-11.1898	-3.4856	1.9831
Peru	-9.0634	-3.4856	1.9497
Philippines	-10.9599	-3.4678	2.0081
Poland	-10.1129	-3.4856	2.0120
Russia	-8.9690	-3.4993	1.9831
South Africa	-10.5068	-3.4856	1.9838
Taiwan	-11.9015	-3.4678	2.0045
Thailand	-12.0970	-3.4678	2.0009
Turkey	-12.8710	-3.4678	1.9898
Venezuela	-11.6312	-3.4856	1.9882

Although the DF tests provide significant evidence that all series are stationary and Durbin Watson test prove that there is no serial correlation in the residuals, ADF tests are also employed with three lags for the monthly data. The results confirm the findings of DF and DW tests assuring the researcher that there is no autocorrelation in the series. The results of the unit root tests for monthly data evidence that none of the country indexes has a unit root. Thus the null hypothesis of random walk is rejected and all series are found to be stationary. The following tables summarize the ADF test values and respective Durbin-Watson statistics for the monthly data.

Table 4.5 Unit root tests of developed markets data – ADF

Developed Markets	ADF Test Statistic	1% Critical Value*	Durbin-Watson Statistic
Australia	*-8.5170*	*-3.4595*	*2.0091*
Austria	-6.8301	-3.4595	2.0282
Belgium	-7.7240	-3.4595	1.9850
Canada	-8.7682	-3.4595	1.9901
Denmark	-6.8299	-3.4595	1.9983
Finland	-7.7942	-3.4595	1.9658
France	-6.8548	-3.4595	1.9954
Germany	-6.7757	-3.4595	1.9815
Hong Kong	-8.9305	-3.4595	2.0093
Ireland	-7.2325	-3.4684	1.9839
Italy	-6.5002	-3.4595	2.0123
Japan	-7.1357	-3.4595	2.0000
Netherlands	-8.0935	-3.4595	1.9671
New Zealand	-7.3124	-3.4595	2.0011
Norway	-8.3525	-3.4595	2.0035
Portugal	*-7.5428*	*-3.4684*	*2.0016*
Singapore	-7.0331	-3.4684	1.9988
Spain	-7.7816	-3.4595	1.9889
Sweden	-7.6553	-3.4595	1.9901
Switzerland	-7.9384	-3.4595	1.9837
UK	-7.9432	-3.4595	1.9936
USA	-8.4508	-3.4595	1.9735

Table 4.6 Unit root tests of emerging markets data – ADF

Emerging Markets	ADF Test Statistic	1% Critical Value*	Durbin-Watson Statistic
Argentina	-6.6395	-3.4684	1.9772
Brazil	-8.3615	-3.4684	2.0001
Chile	-6.8397	-3.4684	1.9943
China	-7.2367	-3.4870	2.0144
Colombia	-5.4471	-3.4870	2.0161
Czech	-6.2036	-3.5015	1.9991
Egypt	-4.0466	-3.5015	1.9704
Hungary	-5.3110	-3.5015	1.9767
India	-5.6916	-3.4870	1.9611
Indonesia	-6.2152	-3.4684	2.0083
Israel	-5.1478	-3.4870	1.9857
Jordan	-5.6072	-3.4684	1.9991
Korea	-6.7126	-3.4684	1.9757
Malaysia	-5.8312	-3.4684	1.9882
Mexico	-6.3649	-3.4684	1.9180
Morocco	-4.6130	-3.5015	1.9665
Pakistan	-5.1511	-3.4870	1.9899
Peru	-6.1885	-3.4870	2.0280
Philippines	-6.4237	-3.4684	1.9969
Poland	-4.9654	-3.4870	1.9563
Russia	-5.1160	-3.5015	1.9423
South Africa	-7.0436	-3.4870	2.0363
Taiwan	-6.4652	-3.4684	2.0062
Thailand	-7.9614	-3.4684	2.0498
Turkey	-5.8319	-3.4684	1.9794
Venezuela	-6.1946	-3.4870	1.9937

4.2 Normality Assumption:

From the literature review, it is seen that different than developed markets the emerging markets data is highly non-normal exhibiting skewness and kurtosis. Skewness shows the asymmetry of the series' distribution around its mean. Positive skewness implies a long right tail while negative skewness implies a long left tail in the distribution. Kurtosis on the other hand is a measure of the flatness of the distribution.

The normality assumption requires the skewness, τ, the third central moment to equal zero and kurtosis, κ, the fourth central moment to equal three for a distribution to be assumed normal.

$$\tau = E\left[\left(X - \mu^3\right)\right] / \sigma^3$$
$$\kappa = E\left[\left(X - \mu^4\right)\right] / \sigma^4$$

As the Kurtosis should equal three, normally 3 is subtracted from the Kurtosis value and excess kurtosis is used in the analysis. Thus, if the excess kurtosis exceeds three the distribution is said to have a fat tail and is called leptokurtic. In this case the probability of extreme events (values) to occur is higher than the probability of extreme events to occur in a normal distribution.

4.2.1 Normality Tests

The normality assumption is tested via Jarque-Bera and Kolmogorov-Smirnov normality tests. The Jarque-Bera test measures whether the series are normally distributed, thus the null hypothesis is that the series are normally distributed. The statistic is calculated as

$$JB = \frac{N-k}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)$$

where skewness and excess kurtosis are computed as

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^3$$

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^4$$

and k is the number of coefficients estimated to create the series. The test statistic is distributed as chi-square with 2 degrees of freedom. If the reported probability value exceeds the chosen significance level, the assumption of normality is accepted. That is insignificant Jarque-Bera test statistic implies a normal distribution. The chosen significance level for this study is 5%.

Kolmogorov-Smirnov tests the null hypothesis that "data is normally distributed". A low significance value of less than 0.05 implies a non-normal distribution. This is the basic statistic used in the study to check for normality assumption. In the analysis 0.200 is the lower bound of true significance for this test.

If the number of observations is less than 50, then Shapiro-Wilk test is also utilized which also tests the hypothesis of normal distribution. This time normality is rejected if the results are insignificant.

4.2.2 Interpretation of the Findings

The normality statistics are provided below for the monthly data. These statistics include skewness, kurtosis, excess kurtosis values and results of the Jarque-Bera and Kolmogorov-Smirnov normality tests computed for the 48 individual country index time series.

Table 4.7 Normality statistics of developed markets data

				Jarque-Bera		Kolmogorov-Smirnov		
Developed *Markets*	*Skew.*	*Kurt.*	Exc. *Kurt.*	*Stat*	*Prob*	*Stat*	*df*	*Sig.*
Australia	-1.23	11.07	8.07	711.63	0.000	0.056	240	0.062
Austria	0.41	5.26	2.26	57.79	0.000	0.070	240	0.007
Belgium	0.41	5.92	2.92	91.86	0.000	0.057	240	0.060
Canada	-0.40	4.80	1.80	38.96	0.000	0.056	240	0.063
Denmark	0.09	3.27	0.27	1.01	0.602	0.052	240	0.2*
Finland	0.43	3.27	0.27	28.19	0.000	0.052	240	0.2*
France	-0.03	3.32	0.32	1.02	0.600	0.043	240	0.2*
Germany	-0.27	3.44	0.44	4.93	0.085	0.063	240	0.022
Hong Kong	-0.33	6.29	3.29	112.97	0.000	0.062	240	0.026
Ireland	-0.04	3.92	0.92	6.43	0.040	0.073	181	0.020
Italy	0.51	3.74	0.74	15.82	0.000	0.049	240	0.2*
Japan	0.42	3.59	0.59	10.35	0.006	0.050	240	0.2*
Netherlands	-0.32	4.11	1.11	16.30	0.000	0.051	240	0.2*
New Zealand	-0.08	5.58	2.58	66.89	0.000	0.057	240	0.057
Norway	-0.49	4.48	1.48	31.71	0.000	0.033	240	0.2*
Portugal	0.58	4.67	1.67	31.20	0.000	0.052	181	0.2*
Singapore	0.38	5.79	2.79	62.86	0.000	0.083	181	0.004
Spain	0.27	4.10	1.10	14.96	0.001	0.040	240	0.2*
Sweden	-0.25	3.18	0.18	2.90	0.235	0.038	240	0.2*
Switzerland	0.04	4.47	1.47	21.68	0.000	0.049	240	0.2*
UK	-0.04	3.99	0.99	9.80	0.007	0.056	240	0.069
USA	-0.55	5.06	2.06	54.79	0.000	0.058	240	0.051

The Jarque-Bera test statistic provide interesting results. In conflict with the literature a majority of the developed markets is found to display non-normal distributions. Except for the Denmark, France, Germany, and Sweden all the remaining developed countries had very high and definitely significant Jarque-Bera test statistics. On the other hand, Kolmogorov-Smirnov test provides sufficient evidence to accept the assumption of normal distribution for a majority of developed markets. Kolmogorov-Smirnov test results show that except Austria, Belgium, Germany, Hong Kong, Ireland and Singapore the developed markets have normal distributions. However, Jarque-Bera test suggests that Germany has a normal distribution. Although Kolmogorov-Smirnov is chosen as the primary test for checking normality assumption, Germany is assumed to be normal according to this finding. The investigation of the histogram charts for these markets reveal that the main cause of non-normality is the excess kurtosis observed in the time series. This excess kurtosis comes from the extreme positive or extreme negative returns in the series. If these extreme returns would be dropped out from the dataset, all the developed markets would have normal distributions. However, these outlier values are believed to have valuable information and thus are kept in the study.

Table 4.8 Normality statistics of emerging markets data

				Jarque-Bera		Kolmogorov-Smirnov		
Emerging *Markets*	*Skew.*	*Kurt.*	Exc. *Kurt.*	*Stat*	*Prob*	*Stat*	*df*	*Sig.*
Argentina	1.71	10.26	7.26	485.94	0.000	0.149	181	0.000
Brazil	0.56	6.44	3.44	98.38	0.000	0.096	181	0.000
Chile	0.01	3.58	0.58	2.51	0.284	0.057	181	0.2*
China	0.71	3.98	0.98	14.85	0.001	0.101	121	0.004
Colombia	0.27	4.96	1.96	20.80	0.000	0.082	121	0.043
Czech	0.13	2.83	-0.17	0.41	0.815	0.066	97	0.2*
Egypt	0.92	5.57	2.57	40.23	0.000	0.107	97	0.008
Hungary	0.58	6.26	3.26	48.37	0.000	0.092	97	0.042
India	0.13	2.85	-0.15	0.47	0.791	0.064	121	0.2*
Indonesia	1.85	11.84	8.84	692.44	0.000	0.141	181	0.000
Israel	0.00	3.68	0.68	2.35	0.308	0.063	121	0.2*
Jordan	-0.41	6.81	3.81	114.35	0.000	0.085	181	0.003
Korea	1.00	6.76	3.76	136.66	0.000	0.090	181	0.001
Malaysia	-0.33	5.17	2.17	38.96	0.000	0.058	181	0.2*
Mexico	-0.17	4.41	1.41	15.84	0.000	0.049	181	0.2*
Morocco	0.53	4.27	1.27	11.07	0.004	0.044	97	0.2*
Pakistan	0.28	4.06	1.06	7.28	0.026	0.092	121	0.013
Peru	0.35	4.89	1.89	20.43	0.000	0.090	121	0.018
Philippines	1.24	9.30	6.30	345.48	0.000	0.085	181	0.003
Poland	1.57	9.11	6.11	237.71	0.000	0.113	121	0.001
Russia	0.72	6.15	3.15	48.50	0.000	0.111	97	0.005
South Africa	-0.43	4.78	1.78	19.79	0.000	0.076	121	0.087
Taiwan	0.52	4.17	1.17	18.66	0.000	0.062	181	0.090
Thailand	1.08	7.80	4.80	208.89	0.000	0.087	181	0.002
Turkey	1.13	6.03	3.03	107.66	0.000	0.087	181	0.002
Venezuela	0.08	4.48	1.48	11.23	0.004	0.090	121	0.018

The emerging markets on the other hand are found to possess non-normal distributions as expected. The Jarque-Bera test suggests that only Chile, Czech, India and Israel markets have normal distributions. Kolmogorov-Smirnov confirming these findings furthermore shows that Malaysia, Mexico, Morocco and South Africa also have normal distributions at the 5% significance level.

4.3 Independence Assumption:

Autocorrelation, defined as the covariance of disturbance terms not being equal to zero, has to be checked to verify the independence assumption. Autocorrelation of a series y is estimated by

$$r_k = \frac{\sum_{t=k+1}^{T}(y_t - \bar{y})(y_{t-k} - \bar{y}_{t-k})/(T-k)}{\sum_{t=1}^{T}(y_t - \bar{y})^2/T}$$

where $\bar{y}$ is the sample mean of series y, k is the number of lags, T is the number of observations and $\bar{y}_{t-k} = \sum_{t=k+1}^{T} y_{t-k}/(T-k)$. If series are first order correlated then r_1 has a value other than zero.

The correlogram plots of autocorrelation provide a visual inspection of the data. If the autocorrelation is within the two standard error bounds, computed as $\pm 2/\sqrt{T}$, then the series are said to be independent that is there is no serial autocorrelation at the 5% significance level.

4.3.1 Autocorrelation Tests

Ljung-Box Q-statistics and Durbin-Watson test check the autocorrelation. The Ljung-Box Q-statistics tests for the null hypothesis of no autocorrelation up to k lags and computed as

$$Q_{LB} = T(T+2)\sum_{j=1}^{k}\frac{r_j^2}{T-j}$$

where r_j is the *j-th* autocorrelation. Q is distributed as chi-square with j degrees of freedom. If the autocorrelations and partial autocorrelations at all lags are close to zero and all Q-statistics are insignificant with large probability values, then there is no serial correlation in the residuals. Ljung-Box is preferred for higher order serial correlation while DW may test only first-order serial correlation. Another drawback of DW is; it fails when there is lagged dependent variable on the right-hand side of the equation. The Durbin-Watson statistic checks for the serial correlation in the residuals by testing the null hypothesis of $\rho = 0$ in the equation

$$u_t = \rho u_{t-1} + \varepsilon_t$$

The statistics is computed as

$$DW = \sum_{i=2}^{T} \left(\hat{\varepsilon}_i - \hat{\varepsilon}_{i-1}\right)^2 \Big/ \sum_{i=1}^{T} \hat{\varepsilon}_i^2$$

where T is the number of observations. If DW is around two, then there is no serial correlation. If it is less than 1.5, then there is strong evidence of positive serial correlation. In the case that it is greater than 2 up to 4, series are negatively serially correlated.

4.3.2 Interpretation of the Findings

The Q-statistics are computed for the monthly data up to 15 lags. The results of the tests for the monthly data provide sufficient evidence to accept the null hypothesis of no serial correlation in the residuals for the developed markets and for the majority of emerging markets except for Malaysia, Peru, Philippines, and Thailand. Malaysia is found to have autocorrelation at the first three lags while Peru had autocorrelation at the 7th, 8th, 9th, 14th and 15th lags. Philippines displayed autocorrelation at 1st lag. Thailand had autocorrelation at lags from 9 to 13. However, there is no significant pattern of autocorrelation and the visual inspection of the correlograms of these markets does not support the low significance values of the Q-statistics leading to the rejection of no serial correlation hypothesis. The Durbin-Watson test results provided at the stationarity section also fail to reject the hypothesis of no serial correlation in the residuals that would bias the independence assumption. Therefore, the monthly data is assumed to have no serial correlation in the residuals. The autocorrelation tests for the monthly data are provided in the Appendix A.

5. TURKEY VS. GLOBAL PORTFOLIOS IN THE ABSENCE OF RISKLESS ASSET

In this chapter the aim of the researcher is to investigate the international diversification potential of Turkish stock market within global portfolios in the absence of a risk-free rate. In this respect global portfolios are constructed from the MSCI country index data. These portfolios include Developed Markets, Emerging Markets, and World portfolio. Turkish stock market is then added to these portfolios in order to investigate how much risk reduction it provides.

5.1 Developed Markets

In this section the mean-variance theory is implemented to a portfolio of developed markets. The aim is to see the risk-return characteristics of these markets and the diversification benefit of a portfolio consisting of only developed markets. The portfolio is composed of the MSCI country indexes of the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, and US. The monthly dollar return data, whose distributional and time series properties meet the mean-variance theory assumptions, is used in the analysis. The time period extends from 1988:02 to 2003:02 covering the last 15 years of stock markets. Although developed markets have longer histories the analysis starts from 1988:02 in order to have a comparable time series length with Turkey. In the construction of the efficient frontier portfolios short-selling is allowed. The examination of the correlation matrix shows relatively lower correlations of Turkey with the developed markets. The correlation matrix is provided in Table 5.1 in the Appendix B. The minimum variance portfolio mean and standard deviation are found to be 0.004403 and 0.033509, respectively. The relevant standard deviations for the developed markets portfolio ranged from a low of 0.033 to a maximum of 0.047 for the given expected returns. The inclusion of Turkey in the DM portfolio produces the following results. The minimum variance portfolio mean and standard deviation are found to be 0.004426 and 0.033507, respectively.

Table 5.2 Developed Markets including Turkey Minimum Variance Portfolio

	DM+T	DM
Minimum Variance Portfolio Mean	0.004426	0.004403
Minimum Variance Portfolio Standard Deviation	0.033507	0.033508

A quick comparison of the two portfolios reveals that adding Turkey to the international portfolio of developed markets slightly increased the minimum variance portfolio's mean while decreasing the standard deviation. The risk reduction potential of Turkish stock market can be more easily observed from the following table and graph. For the given expected mean values, adding Turkish stock market reduces the standard deviation of the portfolio slightly.

Table 5.3 Change in St. Dev. of Developed Markets Portfolio

Mean	St. Dev. DM+Turkey	St.Dev. DM	Change in St. Dev.
0.000	0.036322	0.036387	0.000064
0.001	0.035168	0.035256	0.000088
0.002	0.034270	0.034391	0.000121
0.003	0.033648	0.033812	0.000165
0.004	0.033317	0.033534	0.000217
0.005	0.033286	0.033564	0.000278
0.006	0.033556	0.033901	0.000345
0.007	0.034121	0.034537	0.000416
0.008	0.034964	0.035455	0.000490
0.009	0.036068	0.036634	0.000566
0.010	0.037409	0.038050	0.000641
0.011	0.038962	0.039677	0.000715
0.012	0.040704	0.041491	0.000787
0.013	0.042611	0.043468	0.000858
0.014	0.044661	0.045588	0.000926
0.015	0.046837	0.047830	0.000993

The below graph depicts the two frontiers visually where a slight leftward shift is observed in the efficient frontier after the inclusion of Turkey in the portfolio.

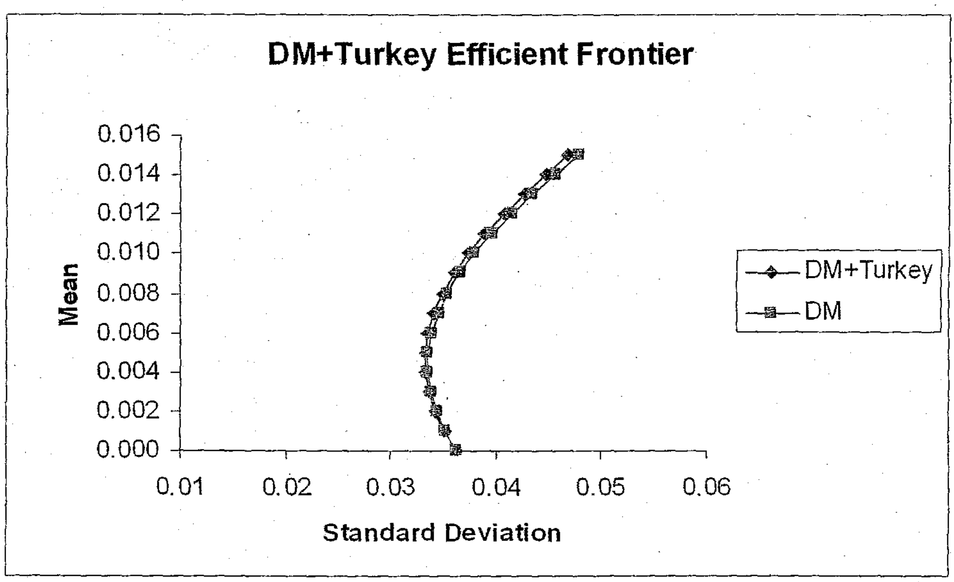

Figure 5.1 Developed Markets including Turkey Efficient Frontier

The significance of this shift is explored via the spanning test of Jobson and Korkie.

Table 5.4 Developed Markets+Turkey Spanning Analysis

Spanning Test Statistic Parameters	
T	181
N	23
N_1	22
c	903.8601
c_1	890.5988
Potential Performance	
P_0	89.8805
P_{01}	85.8501
Marginal potential performance	**4.0303**
Spanning test statistic	**1.3928**

The spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Therefore, it is concluded that over the full length history of 15 years Turkish stock market fails to provide risk reduction in the set of Developed Markets portfolio. However, it is not observed to worsen the performance of the portfolio either. Turkey's contribution to the Developed Markets portfolio is negligible.

5.2 Emerging Markets Portfolio

In this section an international portfolio of securities from emerging markets (EM) is constructed. The countries included in this portfolio are Argentina, Brazil, Chile, China, Colombia, Czech, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Venezuela. The monthly dollar returns data is used in the analysis. The time period extends from 1995:02 to 2003:02. This time period is shorter compared to developed markets. However, this is due to the shorter history of emerging stock markets. In the construction of the efficient portfolios short-selling is allowed in the analysis. The correlation matrix shows that Turkey had relatively higher correlations with Brazil, Chile, Israel, Korea, Mexico, Poland, Russia, South Africa and Taiwan while having correlations less than 0.4 with the rest. The correlation matrix is provided in the Table 5.4 in Appendix B. The results show that the minimum variance portfolio mean and standard deviation are -0.000706 and 0.024278, respectively. Interestingly, emerging markets minimum variance portfolio had negative return over the period of 1995:02-2003:02. This is probably due to the global crisis of Asia and Russia experienced during 1997-1998, which had heavily affected the emerging markets causing very sharp drops in the returns. For the given expected means the standard deviation ranged from 0.0243 to 0.0402. Turkish stock market is then added to see if Turkish stock market furthermore provides risk reduction among the set of emerging market assets. Under these conditions emerging markets including Turkey portfolio produced the following results.

Table 5.6 Emerging Markets including Turkey Minimum Variance Portfolio

	EM+T	EM
Minimum Variance Portfolio Mean	-0.000953	-0.000705
Minimum Variance Portfolio Standard Deviation	0.023846	0.024277

It is seen that addition of Turkey not only decreases the minimum variance portfolio's mean but also its standard deviation. Turkey is observed to provide no significant risk reduction to the Emerging Markets portfolio. This is possibly due to the higher correlation thus higher covariance of Turkish stock market with the emerging markets compared to developed markets.

Table 5.7 Change in St. Dev. of Emerging Markets Portfolio

Mean	St. Dev. EM+Turkey	St. Dev. EM	Change in St. Dev.
-0.007	0.026978	0.027643	0.000665
-0.006	0.026067	0.026702	0.000635
-0.005	0.025297	0.025898	0.000602
-0.004	0.024679	0.025244	0.000565
-0.003	0.024225	0.024751	0.000526
-0.002	0.023946	0.024429	0.000483
-0.001	0.023846	0.024285	0.000439
0.000	0.023929	0.024323	0.000394
0.001	0.024192	0.024540	0.000348
0.002	0.024630	0.024934	0.000304
0.003	0.025233	0.025495	0.000262
0.004	0.025990	0.026212	0.000222
0.005	0.026888	0.027074	0.000186
0.006	0.027913	0.028067	0.000153
0.007	0.029053	0.029177	0.000124
0.008	0.030293	0.030392	0.000099
0.009	0.031622	0.031700	0.000077
0.010	0.033030	0.033089	0.000059
0.011	0.034507	0.034551	0.000044
0.012	0.036044	0.036075	0.000031
0.013	0.037634	0.037655	0.000021
0.014	0.039270	0.039284	0.000013
0.015	0.040948	0.040955	0.000008

The graph below provides the efficient frontiers of the respective portfolios where the estimated leftward shift is almost impossible to detect.

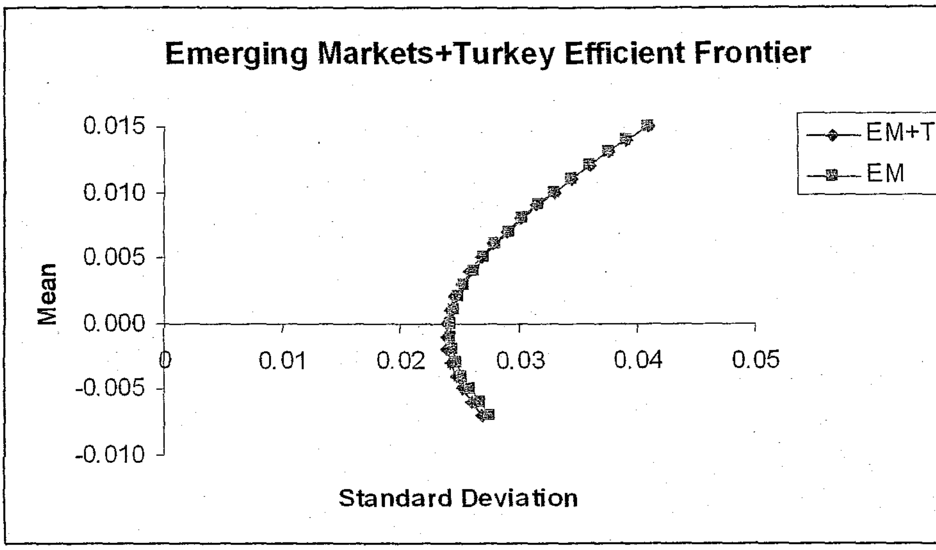

Figure 5.2 Emerging Markets including Turkey Efficient Frontier

The statistical significance analysis of this very small change confirms that this change is in fact a sampling artifact rather than a significant reduction in risk of the portfolio.

Table 5.8 Emerging Markets+Turkey Spanning Analysis

Spanning Test Statistic Parameters	
T	97
N	26
N_1	25
c	1758.591
c_1	1696.644
Potential Performance	
P_0	403.9342
P_{01}	384.6904
Marginal potential performance	19.2437
Spanning test statistic	1.37158

Although inclusion of Turkey produces 19.2 marginal potential performance, the spanning test statistic fails to reject the null hypothesis at the 1% level. Emerging markets portfolio spans the Emerging markets including Turkey portfolio. It is concluded that Turkey fails to provide significant risk reduction in the Emerging markets portfolio.

5.3 World Portfolio

This portfolio is constructed from the monthly dollar returns of all developed and emerging markets' stock indices except Turkey. The countries included in this portfolio are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, UK, and US from developed markets sample and Argentina, Brazil, Chile, China, Colombia, Czech, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Venezuela from emerging markets sample. The time period investigated extends from 1995:02 to 2003:02. In the construction of the efficient frontier short-selling is allowed. The correlation matrix is provided in the Table 5.9 in Appendix B. The minimum variance portfolio mean and standard deviation are found to be 0.0007 and 0.01669, respectively while the standard deviation ranged from 0.01669 to 0.0273.

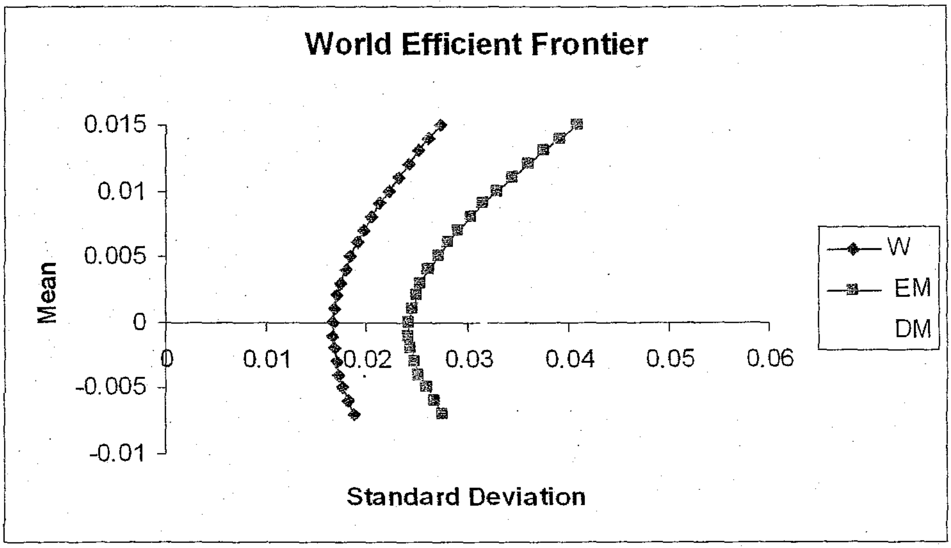

Figure 5.3 World Portfolio Efficient Frontier

The visual inspection of the above graph reveals that emerging markets portfolio adds significant risk diversification benefit to a portfolio solely composed of developed markets. Consistent with the theory emerging markets' low correlation with the developed markets lead to lower standard deviation for the given expected means. For the expected return of 0.015, the developed markets portfolio had approximately 4.7% standard deviation and emerging markets portfolio had 4% standard deviation while the World portfolio consisting of both developed and emerging markets assets had only 2.7% standard deviation which is considerably lower compared to both portfolios. Then Turkey is added to the above designed portfolio of world markets. The objective is to analyze the risk reduction property of Turkish stock market to a World market portfolio. Inclusion of Turkey in the World portfolio produced the following results.

Table 5.10 World including Turkey Minimum Variance Portfolio

	W+T	W
Minimum Variance Portfolio Mean	-0.001675	-0.000725
Minimum Variance Portfolio Standard Deviation	0.015806	0.016690

It is observed that inclusion of Turkey in the World portfolio decreases both the mean and the standard deviation of the minimum variance portfolio. However, the decrease in standard deviation is much more pronounced compared to the decrease in mean. The following table displays the decrease in risk of the portfolio provided by addition of Turkish stock market to the World portfolio.

Table 5.11 Change in St. Dev. of World Portfolio

Mean	St. Dev. W+Turkey	St. Dev. W	Change in St. Dev.
-0.007	0.017337	0.018775	0.001438
-0.006	0.016832	0.018181	0.001349
-0.005	0.016420	0.017675	0.001255
-0.004	0.016110	0.017264	0.001155
-0.003	0.015906	0.016956	0.001050
-0.002	0.015813	0.016755	0.000942
-0.001	0.015832	0.016666	0.000834
0.000	0.015965	0.016691	0.000726
0.001	0.016207	0.016829	0.000622
0.002	0.016554	0.017077	0.000524
0.003	0.016999	0.017431	0.000432
0.004	0.017535	0.017885	0.000349
0.005	0.018154	0.018430	0.000276
0.006	0.018848	0.019060	0.000211
0.007	0.019609	0.019765	0.000156
0.008	0.020429	0.020539	0.000110
0.009	0.021302	0.021374	0.000073
0.010	0.022221	0.022263	0.000043
0.011	0.023180	0.023200	0.000019
0.012	0.024176	0.024179	0.000003
0.013	0.025203	0.025195	-0.000008
0.014	0.026259	0.026244	-0.000014
0.015	0.027339	0.027323	-0.000016

The visual inspection of efficient frontier shows that addition of Turkey slightly decreases risk.

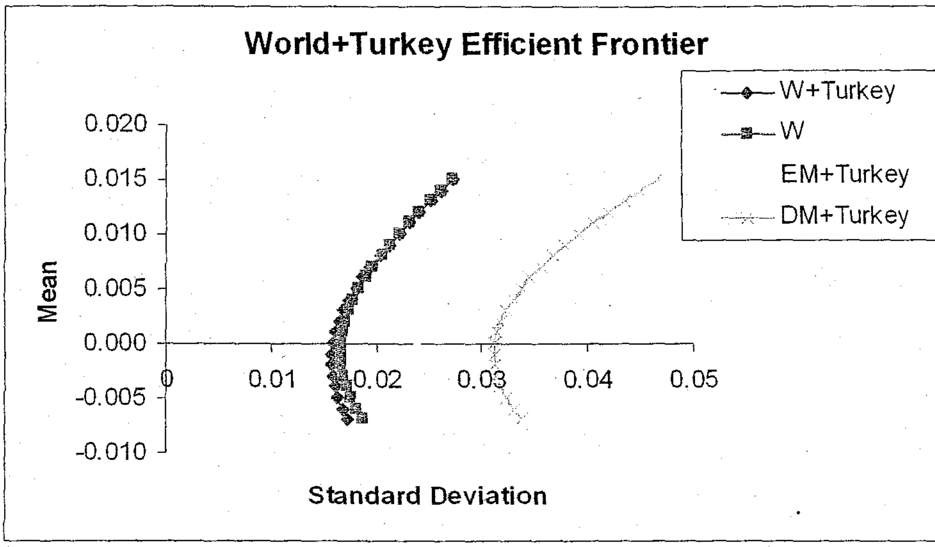

Figure 5.4 World Portfolio including Turkey Efficient Frontier

The statistical significance of this shift is analyzed with the spanning test of Jobson and Korkie. The test statistic parameters are provided below.

Table 5.12 World including Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	97
N	48
N_1	47
c	4002.397
c_1	3602.204
Potential Performance	
P_0	2236.745
P_{01}	1897.783
Marginal potential performance	**338.961**
Spanning test statistic	**3.188**

Inclusion of Turkey in the World portfolio produces 338.96 marginal potential performance. The spanning test statistic is found greater than the required f-value of 3.09 with (2, 98) d.f. and The null hypothesis of zero marginal potential performance is rejected at the 5% significance level. Under classic mean-variance estimation Turkish stock market is found to provide significant risk reduction in the World portfolio over the full period. However, Stein estimation suggests the opposite. It is found that once the estimation bias is minimized the contribution of Turkish stock market to the World portfolio becomes negligible.

Table 5.13 World including Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	STEIN
T	97
N	48
N_1	47
c	4002.397
c_1	3602.204
Potential Performance	
P_0	275.984
P_{01}	222.931
Marginal potential performance	**53.052**
Spanning test statistic	**2.8217**

It is seen that the marginal potential performance measure drops to 53 and the test statistic is found to be lower than the F-value of 4.82 with (2, 98) d.f. at the 1 percent significance level. Thus, the null hypothesis is accepted. It is shown that Turkey fails to improve the performance of World portfolio over the full period.

6. TURKEY VS. REGIONAL PORTFOLIOS IN THE ABSENCE OF RISKLESS ASSET

In this chapter the aim of the researcher is to investigate the international diversification potential of Turkish stock market within regional portfolios in the absence of a risk-free rate. In this respect regional portfolios of international stock markets are constructed from the MSCI country index data. These regional portfolios include Developed Europe, Emerging Europe, Asia, Pacific Rim, North America, Latin America regions and G7 portfolio.

6.1 Developed Europe Region

The Developed Europe Region portfolio consists of 15 developed countries' stock markets namely Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and UK. The portfolio is constructed from the monthly dollar returns of these countries' respective stock market indexes. The objective of this analysis is to investigate the risk-return attributes of Developed Europe countries and whether Turkish stock market contributes to the portfolio in terms of risk reduction or not. The investigation is made over the full period and then detailed into global crises periods of 92-93, 94-95 and 97-98. For each time period investigated Classic Efficient Frontier, Stein Estimated Efficient Frontier and Short-selling Restricted Efficient Frontier Analyses are provided.

6.1.1 Full Period Analysis

Although respective Developed Europe countries have longer historical stock market index data, the full period analysis of this portfolio is started from 1988:01 in order to obtain a comparable investment period with Turkish stock market whose data starts from 1988:01. A total of 181 monthly observations are used and short-selling is allowed in the construction of efficient portfolios. The minimum variance portfolio mean and standard deviation, Tangency portfolio mean and standard deviation, Sharpe ratios and Asset spanning test results of the full period are summarized below.

Table 6.1 Developed Europe Region Full Period Analyses

FULL PERIOD				
	DE+T	DE		
Minimum Variance Portfolio Mean	0.005600	0.005572		
Minimum Variance Portfolio St. Dev.	0.041241	0.041243		
	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.008298	0.022356	0.007227	0.020940
Standard Deviation	0.050203	0.082404	0.046969	0.079950
Sharpe Ratio	0.165281	0.271295	0.153865	0.261911
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	2.036080	2.838201		
Test Statistic	0.291358	0.385861		

6.1.1.1 Classic Efficient Frontier Analysis

During the period the minimum correlation (0.11) is observed between Turkey and Belgium whereas the maximum is observed between France and Germany (0.81).

The correlation of Turkey with Developed Europe countries is less than 0,3 except for Portugal and Sweden with which it has 0,32 and 0,31 correlation, respectively.

Table 6.2 Developed Europe Region Full Period Correlation Matrix

	AUS	BEL	DEN	FIN	FR	GER	IRE	IT	NET	NOR	POR	SP	SW	SWT	TR	U
AUS	1															
BEL	0.44	1														
DEN	0.42	0.59	1													
FIN	0.22	0.24	0.40	1												
FRA	0.45	0.69	0.61	0.46	1											
GER	0.58	0.67	0.69	0.48	0.81	1										
IRE	0.44	0.53	0.55	0.40	0.50	0.55	1									
ITA	0.38	0.44	0.53	0.46	0.55	0.58	0.40	1								
NET	0.53	0.72	0.67	0.50	0.76	0.78	0.62	0.53	1							
NOR	0.47	0.49	0.57	0.46	0.52	0.52	0.57	0.44	0.62	1						
POR	0.41	0.45	0.46	0.34	0.49	0.51	0.50	0.44	0.57	0.41	1					
SPA	0.43	0.55	0.59	0.48	0.65	0.63	0.62	0.58	0.65	0.56	0.66	1				
SWE	0.30	0.41	0.60	0.68	0.63	0.68	0.54	0.53	0.65	0.59	0.54	0.71	1			
SWIT	0.51	0.63	0.58	0.34	0.63	0.63	0.52	0.42	0.72	0.48	0.52	0.58	0.52	1		
TUR	**0.28**	**0.11**	**0.17**	**0.26**	**0.25**	**0.27**	**0.24**	**0.15**	**0.24**	**0.20**	**0.32**	**0.19**	**0.31**	**0.17**	**1**	
UK	0.47	0.57	0.60	0.48	0.65	0.61	0.69	0.43	0.76	0.62	0.48	0.64	0.60	0.68	0.18	1

For the Developed Europe portfolio the minimum variance portfolio mean and standard deviation are found to be 0.0055 and 0.0412, respectively and the standard deviation of the portfolio ranges from 0.042 to 0.059 for the given expected means. However, the analysis show that the inclusion of Turkey in the Developed Europe portfolio results in a minor increase in the minimum variance portfolio mean while reducing the standard deviation of it. This minor change in the mean as well as the minor risk reduction achieved by the addition of Turkey can be attributed to the respectively lower correlation between these countries and Turkey as can be observed from the correlation table. On the other hand, Sharpe ratio is found to be higher (0.27) than the DE portfolio's Sharpe ratio (0.26) computed with zero risk free rate. The following table demonstrates the estimated risk reduction potential of Turkish stock market due to its low correlation with this region.

Table 6.3 Change in St. Dev. of Developed Europe Portfolio

Mean	St. Dev. DE+Turkey	St. Dev. DE	Change in St. Dev.
0.000	0.04763656	0.04814354	0.00050698
0.001	0.04565477	0.04600313	0.00034835
0.002	0.04399693	0.04420976	0.00021283
0.003	0.04270076	0.04280707	0.00010631
0.004	0.04179994	0.04183438	0.00003444
0.005	*0.04132033*	*0.04132207*	*0.00000174*
0.006	0.04127661	0.04128728	0.00001066
0.007	0.04167016	0.04173119	0.00006103
0.008	0.04248883	0.04263887	0.00015005
0.009	0.04370873	0.04398161	0.00027288
0.010	0.04529746	0.04572109	0.00042363
0.011	0.04721781	0.04781404	0.00059623
0.012	0.04943114	0.05021627	0.00078513
0.013	0.05189998	0.05288566	0.00098568
0.014	0.05458968	0.05578387	0.00119418
0.015	0.05746923	0.05887711	0.00140788

The following graph shows the slight shift of the efficient frontier after the inclusion of Turkey in the Developed Europe portfolio. However, it is necessary to statistically test if this shift is significant or if it is just a sampling artifact. Therefore, Spanning test of Jobson and Korkie is implemented.

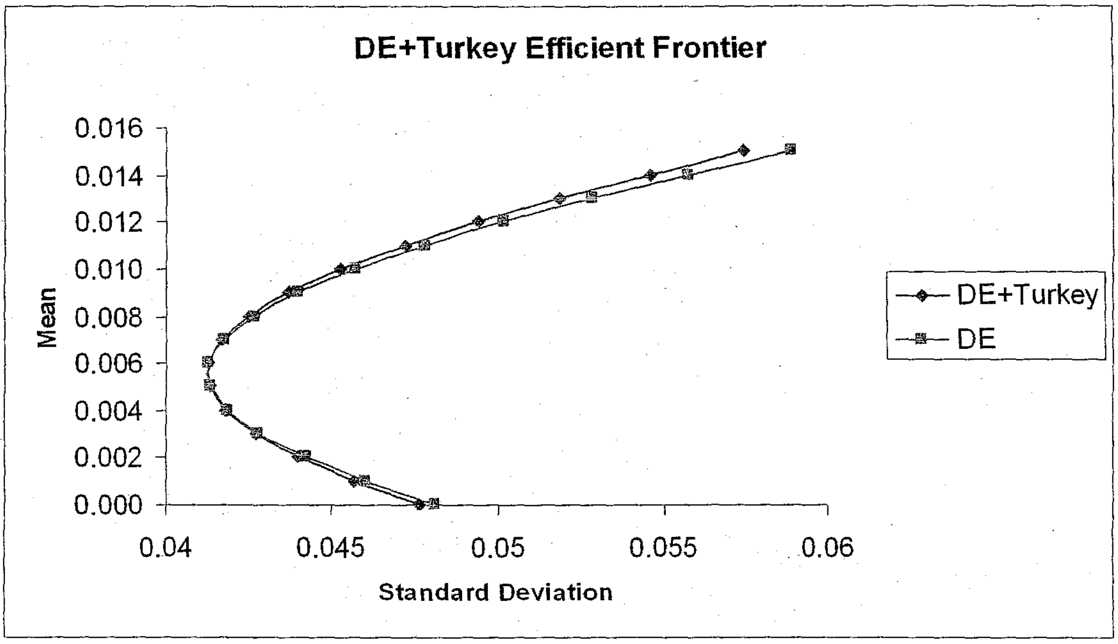

Figure 6.1 Developed Europe including Turkey Efficient Frontier

Although a positive marginal potential performance is achieved with the inclusion of Turkey in the Developed Europe portfolio, the test statistic falls below the required f-value of 4.66 at 1% significance level with (2, 330) d.f. and hypothesis of zero marginal potential performance is accepted. Thus, it is concluded that Turkey does not significantly add value to the Developed Europe portfolio over the full period. However, it does not worsen the situation as well. The spanning test parameters are provided in the Table 6.4 in Appendix C.

6.1.1.2 Stein Estimated Efficient Frontier Analysis

For the Developed Europe portfolio the smoothing is done with the minimum variance portfolio mean of Developed Europe portfolio which is 0.0055. The lambda and shrinkage factor are found to be 370 and 0.67, respectively. The following re-estimated means are derived:

Table 6.5 Developed Europe Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.004748	0.005302
BELGIUM	0.005547	0.005564
DENMARK	0.008443	0.006514
FINLAND	0.012332	0.007790
FRANCE	0.007717	0.006276
GERMANY	0.005801	0.005647
IRELAND	0.006312	0.005815
ITALY	0.004358	0.005174
NETHERLANDS	0.006971	0.006031
NORWAY	0.006082	0.005740
PORTUGAL	0.001269	0.004160
SPAIN	0.005639	0.005594
SWEDEN	0.009841	0.006973
SWITZERLAND	0.008939	0.006677
UK	0.004622	0.005260

The resulting Stein estimated portfolio reveals that actually the Developed Europe Region portfolio is much more volatile. There is much more risk per return compared to the Classic Efficient Frontier Analysis. The standard deviation of the portfolio ranges from 0.04 to 0.13 while it ranged between 0.04 and 0.05 in the Classic Efficient Frontier Analysis. The Sharpe ratio of the classic tangency portfolio drops from 0.26 to 0.15, suggesting less reward to risk.

The Stein estimation for the Developed Europe including Turkey portfolio is done with the minimum variance portfolio mean of 0.0056 and the lambda and shrinkage factor are found as 270 and 0.60, respectively. The following table provides the re-estimated means for the DE+T portfolio:

Table 6.6 Developed Europe+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.004748	0.005258
BELGIUM	0.005547	0.005578
DENMARK	0.008443	0.006740
FINLAND	0.012332	0.008301
FRANCE	0.007717	0.006449
GERMANY	0.005801	0.005680
IRELAND	0.006312	0.005885
ITALY	0.004358	0.005101
NETHERLANDS	0.006971	0.006150
NORWAY	0.006082	0.005793
PORTUGAL	0.001269	0.003862
SPAIN	0.005639	0.005615
SWEDEN	0.009841	0.007302
SWITZERLAND	0.008939	0.006939
UK	0.004622	0.005207
TURKEY	0.019457	0.011160

Turkey's mean is observed to decrease from 0.019 to 0.011. The Stein estimated portfolio shows that actually the mean and the standard deviation of the Developed Europe including Turkey tangency portfolio is much lower than estimated by the classic frontier analysis. The Sharpe ratio falls from 0.27 to 0.16. However, it is observed to be greater than the Sharpe ratio of Developed Europe portfolio.

The Stein estimated efficient frontier of DE+T is also found to be much more flat than the classic efficient frontier analysis. The Stein estimated frontier displays the high volatility of the portfolio. The examination of the following table shows that inclusion of Turkey in the Developed Europe portfolio reduces the standard deviation of the portfolio for the given means especially at the high risk region.

Table 6.7 Change in St. Dev. of Developed Europe Portfolio

Mean	St. Dev. Stein DE+T	St. Dev. Stein DE	Change in St. Dev.
0.000	0.072325	0.086197	0.013873
0.001	0.063895	0.074554	0.010658
0.002	0.056210	0.063683	0.007473
0.003	0.049615	0.054054	0.004439
0.004	0.044597	0.046445	0.001848
0.005	0.041729	0.041970	0.000240
0.006	0.041460	0.041650	0.000191
0.007	0.043836	0.045575	0.001738
0.008	0.048472	0.052805	0.004333
0.009	0.054796	0.062199	0.007403
0.010	0.062296	0.072925	0.010629
0.011	0.070599	0.084477	0.013878
0.012	0.079453	0.096559	0.017106
0.013	0.088693	0.108995	0.020303
0.014	0.098210	0.121677	0.023467
0.015	0.107932	0.134535	0.026603

The range of the standard deviation reduces from 0.04 - 0.13 to 0.04 - 0.1 with the inclusion of Turkey. The change in standard deviation reaches to 0.027 whereas it was found to be only 0.001 in the classic frontier analysis. The following graph provides the classic and the Stein estimated efficient frontiers for both portfolios. It can be easily depicted that Turkey's contribution becomes more visible at the Stein estimated efficient frontier analysis.

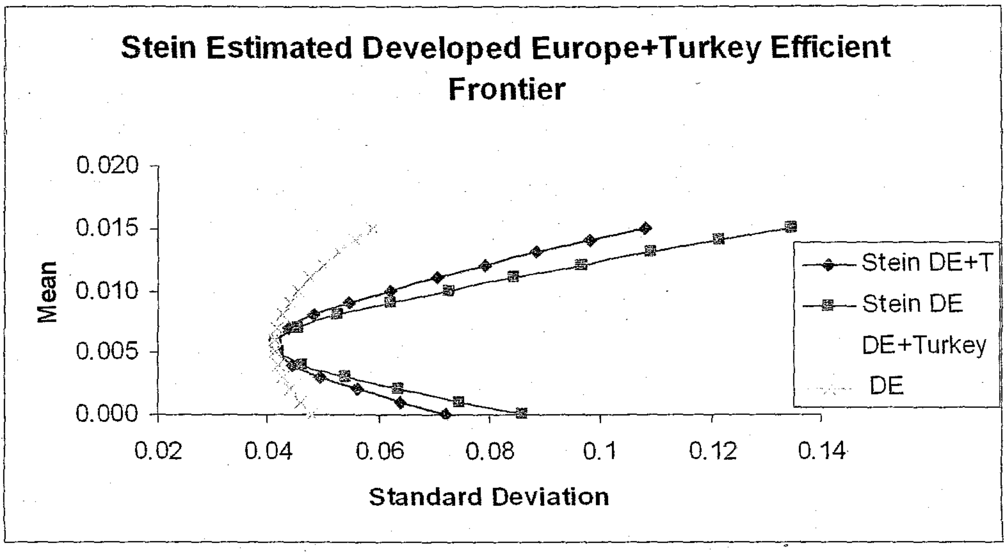

Figure 6.2 Stein Estimated Developed Europe+Turkey Efficient Frontier

However, the spanning test statistic falls below the required f-value of 4.66 at the 1% significance level with (2, 330) d.f. and hypothesis of zero marginal potential performance is accepted. Stein estimation confirms that inclusion of Turkey in the Developed Europe portfolio does not significantly shift the efficient frontier in the full period. The spanning test parameters are provided in the table 6.8 in Appendix C.

6.1.1.3 Short-selling Restricted Efficient Frontier Analysis

The short-selling restricted efficient frontier analysis of the Developed Europe region shows that short-selling enhances the investment set and extends the efficient frontier. Short-selling restricted DE portfolio do not optimize for expected means over 0.012. The inclusion of Turkish stock market to the Developed Europe portfolio enhances the investment set and extends the frontier. The contribution of Turkey can be visually observed from the following graph. However, no significant shift is observed in the minimum variance portfolio mean.

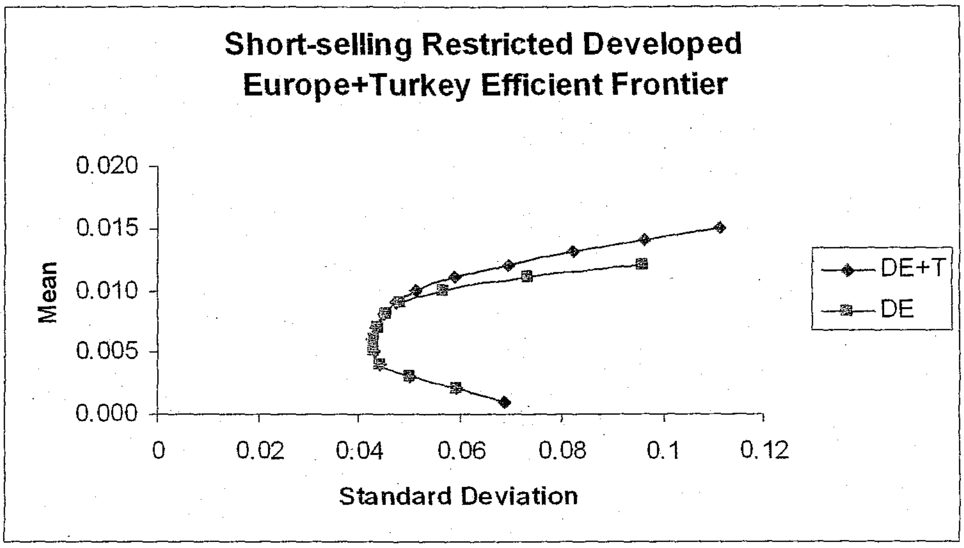

Figure 6.3 Short-selling Restricted DE+Turkey Efficient Frontier

6.1.2 Crises Periods Analyses

In this section the 1992-93 ERM Crisis, 1994-95 Latin Crisis and 1997-98 Asian and Russian Crises are examined in detail. The analyses aim to observe the effect of crisis on the Developed Europe region portfolio and investigate whether Turkish stock market provides risk reduction during the crises. The periods under investigation for the crises are respectively 1992:01 to 1993:12, 1994:01 to 1995:12 and 1997:01 to 1998:12. A total of 24 monthly observations are provided for each crisis period and short-selling is allowed in the analyses unless otherwise stated. The minimum variance portfolio mean and standard deviation, tangency portfolio mean and standard deviation, Sharpe ratios and Asset spanning test results of the crises periods are summarized below.

Table 6.9 Developed Europe Region Crises Periods Analyses

1992-93 PERIOD

	DE+T	DE
Minimum Variance Portfolio Mean	0.005581	0.005093
Minimum Variance Portfolio St. Dev.	0.018606	0.019350

	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.016004	0.096710	0.021063	0.112491
Standard Deviation	0.031507	0.077450	0.039352	0.090942
Sharpe Ratio	0.507964	1.248678	0.535250	1.236956

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-94.679067	342.918415
Test Statistic	0.150423	0.334452

1994-95 PERIOD

	DE+T	DE
Minimum Variance Portfolio Mean	0.001383	0.001413
Minimum Variance Portfolio St. Dev.	0.024549	0.024572

	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.079841	0.661090	0.101723	0.647909
Standard Deviation	0.186558	0.536823	0.208514	0.526239
Sharpe Ratio	0.427970	1.231486	0.487847	1.231208

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-90.056198	5.957598
Test Statistic	-0.172051	0.008646

1997-98 PERIOD

	DE+T	DE
Minimum Variance Portfolio Mean	0.008654	0.010095
Minimum Variance Portfolio St. Dev.	0.021690	0.023464

	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.019863	0.095944	0.024181	0.096257
Standard Deviation	0.032861	0.072221	0.036316	0.072456
Sharpe Ratio	0.604470	1.328484	0.665844	1.328480

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-30.767597	543.811674
Test Statistic	0.473595	0.697888

6.1.2.1 Classic Efficient Frontier Analysis

The correlation matrix shows that during the 92-93 crisis the minimum correlation is observed between Belgium and Italy (-0.32) while the maximum correlation is observed between France and Netherlands (0.81), followed by France and Germany (0.73). Meanwhile Denmark, Italy and Spain had negative mean returns during the period. Turkey had the lowest correlation with Austria while having the highest with Ireland.

Table 6.10 Developed Europe Region 92-93 Crisis Correlation Matrix

	AUS	BEL	DEN	FIN	FR	GER	IRE	IT	NET	NOR	POR	SP	SW	SWT	TR
AUS	1														
BEL	0.16	1													
DEN	0.17	0.51	1												
FIN	0.19	-0.16	0.28	1											
FRA	0.63	0.47	0.20	-0.03	1										
GER	0.68	0.44	0.51	0.22	0.73	1									
IRE	-0.01	0.61	0.49	0.20	0.36	0.46	1								
ITA	0.10	-0.32	0.28	0.62	-0.06	0.20	0.06	1							
NET	0.56	0.63	0.50	-0.02	0.81	0.79	0.61	-0.06	1						
NOR	0.22	0.53	0.58	0.46	0.45	0.57	0.60	0.22	0.60	1					
POR	0.44	0.33	0.41	-0.05	0.56	0.72	0.43	0.18	0.78	0.49	1				
SPA	0.42	0.30	0.65	0.39	0.49	0.77	0.55	0.41	0.62	0.58	0.63	1			
SWE	0.21	-0.01	0.41	0.53	0.28	0.53	0.34	0.29	0.41	0.61	0.51	0.58	1		
SWIT	0.51	0.55	0.43	-0.12	0.54	0.46	0.35	-0.24	0.76	0.35	0.50	0.28	0.22	1	
TUR	-0.16	0.05	0.14	-0.11	-0.09	0.00	0.25	-0.03	0.03	-0.09	0.11	-0.01	0.01	0.03	1
UK	0.26	0.47	0.51	0.21	0.66	0.53	0.67	0.08	0.73	0.61	0.46	0.55	0.39	0.59	-0.11

However during the 94-95 crisis Turkey and Italy had the lowest correlation (-0.33) while Belgium and Netherlands had the highest (0.89) which is almost one. On the other hand Turkey's correlations with the Developed Europe countries is observed to be higher while still a majority is found to be around zero and some even negative. This time Turkey had the highest correlation with France (0.41). Compared to 92-93 crisis period Turkey had higher correlations with Austria, Belgium, France, Netherlands, Spain, Switzerland and UK.

Table 6.11 Developed Europe Region 94-95 Crisis Correlation Matrix

	AUS	BEL	DEN	FIN	FR	GER	IRE	IT	NET	NOR	POR	SP	SW	SWT	TR	UK
AUS	1															
BEL	0.39	1														
DEN	0.42	0.55	1													
FIN	0.29	0.51	0.51	1												
FRA	0.29	0.82	0.44	0.32	1											
GER	0.45	0.65	0.45	0.45	0.43	1										
IRE	0.41	0.62	0.48	0.79	0.52	0.5	1									
ITA	0.01	0.34	0.47	0.43	0.19	0.34	0.33	1								
NET	0.4	0.89	0.59	0.65	0.74	0.69	0.74	0.28	1							
NOR	0.23	0.64	0.51	0.73	0.47	0.33	0.62	0.36	0.65	1						
POR	0.33	0.52	0.37	0.51	0.53	0.34	0.54	0.11	0.52	0.4	1					
SPA	0.2	0.61	0.57	0.65	0.52	0.34	0.61	0.37	0.61	0.62	0.35	1				
SWE	0.19	0.67	0.57	0.77	0.44	0.37	0.7	0.38	0.73	0.72	0.42	0.81	1			
SWIT	0.57	0.49	0.34	0.29	0.38	0.23	0.56	0.01	0.49	0.24	0.51	0.4	0.51	1		
TUR	0.28	0.20	-0.01	-0.19	0.41	-0.01	-0.03	-0.33	0.12	-0.06	0.01	0.02	-0.12	0.19	1.00	
UK	0.46	0.79	0.48	0.57	0.82	0.54	0.77	0.15	0.88	0.52	0.51	0.56	0.62	0.58	0.31	1

The 1997-98 crises period correlation matrix shows higher correlations. It is found that Turkey and Belgium had the lowest correlation (0.36) while Germany and France had the highest (0.90). Meanwhile Turkey had the highest correlation with Norway (0.66). It is also observed that on average Turkey's correlation with the region countries has increased to on average 0.47 which was 0.03 during 94-95 and 0.01 during 92-93 crises periods. Nonetheless the Developed countries' correlations with each other are also observed to be much higher than the previous crises. This fact is possibly due to the severity of the both crisis as well as the stronger economic and political linkages that Developed Europe countries had developed in time.

Table 6.12 Developed Europe Region 97-98 Crises Correlation Matrix

	AUS	BEL	DEN	FIN	FR	GER	IRE	IT	NET	NOR	POR	SP	SW	SWT	TR
AUS	1														
BEL	0.72	1													
DEN	0.73	0.54	1												
FIN	0.75	0.70	0.58	1											
FRA	0.75	0.85	0.70	0.71	1										
GER	0.82	0.84	0.73	0.69	0.90	1									
IRE	0.80	0.49	0.53	0.78	0.57	0.59	1								
ITA	0.60	0.58	0.72	0.60	0.80	0.65	0.45	1							
NET	0.84	0.81	0.76	0.77	0.86	0.90	0.71	0.59	1						
NOR	0.76	0.51	0.70	0.74	0.55	0.55	0.74	0.51	0.68	1					
POR	0.71	0.78	0.72	0.74	0.80	0.73	0.63	0.68	0.85	0.68	1				
SPA	0.75	0.72	0.68	0.73	0.81	0.73	0.67	0.74	0.76	0.70	0.83	1			
SWE	0.80	0.74	0.75	0.82	0.89	0.89	0.71	0.73	0.88	0.71	0.81	0.84	1		
SWIT	0.78	0.84	0.65	0.69	0.83	0.86	0.59	0.65	0.86	0.61	0.86	0.81	0.82	1	
TUR	**0.45**	**0.36**	**0.54**	**0.51**	**0.40**	**0.38**	**0.48**	**0.38**	**0.44**	**0.66**	**0.53**	**0.40**	**0.54**	**0.48**	**1**
UK	0.80	0.68	0.71	0.74	0.75	0.77	0.81	0.59	0.86	0.68	0.79	0.84	0.80	0.77	0.39

For the 92-93 period the minimum variance portfolio mean and standard deviation of Developed Europe portfolio are found to be 0.005 and 0.019, respectively. On the other hand, inclusion of Turkey is found to increase the minimum variance portfolio mean to 0.0055 while decreasing the standard deviation to 0.018. The almost zero and even negative correlations Turkey had with the Developed Europe countries during 92-93 crisis support this finding. The Sharpe ratio is found to increase from 1.23 to 1.24. On the other hand, for the 94-95 period Developed Europe portfolio minimum variance portfolio mean and standard deviation are found to be higher compared to 92-93 period. The mean and standard deviation are found as 0.0014 and 0.02457, respectively. However, inclusion of Turkey leads to a slight drop in the mean and standard deviation of the minimum variance portfolio.

For the 97-98 crises period the minimum variance portfolio mean and standard deviation of DE portfolio is found to be 0.01 and 0.023, respectively. Despite the increased correlations the minimum variance portfolio mean is found to be higher compared to the 94-95 and 92-93 crises periods while the standard deviation is slightly lower than the 94-95 value. Inclusion of Turkey however results in a reduction in the mean and the standard deviation of the minimum variance portfolio which are found as 0.008 and 0.021, respectively.

The following graphs provide the respective efficient frontiers for the mentioned crises periods. While a leftward shift is observed for the 92-93 and 97-98 crises periods, two frontiers overlap during the 94-95 period.

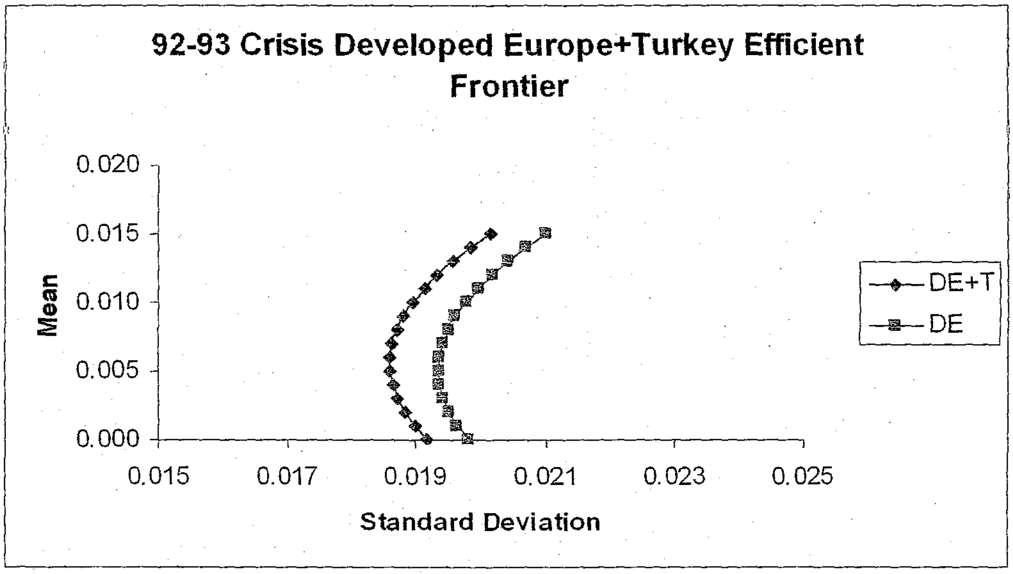

Figure 6.4 92-93 Crisis Developed Europe +Turkey Efficient Frontier

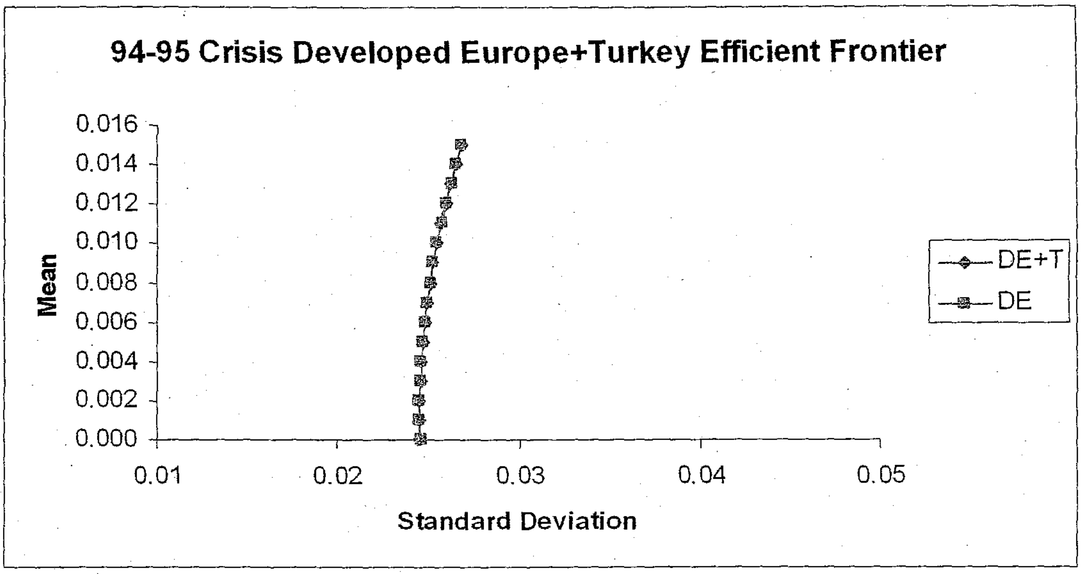

Figure 6.5 94-95 Crisis Developed Europe +Turkey Efficient Frontier

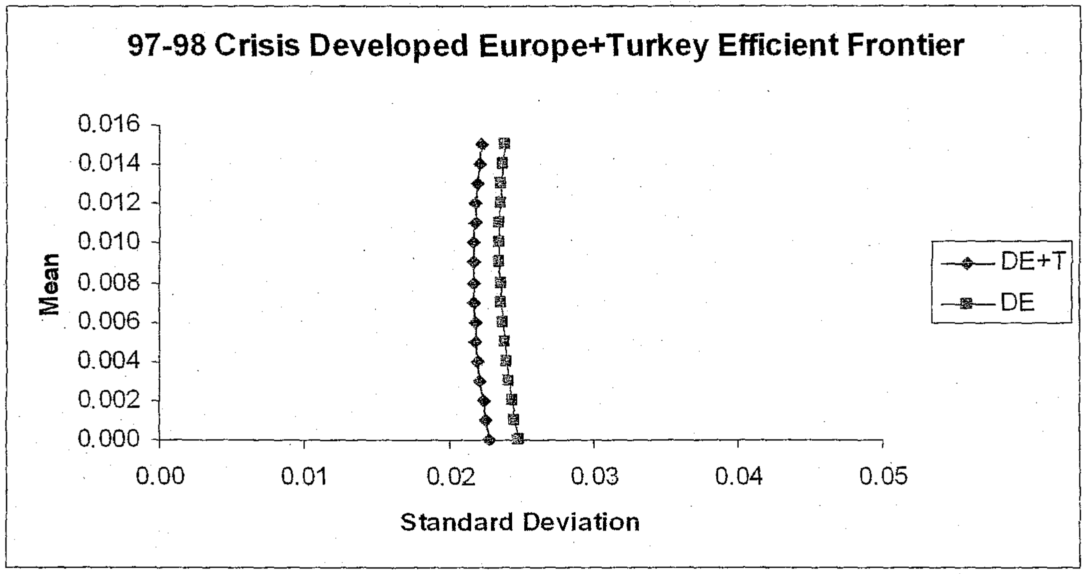

Figure 6.6 97-98 Crisis Developed Europe +Turkey Efficient Frontier

The significance of these findings are tested with the spanning test of Jobson and Korkie. Inclusion of Turkey in the Developed Europe portfolio is found to result in marginal potential performance value of 343, 5.95 and 543 respectively for the crises periods. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1 % significance level for all crises periods. The detailed spanning test parameters are provided in tables 6.13, 6.14 and 6.15 in the Appendix C. The null hypothesis of zero marginal potential performance is accepted for the 92-93, 94-95 and 97-98 crises periods. It is concluded that Turkey fails to significantly shift the efficient set leftward. For the crises periods Turkey's contribution to the Developed Europe portfolio is negligible.

6.1.2.2 Stein Estimated Efficient Frontier Analysis

For the Developed Europe portfolio the 92-93 crisis period lambda and shrinkage factor are found as 38.24 and 0.61, respectively. The re-estimated means by the minimum variance portfolio mean of 0.005 are provided in tables 6.16 in the Appendix C. The Stein estimation leads to lower tangency mean and standard deviation. The Sharpe ratio of the DE tangency portfolio (computed with zero risk-free rate) is found to drop from 1.24 to 0.53. On the other hand, the sample means of Developed Europe including Turkey portfolio is smoothed with the minimum variance portfolio mean of the classic efficient frontier optimization 0.0055. Accordingly, the lambda and the shrinkage factor are found as 46.97 and 0.66, respectively. The sample means and the re-estimated means of the DE+T portfolio are provided in table 6.17 in the Appendix C. It is observed that smoothing leads to a reduction in the mean of Turkey as well as other countries with above average returns for the period. The comparison of the Sharpe ratios of classic and Stein estimated DE+T portfolios demonstrate a decrease from 1.24 to 0.50. For the 92-93 period inclusion of Turkey is found to decrease the Sharpe ratio.

The Developed Europe portfolio 94-95 crisis period lambda and shrinkage factor are found as 36.92 and 0.60, respectively. The re-estimated means via the minimum variance portfolio mean of 0.0014 are provided in table 6.18 in the Appendix C. Compared to 92-93 period a higher shrinkage factor is found for the DE portfolio and it is observed that the Sharpe ratio of the classic tangency portfolio drops from 1.23 to 0.48 in the Stein estimated tangency portfolio. Likewise the sample means of Developed Europe including Turkey portfolio are smoothed by the minimum variance portfolio mean, 0.0014 of the classic efficient frontier optimization. The sample means are then estimated by the lambda and shrinkage factor that are found to be 45.6 and 0.65, respectively. The re-estimated means are provided in table 6.19 in the Appendix C. It is observed that after the smoothing Turkey's sample mean increases from –0.014 to -0.004 becoming closer to the average while Finland's, Ireland's, Netherlands' and Norway's means drop. These drops in the extreme returns lead to a smaller tangency portfolio mean standard deviation. The Sharpe ratio drops from 1.23 to 0.43 after the Stein estimation.

The Stein estimated efficient frontier of DE portfolio for the 97-98 crises period is calculated by lambda (35.35) and shrinkage factor (0.59). The sample means are smoothed by the minimum variance portfolio mean which was 0.010 for the period. The sample means and the re-estimated means of DE portfolio are provided in table 6.20 in the Appendix C. The Stein estimated portfolio shows that actually the mean and the standard deviation of the Developed Europe tangency portfolio is much lower than estimated by the classic frontier analysis. The Sharpe ratio falls from 1.33 to 0.66. The sample means of DE+T portfolio for the 97-98 crises period are likewise smoothed by the minimum variance portfolio mean of (0.0087). The lambda and shrinkage factor are found as 43 and 0.67, respectively. The re-estimated means derived by lambda and the shrinkage factor are provided in table 6.21 in the Appendix C. The Stein estimator smoothes the extremely high or low sample means towards the average. Turkey's return is shrunk to 0.01 whereas the major shrinkage is observed in the return of Denmark. The Sharpe ratio of the Developed Europe including Turkey portfolio is observed to drop from 1.33 to 0.66 in the Stein estimation. This major cause of this drop is the decrease in mean of the portfolio.

The Stein estimation demonstrates flatter efficient frontiers for the respective portfolios than the classic efficient frontiers, indicating that actually these portfolios have higher risk than estimated by the classic efficient frontier during the crises periods.

The following graphs show the classic and Stein estimated efficient frontiers for the both portfolios. It is found that once the estimation bias is minimized Turkey's contribution disappears confirming the zero marginal potential performance hypothesis of the classic efficient frontier findings for the 92-93 and 94-95 crises periods.

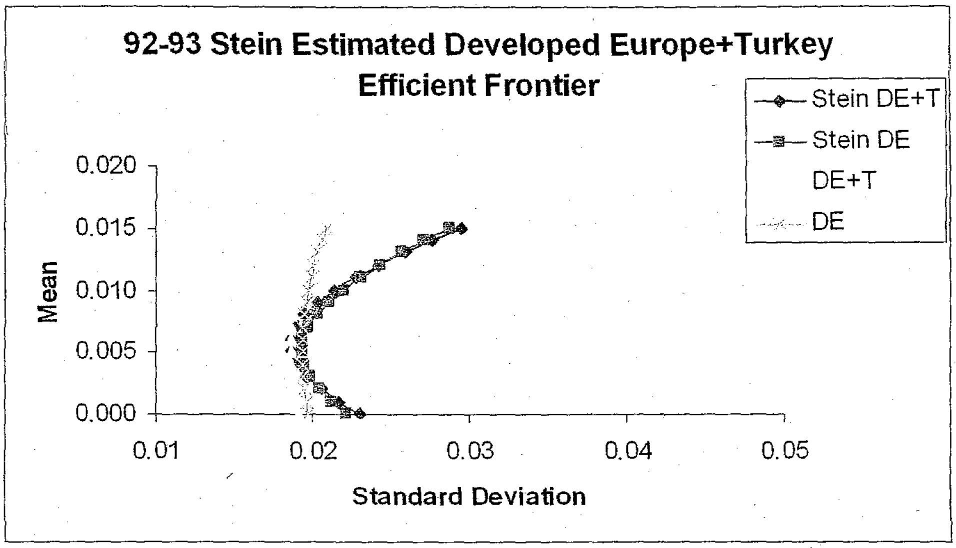

Figure 6.7 92-93 Crisis Stein Estimated DE+Turkey Efficient Frontier

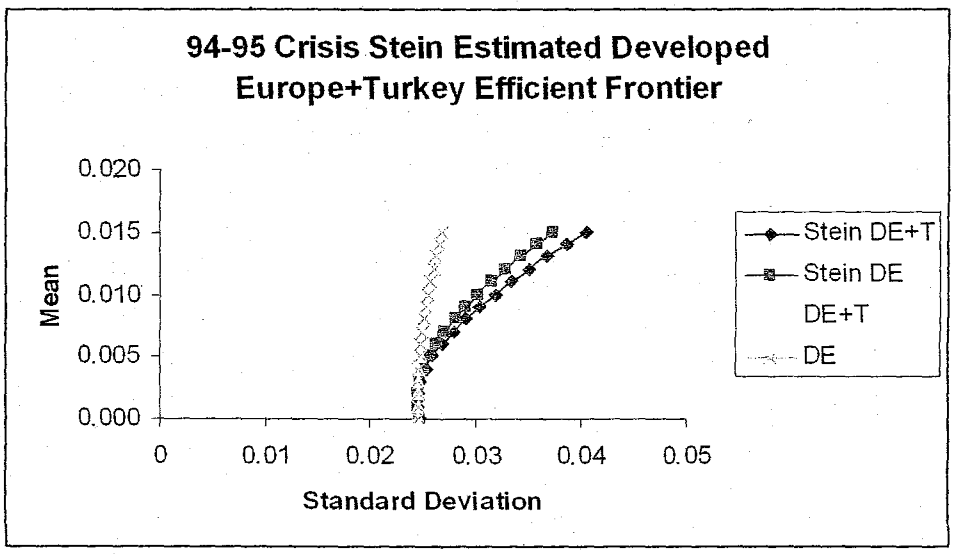

Figure 6.8 94-95 Crisis Stein Estimated DE+Turkey Efficient Frontier

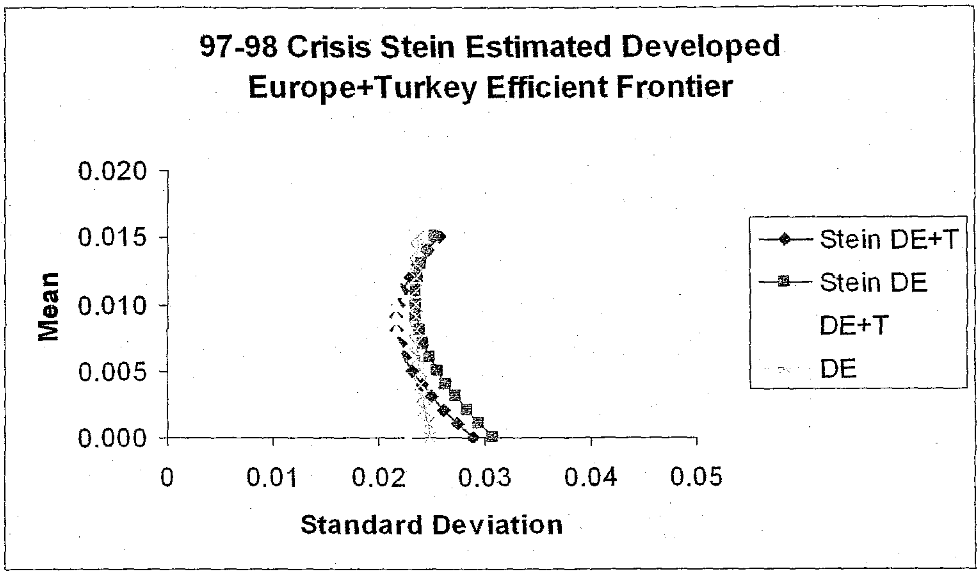

Figure 6.9 97-98 Crisis Stein Estimated DE+Turkey Efficient Frontier

Negative marginal potential performance values of -94, -90 and -30 are found respectively for the crises mentioned. The negative values of marginal potential performance measure confirm the finding observed in the graph that DE portfolio dominates the DE+T portfolio during crises. The test statistic fails to reject the null hypothesis at the 1% level for all crises periods. The significance analysis of Stein estimated frontiers confirm the observed shifts that Turkey fails to improve the efficient frontier. It is concluded that Turkey's contribution to the DE portfolio is negligible during the crises. The spanning test parameters are given in tables 6.22, 6.23 and 6.24 in the Appendix C.

6.1.2.3 Short-selling Restricted Efficient Frontier Analysis

The comparison of the short-selling restricted efficient frontiers of DE and DE+T portfolios reveal that inclusion of Turkey do not change the investment set. For the 92-93 and 94-95 crises periods the two frontiers almost overlap. During the 97-98 crisis period again no significant change in the efficient frontier is achieved. The following graphs depict the efficient frontiers overlap.

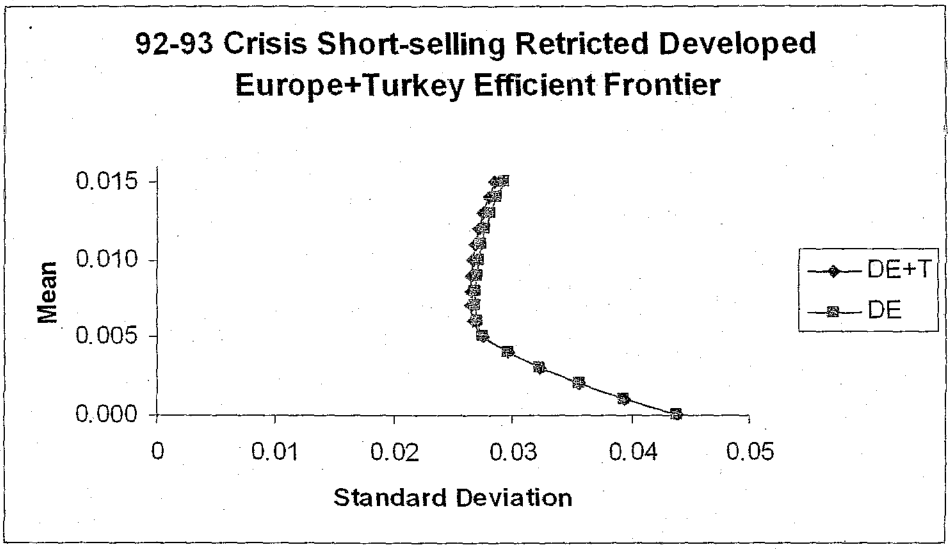

Figure 6.10 92-93 Crisis Short-selling Restricted DE+T Efficient Frontier

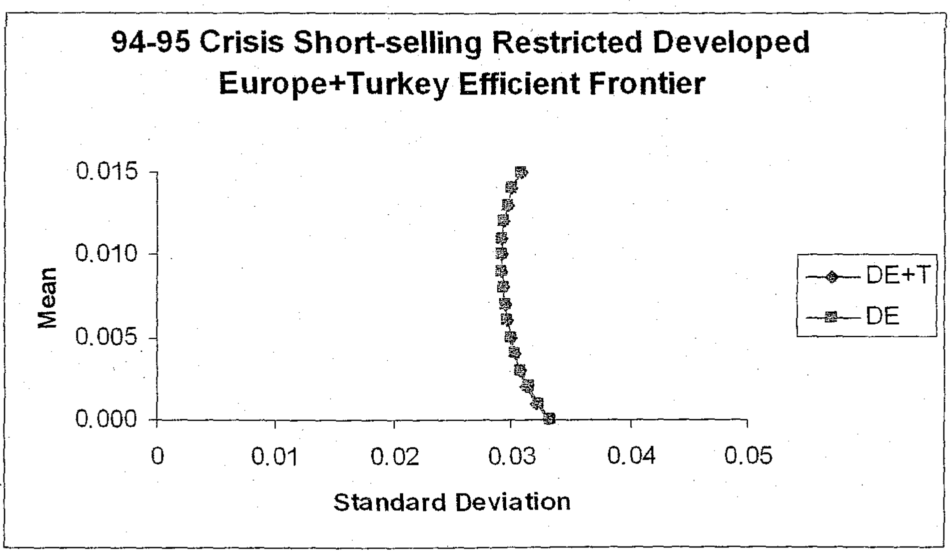

Figure 6.11 94-95 Crisis Short-selling Restricted DE+T Efficient Frontier

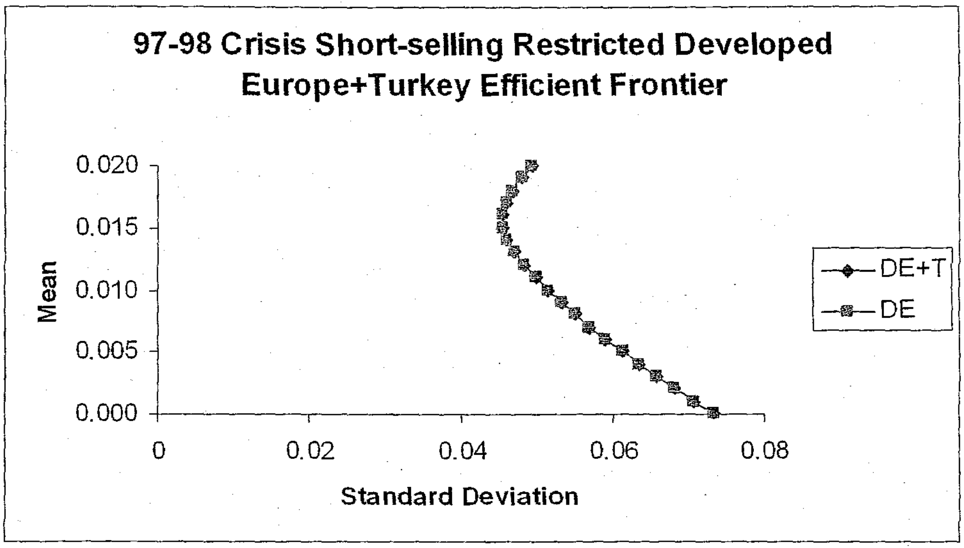

Figure 6.12 97-98 Crisis Short-selling Restricted DE+T Efficient Frontier

6. 2 Emerging Europe Region

Czech, Hungary, Poland and Russia compose the Emerging Europe Region portfolio. The portfolio is constructed from the monthly dollar returns of these countries' respective stock market indexes. The aim of this regional analysis is to explore the risk-return characteristics of the region countries and risk reduction Turkey may provide in the region. The analyses start with full-period investigation of the classic, Stein and short-selling restricted efficient frontiers and then detail to global crises. Despite longer historical data is available for the other Emerging Europe countries in the region, the analysis data start from 1995:01 due to the shorter history of Russia.

6.2.1. Full Period Analysis

The time period under investigation starts from 02:1995 and extends to 02:2003, a total of 97 monthly observations are put into analysis. Short-selling is allowed in the construction of the efficient portfolios. The following table summarizes the findings of the Emerging Europe Region.

Table 6.25 Emerging Europe Region Full Period Analyses

FULL PERIOD				
	EE+T	EE		
Minimum Variance Portfolio Mean	0.007458	0.007346		
Minimum Variance Portfolio St. Dev.	0.086668	0.086781		
	EE+T		EE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.009710	0.037018	0.010095	0.036782
Standard Deviation	0.098894	0.193092	0.101727	0.194179
Sharpe Ratio	0.098188	0.191715	0.099236	0.189423
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	-0.058308	0.094481		
Test Statistic	0.099052	0.147930		

6.2.1.1 Classic Efficient Frontier Analysis

In the region over the full period of available data it is observed that Hungary and Poland had the highest correlation (0.7) and Russia and Czech had the lowest (0.33). The examination of the correlation matrix below shows that over the full period Turkey had the lowest correlation with Czech (0.34) and the highest correlation with Hungary (0.44).

Table 6.26 Emerging Europe Region Full Period Correlation Matrix

	CZHECH	HUNGARY	POLAND	RUSSIA	TURKEY
CZHECH	1				
HUNGARY	0.57	1			
POLAND	0.58	0.70	1		
RUSSIA	0.33	0.49	0.40	1	
TURKEY	0.34	0.44	0.39	0.40	1

The minimum variance portfolio mean and standard deviation of the Emerging Europe portfolio are found as 0.007346 and 0.086780, respectively. The results of the classic efficient frontier estimation reveal that addition of Turkey slightly improves the minimum variance portfolio mean while decreasing the standard deviation of it. This fact shows that Turkey although being an emerging market still offers diversification benefit among the set of emerging markets, which are known to be much more correlated within themselves. The Sharpe ratio is also found to increase from 0.18 to 0.19 due to inclusion of Turkey. The table below provides the change in standard deviation after the inclusion of Turkey in the Emerging Europe portfolio.

Table 6.27 Change in St. Dev. of Emerging Europe Portfolio

Mean	St. Dev. EE+T	St. Dev. EE	Change in St. Dev.
0.000	0.09698628	0.09700706	0.00002077
0.001	0.09451039	0.09451726	0.00000687
0.002	0.09233760	0.09233800	0.00000040
0.003	0.09048974	0.09049171	0.00000197
0.004	0.08898707	0.08899913	0.00001206
0.005	0.08784729	0.08787827	0.00003099
0.006	0.08708465	0.08714349	0.00005883
0.007	0.08670912	0.08680458	0.00009546
0.008	0.08672571	0.08686618	0.00014047
0.009	0.08713420	0.08732744	0.00019323
0.010	0.08792913	0.08818209	0.00025295
0.011	0.08910017	0.08941885	0.00031868
0.012	0.09063272	0.09102214	0.00038942
0.013	0.09250883	0.09297302	0.00046419
0.014	0.09470808	0.09525011	0.00054204
0.015	0.09720854	0.09783065	0.00062212

The contribution of Turkey can be observed from the efficient frontier graph where both efficient frontiers are provided. The statistical significance of this slight shift is explored by the following spanning test.

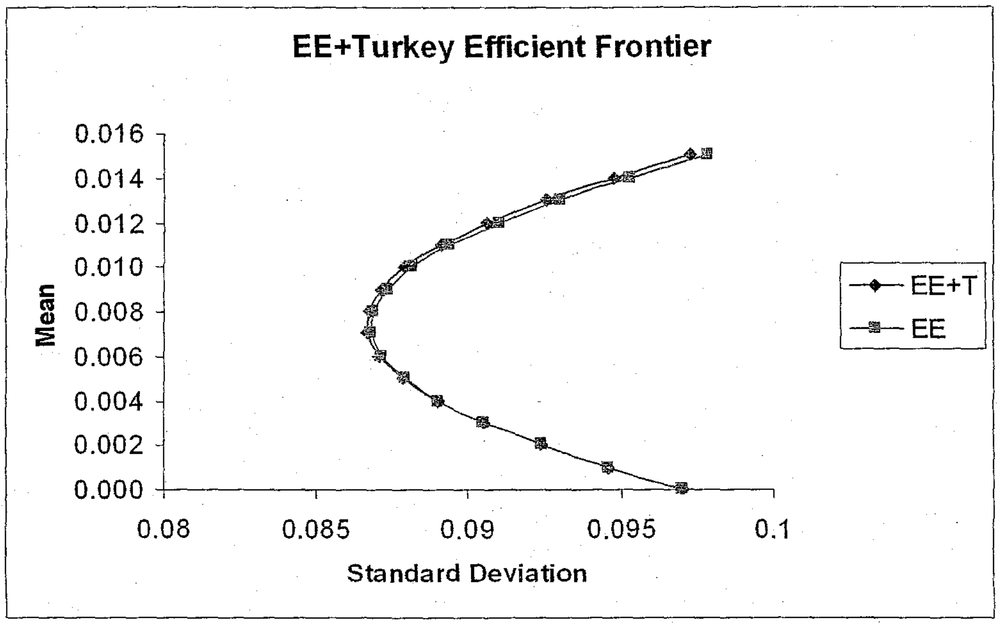

Figure 6.13 Emerging Europe including Turkey Efficient Frontier

It is found that inclusion of Turkey provides a very small marginal potential performance value of 0.09. The test statistic fails to reject the null hypothesis of zero marginal potential performance. It is concluded that Turkey's contribution to the Emerging Europe portfolio over the full period is negligible. The full period spanning test parameters are provided in table 6.28 in the Appendix C.

6.2.1.2 Stein Estimated Efficient Frontier Analysis

In the Stein estimation of the full period data the sample means of the Emerging Europe portfolio are smoothed by the minimum variance portfolio mean found as 0.0073 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 220.4 and 0.69, respectively. The table below provides the re-estimated sample means.

Table 6.29 Emerging Europe Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CZECH	0.005266	0.006711
HUNGARY	0.016397	0.010112
POLAND	0.005942	0.006917
RUSSIA	0.033699	0.015399

The table shows that sample means are shrunk towards the minimum variance portfolio mean. Stein estimated portfolio suggests higher volatility that the classic efficient frontier optimization is biased. Also Sharpe ratio is observed to drop form 0.18 to 0.09.

The sample means of the Emerging Europe including Turkey portfolio are smoothed by the minimum variance portfolio mean (0.0074). The lambda and shrinkage factor are then derived from the data and found as 254.4 and 0.72, respectively. The sample means and the re-estimated means are provided below.

Table 6.30 Emerging Europe+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CZECH	0.005266	0.006853
HUNGARY	0.016397	0.009925
POLAND	0.005942	0.007039
RUSSIA	0.033699	0.014701
TURKEY	0.019509	0.010784

It is observed that Stein estimation had shrunk the extreme means toward the minimum variance portfolio means. The highest change is observed in Russia followed by Turkey. The following table gives the change in standard deviation achieved by the inclusion of Turkey in the EE portfolio. Compared to the classic frontier analysis where the standard deviation of the EE including Turkey portfolio ranged between 0.087 and 0.097, the Stein estimated portfolio standard deviation is found to be higher ranging between 0.087 and 0.18. Sharpe ratio falls from 0.19 to 0.098. Compared to the classic efficient frontier analysis it is found that Stein estimated portfolios are much more risky and inclusion of Turkey does not improve the risk of the portfolio.

Table 6.31 Change in St. Dev. of Developed Europe Portfolio

Mean	St. Dev. Stein EE+T	St. Dev. Stein EE	Change in St. Dev.
0.000	0.179948	0.166310	-0.013638
0.001	0.161737	0.150174	-0.011563
0.002	0.144329	0.134876	-0.009453
0.003	0.128051	0.120733	-0.007318
0.004	0.113391	0.108201	-0.005191
0.005	*0.101057*	*0.097899*	*-0.003158*
0.006	0.091987	0.090592	-0.001395
0.007	0.087207	0.087038	-0.000169
0.008	0.087423	0.087694	0.000271
0.009	0.092601	0.092470	-0.000131
0.010	0.101986	0.100782	-0.001204
0.011	0.114551	0.111845	-0.002706
0.012	0.129371	0.124930	-0.004441
0.013	0.145761	0.139469	-0.006292
0.014	0.163248	0.155054	-0.008194
0.015	0.181515	0.171399	-0.010116

The graph below provides the efficient frontiers of Emerging Europe including Turkey and Emerging Europe portfolios under both classic and Stein estimation. The comparison of the portfolios express that Stein estimated portfolios are more volatile. While Turkey is observed to provide a leftward shift in the classic frontier the opposite is observed in the Stein analysis.

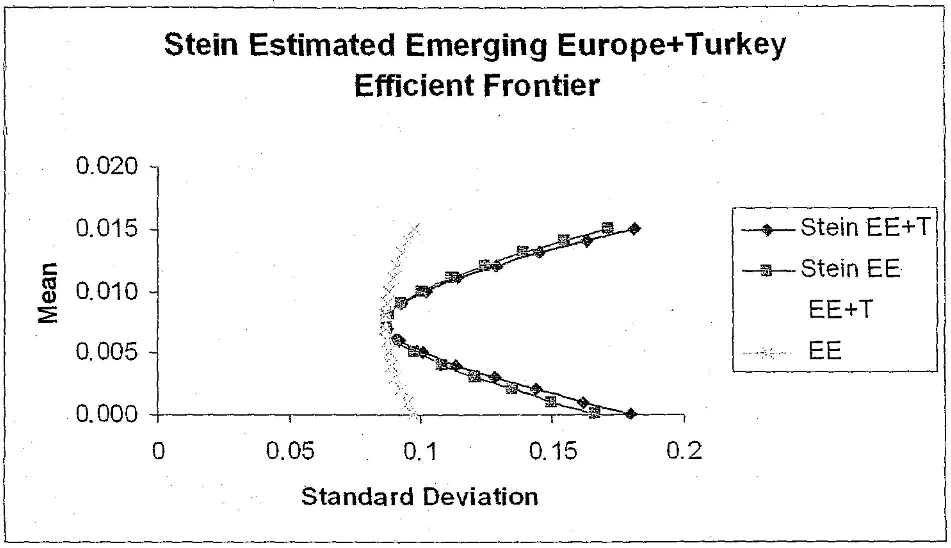

Figure 6.14 Stein Estimated Emerging Europe+Turkey Efficient Frontier

It is found that inclusion of Turkey generates negative marginal potential performance and the spanning test statistic fails to reject the null hypothesis at the 1% significance level with (2,184) degrees of freedom. Thus, it is concluded that the observed shift is insignificant. Turkey neither improves nor weakens the performance of the Emerging Europe portfolio over the full period sample. The spanning test parameters are provided in table 6.32 in the Appendix C.

6.2.1.3 Short-selling Restricted Efficient Frontier Analysis

The comparison of the short-selling restricted EE and EE+T portfolios reveals that the inclusion of Turkey does not provide significant risk reduction over the full period. The change in standard deviation of the portfolio is minimal. Neither portfolio provides an optimal investment below 0.006 mean. The following graph provides the respective efficient frontiers where it can be observed that they almost overlap over the full period.

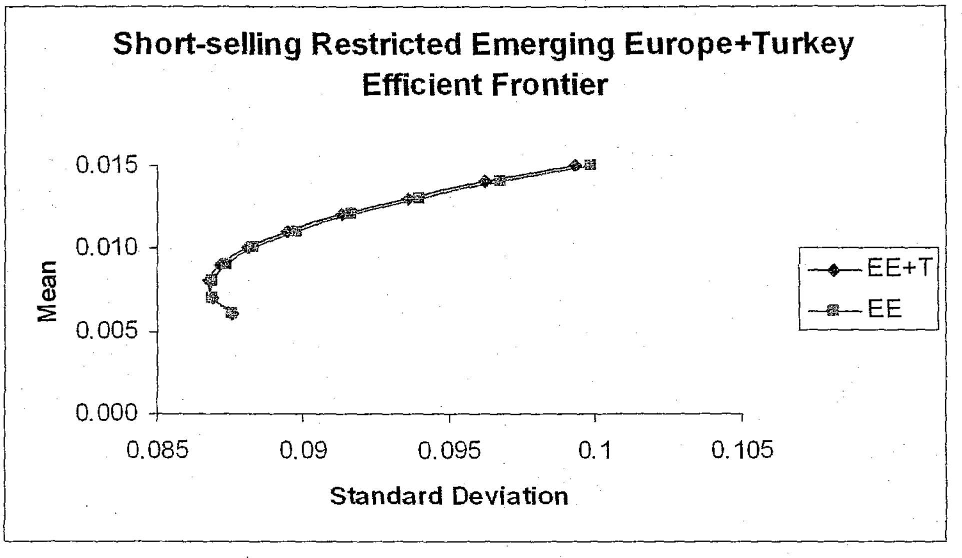

Figure 6.15 Short-selling Restricted EE+Turkey Efficient Frontier

6.2.2 Crises Periods Analyses

Due to the unavailability of the data, ERM crisis and Latin crisis cannot be examined by the researcher. Since the available data for the Emerging Europe Region starts from 1995:01 and extends to 2003:02, the crises periods cannot be fully incorporated into the analysis. While no data is available for the ERM crisis limited number of data is found for the Latin Crisis. However, the analyses concerning the 94-95 crisis period are not provided not only due to limited number of observations but also due to the lack of information. The time period for the 1997-98 Asian and Russian Crises Analysis starts from 1997:01 and extends to 1998:12. A total of 24 monthly observations are put into estimation and short-selling is allowed in the construction of efficient portfolios. The following table summarizes the 97-98 period findings of the Emerging Europe Region.

Table 6.33 Emerging Europe Region 97-98 Period Analyses

1997-98 PERIOD				
	EE+T	EE		
Minimum Variance Portfolio Mean	0.006457	0.006273		
Minimum Variance Portfolio St. Dev.	0.080169	0.080477		
	EE+T		EE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.018679	0.160491	0.023111	0.165342
Standard Deviation	0.136356	0.399690	0.154477	0.413184
Sharpe Ratio	0.136986	0.401537	0.149611	0.400167
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	-0.607628	20.264123		
Test Statistic	1.499305	2.790342		

6.2.2.1 Classic Efficient Frontier Analysis

The aim of the researcher is to examine the effect of crisis on the region and risk-return attributes of Emerging Europe countries. The examination of the correlation matrix indicates that during the crises the correlations have increased. During the period the lowest correlation is observed between Russia and Czech (0.65) while the highest is observed between Poland and Czech (0.86). The high values of the correlation matrix reveal the strong economic linkages and integration among the region countries. Turkey had the lowest correlation with Poland and the highest correlation with Hungary.

Table 6.34 Emerging Europe 97-98 Crises Correlation Matrix

	CZHECH	HUNGARY	POLAND	RUSSIA	TURKEY
CZECH	1				
HUNGARY	0.64	1			
POLAND	0.86	0.70	1		
RUSSIA	0.65	0.84	0.68	1	
TURKEY	0.58	0.63	0.52	0.62	1

The minimum variance portfolio mean and return of the Emerging Europe region are found as 0.0063 and 0.08, respectively. Compared to the full period analysis it is seen that both the minimum variance mean and standard deviation are smaller. The inclusion of Turkey in the Emerging Europe portfolio over the 97-98 crises slightly improves the mean while reducing the standard deviation of the portfolio. The minimum variance portfolio mean and standard deviation are found as 0.0064 and 0.0801, respectively. Turkey is found to provide minimal risk reduction. The minimal decrease in the standard deviation of the portfolio can be observed from the following graph where both efficient frontiers are provided.

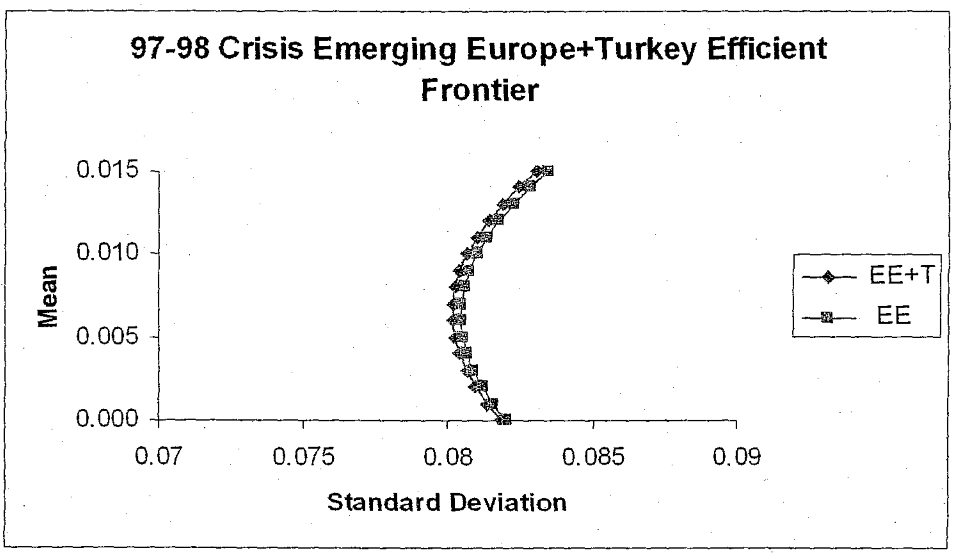

Figure 6.16 97-98 Crisis EE+Turkey Efficient Frontier

It is found that Turkish stock market provided a marginal potential performance of (20.27) over the crises period. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Thus, it is concluded that the Emerging Europe portfolio spans the Emerging Europe including Turkey portfolio in the 97-98 crises period. The details of spanning test is provided in table 6.35 in the Appendix C.

6.2.2.2 Stein Estimated Efficient Frontier Analysis

In order to minimize the estimation bias during the 97-98 crises period analyses the sample means of the Emerging Europe portfolio is smoothed by the minimum variance portfolio mean (0.006). The lambda and the shrinkage factor are then derived from data by using the smoothed means and found as 49.7 and 0.67, respectively. The sample means and the re-estimated means are provided in table 6.36 in the Appendix C. It is observed that by the Stein estimation the sample means are shrunk towards the minimum variance portfolio mean. The Sharpe ratio drops from 0.40 to 0.14 after the Stein estimation.

The 97-98 period sample means of the Emerging Europe including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.0064). The lambda and shrinkage factor are then derived from the data and found as 48.25 and 0.33, respectively. The sample means and the re-estimated means are provided in table 6.37 in the Appendix C. Turkey's mean is observed to drop from 0.013 to 0.011 due to the shrinkage. The Sharpe ratio of the classic tangency portfolio drops from 0.40 to 0.13. This drop is the result of the Stein smoothing of the sample means. The following graph provides the efficient frontiers of the two respective portfolios where Turkey's contribution is observed to diminish once the estimation bias is minimized.

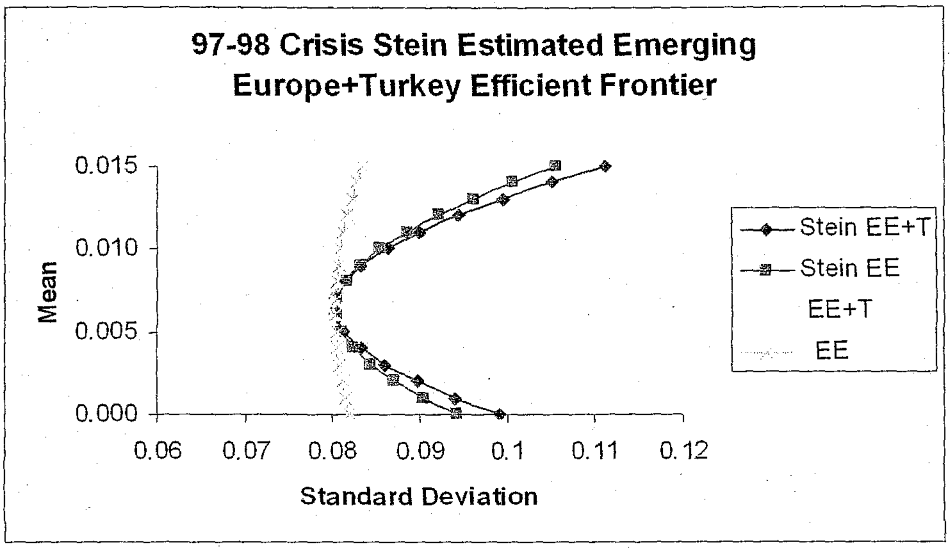

Figure 6.17 *97-98* Crisis Stein *Estimated* EE+Turkey Efficient Frontier

It is seen that Stein estimated frontier of EE+T and EE portfolios are much flatter than the classic estimated efficient frontiers indicating higher risk. Stein estimated analysis also reveals that Emerging Europe portfolio's performance is slightly better than the Emerging Europe including Turkey portfolio. It is found that for the 97-98 period inclusion of Turkey in Emerging Europe portfolio provided negative marginal potential performance. The spanning test parameters are provided in table 6.38 in the Appendix C. The spanning test statistic falls below the required f-value of 5.21 with (2,38) d.f. at the 1% significance level. Thus, the hypothesis of zero marginal potential performance is accepted. It is concluded that Turkey did not improve the performance of the Emerging Europe portfolio over the 97-98 crises period.

6.2.2.3 Short-selling Restricted Efficient Frontier Analysis

The short-selling restricted efficient frontier analysis reveals that when short-selling is restricted in the construction of efficient portfolios inclusion of Turkey provides a minimal change in the standard deviation of the Emerging Europe portfolio. On the other hand, short-selling increases the portfolio risk sweeping away the diversification benefits of short-selling allowed portfolio. The below graph provides the efficient frontiers of Emerging Europe including Turkey and Emerging Europe portfolios over the 97-98 crises. It is observed that there is no significant change in the efficient frontier caused by the inclusion of Turkey in the portfolio.

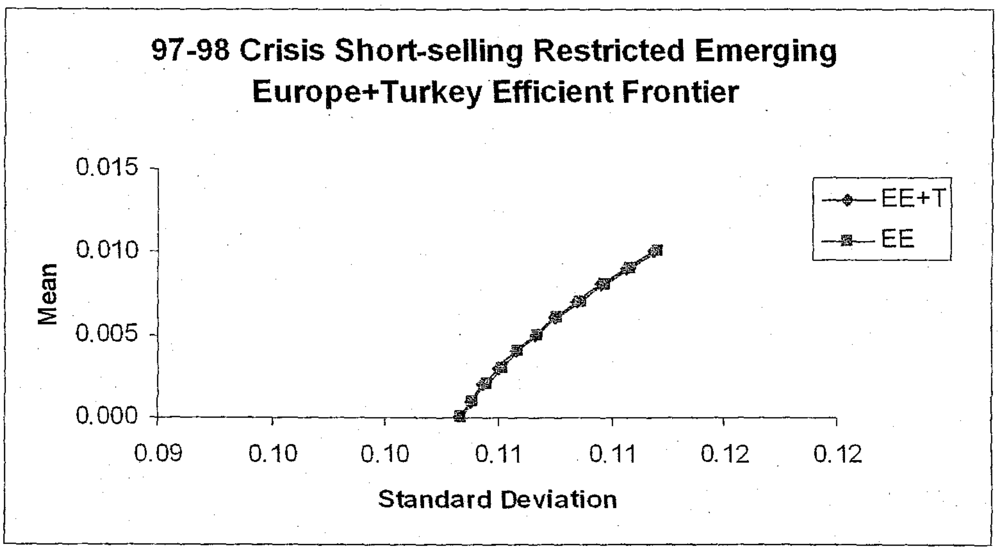

Figure 6.18 97-98 Crisis Short-selling Restricted EE+Turkey Efficient Frontier

6.3 Asia Region

The Asia region portfolio consists of the following countries; China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Taiwan and Thailand. The portfolio is constructed from the monthly dollar returns of these countries' stock market indexes. The aim of this regional analysis is to explore the risk-return characteristics of the region countries as well as exploring the diversification benefit of Turkey within the region. The analyses start with full-period investigation of the classic, Stein and short-selling restricted efficient frontiers and then detail into global crises periods.

6.3.1 Full Period Analysis

The time period under investigation starts from 1993:02 and extends to 2003:02, a total of 121 observations are put into estimation. Although majority of countries in the region has longer history, due to the relatively shorter history of China, India and Pakistan stock markets the time period under investigation starts form 1993:02. In the construction of the efficient portfolios short-selling is allowed. The full period findings are summarized in the following table.

Table 6.39 Asia Region Full Period Analyses

FULL PERIOD	A+T	A		
Minimum Variance Portfolio Mean	0.000667	0.000744		
Minimum Variance Portfolio St. Dev.	0.062483	0.062486		
	A+T		A	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.019619	0.246496	0.008641	0.153684
Standard Deviation	0.338994	1.201595	0.212881	0.897803
Sharpe Ratio	0.057874	0.205140	0.040589	0.171178
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	0.443209	3.281809		
Test Statistic	0.102584	0.695399		

6.3.1.1 Classic Efficient Frontier Analysis

The examination of the correlation matrix reveals that the region countries had relatively lower correlations on average. However some countries are more integrated than the others such as Philippines and Thailand. They had the highest correlation over the full period. Meanwhile, the lowest correlation was between Pakistan and Philippines. On the other hand, Turkey had the lowest correlation with India followed by Thailand, Philippines and Indonesia. Compared to the average correlations of the Asia countries' with each other, Turkey had relatively lower correlations. The highest correlation of Turkey is observed with Taiwan.

Table 6.40 Asia Region Full Period Correlation Matrix

	CHI	IND	INDO	KOR	MAL	PAK	PHI	TAI	THA	TUR
CHINA	1									
INDIA	0.15	1								
INDONESIA	0.32	0.16	1							
KOREA	0.30	0.19	0.44	1						
MALAYSIA	0.32	0.21	0.59	0.49	1					
PAKISTAN	0.10	0.37	0.11	0.12	0.20	1				
PHILIPPINES	0.43	0.14	0.61	0.43	0.57	0.03	1			
TAIWAN	0.47	0.30	0.28	0.41	0.44	0.21	0.46	1		
THAILAND	0.43	0.14	0.48	0.63	0.61	0.15	0.72	0.44	1	
TURKEY	0.28	0.17	0.19	0.23	0.22	0.22	0.19	0.30	0.19	1

The mean and the standard deviation of the minimum variance portfolio of Asia portfolio are found as 0.000744 and 0.062486, respectively. However, the comparison of the portfolio with the Asia including Turkey portfolio reveals that inclusion of Turkey slightly reduces the mean and the standard deviation of the portfolio. The minimum variance portfolio mean and standard deviation are found as 0.0006 and 0.0624, respectively. Sharpe ratio is found to increase from 0.17 to 0.20. Inclusion of Turkey is also estimated to reduce risk up to 1% at the high risk region. The following table gives the change in standard deviation.

Table 6.41 Change in St. Dev. of Asia Portfolio

Mean	St. Dev. A+T	St. Dev. A	Change in St. Dev.
0.000	0.062567	0.062638	0.000071
0.001	0.062504	0.062504	0.000001
0.002	0.062821	0.062918	0.000097
0.003	0.063512	0.063867	0.000355
0.004	0.064567	0.065330	0.000763
0.005	0.065966	0.067273	0.001306
0.006	0.067690	0.069655	0.001965
0.007	0.069713	0.072433	0.002720
0.008	0.072010	0.075564	0.003553
0.009	0.074557	0.079005	0.004448
0.010	0.077329	0.082718	0.005389
0.011	0.080302	0.086669	0.006367
0.012	0.083454	0.090825	0.007370
0.013	0.086767	0.095160	0.008393
0.014	0.090223	0.099651	0.009428
0.015	0.093805	0.104277	0.010472

This risk reduction can also be observed from the below graph where efficient frontiers of both portfolios are provided.

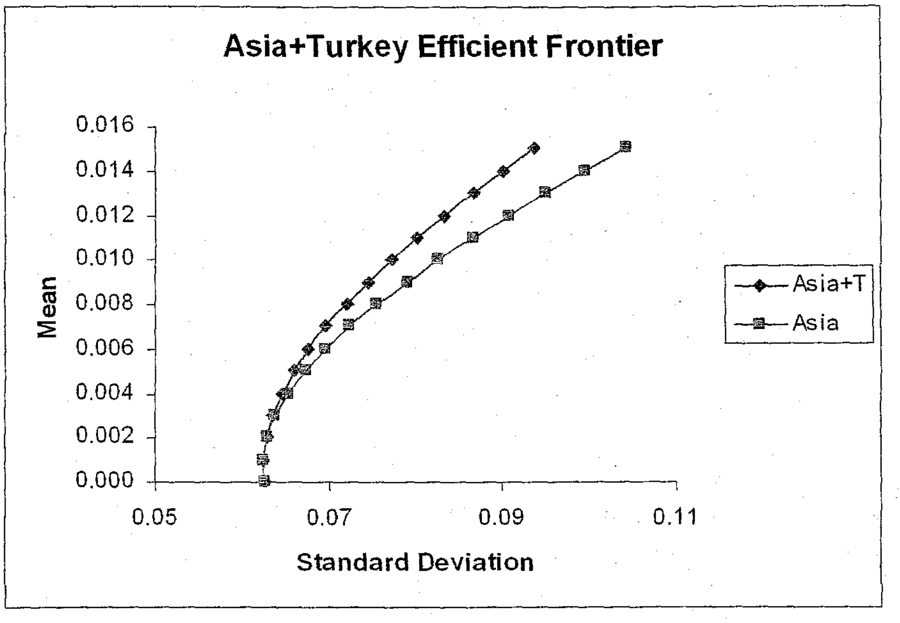

Figure 6.19 Asia including Turkey Efficient Frontier

Despite the 3.28 marginal potential performance produced by the inclusion of Turkey in the Asia portfolio, the test statistic fails to reject the null hypothesis at the 1% significance level. Thus, Asia portfolio spans the Asia including Turkey portfolio over the full period. It is concluded that Turkey fails to significantly shift the efficient frontier leftward over the full period. The spanning test parameters are provided in table 6.42 in the Appendix C.

6.3.1.2 Stein Estimated Efficient Frontier Analysis

In Stein estimation the full period Asia region portfolio sample means are smoothed by the minimum variance portfolio mean (0.00074) in order to minimize the estimation bias. The lambda and shrinkage factor are calculated as 411.52 and 0.77, respectively. The sample means and the re-estimated means are provided below.

Table 6.43 Asia Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINA	-0.009319	-0.001542
INDIA	0.002865	0.001226
INDONESIA	0.001750	0.000973
KOREA	0.008073	0.002410
MALAYSIA	0.003854	0.001451
PAKISTAN	0.002633	0.001174
PHILIPPINES	-0.004616	-0.000473
TAIWAN	0.006536	0.002060
THAILAND	-0.001783	0.000170

After the shrinkage of the means toward the minimum variance portfolio, a very slight drop is observed in the mean of the tangency portfolio while no change is observed in the standard deviation of it. The Sharpe ratio of the Asia tangency portfolio is found to drop from 0.17 to 0.04. The standard deviation ranges from 0.06 to 0.37 which is a wider range than the classic analysis estimates. It is found that Asia portfolio is more risky than estimated by the classic efficient frontier estimation.

The sample means of Asia including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.00066). The lambda and shrinkage factor by which sample means are re-estimated are then derived as 314.7 and 0.72, respectively. The sample means and re-estimated means are provided below.

Table 6.44 Asia+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINAPI	-0.009319	-0.002106
INDIAPI	0.002865	0.001277
INDONESIAPI	0.001750	0.000967
KOREAPI	0.008073	0.002723
MALAYSIAPI	0.003854	0.001552
PAKISTANPI	0.002633	0.001213
PHILIPPINESPI	-0.004616	-0.000800
TAIWANPI	0.006536	0.002296
THAILANDPI	-0.001783	-0.000014
TURKEYPI	0.021899	0.006562

It is seen that Stein estimation shrinks the means towards the minimum variance portfolio mean. In this respect Turkey's sample mean drops from 0.021 to 0.006. The tangency portfolio mean and standard deviation decrease to 0.019 and 0.33, respectively. The Sharpe ratio is found to decrease from 0.20 to 0.05.

On the other hand, inclusion of Turkey is found to reduce the risk of the portfolio up to 11% at the high risk region. Compared to classic optimization Stein estimation reveals that this risk reduction is actually higher once the estimation bias is minimized. Following table also demonstrates that the risk of the portfolio is greater than estimated by the classic efficient frontier analysis.

Table 6.45 Change in St. Dev. of Asia Portfolio

Mean	St. Dev. Stein A+T	St. Dev. Stein A	Change in St. Dev.
0.000	0.063572	0.065366	0.001794
0.001	0.062757	0.062833	0.000075
0.002	0.066736	0.070368	0.003632
0.003	0.074746	0.085345	0.010600
0.004	0.085664	0.104616	0.018952
0.005	0.098529	0.126229	0.027700
0.006	0.112675	0.149169	0.036494
0.007	0.127677	0.172909	0.045232
0.008	0.143266	0.197160	0.053893
0.009	0.159271	0.221754	0.062483
0.010	0.175577	0.246590	0.071012
0.011	0.192108	0.271600	0.079491
0.012	0.208811	0.296740	0.087929
0.013	0.225647	0.321981	0.096334
0.014	0.242588	0.347300	0.104712
0.015	0.259615	0.372681	0.113066

The below graph provides the classic and Stein efficient frontiers of the Asia and Asia including Turkey portfolios over the full period. As can be seen the Stein estimated frontiers are flatter indicating higher risk and Turkey's contribution is more evident.

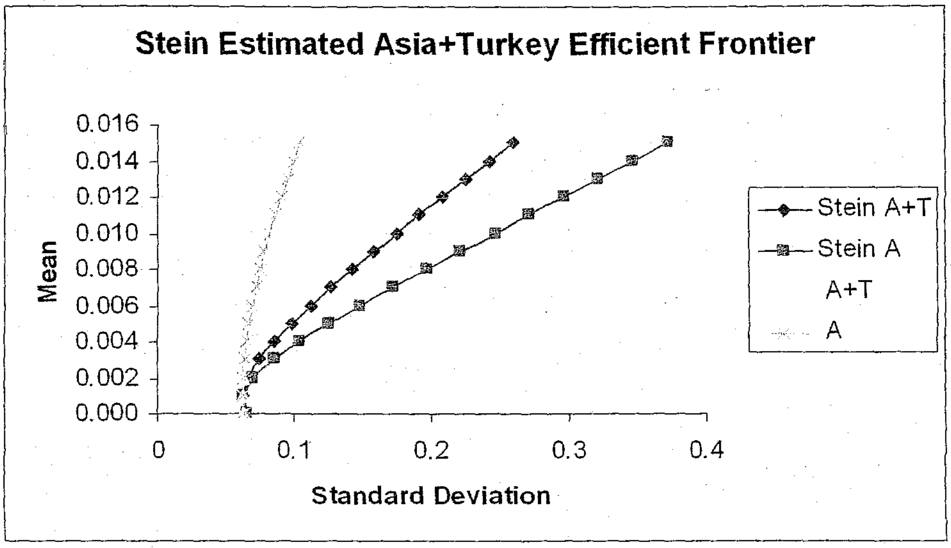

Figure 6.20 Stein Estimated Asia+Turkey Efficient Frontier

However, inclusion of Turkey results in a minor (0.44) marginal potential performance. The spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Thus, Stein estimation confirms that over the full period Turkey provided no significant risk reduction to the Asia portfolio. The spanning test parameters are provided in table 6.46 in the Appendix C.

6.3.1.3 Short-selling Restricted Efficient Frontier Analysis

For the full period analysis once the short-selling is restricted it is observed that the risk of the portfolios increases. While no optimal solution can be found for the Asia portfolio for means over 0.008 in the short-selling restricted estimation, comparison of the short-selling restricted portfolios of Asia and Asia including Turkey demonstrates that inclusion of Turkish stock not only reduces the risk of the Asia portfolio up to 5%

but also extends the efficient frontier beyond mean 0.08. The following graph depicts the risk reduction and efficient frontier extension achieved by the inclusion of Turkish stock market in the Asia portfolio.

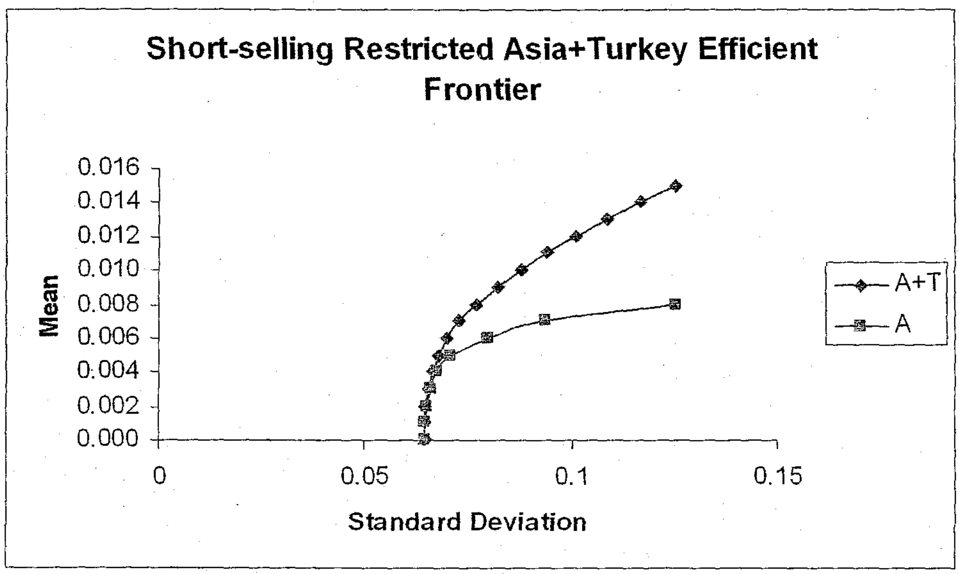

Figure 6.21 Short-selling Restricted A+Turkey Efficient Frontier

6.3.2 Crises Periods Analyses

Due to the unavailability of the data, ERM crisis cannot be examined by the researcher. Since the available data starts from 1993:01, ERM crisis period falls out of range of the data. As the crisis period cannot be fully incorporated into the estimation, the analyses cannot be provided for the ERM crisis. The crises analyses are respectively provided for Latin, Asian and Russian crises periods. For the Latin crisis the time period under investigation starts from 1994:01 and extends to 1995:12 and for the Asian and Russian crises the time period under investigation starts from 1997:01 and extends to 1998:12. A total of 24 monthly observations are put into estimation for both periods and short-selling is allowed in the construction of the efficient portfolios. The table below summarizes the crises periods findings of the Asia region.

Table 6.47 Asia Region Crises Periods Analyses

1994-95 PERIOD				
	A+T	A		
Minimum Variance Portfolio Mean	0.007898	0.007539		
Minimum Variance Portfolio St. Dev.	0.043335	0.043692		
	A+T		A	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.013423	0.088627	0.014941	0.093099
Standard Deviation	0.056494	0.145165	0.061509	0.153541
Sharpe Ratio	0.237598	0.610525	0.242903	0.606347
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	-2.938179	3.806794		
Test Statistic	0.074379	0.124192		

1997-98 PERIOD				
	A+T	A		
Minimum Variance Portfolio Mean	0.005538	0.004930		
Minimum Variance Portfolio St. Dev.	0.061987	0.062472		
	A+T		A	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.021457	0.239926	0.027611	0.270217
Standard Deviation	0.122020	0.408022	0.147850	0.462523
Sharpe Ratio	0.175850	0.588022	0.186753	0.584223
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	-1.370134	2.049670		
Test Statistic	0.070203	0.123656		

6.3.2.1 Classic Efficient Frontier Analysis

The aim of this analysis is to investigate the effect of crises on the Asia Region and contribution of Turkey during the crises. The examination of the following correlation matrix points out that during the 94-95 crisis the correlations of Asian countries were respectively higher than their average correlations. The highest correlation is observed between Philippines and Thailand (0.90) while the lowest is observed between Pakistan and Turkey (0). In the region Thailand had the highest correlations. It had the highest correlation with Philippines followed by China and Malaysia. During the period Turkey had the highest correlation with China (0.45). Meanwhile, Turkey and Thailand had a relatively low correlation of 0.35 during the period.

Table 6.48 Asia Region 94-95 Crisis Correlation Matrix

	CHI	IND	INDO	KOR	MAL	PAK	PHI	TAI	THA	TUR
CHINA	1									
INDIA	0.48	1								
INDONESIA	0.72	0.61	1							
KOREA	0.27	0.35	0.24	1						
MALAYSIA	0.77	0.23	0.56	0.12	1					
PAKISTAN	0.38	0.52	0.23	0.20	0.35	1				
PHILIPPINES	0.72	0.41	0.67	0.17	0.75	0.35	1			
TAIWAN	0.46	0.38	0.34	0.46	0.54	0.40	0.60	1		
THAILAND	0.81	0.42	0.76	0.23	0.80	0.21	0.90	0.56	1	
TURKEY	0.45	0.10	0.21	0.09	0.35	0.00	0.15	0.21	0.35	1

The Asian crisis combined with Russian crisis was a very severe crisis especially for the Asian countries. The correlation matrix reveals that during the period region countries' correlations have increased. The highest correlation is observed between Thailand and Korea (0.77) while the lowest is between Philippines and Pakistan (-0.15). It can be said that compared to 94-95 crisis period China had lower correlations with the Region while Korea had higher correlations on average. Meanwhile, Turkey had the highest correlation with Philippines (0.27) and the lowest with the China (-0.03). Interestingly Turkey's correlations with the Asia region countries are reversed compared to 94-95 crisis periods. Turkey's correlation with China, India, Korea, Malaysia, and

Thailand had decreased while its correlation with Indonesia, Pakistan, Philippines and Taiwan had increased.

Table 6.49 Asia Region 97-98 Crisis Correlation Matrix

	CHI	IND	INDO	KOR	MAL	PAK	PHI	TAI	THA	TUR
CHINA	1									
INDIA	0.43	1								
INDONESIA	0.18	0.19	1							
KOREA	0.19	-0.07	0.50	1						
MALAYSIA	0.19	0.28	0.68	0.66	1					
PAKISTAN	0.07	0.36	0.07	0.02	0.24	1				
PHILIPPINES	0.43	0.02	0.60	0.57	0.64	-0.15	1			
TAIWAN	0.63	0.29	0.43	0.47	0.45	0.16	0.62	1		
THAILAND	0.39	0.03	0.32	0.77	0.58	0.08	0.70	0.58	1	
TURKEY	-0.03	0.07	0.26	0.07	0.24	0.11	0.27	0.26	0.06	1

For the 94-95 crisis period the Asia portfolio's minimum variance portfolio mean and standard deviation are found as 0.0075 and 0.0436, respectively. However, compared to the full period analysis the crisis period mean is found to be higher while the standard deviation is found to be lower. The inclusion of Turkey in the Asia portfolio is found to increase the minimum variance portfolio mean while slightly decreasing the standard deviation. The minimum variance portfolio mean and standard deviation are found as 0.0078 and 0.0433, respectively. The Sharpe ratio increases from 0.60 to 0.61.

For the 97-98 period the Asia portfolio minimum variance portfolio mean and standard deviation are found as 0.0049 and 0.0624, respectively. The portfolio standard deviation ranges between 0.062 and 0.065 for the given means. The inclusion of Turkey in the Asia portfolio is found to increase the mean to 0.0055 while the standard deviation is found to decrease to 0.061. No significant change is found for Sharpe ratio however. The change in the efficient frontiers can be seen at the following graphs where the efficient frontiers of respective portfolios are provided. For both crises periods inclusion of Turkey is observed to shift the efficient frontier leftward, implying diversification benefit.

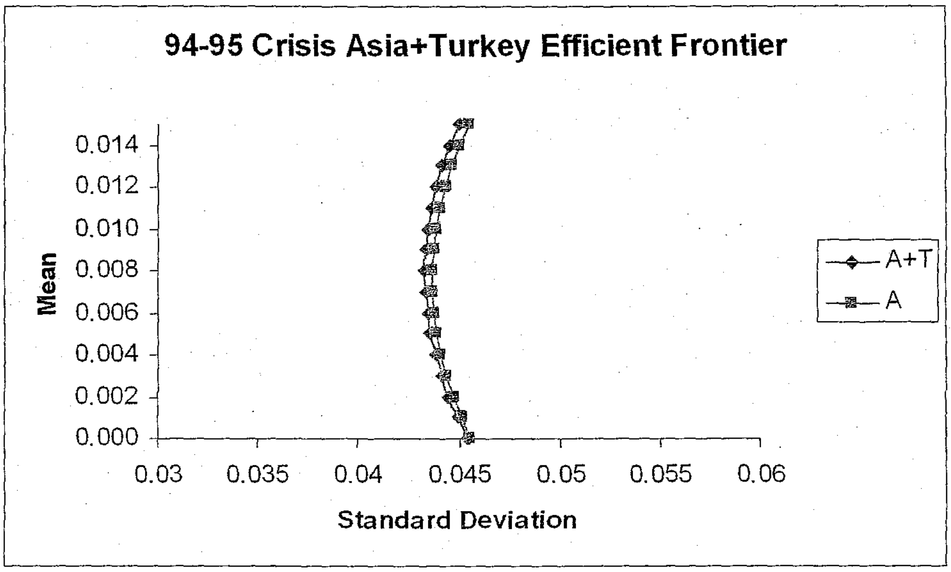

Figure 6.22 94-95 Crisis A+Turkey Efficient Frontier

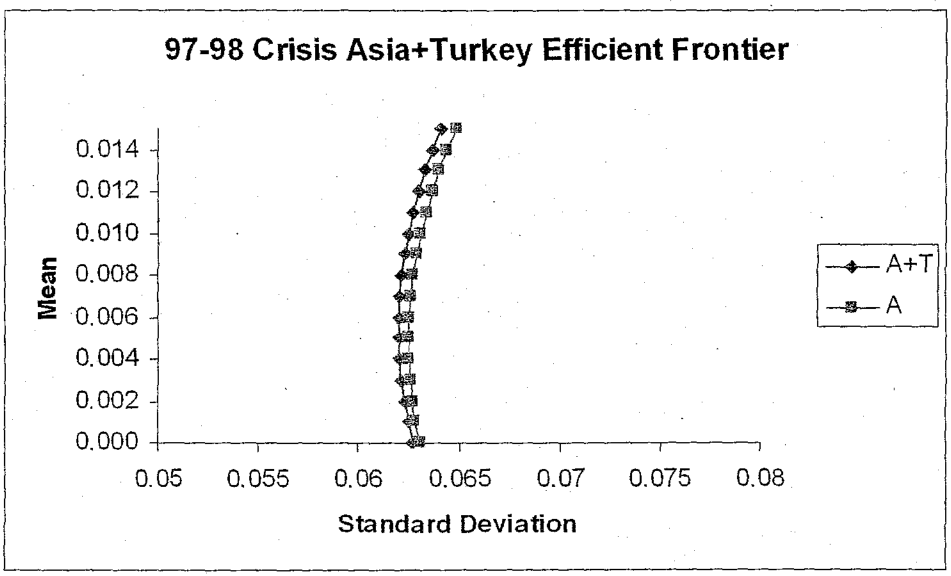

Figure 6.23 97-98 Crisis A+Turkey Efficient Frontier

The statistical significance of observed leftward shifts achieved by the inclusion of Turkey is explored by the spanning test. Parameters of the tests are provided in tables 6.50 and 6.51 in the Appendix C. During the 94-95 and 97-98 periods inclusion of Turkey is found to produce respectively 3.80 and 2.04 marginal potential performance. However, the test statistic fails to reject the null hypothesis at the 1% significance level for both periods. Thus, it is decided that Asia portfolio spans the Asia including Turkey portfolio that Turkish stock market did not provide any significant risk reduction in the Asia region during the 94-95 and 97-98 crises, its contribution is negligible.

6.3.2.2 Stein Estimated Efficient Frontier Analysis

For the 94-95 crisis period the sample means of Asia portfolio is smoothed by the minimum variance portfolio mean (0.0075). The lambda and shrinkage factor used in the estimation are then derived as 57.6 and 0.70, respectively. The sample means and the re-estimated means are provided in table 6.52 the Appendix C. It is observed that sample means are shrunk towards the minimum variance portfolio to minimize the estimation bias. The comparison of the Stein and classic tangency portfolios verify that Stein estimation leads to lower mean and lower standard deviation. The Sharpe ratio drops from 0.60 to 0.24.

The Asia including Turkey portfolio sample means are likewise smoothed by the minimum variance portfolio mean (0.0079) to minimize the estimation bias. The lambda and the shrinkage factor used in the estimation are then found as 67.7 and 0.73, respectively. The sample means and the re-estimated means of the Asia including

Turkey portfolio for the 94-95 crisis period is provided in table 6.53 in the Appendix C. It is observed that during the 94-95 crisis China, India, Indonesia, Pakistan and Turkey had negative average returns. However, Stein estimation shrinks them towards the minimum variance portfolio mean. Turkey's negative sample mean increases to 0.002. The Stein estimated tangency portfolio mean and standard deviation are found to be lower and Sharpe ratio reduces to 0.23 from 0.61. Classic estimation had suggested an increase in the Sharpe ratio from 0.60 to 0.61 due to the inclusion of Turkey but Stein shows that Sharpe ratio actually decreases from 0.24 to 0.23 once the estimation bias is minimized. On the other hand, the Stein estimation illustrates that the reduction suggested in the standard deviation of the Asia including Turkey portfolio by the classic efficient frontier analysis is biased. The inclusion of Turkey increases the standard deviation of Asia portfolio over the 94-95 crisis period.

The 97-98 period sample means of Asia region countries are smoothed by the minimum variance portfolio mean (0.0055) to get a better estimate of the risk-return characteristics of the Asia region portfolio. The lambda and shrinkage factor are calculated as 58 and 0.70, respectively. The sample means and the re-estimated means are provided in the table 6.54 in the Appendix C. It is observed that during the crisis all Asian countries had negative returns. The Stein estimation shrinks the sample means towards the minimum variance portfolio mean. The estimated standard deviation ranges from 0.06 to 0.08, a wider range than estimated by the classic approach. The mean and standard deviation of tangency portfolio reduces to 0.027 and 0.14, respectively. Accordingly, the Sharpe ratio decreases from 0.58 to 0.18.

The sample means of Asia including Turkey portfolio are smoothed by the minimum variance portfolio mean (0.0055). The lambda and shrinkage factor are found as 68 and 0.74, respectively. A higher shrinkage factor is found compared to the 94-95 period. The sample means and re-estimated means are provided in table 6.55 in the Appendix C. During the crisis period while Asian countries had negative average returns, Turkish stock market had 1.3% average return. After the Stein estimation the sample means are shrunk towards the minimum variance portfolio mean. Turkey's sample mean drops to 0.007. The mean and standard deviation of tangency portfolio drops to 0.021 and 0.12, respectively. The Sharpe ratio decreases from 0.18 to 0.17 due to the shrinkage of the sample means. Compared to 94-95 period lower Sharpe ratios are found under both estimation approaches for the Asia including Turkey portfolio.

The Stein estimation also reveals that the Asia including Turkey portfolio and the Asia portfolio both are more volatile than estimated by the classic optimization as efficient frontiers are flatter than the classic efficient frontiers for both crisis periods. It is also observed that once the estimation bias is minimized the risk reduction achieved by the inclusion of Turkey in the Asia portfolio diminishes. The following graphs provide the classic and Stein estimated efficient frontiers for the two respective portfolios. Stein estimated frontiers are observed to overlap.

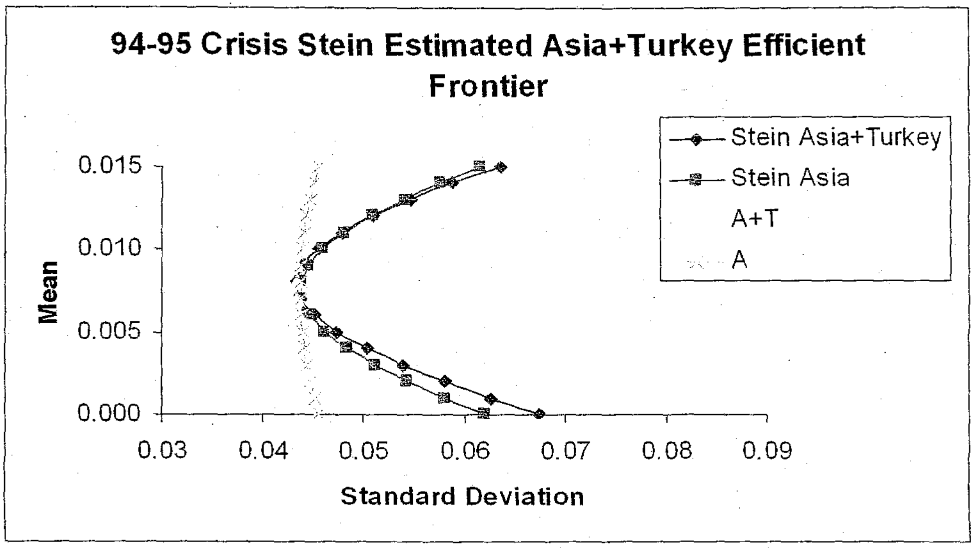

Figure 6.24 94-95 Crisis Stein Estimated A+Turkey Efficient Frontier

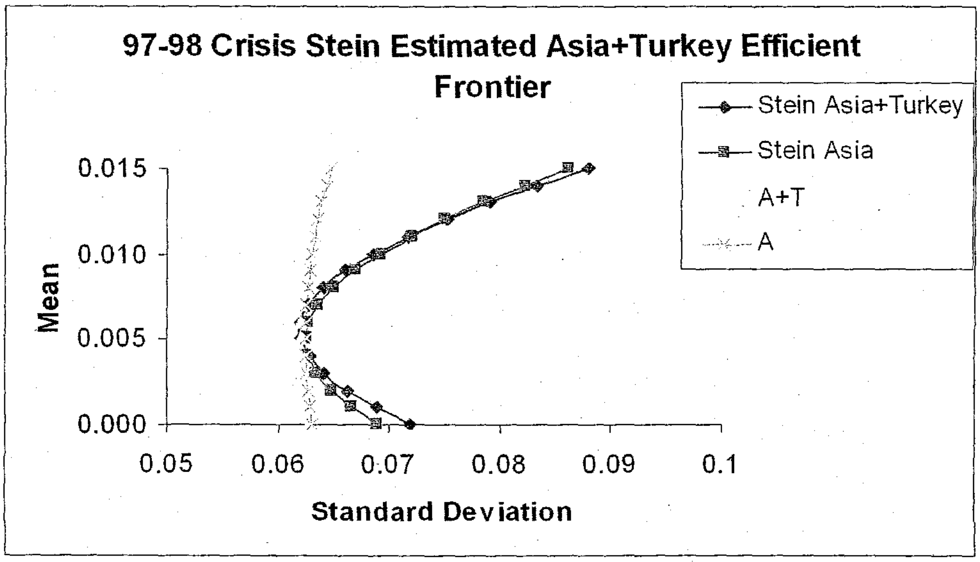

Figure 6.25 97-98 Crisis Stein Estimated A+Turkey Efficient Frontier

The statistical significance of the efficient frontier shifts is explored by the spanning test. In confirmation with the findings provided above Turkey's inclusion produces negative marginal potential performance for the 94-95 and the 97-98 crises period. Test parameters are provided in tables 6.56 and 6.57 in the Appendix C. Test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Thus, despite the negative marginal potential performance, the shift of the efficient frontier is insignificant and it is concluded that Asia portfolio spanned the Asia including Turkey frontier during the 94-95 crisis period. Turkey's contribution is negligible.

6.3.2.3 Short-selling Restricted Efficient Frontier Analysis

For the 94-95 period it is seen that inclusion of Turkey does not provide any significant risk reduction in the short-selling restricted portfolio. It is found that the respective portfolios overlap. However, for the 97-98 crises period no feasible solution can be found for the short-selling restricted Asia portfolio for any given mean as all the assets in the portfolio had negative sample returns. However, the short-selling restricted Asia including Turkey portfolio produces the following efficient frontier.

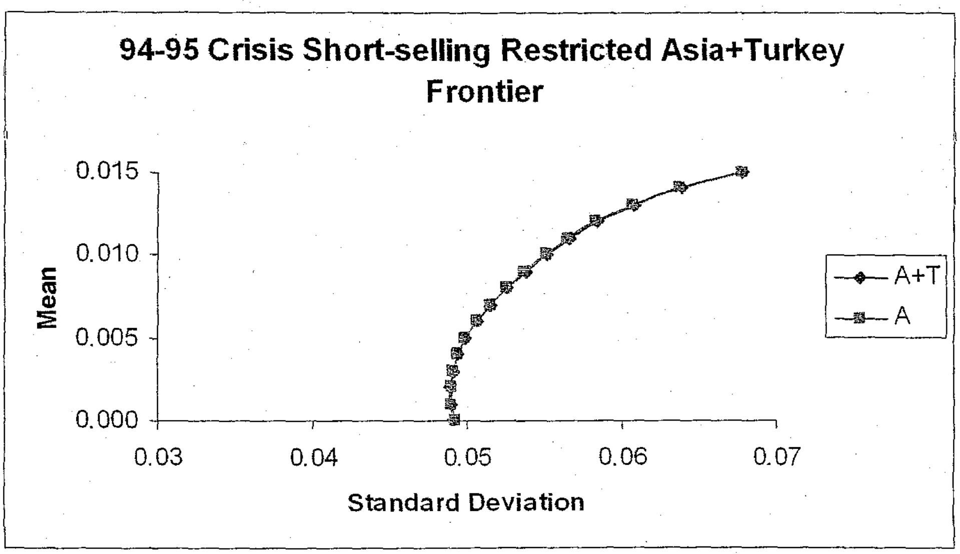

Figure 6.26 94-95 Crisis Short-selling Restricted A+Turkey Efficient Frontier

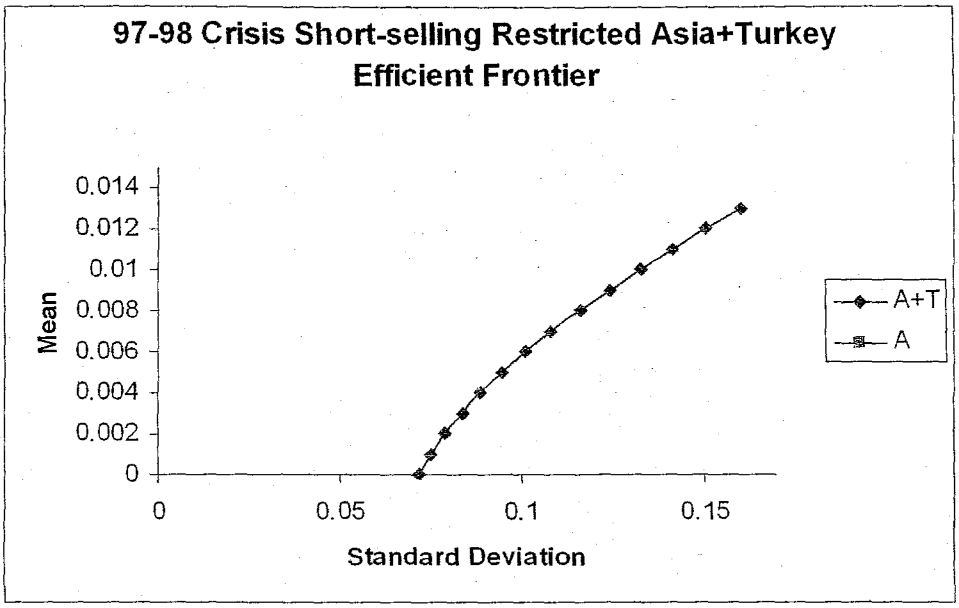

Figure 6.27 97-98 Crisis Short-selling Restricted A+Turkey Efficient Frontier

6.4 North America Region

The North America region portfolio consists of Canada and US stock market indexes. The portfolio is constructed from the monthly dollar returns of the respective countries stock market indexes. The objective of the following analyses is to explore the diversification properties of this region and investigate the risk reduction Turkey provides. The analyses start with the full period analysis and then details into the crises periods. Classic efficient frontier analysis, Stein estimated efficient frontier analysis and short-selling restricted efficient frontier analysis are provided for each time period under investigation.

6.4.1 Full Period Analysis

The full period analysis period start from 1988:02 and extends to 2003:02. Although Canada and US stock markets have longer histories, to have a comparable time period with Turkish stock market the analysis is started from 1988 which is the inclusion date of Turkish stock market to the MSCI Emerging Markets index. A total of 180 observations are put into analysis and short-selling is allowed. The following table summarizes the findings of the full period analyses.

Table 6.58 North America Region Full Period Analyses

FULL PERIOD				
	NA+T	NA		
Minimum Variance Portfolio Mean	0.007405	0.007426		
Minimum Variance Portfolio St. Dev.	0.042837	0.042720		
	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.007584	0.009940	0.007493	0.008907
Standard Deviation	0.043352	0.049632	0.042910	0.046915
Sharpe Ratio	0.174934	0.200274	0.174614	0.189858
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	0.246469	2.273661		
Test Statistic	-0.446666	-0.116303		

6.4.1.1 Classic Efficient Frontier Analysis

The examination of the correlation matrix reveals that Canada and US has a strong correlation. This correlation is due to their not only economically but also politically strong relations. On the other hand Turkey is found to have very low correlations with the North America region countries. Turkey had 0.21 correlation with both countries.

Table 6.59 North America Region Full Period Correlation Matrix

	CAN	US	TUR
CANADA	1		
USA	0.74	1	
TURKEY	0.21	0.21	1

The minimum variance portfolio mean and standard deviation of North America portfolio are found as 0.007 and 0.043, respectively. The standard deviation of the portfolio ranges between 0.04 and 0.10 for the given means. Despite its relatively lower correlation with region countries the inclusion of Turkey in the North America portfolio, creates almost no change in the mean and the standard deviation of the portfolio. On the other hand, the following table demonstrates that at the high risk region inclusion of Turkey provides risk reduction up to 2% for the given means.

Table 6.60 Change in St. Dev. of North America Portfolio

Mean	St. Dev. NA+T	St. Dev. NA	Change in St. Dev.
0.000	0.084817	0.104775	0.019958
0.001	0.076447	0.093160	0.016713
0.002	0.068483	0.081925	0.013442
0.003	0.061083	0.071250	0.010167
0.004	0.054479	0.061428	0.006949
0.005	0.048991	0.052934	0.003943
0.006	0.045031	0.046504	0.001473
0.007	0.043023	0.043071	0.000048
0.008	0.043239	0.043354	0.000114
0.009	0.045649	0.047285	0.001637
0.010	0.049934	0.054075	0.004141
0.011	0.055665	0.062804	0.007139
0.012	0.062443	0.072776	0.010333
0.013	0.069966	0.083549	0.013583
0.014	0.078018	0.094849	0.016831
0.015	0.086452	0.106509	0.020057

This reduction in the standard deviation of the portfolio can be observed at the following graph where both respective portfolios are provided. The statistical significance of this leftward shift of the efficient frontier is investigated by the spanning test.

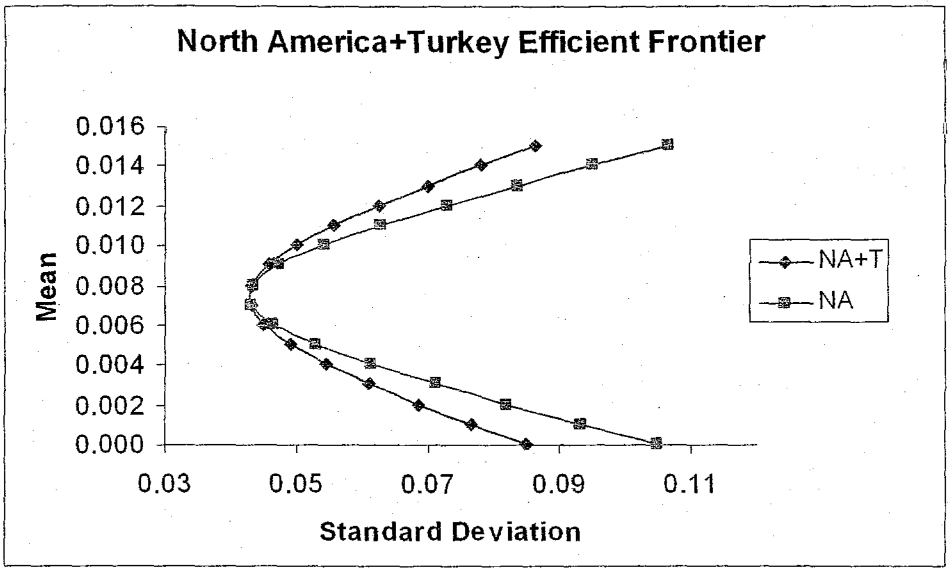

Figure 6.28 North America including Turkey Efficient Frontier

It is observed that inclusion of Turkey produces 2.27 marginal potential performance. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. It is concluded that despite its low correlation with the region countries Turkey's contribution to North America portfolio is negligible. The spanning test parameters are provided in table 6.61 in the Appendix C.

6.4.1.2 Stein Estimated Efficient Frontier Analysis

In the Stein estimation of the full period data the sample means of the North America portfolio are smoothed by the minimum variance portfolio mean found as

0.0074 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 675.08 and 0.79, respectively. The table below provides the re-estimated sample means.

Table 6.62 North America Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.005180	0.006951
US	0.007911	0.007529

Not much difference is observed between the sample means and the re-estimated means since the average means of the Canada and US market have already been close to the minimum variance portfolio mean. The Sharpe ratio slightly drops from 0.18 to 0.17. The historical averages of North America portfolio is found to be good estimators of the sample means.

The full period sample means of North America including Turkey portfolio is smoothed by the minimum variance portfolio mean 0.0074. The lambda and the shrinkage factor are found as 499.82 and 0.73, respectively. Inclusion of Turkey is observed to result in a lower shrinkage factor. The sample means and re-estimated means are provided below.

Table 6.63 North America+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.005180	0.006813
US	0.007911	0.007539
TURKEY	0.019457	0.010609

It is observed that Turkey's relatively higher mean is shrunk towards the minimum variance portfolio mean. It decreases from 0.019 to 0.01 while Canada and US experience minimal changes. The examination of the Sharpe ratios of the tangency portfolios computed with zero risk-free rate reveal a slight drop from 0.20 to 0.17.

However, the estimated standard deviation of the portfolio range changes dramatically. The standard deviation ranges from 0.04 to 0.46. This finding confirms the estimation bias inherit in the classic MV optimization. Stein estimation demonstrates the high risk of the North America portfolio. On the other hand the following table displays that once the estimation bias is minimized the contribution of Turkish stock market becomes more significant. At the high risk level Turkey is expected to provide up to 17.7% risk reduction.

Table 6.64 Change in St. Dev. of North America Portfolio

Mean	St. Dev. Stein NA+T	St. Dev. Stein NA	Change in St. Dev.
0.000	0.278669	0.454507	0.175838
0.001	0.241991	0.393888	0.151897
0.002	0.205496	0.333383	0.127887
0.003	0.169303	0.273066	0.103763
0.004	0.133657	0.213099	0.079442
0.005	0.099150	0.153891	0.054741
0.006	0.067550	0.096844	0.029293
0.007	0.045401	0.050000	0.004599
0.008	0.048222	0.055194	0.006972
0.009	0.073180	0.104966	0.031786
0.010	0.105599	0.162525	0.056926
0.011	0.140402	0.221891	0.081489
0.012	0.176182	0.281926	0.105744
0.013	0.212446	0.342277	0.129831
0.014	0.248983	0.402803	0.153820
0.015	0.285688	0.463435	0.177747

The graph below provides the respective portfolio's classic and Stein estimated efficient frontiers. Two points are evident. The Stein estimation points out that both portfolios have higher risk which can be visually observed from the flatter efficient frontiers of Stein estimated portfolios. Turkey is found to be producing higher risk reduction under the Stein estimation compared to classic efficient frontier analysis.

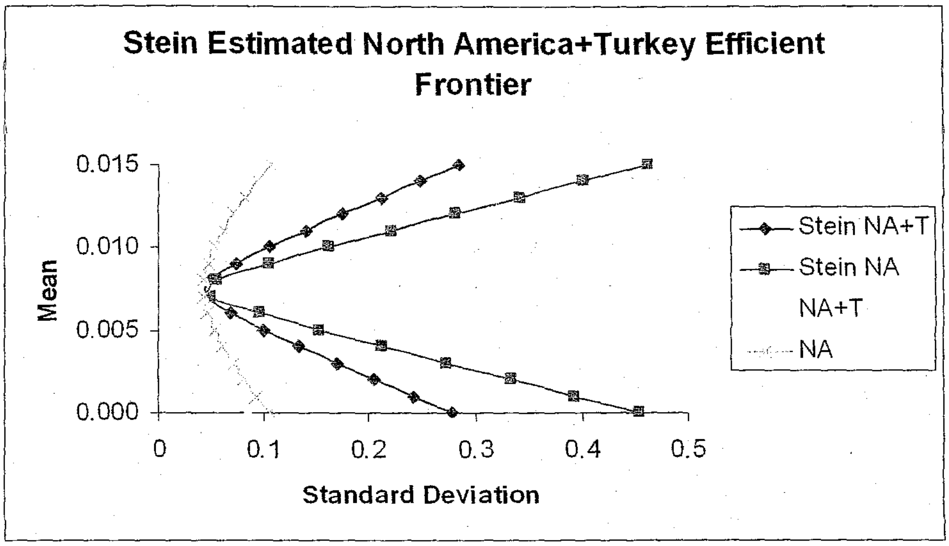

Figure 6.29 Stein Estimated North America+Turkey Efficient Frontier

It is found that inclusion of Turkey into the North America portfolio generates a very small marginal potential performance (0.24) which is insignificant. The test statistics falls short of the required f-value and fails to reject the null hypothesis. It is concluded that over the full period Turkish stock markets contribution to North America portfolio is negligible. The spanning test parameters are provided in table 6.65 in the Appendix C.

6.4.1.3 Short-selling Restricted Efficient Frontier Analysis

The analysis reveals that short-selling restricted North America portfolio is outperformed by the short-selling restricted North America including Turkey portfolio. Inclusion of Turkey extends the efficient frontier beyond the mean 0.007 which is the only optimal efficient portfolio NA portfolio can produce. The graph below gives the short-selling restricted efficient frontiers of the respective portfolios.

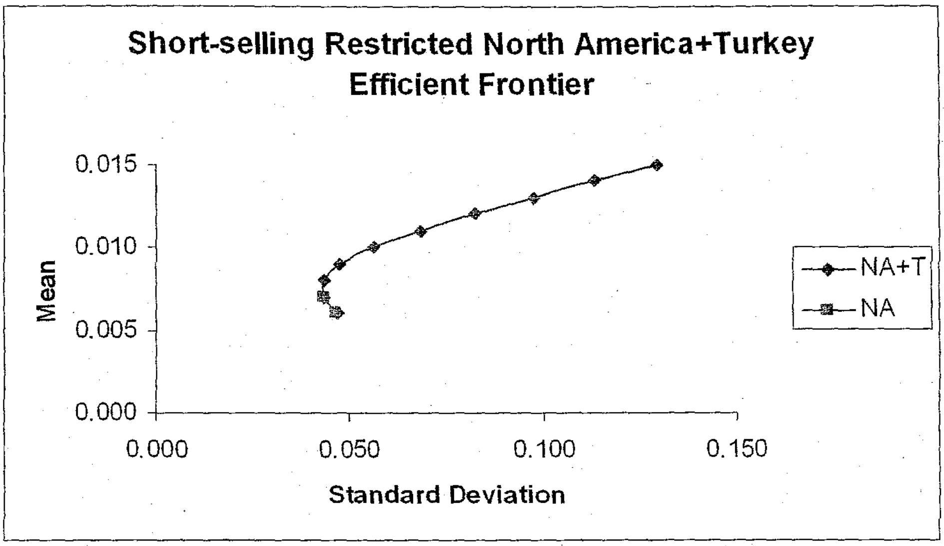

Figure 6.30 Short-selling Restricted NA+Turkey Efficient Frontier

6.4.2 Crises Periods Analyses

In this section the 1992-93 ERM Crisis, 1994-95 Latin Crisis and 1997-98 Asian and Russian Crises are examined in detail. The analyses aim to observe the effect of crisis on the North America region portfolio and investigate whether Turkish stock market provides risk reduction during the crises. The periods under investigation for the crises are respectively 1992:01 to 1993:12, 1994:01 to 1995:12 and 1997:01 to 1998:12. A total of 24 monthly observations are provided for each crisis period and short-selling is allowed in the analyses unless otherwise stated. The following table summarizes the crises period findings of the North America region.

Table 6.66 North America Region Crises Periods Analyses

1992-93 PERIOD

	NA+T	NA
Minimum Variance Portfolio Mean	0.006317	0.005105
Minimum Variance Portfolio St. Dev.	0.022430	0.024076

	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.006674	0.012600	0.005487	0.011881
Standard Deviation	0.023055	0.031678	0.024961	0.036730
Sharpe Ratio	0.289474	0.397745	0.219811	0.323461

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	7.120907	53.841707
Test Statistic	1.579453	1.744079

1994-95 PERIOD

	NA+T	NA
Minimum Variance Portfolio Mean	0.012338	0.012386
Minimum Variance Portfolio St. Dev.	0.026979	0.026982

	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.012491	0.016093	0.012504	0.015252
Standard Deviation	0.027145	0.030811	0.027110	0.029941
Sharpe Ratio	0.460149	0.522297	0.461220	0.509393

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.794799	20.453517
Test Statistic	0.008231	0.150612

1997-98 PERIOD

	NA+T	NA
Minimum Variance Portfolio Mean	0.023945	0.024815
Minimum Variance Portfolio St. Dev.	0.051743	0.052101

	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.032580	0.055194	0.034180	0.053160
Standard Deviation	0.060355	0.078558	0.061147	0.076257
Sharpe Ratio	0.539796	0.702588	0.558980	0.697108

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-2.697407	8.926683
Test Statistic	0.063206	0.315342

6.3.2.4 Classic Efficient Frontier Analysis

The examination of the correlation matrix of North America region reveals that during the crisis period of 92-93 Canada and US had a very low correlation. A correlation that is remarkably lower than their long term average correlation. While the highest correlation is observed between Canada and US (0.14), Turkey had negative correlations with US and Canada, promising diversification benefit during the crisis.

Table 6.67 North America Region 92-93 Crisis Correlation Matrix

	CAN	US	TUR
CANADA	1		
USA	0.14	1	
TURKEY	-0.16	-0.2	1

For the 94-95 period the examination of the correlation matrix shows an increase in the correlation of Canada and US. It has increased from 0.14 to 0.71 during the crisis period. While the highest correlation is observed between Canada and US, Turkey had relatively lower correlations with US (0.18) and Canada (0.14), promising diversification benefit during the crisis. However, it is also observed that compared to 92-93 crisis periods Turkey's correlations have become positive, indicating stronger economic and political linkages with the region countries.

Table 6.68 North America Region 94-95 Crisis Correlation Matrix

	CAN	US	TUR
CANADA	1		
USA	0.71	1	
TURKEY	0.18	0.14	1

The examination of the correlation matrix shows that during the Asian and Russian crises Canada and US correlation has reached its highest value. While the highest correlation is observed between Canada and US (0.86), Turkey's correlation with US and Canada had increased to 0.48 and 0.56, respectively. Nonetheless, the relatively lower correlation Turkey had still suggests significant risk reduction.

Table 6.69 North America Region 97-98 Crisis Correlation Matrix

	CAN	US	TUR
CANADA	1		
USA	0.86	1	
TURKEY	0.56	0.48	1

For the 92-93 period the minimum variance portfolio mean and standard deviation are found as 0.005 and 0.024, respectively. The standard deviation of the portfolio is also found to range between 0.024 and 0.047 for the given means. The inclusion of Turkey in the North America portfolio increases the minimum variance portfolio mean to 0.006 while decreasing the standard deviation to 0.022, causing the efficient frontier to shift leftward. Sharpe ratio increases from 0.32 to 0.39 due to Turkey.

For the 94-95 period the NA minimum variance portfolio mean and standard deviation are found as 0.012 and 0.026, respectively. It is observed that compared to 92-93 crisis period the mean had increased significantly while standard deviation had experienced a slight increase. The standard deviation of the portfolio is found to range between 0.026 and 0.03 for the given expected means. The inclusion of Turkey in the North America portfolio results in a minimal change in the minimum variance portfolio mean and standard. Although it had relatively lower correlation with the region countries, Turkey is not observed to change the minimum variance portfolio significantly. However, Sharpe ratio increases from 0.50 to 0.52, suggesting higher return to risk.

For the 97-98 period the North America minimum variance portfolio mean and standard deviation are found as 0.024 and 0.052, respectively. It is observed that compared to previous crises periods the mean and the standard deviation of the North

America portfolio had increased significantly. The standard deviation is observed to range between 0.052 and 0.053. Over the 97-98 period inclusion of Turkey in the North America portfolio results in a slight decrease in the mean and the standard deviation of the minimum variance portfolio mean. The mean and standard deviation are found as 0.023 and 0.051, respectively. Sharpe ratio increases to 0.70.

The change in the efficient frontiers can be seen at the following graphs where the efficient frontiers of respective portfolios are provided. Inclusion of Turkey is observed to slightly shift the efficient frontiers leftward, evidencing the diversification benefit.

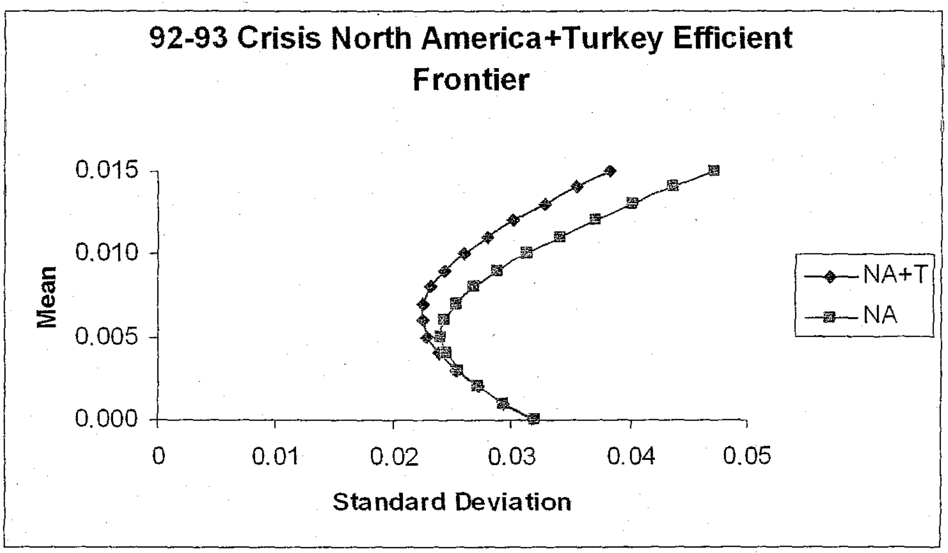

Figure 6.31 92-93 Crisis NA+Turkey Efficient Frontier

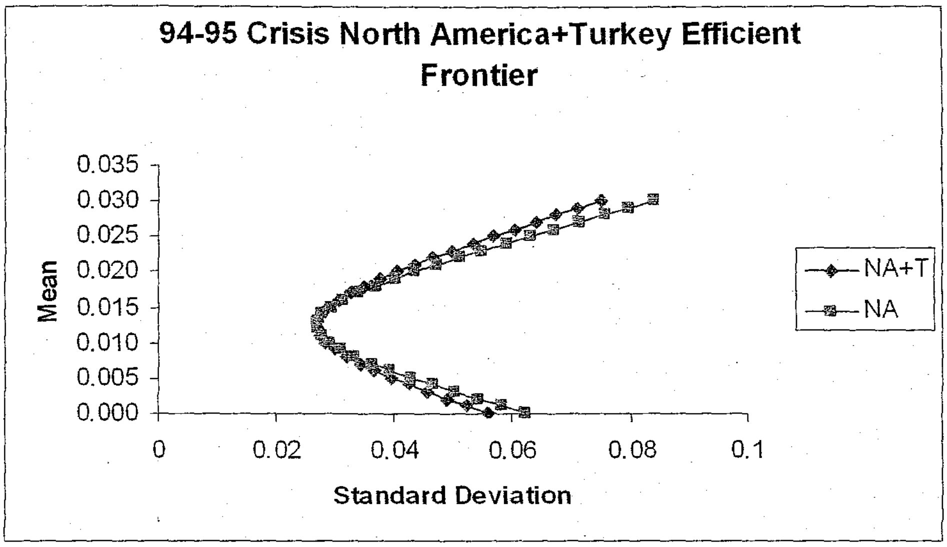

Figure 6.32 94-95 Crisis NA+Turkey Efficient Frontier

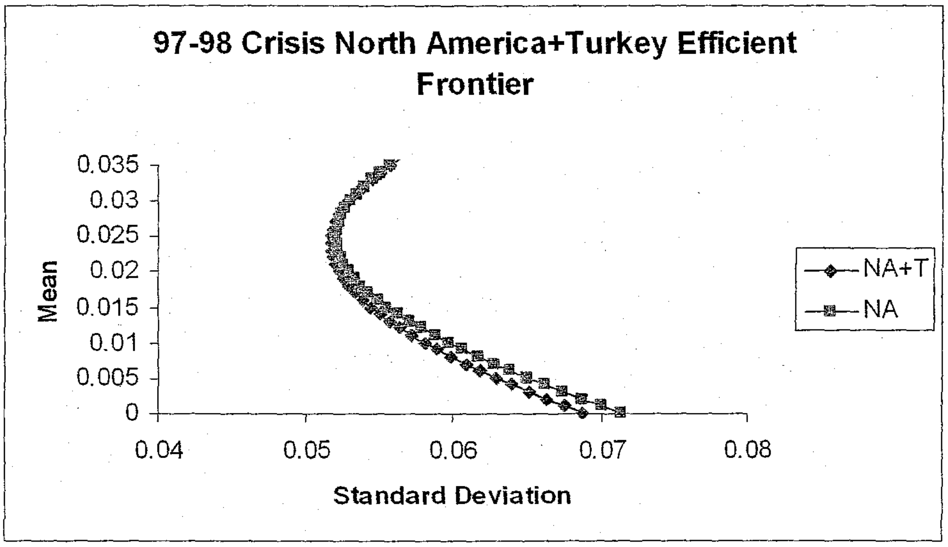

Figure 6.33 97-98 Crisis NA+Turkey Efficient Frontier

The statistical significance of observed leftward shifts is explored by the spanning test of Jobson and Korkie. During the 92-93 period inclusion of Turkey is found to produce 53.8 marginal potential performance while 94-95 and 97-98 period marginal potential performances are found as 20.4 and 8.92, respectively. However, the spanning test statistic fails to reject the null hypothesis at the 1% significance level for all periods. The test statistic parameters are provided in tables 6.70, 6.71 and 6.72 in the Appendix C. It is concluded that North America portfolio spans North America including Turkey portfolio. Thus, during the crises of ERM, Latin, Asia and Russia Turkey's contribution to North America portfolio was negligible.

6.3.2.5 Stein Estimated Efficient Frontier Analysis

The 92-93 crisis period sample means of North America portfolio are smoothed by the minimum variance portfolio mean of the classic estimation (0.005). The lambda and shrinkage factor are derived as 77.08 and 0.76, respectively. The sample means and the re-estimated means are provided in table 6.73 in the Appendix C. It is observed that after shrinkage Canada's negative mean increases to 0.003 while US's mean reduces to 0.006. The Sharpe ratio decreases from 0.32 to 0.21. The standard deviation of the Stein estimated North America portfolio ranges between 0.024 and 0.17 for the given means. Stein estimation reveals that North America portfolio inherits higher risk than estimated by the classic efficient frontier analysis.

92-93 period the sample means of North America including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.0063). The lambda and shrinkage factor by which sample means are re-estimated are then derived as 76.73 and 0.76, respectively. It is seen that inclusion of Turkey creates no difference in the shrinkage factor. The sample means and re-estimated means are provided in table 6.74 in the Appendix C. Turkey's sample mean drops from 0.03 to 0.012 while Canada's mean increase to 0.004. The tangency portfolio mean and standard deviation decreases compared to the Classic Estimation. The Sharpe ratio falls from 0.39 to 0.28 suggesting less reward to risk than estimated by the classic optimization. However, comparison of Stein estimated NA with NA+T portfolio reveals that inclusion of Turkey increases the Sharpe ratio from 0.21 to 0.28. On the other hand, compared to classic optimization Stein estimation reveals that this risk reduction Turkey provides is actually higher once the estimation bias is minimized.

The 94-95 crisis period sample means of North America portfolio are smoothed by the minimum variance portfolio mean of the classic estimation (0.012). The lambda and shrinkage factor are derived as 94.33 and 0.80, respectively. The sample means and the re-estimated means are provided in table 6.75 in the Appendix C. It is observed that after shrinkage Canada's mean increases to 0.011 while US's mean experiences a slight increase. Comparison of Stein estimated and Classic NA portfolios reveal that the Sharpe ratio drops to 0.46. The standard deviation of the Stein estimated North America portfolio ranges between 0.026 and 0.064 for the given means. Stein estimation reveals that North America portfolio has higher risk than estimated by the classic efficient frontier analysis.

94-95 period sample means of North America including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.0123). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 95.1 and 0.80, respectively. The sample means and re-estimated means are provided in table 6.76 in the Appendix C. In this respect Turkey's sample mean increases from -0.013 to 0.007. However, very small difference is observed between the tangency portfolio means and standard deviations of the Stein estimation and the Classic Estimation. The Sharpe ratio falls slightly from 0.52 to 0.46.

The 97-98 period sample means of the North America portfolio are smoothed by the minimum variance portfolio mean found as 0.024 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 17.75 and 0.43, respectively. The re-estimated sample means are provided in table 6.77 in the Appendix C. It is observed that after shrinkage Canada's mean increases from 0.001 to 0.011 while US's mean increases from 0.019 to 0.022. Stein estimation brings sample means closer to the minimum variance portfolio mean. Sharpe ratio drops from 0.69 to 0.55 due to shrinkage. The standard deviation of the Stein estimated North America portfolio ranges between 0.052 and 0.087 for the given means ranging from 0 to 0.045. Stein estimation reveals that North America portfolio inherits higher risk than estimated by the classic efficient frontier analysis.

97-98 period sample means of North America including Turkey portfolio are smoothed by the minimum variance portfolio mean (0.023). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 21.65 and 0.47, respectively. The sample means and re-estimated means are provided in table 6.78 in the Appendix C. Turkey's sample mean increases from 0.013 to 0.018 while Canada's and US's means increase respectively to 0.011 and 0.021. The tangency portfolio mean and standard deviation fall to 0.032 and 0.060, respectively. The Sharpe ratio falls from 0.70 to 0.53. Comparison of Stein and Classic optimization Sharpe ratios reveal that while classic estimation suggests an increase in the Sharpe ratio (from 0.69 to 0.70) due to inclusion of Turkey, Stein estimation discloses a decrease (from 0.55 to 0.53).

The below graphs provide the classic and Stein efficient frontiers of the North America and North America including Turkey portfolios over the 92-93, 94-95 and 97-98 crises period. As can be seen the while Turkey provided a visible leftward shift during the ERM and Latin crises, its contribution diminishes in the 97-98 crises period where Stein estimated frontiers and classic frontiers are found to overlap.

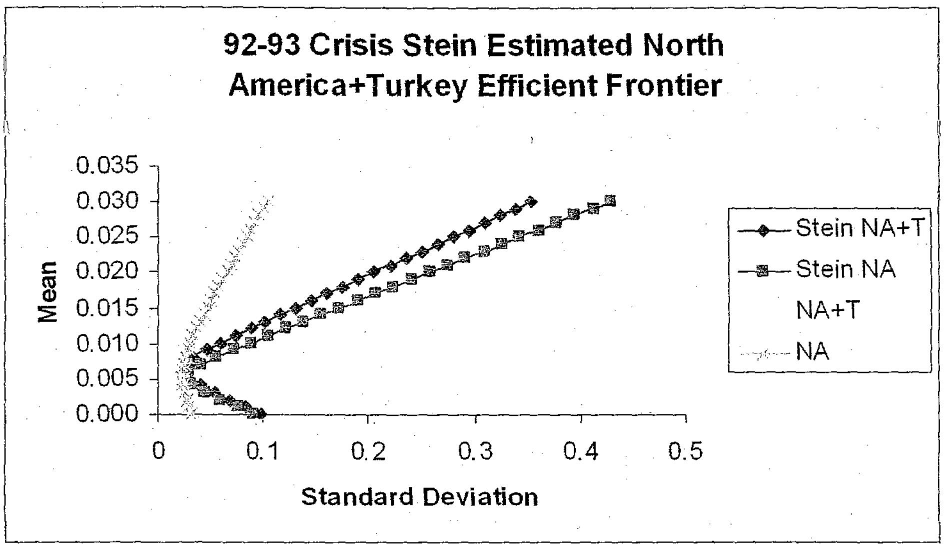

Figure 6.34 92-93 Crisis Stein Estimated NA+Turkey Efficient Frontier

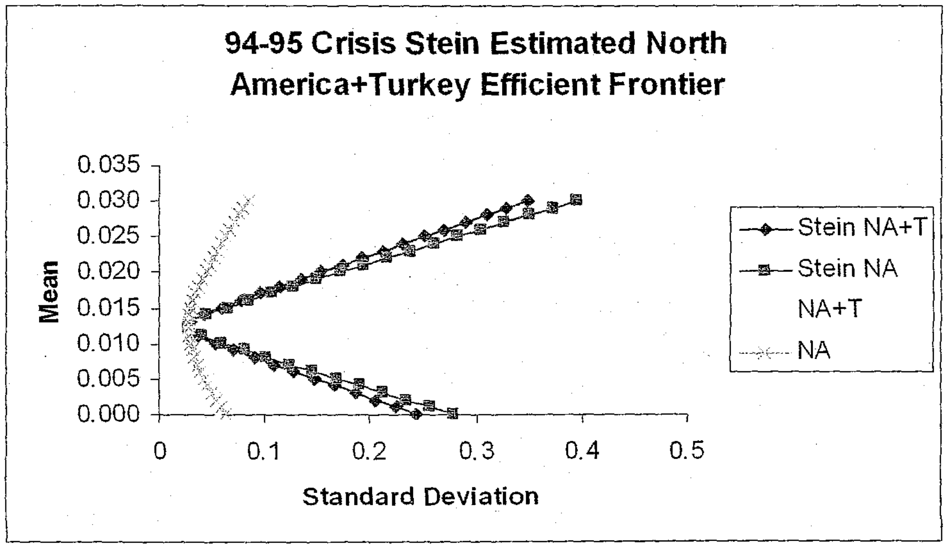

Figure 6.35 94-95 Crisis Stein Estimated NA+Turkey Efficient Frontier

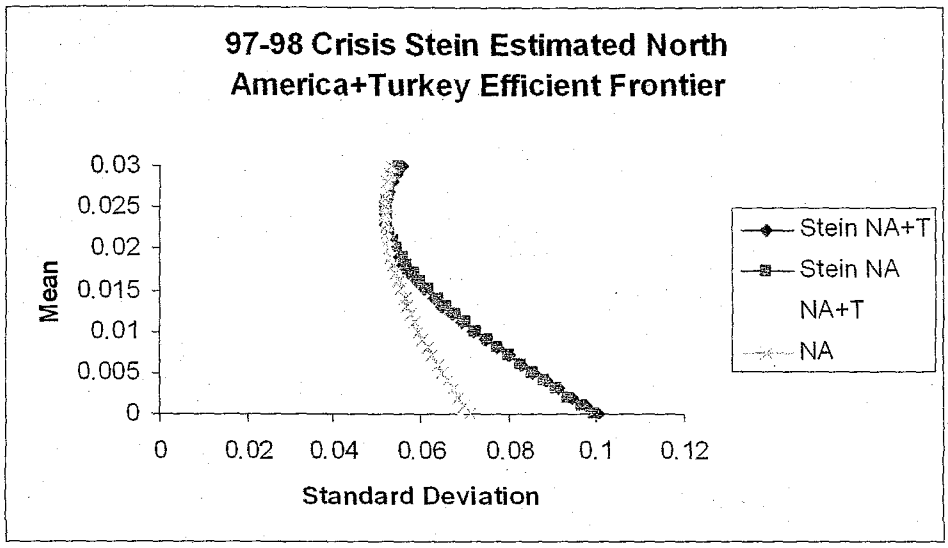

Figure 6.36 97-98 Crisis Stein Estimated NA+Turkey Efficient Frontier

For the 92-93, 94-95 and 97-98 periods inclusion of Turkey is found to result in respectively 7.12, 0.79 and -2.69 marginal potential performance. However, the test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level for all periods under investigation. North America portfolio spans the North America including Turkey portfolio. Thus, it is concluded that over the mentioned crises periods Turkey's contribution to North America portfolio is negligible. Test parameters are provided in tables 6.79, 6.80 and 6.81 in the Appendix C.

6.3.2.6 Short-selling Restricted Efficient Frontier Analysis

For the 92-93 period the comparison of short-selling restricted efficient frontiers of the North America including Turkey and the North America portfolios shows that inclusion of Turkey provides no risk reduction or leads to frontier extension. No feasible solution can be found by both portfolios for means beyond 0.008 as well. For the 94-95 crisis period this time no feasible solution can be found by both portfolios for means below 0.007 and beyond 0.012 and optimization assigns no weight to Turkish stock market. For the 97-98 period it is also seen that inclusion of Turkey provides neither risk reduction nor leads to frontier extension. The optimization assigns no weight to Turkish stock market. Thus, Turkey provides no risk reduction at the North America region during 97-98 crises.

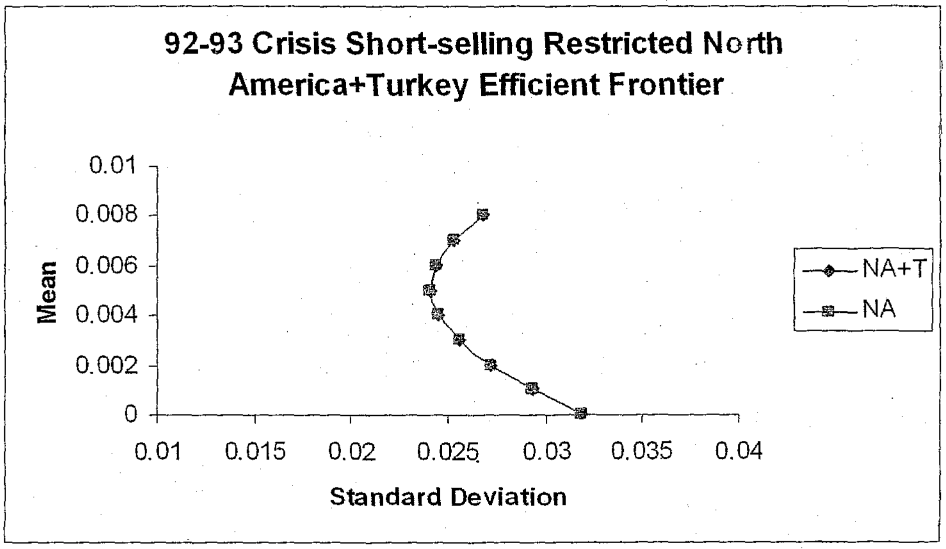

Figure 6.37 92-93 Crisis Short-selling Restricted NA+T Efficient Frontier

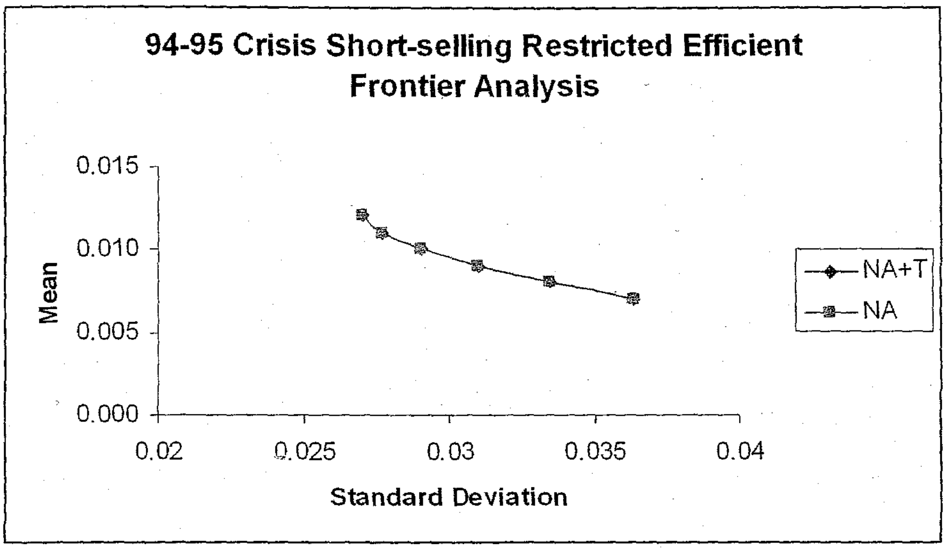

Figure 6.38 94-95 Crisis Short-selling Restricted NA+T Efficient Frontier

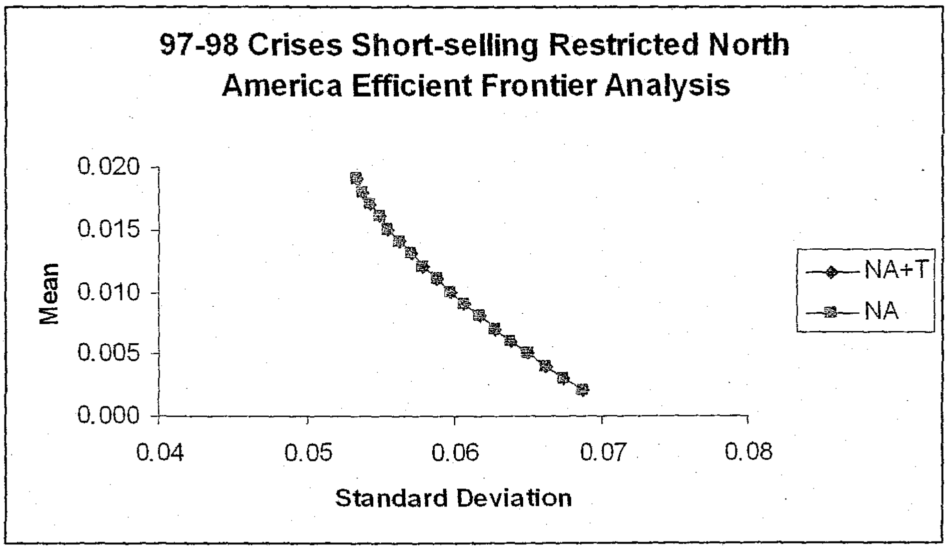

Figure 6.39 97-98 Crisis Short-selling Restricted NA+T Efficient Frontier

6.5 Latin America Region

The Latin America region portfolio consists of Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela stock markets tracked by MSCI country indexes. The portfolio is constructed from the monthly dollar returns of the respective countries stock market indexes. The objective of the following analyses is to explore the risk-return characteristics of the region while investigating the diversification potential of Turkey within the region. The analyses start with the full period analysis and then details into the crises periods. Classic efficient frontier analysis, Stein estimated efficient frontier analysis and short-selling restricted efficient frontier analysis are provided for each time period under investigation.

6.5.1 Full Period Analysis

The full period analysis period start from 1993:02 and extends to 2003:02. Although Argentina, Brazil, Chile, and Mexico stock markets have longer histories, to have a comparable time period with the Colombia, Peru and Venezuela stock markets the analysis is started from 1993:02 which is the inclusion date of these markets to the MSCI Emerging Markets index. A total of 121 observations are put into analysis and short-selling is allowed in the construction of the efficient portfolios. The table below summarizes the findings of the full period analyses.

Table 6.82 Latin America Region Full Period Analyses

FULL PERIOD

	LA+T	LA
Minimum Variance Portfolio Mean	0.003209	0.003091
Minimum Variance Portfolio St. Dev.	0.064762	0.064770

	LA+T		LA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.005754	0.042843	0.003852	0.026737
Standard Deviation	0.086720	0.236633	0.072305	0.190488
Sharpe Ratio	0.066351	0.181052	0.053278	0.140360

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.330589	3.077069
Test Statistic	0.092753	0.728750

6.5.1.1 Classic Efficient Frontier Analysis

The objective of this analysis is to explore the risk-return attributes of the Latin America region from an international diversification point. The examination of the correlation matrix reveals that Brazil and Mexico had the highest correlation (0.62) followed by Argentina and Mexico (0.58). The lowest correlation is observed between Peru and Venezuela (0.1993) followed by Colombia and Mexico (0.1973). Over the full period Turkey had relatively higher correlations with the Argentina, Brazil, Chile and Mexico while having the lowest correlation with Peru stock market.

Table 6.83 Latin America Region Full Period Correlation Matrix

	ARG	BRA	CHI	COL	MEX	PER	VEN	TUR
ARGENTINA	1							
BRAZIL	0.46	1						
CHILE	0.51	0.57	1					
COLOMBIA	0.23	0.24	0.36	1				
MEXICO	0.58	0.62	0.54	0.20	1			
PERU	0.36	0.45	0.56	0.36	0.47	1		
VENEZUELA	0.22	0.35	0.27	0.27	0.29	0.20	1	
TURKEY	0.30	0.31	0.34	0.17	0.36	0.14	0.16	1

The minimum variance portfolio mean and standard deviation of North America portfolio are found as 0.003 and 0.064, respectively. The standard deviation of the portfolio ranges between 0.64 and 0.11 for the given expected means. The inclusion of Turkey in the Latin America portfolio leads to a minimal increase in the mean while a minimal decrease is observed in the standard deviation of the portfolio. On the other hand inclusion of Turkey is found to provide risk reduction up to 1.7% for the given means at the high risk region.

Table 6.84 Change in St. Dev. of Latin America Region

Mean	St. Dev. LA+T	St. Dev. LA	Change in St. Dev.
0.000	0.067333	0.068874	0.001541
0.001	0.065993	0.06668	0.000687
0.002	0.065133	0.065296	0.000163
0.003	0.064773	0.064774	8.67E-07
0.004	0.064921	0.065135	0.000214
0.005	0.065574	0.066365	0.000791
0.006	0.066716	0.068417	0.001701
0.007	0.068323	0.071219	0.002896
0.008	0.070364	0.074687	0.004323
0.009	0.072801	0.078734	0.005933
0.010	0.075597	0.083275	0.007678
0.011	0.078713	0.088234	0.00952
0.012	0.082113	0.093544	0.01143
0.013	0.085764	0.099148	0.013385
0.014	0.089633	0.105001	0.015368
0.015	0.093695	0.111062	0.017367

This reduction in the standard deviation of the portfolio can be observed at the following graph where both respective portfolios are provided.

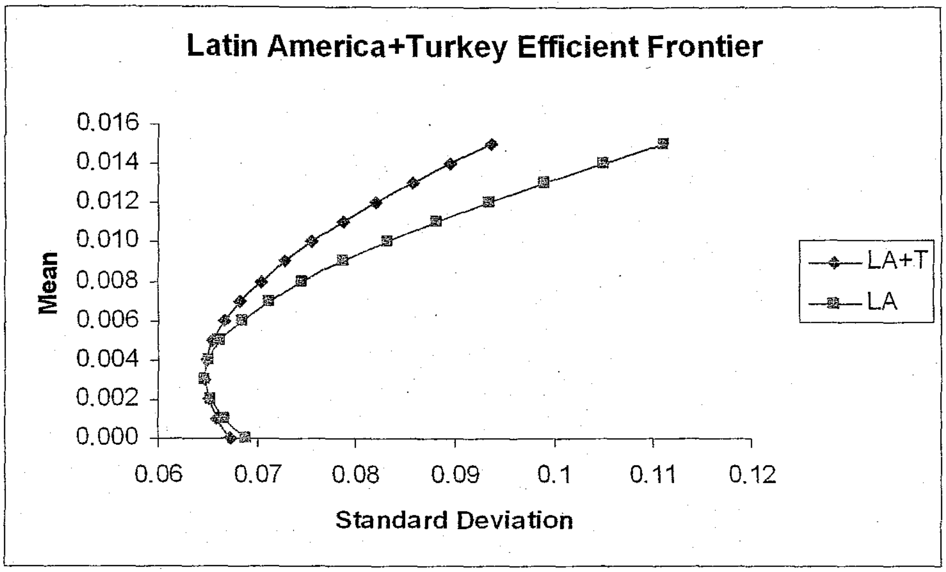

Figure 6.40 Latin America including Turkey Efficient Frontier

It is observed that inclusion of Turkey produces 3.07 marginal potential performance. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Thus, Latin America portfolio spans the Latin America including Turkey portfolio. It is concluded that despite its low correlation with the region countries inclusion of Turkey in the Latin America portfolio does not improve portfolio performance over the full period. The test parameters are provided in table 6.85 in the Appendix C.

6.5.1.2 Stein Estimated Efficient Frontier Analysis

In the Stein estimation of the full period data the sample means of the Latin America portfolio are smoothed by the minimum variance portfolio mean found as 0.003 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 553.4 and 0.82, respectively. The table below provides the re-estimated sample means.

Table 6.86 Latin America Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.002722	0.003025
BRAZIL	0.011205	0.004547
CHILE	0.001435	0.002794
COLOMBIA	0.001554	0.002815
MEXICO	0.005609	0.003543
PERU	0.009260	0.004198
VENEZUELA	0.005309	0.003489

The comparison of the sample means with the re-estimated means show that relatively higher means of Brazil, Mexico, Peru and Venezuela are shrunk towards the minimum variance portfolio mean. The tangency portfolio mean and standard deviation decrease. Thus, Sharpe ratio of LA portfolio falls from 0.14 to 0.05.

The full period sample means of Latin America including Turkey portfolio are smoothed by the minimum variance portfolio mean 0.003. Then lambda and the shrinkage factor are derived from the data and found as 356.5 and 0.75, respectively. The sample means and re-estimated means are provided below.

Table 6.87 Latin America+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.002722	0.003086
BRAZIL	0.011205	0.005235
CHILE	0.001435	0.002759
COLOMBIA	0.001554	0.002790
MEXICO	0.005609	0.003817
PERU	0.009260	0.004742
VENEZUELA	0.005309	0.003741
TURKEY	0.021899	0.007945

It is observed that Turkey's mean decreases from 0.021 to 0.008 while Brazil's decrease from 0.011 to 0.005. The Sharpe ratio of LA+T portfolio falls from 0.18 to 0.06 in the Stein estimation suggesting less reward to risk than classic approach suggests.

Meanwhile both estimations suggest higher Sharpe ratios due to the inclusion of Turkey in the LA portfolio. On the other hand the following table demonstrates that once the estimation bias is minimized the contribution of Turkish stock market becomes more significant. At the high risk level Turkey is estimated to provide up to 23% risk reduction.

Table 6.88 Change in St. Dev. of Latin America Portfolio

Mean	St. Dev. Stein LA+T	St. Dev. Stein LA	Change in St. Dev.
0.000	0.097379	0.145721	0.048343
0.001	0.081854	0.109515	0.027660
0.002	0.070319	0.079489	0.009170
0.003	0.064935	0.064885	-0.000050
0.004	0.067197	0.075285	0.008088
0.005	0.076430	0.103402	0.026973
0.006	0.090524	0.138862	0.048338
0.007	0.107587	0.177312	0.069725
0.008	0.126421	0.217170	0.090749
0.009	0.146345	0.257784	0.111439
0.010	0.166968	0.298845	0.131877
0.011	0.188062	0.340192	0.152131
0.012	0.209483	0.381732	0.172250
0.013	0.231141	0.423408	0.192268
0.014	0.252975	0.465184	0.212209
0.015	0.274943	0.507035	0.232092

The graph below provides the respective portfolios' classic and Stein estimated efficient frontiers. It is found that the Stein estimated portfolios display higher risk, which can be visually observed from the flatter efficient frontier of Stein estimated portfolios and Turkey is found to be providing higher risk reduction under the Stein estimation compared to classic efficient frontier analysis. Thus, once the estimation bias is minimized Turkey is observed to improve portfolio performance more significantly at the high risk levels.

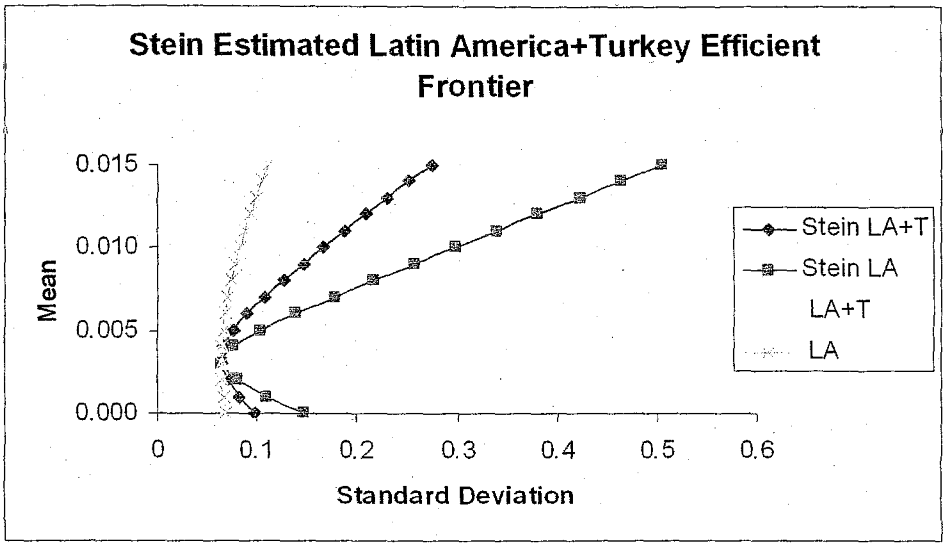

Figure 6.41 Stein Estimated Latin America+Turkey Efficient Frontier

It is found that inclusion of Turkey into the Latin America portfolio generates a very small marginal potential performance which is found to be insignificant. The test statistics falls short of the required f-value and fails to reject the null hypothesis at the 1% significance level. It is concluded that over the full period Turkish stock markets contribution to North America portfolio is negligible. The spanning test parameters are provided in table 6.89 in the Appendix C.

6.5.1.3 Short-selling Restricted Efficient Frontier Analysis

The analysis reveals that short-selling restricted Latin America portfolio is outperformed by the short-selling restricted Latin America including Turkey portfolio. Inclusion of Turkey extends the efficient frontier beyond the mean 0.011 after which short-selling restricted LA portfolio cannot provide an optimal investment. It is also observed that Turkey reduces the risk of the short-selling restricted portfolio. The graph below gives the short-selling restricted efficient frontiers of the respective portfolios.

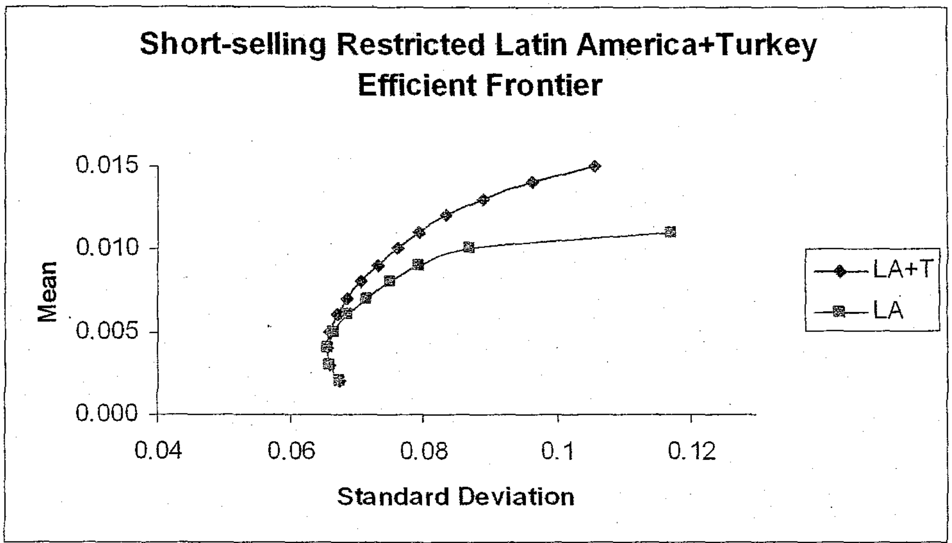

Figure 6.42 Short-selling Restricted LA+Turkey Efficient Frontier

6.5.2 Crises Periods Analyses

As the available data for the Latin America region starts from 1993:02, the 92-93 crisis period analyses are not provided. The limited number of observations is not only considered to be insufficient for the efficient frontier analysis but also found incapable of representing the crisis period. The crises analyses are respectively provided for Latin, Asian and Russian crises periods. For the Latin crisis the time period under investigation starts from 1994:01 and extends to 1995:12 and for the Asian and Russian crises the time period under investigation starts from 1997:01 and extends to 1998:12. A total of 24 monthly observations are put into estimation for both periods and short-selling is allowed in the construction of the efficient portfolios. The following table summarizes the findings of the crises periods analyses.

Table 6.90 Latin America Region Crises Periods Analyses

1994-95 PERIOD

	LA+T	LA
Minimum Variance Portfolio Mean	-0.006481	-0.005852
Minimum Variance Portfolio St. Dev.	0.049100	0.057349

	LA+T		LA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.029860	-0.165124	-0.049224	-0.245292
Standard Deviation	0.105388	0.247829	0.166324	0.371285
Sharpe Ratio	-0.283333	-0.666281	-0.295954	-0.660657

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	2.605616	47.370144
Test Statistic	2.563385	2.691002

1997-98 PERIOD

	LA+T	LA
Minimum Variance Portfolio Mean	-0.006464	-0.005715
Minimum Variance Portfolio St. Dev.	0.068768	0.069357

	LA+T		LA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.008367	-0.041399	-0.005866	-0.040099
Standard Deviation	0.078240	0.174034	0.070269	0.183715
Sharpe Ratio	-0.106942	-0.237877	-0.083485	-0.218268

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.512731	1.604925
Test Statistic	0.156423	0.190295

6.5.2.1 Classic Efficient Frontier Analysis

The correlation matrix reveals that during the period region countries' correlations have increased. The highest correlation is observed between Mexico and Argentina (0.80) and the lowest between Turkey and Colombia (-0.50). While Turkey had the highest correlations with Argentina and Mexico, it is observed to have relatively lower correlations with the remaining region countries. Compared to full period correlations Turkey's correlations have been lower leaving room for diversification during the crisis.

Table 6.91 Latin America Region 94-95 Crisis Correlation Matrix

	ARG	BRA	CHI	COL	MEX	PER	VEN	TUR
ARGENTINA	1							
BRAZIL	0.45	1						
CHILE	0.65	0.45	1					
COLOMBIA	-0.13	0.20	0.18	1				
MEXICO	0.80	0.58	0.55	-0.13	1			
PERU	0.57	0.54	0.67	0.08	0.66	1		
VENEZUELA	0.01	0.37	0.16	0.15	-0.03	0.13	1	
TURKEY	0.33	0.04	0.18	-0.50	0.30	0.11	0.02	1

The correlation matrix unveils that during the 97-98 crises region countries' correlations reach to their highest values. While the highest correlation is observed between Mexico and Argentina (0.92), Turkey's highest correlation is observed with Brazil (0.64) followed by Colombia (0.56). The lowest correlation is observed between Turkey and Venezuela (0.20). Compared to 94-95 period Turkey's correlations with region countries had remarkably increased. The highest increases are observed with Colombia and Brazil stock markets.

Table 6.92 Latin America Region 97-98 Crisis Correlation Matrix

	ARG	BRA	CHI	COL	MEX	PER	VEN	TUR
ARGENTINA	1							
BRAZIL	0.84	1						
CHILE	0.77	0.81	1					
COLOMBIA	0.37	0.50	0.51	1				
MEXICO	0.92	0.83	0.72	0.35	1			
PERU	0.53	0.68	0.67	0.77	0.47	1		
VENEZUELA	0.63	0.66	0.74	0.40	0.69	0.55	1	
TURKEY	0.52	0.64	0.44	0.56	0.55	0.53	0.20	1

For the 94-95 period the minimum variance portfolio mean and standard deviation of LA portfolio are found as -0.005 and 0.057, respectively. The standard deviation of the portfolio is found to range between 0.057 and 0.065 for the given means.

The inclusion of Turkey in the Latin America portfolio however decreases the minimum variance portfolio mean and standard deviation to -0.006 and 0.049, respectively.

For the 97-98 period the minimum variance portfolio mean and standard deviation are found as -0.005 and 0.069, respectively. It is observed that Asian and Russian crises had severely effected this region. Although the mean of the Latin America portfolio had been the same and the standard deviation suggests quite higher risk compared to 94-95 period. The estimated standard deviation is observed to range between 0.069 and 0.12 for the given means. Over the 97-98 period inclusion of Turkey in the Latin America portfolio is found to produce a slight decrease in the mean and the standard deviation.

The change in the efficient frontiers can be seen at the following graphs where the efficient frontiers of respective portfolios are provided. For the 94-95 period inclusion of Turkey is observed to slightly shift the efficient frontier leftward, evidencing the diversification benefit. However, for the 97-98 period two frontiers are observed to overlap.

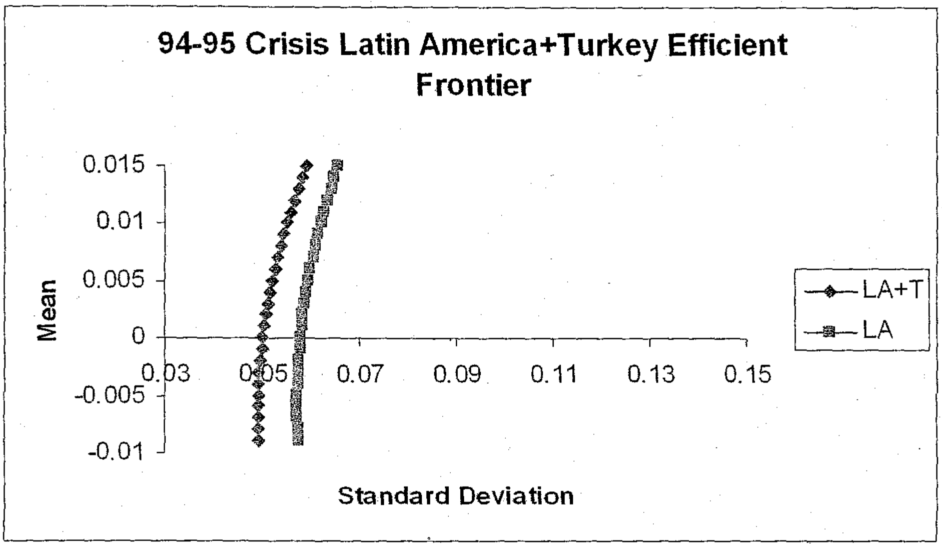

Figure 6.43 94-95 Crisis LA+Turkey Efficient Frontier

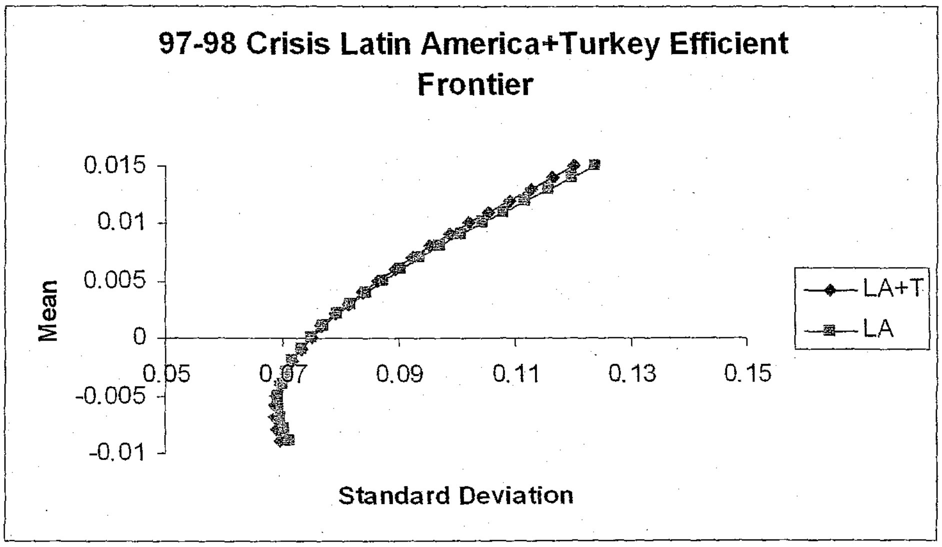

Figure 6.44 97-98 Crisis LA+Turkey Efficient Frontier

For the 94-95 period inclusion of Turkey is found to produce 47.4 marginal potential performance while producing 1.60 marginal potential performance for the 97-98 period. However, the spanning test statistics fall below the required f-value of 5.34 at the 1% level and fails to reject the null hypothesis. It is concluded that Latin America portfolio spans Latin America including Turkey portfolio over the 94-95 and 97-98 crises periods. Thus, Turkey's contribution to Latin America portfolio is found to be negligible. The test parameters are provided in tables 6.93 and 6.94 in the Appendix C.

6.5.2.2 Stein Estimated Efficient Frontier Analysis

The 94-95 crisis period sample means of Latin America portfolio are smoothed by the minimum variance portfolio mean of the classic estimation (-0.0058). The lambda and shrinkage factor are derived as 32.39 and 0.57, respectively. The sample means and the re-estimated means are provided in table 6.95 in the Appendix C. Compared to classic estimation values the Stein estimation is observed to increase the tangency portfolio mean while reducing the standard deviation of it. Consequently, LA portfolio's Sharpe ratio is observed to increase from -0.66 to -0.29.

94-95 period sample means of Latin America including Turkey portfolio is smoothed by the minimum variance portfolio mean (-0.006). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 38.51 and 0.62, respectively. Compared to LA portfolio, inclusion of Turkey results in a higher shrinkage factor. The sample means and re-estimated means are provided in table 6.96 in the Appendix C. Turkey's sample mean increases from -0.013 to -0.009 while Brazil, Chile and Peru's mean decrease to 0.005, 0.003 and 0.009, respectively. Interestingly, Turkey is observed to be much severely effected by the Latin crisis than Latin American countries. The Stein tangency portfolio mean is found to be higher while standard deviation is found to be lower than the classic tangency portfolio and accordingly Sharpe ratio increases to -0.28. On the other hand, compared to classic optimization Stein estimation reveals that the risk reduction Turkey provides is actually lower once the estimation bias is minimized.

In the Stein estimation of the 97-98 crises data the sample means of the Latin America portfolio are smoothed by the minimum variance portfolio mean found as -0.006 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 337.8 and 0.93, respectively. The re-estimated sample means are given in table 6.97 in the Appendix C. It is observed that Stein estimation brings sample means closer to the minimum variance portfolio mean. Accordingly, tangency portfolio mean increases to -0.005 and Sharpe ratio increases to -0.08 though being still negative.

The 97-98 period sample means of Latin America including Turkey portfolio are smoothed by the minimum variance portfolio mean (-0.064). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 78.83 and 0.747, respectively. The sample means and re-estimated means are provided in table 6.98 in the Appendix C. Inclusion of Turkey is found to decrease the Shrinkage factor. Turkey's sample mean decreases from 0.013 to -0.0018 likewise Argentina and Mexico. However, a minimal increase is observed in the tangency portfolio mean and standard deviation of the Stein estimation and the Sharpe ratio improves slightly to -0.10. On the other hand Turkey is estimated to reduce the risk of the portfolio more significantly at the higher risk levels. Different than 94-95 period Turkey is estimated to provide risk reduction even under Stein estimation.

The below graphs provide the classic and Stein efficient frontiers of the Latin America and Latin America including Turkey portfolios over the94-95 and 97-98 crises periods. As can be seen the Stein estimated frontiers are flatter than classic frontiers indicating higher estimated risk. However, for the 94-95 period Turkey's contribution is observed to diminish once the means are smoothed. On the other hand, for the 97-98 period Turkey is still observed to provide a leftward shift.

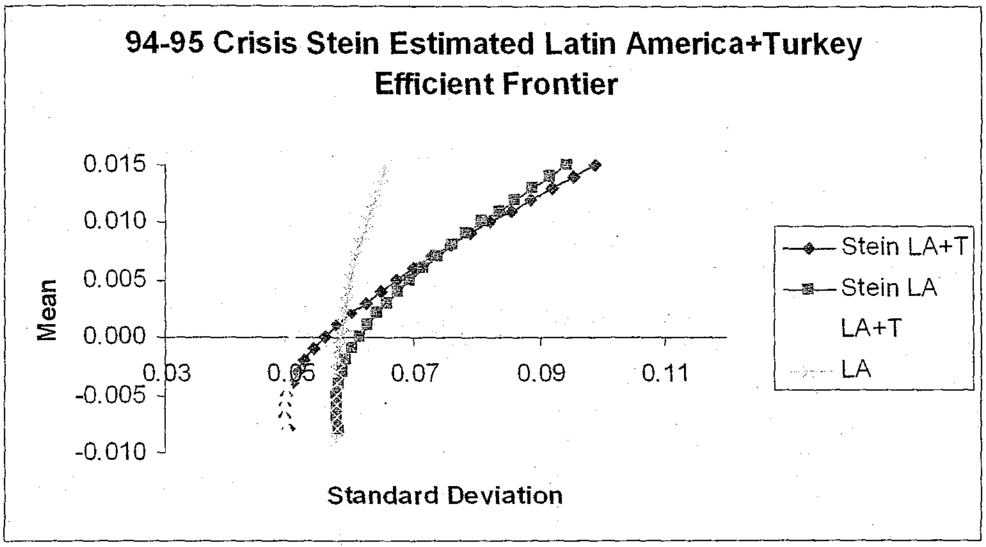

Figure 6.45 94-95 Crisis Stein Estimated LA+T Efficient Frontier

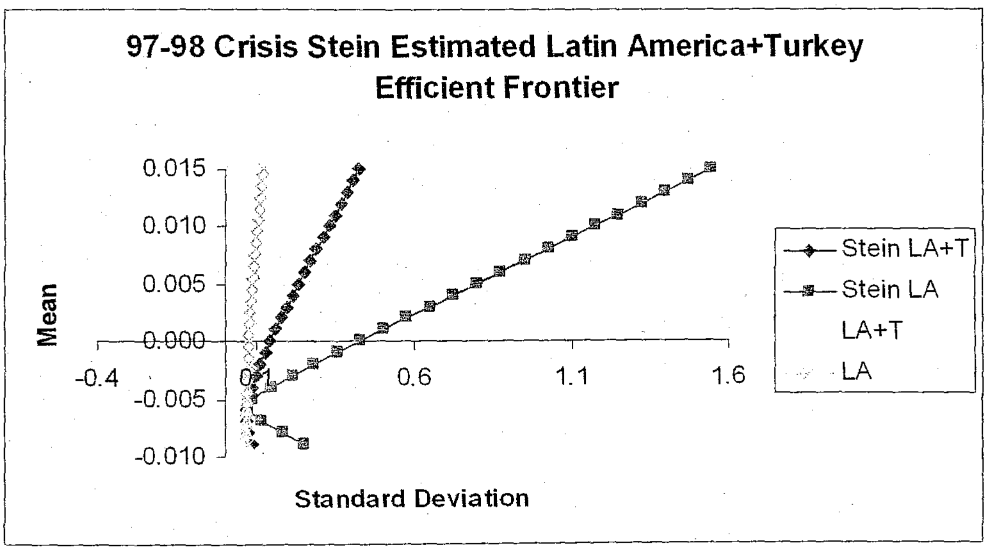

Figure 6.46 97-98 Crisis Stein Estimated LA+T Efficient Frontier

For the 94-95 period once the sample means are smoothed by the minimum variance portfolio mean Turkey is found to produce 2.60 marginal potential performance which is quite lower than found in the classic estimation. On the other hand, for the 97-98 crises inclusion of Turkey in the Latin America portfolio is found to produce a minimal marginal potential performance. However, the test statistics fail to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Latin America portfolio spans the Latin America including Turkey portfolio. Thus, it is concluded that over the 94-95 and 97-98 crises periods Turkey's contribution to Latin America portfolio is negligible. The spanning test parameters are provided in tables 6.99 and 6.100 in the Appendix C.

6.5.2.3 Short-selling Restricted Efficient Frontier Analysis

For the 94-95 period the comparison of short-selling restricted efficient frontiers of the Latin America including Turkey and the Latin America portfolio confirm that inclusion of Turkey provides risk reduction up to mean value of 0.015 after which two frontiers overlap. The contribution of Turkey is observed at the minimum variance portfolio.

For the 97-98 period inclusion of Turkey extends the investment set beyond mean 0.002 after which short-selling restricted Latin America portfolio cannot estimate an efficient portfolio. Thus, Turkey extends the efficient frontier of the Latin America portfolio for the 97-98 crises period. The contribution of Turkey is given in the following graphs.

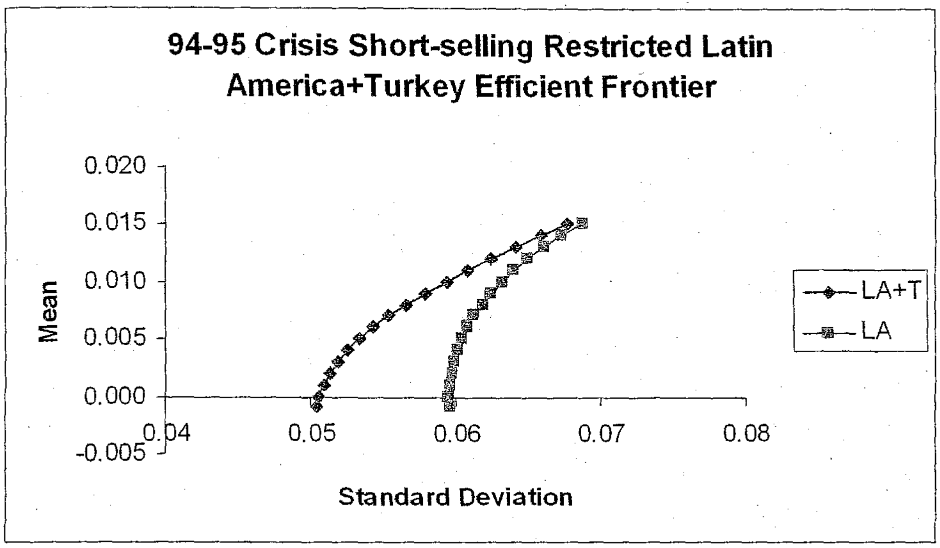

Figure 6.47 94-95 Crisis Short-selling Restricted LA+T Efficient Frontier

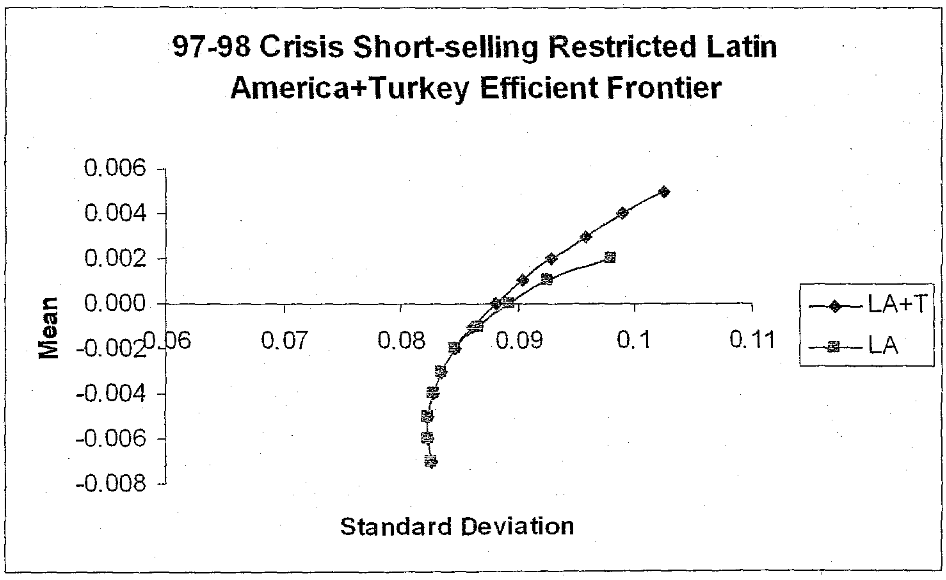

Figure 6.48 97-98 Crisis Short-selling Restricted LA+T Efficient Frontier

6.6 Pacific Rim Region

The Pacific Rim Region portfolio is composed of 5 developed countries namely Australia, Hong Kong, Japan, New Zealand and Singapore. The portfolio is constructed from the monthly dollar returns of these countries' respective stock market indexes. The objective of this analysis is to investigate the risk-return attributes of Pacific Rim countries and contribution of Turkish stock market. The investigation is made over the full period and then detailed into global crises periods of 92-93, 94-95 and 97-98. For each time period the classic, Stein and short-selling restricted efficient frontier analyses are provided.

6.6.1 Full Period Analysis

Although respective Pacific Rim countries have longer historical stock market index data, the full period analysis of this portfolio is started from 1988:01 in order to obtain a comparable investment period with Turkish stock market. A total of 181 monthly observations are used and short-selling is allowed in the construction of efficient portfolios. The full period findings are summarized in the following table.

Table 6.101 Pacific Rim Region Full Period Analyses

FULL PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	0.003844	0.003445
Minimum Variance Portfolio St. Dev.	0.049742	0.050114

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.005551	0.018883	0.004805	0.016936
Standard Deviation	0.059773	0.110241	0.059083	0.110925
Sharpe Ratio	0.092871	0.171284	0.081323	0.152680

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.328147	2.038623
Test Statistic	1.215278	1.560886

6.6.1.1 Classic Efficient Frontier Analysis

During the period the minimum correlation (0.07) is observed between Turkey and Japan whereas the maximum is observed between Hong Kong and Singapore (0.72). The examination of the correlation matrix reveals that over the full period Turkey had relatively lower correlations with the region countries. Turkey had the highest correlation with Singapore and the lowest correlation with the Japan.

Table 6.102 Pacific Rim Region Full Period Correlation Matrix

	AUST	HON	JAP	NEW	SIN	TUR
AUSTRALIA	1					
HONGKONG	0.46	1				
JAPAN	0.38	0.34	1			
NEW ZEALAND	0.66	0.37	0.34	1		
SINGAPORE	0.47	0.72	0.39	0.50	1	
TURKEY	0.11	0.19	0.07	0.16	0.27	1.00

The minimum variance portfolio mean and standard deviation of PR portfolio are found to be 0.0034 and 0.050, respectively. The standard deviation of the portfolio ranges from 0.050 to 0.098 for the given expected means. The analysis reveals that the inclusion of Turkey in the Pacific Rim portfolio results in a minor increase in the minimum variance portfolio mean while reducing the standard deviation of it. The mean increases to 0.0038 while deviation decreases to 0.049. The Sharpe ratio is also found to increase from 0.15 to 0.17. The following table also exhibits the risk reduction potential of Turkish stock market due its low correlation with this region. At the high risk region Turkey is estimated to reduce the standard deviation up to 1% for the given means.

Table 6.103 Change in St. Dev. of Pacific Rim Portfolio

Mean	St. Dev. PR+T	St. Dev. PR	Change in St. Dev.
0.000	0.055738	0.056108	0.000370
0.001	0.053108	0.053200	0.000092
0.002	0.051184	0.051187	0.000003
0.003	0.050048	0.050177	0.000129
0.004	0.049752	0.050230	0.000478
0.005	0.050313	0.051343	0.001030
0.006	0.051702	0.053451	0.001748
0.007	0.053856	0.056441	0.002585
0.008	0.056687	0.060182	0.003496
0.009	0.060099	0.064544	0.004446
0.010	0.064000	0.069411	0.005411
0.011	0.068306	0.074682	0.006376
0.012	0.072945	0.080279	0.007334
0.013	0.077858	0.086138	0.008280
0.014	0.082996	0.092210	0.009213
0.015	0.088320	0.098454	0.010134

The following graph shows the slight shift of the efficient frontier after the inclusion of Turkey in the Pacific Rim portfolio.

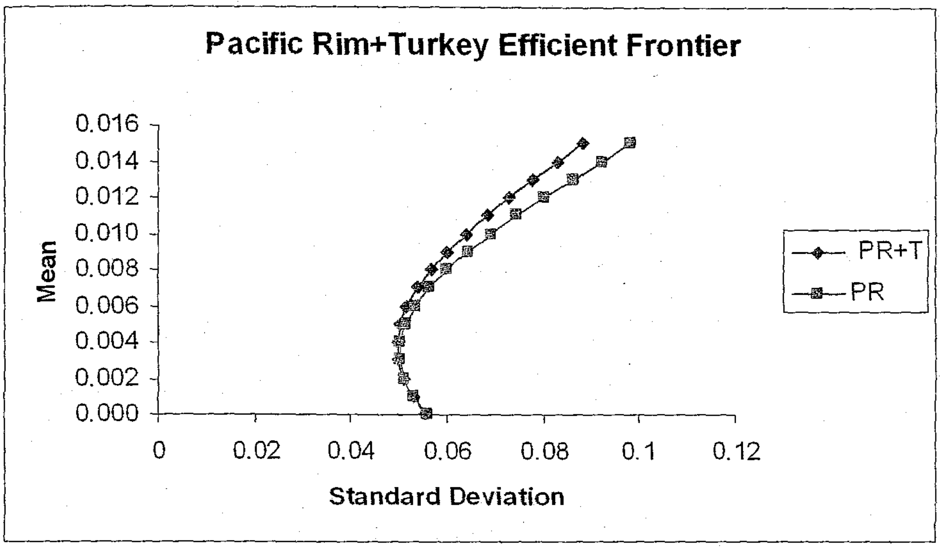

Figure 6.49 Pacific Rim including Turkey Efficient Frontier

Although 2.03 marginal potential performance is achieved with the inclusion of Turkey in the Pacific Rim portfolio, the test statistic falls below the required f-value of 4.71 at 1% significance level with (2, 350) d.f. and hypothesis of zero marginal potential performance is accepted. Thus, it is concluded that Turkey does not significantly improve the performance of the Pacific Rim portfolio over the full period. The contribution of Turkey is negligible. The spanning test parameters are provided in table 6.104 in the Appendix C.

6.6.1.2 Stein Estimated Efficient Frontier Analysis

The smoothing is done with the minimum variance portfolio mean of Pacific Rim Region which is 0.0034. The lambda and shrinkage factor are found to be 390 and 0.68, respectively. The following re-estimated means are derived:

Table 6.105 Pacific Rim Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.004825	0.003886
HONGKONG	0.009333	0.005315
JAPAN	-0.001125	0.002000
NEW ZEALAND	0.000885	0.002637
SINGAPORE	0.006802	0.004512

The resulting portfolio reveals that actually the Pacific Rim portfolio is much more volatile than estimated by the classic efficient frontier analysis. There is much more risk per return. The standard deviation of the portfolio ranges from 0.049 to 0.27 while it ranged between 0.050 and 0.098 in the Classic Efficient Frontier Analysis. Shrinkage leads to a decrease in the mean and standard deviation of the tangency portfolio. Sharpe ratio drops to 0.08.

For the PR+T portfolio smoothing is done with the minimum variance portfolio mean of 0.004 and the lambda and shrinkage factor are found as 356.24 and 0.66, respectively. The following table provides the sample and the re-estimated means.

Table 6.106 Pacific Rim+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.004825	0.004175
HONGKONG	0.009333	0.005693
JAPAN	-0.001125	0.002170
NEW ZEALAND	0.000885	0.002847
SINGAPORE	0.006802	0.004841
TURKEY	0.019457	0.009104

After the shrinkage Turkey's country mean is observed to drop from 0.019 to 0.009 towards the minimum variance portfolio mean. Compared to Classic Sharpe ratio, Stein Sharpe ratio is found to be lower, evidencing the estimation bias. However, comparison of Stein portfolios suggests that inclusion of Turkey is beneficial as Sharpe ratio increases from 0.08 to 0.09.

Meanwhile the Stein estimated efficient frontiers are observed to be flatter than the classic efficient frontiers. The flatness of the Stein estimated frontier proves the high risk of the Pacific Rim portfolio. The examination of the following table shows that inclusion of Turkey in the Pacific Rim portfolio reduces the standard deviation of the portfolio for the given means especially at the high risk region. The risk reduction Turkey provides is estimated to reach up to 5% for the given means.

Table 6.107 Change in St. Dev. of Pacific Rim Portfolio (Stein)

Mean	St. Dev. Stein PR+T	St. Dev. Stein PR	Change in St. Dev.
0.000	0.089703	0.094299	0.004595
0.001	0.074328	0.075679	0.001351
0.002	0.061293	0.060291	-0.001002
0.003	0.052374	0.051142	-0.001232
0.004	0.049834	0.051660	0.001827
0.005	0.054570	0.061602	0.007032
0.006	0.065011	0.077418	0.012407
0.007	0.078925	0.096256	0.017330
0.008	0.094795	0.116659	0.021865
0.009	0.111790	0.137936	0.026147
0.010	0.129468	0.159738	0.030270
0.011	0.147585	0.181876	0.034291
0.012	0.165996	0.204240	0.038245
0.013	0.184613	0.226764	0.042151
0.014	0.203380	0.249405	0.046025
0.015	0.222259	0.272133	0.049874

The range of the portfolio's standard deviation is also observed to be narrowed with the inclusion of Turkey. The following graph provides the classic and the Stein estimated efficient frontiers for both portfolios. It can be easily depicted that Turkey's contribution becomes more visible at the Stein estimated efficient frontier analysis.

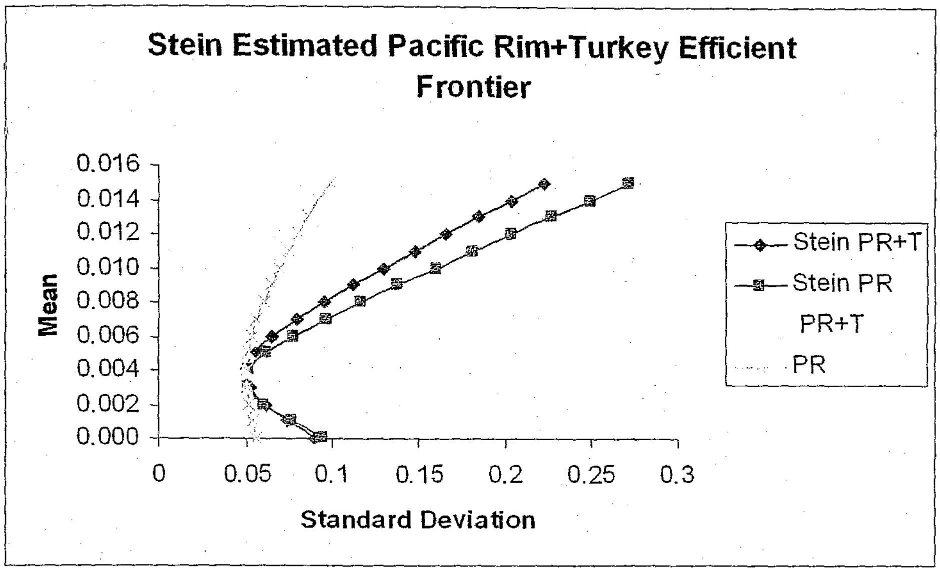

Figure 6.50 Stein Estimated PR+Turkey Efficient Frontier

However, the test statistic falls below the required f-value of 4.71 at the 1% significance level with (2, 350) d.f. and hypothesis of zero marginal potential performance is accepted. It is concluded that inclusion of Turkey in the Pacific Rim portfolio does not significantly shift the efficient frontier in the full period analysis. Turkey's contribution is negligible. The spanning test parameters are provided in table 6.109 in the Appendix C.

6.6.1.3 Short-selling Restricted Efficient Frontier Analysis

The short-selling restricted efficient frontier analysis reveals that inclusion of Turkish stock market to the Pacific Rim portfolio enhances the investment set and extends the efficient frontier beyond what can be achieved with the short-selling restricted Pacific Rim portfolio. No efficient portfolio can be found for the short-selling restricted Pacific Rim portfolio beyond mean 0.009. The contribution of Turkey can be visually observed from the following graph. However, no significant shift is observed in the minimum variance portfolio mean.

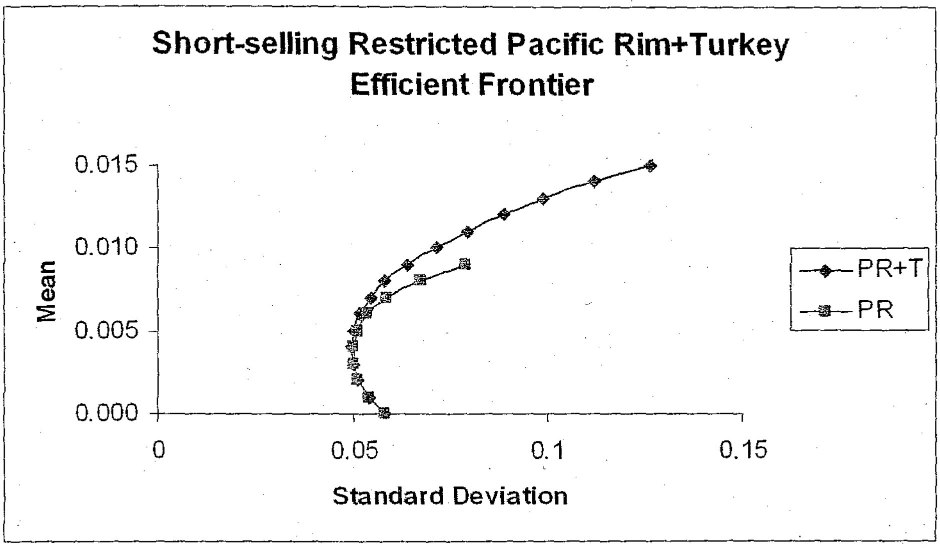

Figure 6.51 Short-selling Restricted PR+Turkey Efficient Frontier

6.6.2 Crises Periods Analyses

In this section the 1992-93 ERM Crisis, 1994-95 Latin Crisis and 1997-98 Asian and Russian Crises are examined in detail. The analyses aim to observe the effect of crisis on the Developed Europe region portfolio and investigate whether Turkish stock market provides risk reduction during the crises. The periods under investigation for the crises are respectively 1992:01 to 1993:12, 1994:01 to 1995:12 and 1997:01 to 1998:12. A total of 24 monthly observations are provided for each crisis period and short-selling is allowed in the analyses unless otherwise stated. The findings of the crises periods are summarized in the following table.

Table 6.110 Pacific Rim Region Crises Periods Analyses

1992-93 PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	0.013133	0.009517
Minimum Variance Portfolio St. Dev.	0.036553	0.042111

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.016926	0.041352	0.016365	0.055626
Standard Deviation	0.041497	0.064863	0.055222	0.101810
Sharpe Ratio	0.407872	0.637525	0.296354	0.546369

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	7.175188	68.042111
Test Statistic	2.741930	2.983804

1994-95 PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	0.010128	0.011220
Minimum Variance Portfolio St. Dev.	0.045224	0.045856

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.010602	0.028585	0.011784	0.024469
Standard Deviation	0.046269	0.075976	0.046075	0.067720
Sharpe Ratio	0.229129	0.376240	0.255752	0.361332

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-0.007870	11.070633
Test Statistic	0.250775	0.427169

1997-98 PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	-0.005677	-0.005139
Minimum Variance Portfolio St. Dev.	0.055339	0.055926

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.008851	-0.075640	-0.006026	-0.043269
Standard Deviation	0.069101	0.202002	0.059923	0.158701
Sharpe Ratio	-0.128092	-0.374451	-0.100568	-0.272644

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	1.504370	21.047946
Test Statistic	0.049082	0.544054

6.6.2.1 Classic Efficient Frontier Analysis

During the 92-93 crisis zero correlation is observed between Hong Kong and Japan while the maximum correlation is observed between New Zealand and Australia (0.74) followed by Singapore and Hong Kong (0.46). The examination of the correlation matrix displays the very low even negative correlations Turkey had with the region countries in the period. Turkey had the lowest correlation with Hong Kong (-0.36) and the highest correlation with Singapore (-0.02).

Table 6.111 Pacific Rim Region 92-93 Crisis Correlation Matrix

	AUST	HON	JAP	NEW	SIN	TUR
AUSTRALIA	1					
HONGKONG	0.27	1				
JAPAN	0.19	0.00	1			
NEW ZEALAND	0.74	0.25	0.39	1		
SINGAPORE	0.52	0.46	0.24	0.62	1	
TURKEY	-0.25	-0.36	-0.03	-0.15	-0.02	1

The examination of the following correlation matrix points out that during the 94-95 crisis the correlations of Pacific Rim countries were respectively higher than their 92-93 period correlations. During the period Turkey had the highest correlation with Hong Kong (0.35) and the lowest correlation with Japan (-0.05). In the region highest correlation is observed between Hong Kong and Singapore (0.83) while the lowest is observed between Hong Kong and Japan (-0.00095). Compared to 92-93 period Turkey's correlations have increased and turned into positive values except for the Japan.

Table 6.112 Pacific Rim Region 94-95 Crisis Correlation Matrix

	AUST	HON	JAP	NEW	SIN	TUR
AUSTRALIA	1					
HONGKONG	0.58	1				
JAPAN	0.53	-0	1			
NEW ZEALAND	0.77	0.5	0.42	1		
SINGAPORE	0.52	0.83	0.11	0.54	1	
TURKEY	0.08	0.35	-0.05	0.26	0.28	1

During the 1997-98 crises the highest correlation is observed between Hong Kong and Singapore (0.85) and the lowest between Japan and Turkey (0.14). Compared to previous crisis periods' and full period correlation matrixes it is seen that 97-98 correlations are much higher on average. This fact is possibly due to the severity of the both crisis as well as the stronger economic and political linkages that Pacific Rim countries had developed in time. Meanwhile, Turkey had the highest correlation with New Zealand (0.50). Although Turkey's correlations with the Pacific Rim region countries are observed to be higher compared to previous crisis periods, it remains relatively lower compared to the correlations of region countries. Indeed Turkey's correlation with Hong Kong has decreased from 0.35 to 0.18.

Table 6.113 Pacific Rim Region 97-98 Crises Correlation Matrix

	AUST	HON	JAP	NEW	SIN	TUR
AUSTRALIA	1					
HONGKONG	0.68	1				
JAPAN	0.65	0.55	1			
NEW ZEALAND	0.64	0.63	0.64	1		
SINGAPORE	0.61	0.85	0.49	0.75	1	
TURKEY	0.30	0.18	0.14	0.50	0.34	1

For the 92-93 period the minimum variance portfolio mean and standard deviation of PR portfolio are found to be 0.0095 and 0.042, respectively. The standard deviation ranges from 0.042 to 0.047 for the given expected means. Compared to full period analysis the mean is found to be higher while the standard deviation is found to be higher. Inclusion of Turkey increases the minimum variance portfolio mean from 0.009 to 0.013 while decreasing the standard deviation from 0.042 to 0.036. The Sharpe ratio increases from 0.54 to 0.63.

For the 94-95 period the minimum variance portfolio mean and standard deviation of PR are found to be 0.011 and 0.046, respectively. Compared to 92-93 crisis the minimum variance portfolio mean and the standard deviation are found to be higher. Also the range of standard deviation for the given means is higher which is estimated to be between 0.045 and 0.056. The inclusion of Turkey in the Pacific Rim portfolio is found to produce the following values. The minimum variance portfolio mean and standard deviation are found to be slightly lower; 0.010 and 0.0452, respectively. Compared to 92-93 period increase in Sharpe ratio is less pronounced. It increases from 0.36 to 0.37.

For the 97-98 period the minimum variance portfolio mean and standard deviation of PR portfolio are found as -0.005 and 0.055, respectively. It is observed that the minimum variance portfolio mean had been negative while the standard deviation had increased compared to previous crises. The inclusion of Turkey in the Pacific Rim portfolio decreases the minimum variance portfolio mean and standard deviation slightly. The mean and standard deviation are found as -0.0056 and 0.0553. The Sharpe ratio decreases to -0.37. Nonetheless Turkey is estimated to reduce the standard deviation of the Pacific Rim portfolio more significantly at the high risk region even up to 1.6%. The change in the efficient frontiers can be seen at the following graphs where the efficient frontiers of respective portfolios are provided for all crises periods. Inclusion of Turkey is observed to shift the efficient frontier leftward, implying diversification benefit, for the 92-93 and 97-98 periods.

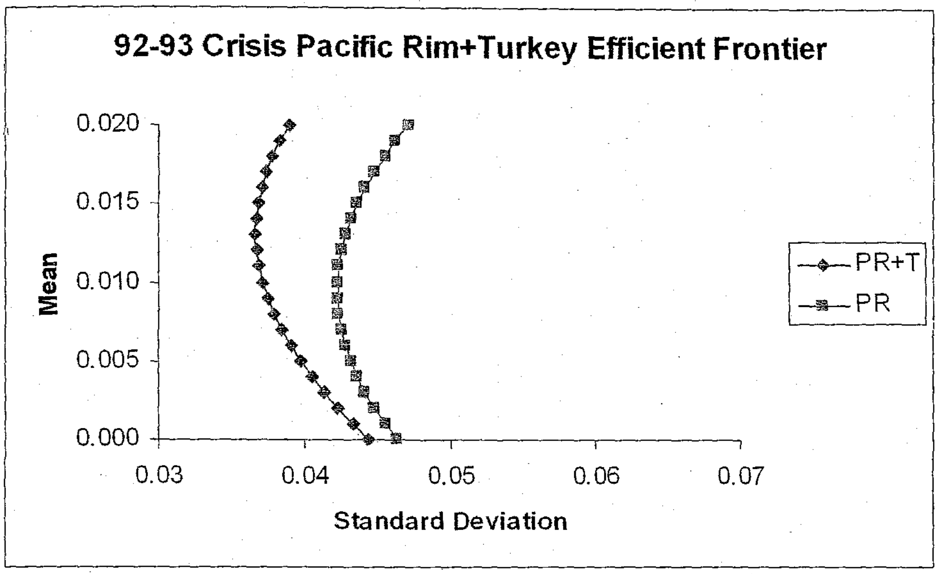

Figure 6.52 92-93 Crisis PR+Turkey Efficient Frontier

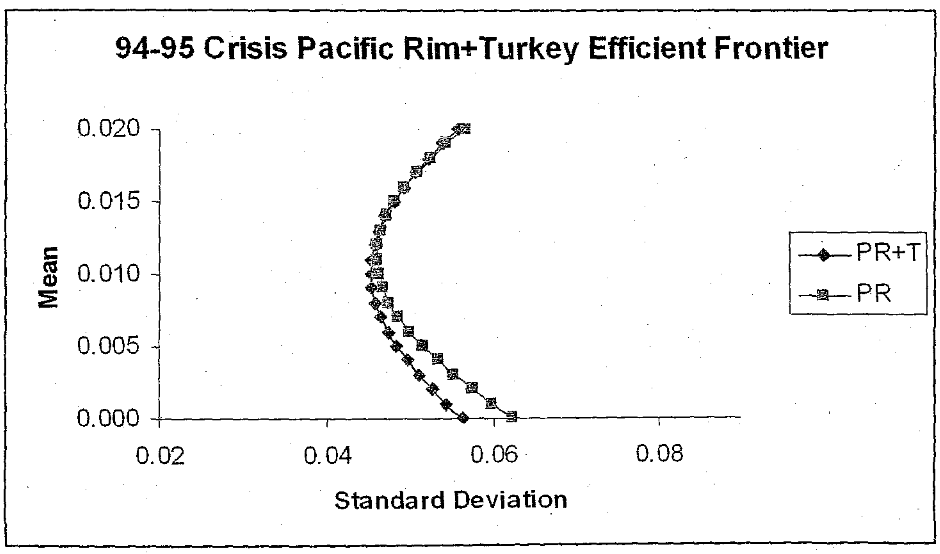

Figure 6.53 94-95 Crisis PR+Turkey Efficient Frontier

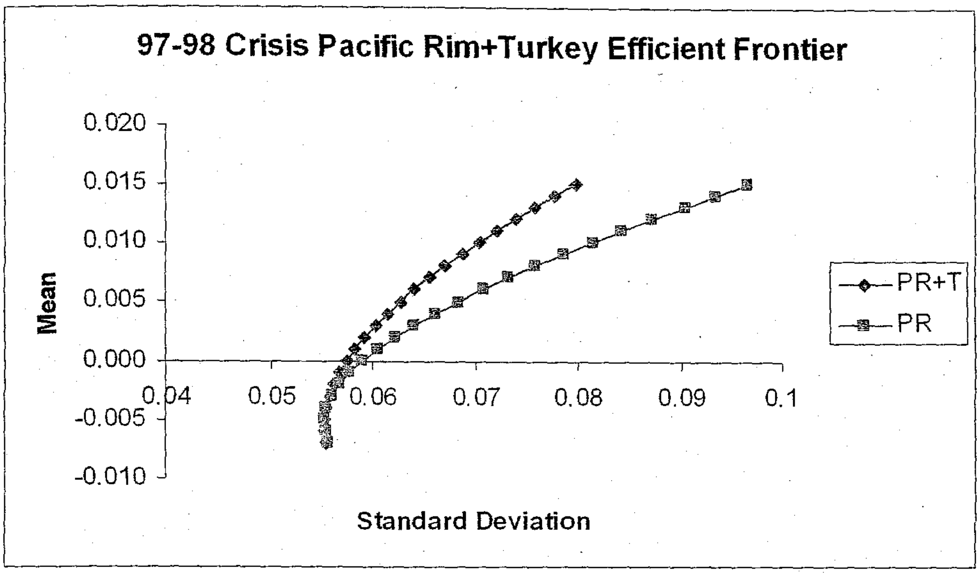

Figure 6.54 97-98 Crisis PR+Turkey Efficient Frontier

Inclusion of Turkey is found to produce 68.04, 11.07 and 21.04 marginal potential performance for the crises respectively. However, the spanning test statistics fail to reject the null hypothesis at the 1% significance level. It is concluded that Pacific Rim portfolio spans the Pacific Rim including Turkey portfolio for the 92-93 crisis period. Turkey's contribution is negligible. Spanning test parameters are provided in tables 6.113, 6.114 and 6.115 in the Appendix C.

6.6.2.2 Stein Estimated Efficient Frontier Analysis

The Pacific Rim portfolio 92-93 period sample means are smoothed by the minimum variance portfolio mean 0.0095. The lambda and shrinkage factor are found as 38.27 and 0.61, respectively. The sample means and re-estimated means are provided in table 6.116 in the Appendix C. It is observed that the highest shrinkage is made for Hong Kong and Singapore that have had relatively higher average returns during the crisis. The Sharpe ratio for a zero risk free rate of the tangency portfolio is found to drop from 0.54 to 0.29.

The sample means of the Pacific Rim including Turkey portfolio is smoothed by the minimum variance portfolio mean 0.013. Then the lambda and shrinkage factor are derived from the data as 41.46 and 0.63, respectively. The sample means and the re-estimated means are provided in table 6.117 in the Appendix C. This time the highest shrinkage is observed for Hong Kong and Turkey which had remarkably higher means during the 92-93 crisis. The mean of the tangency portfolio is observed to decrease from 0.041 to 0.016 in the Stein estimation while a minimal decrease is also evident for the standard deviation of it. Accordingly Sharpe ratio of Classic estimation falls from 0.63 to 0.40 in Stein estimation, indicating less reward to risk than classic estimation suggests. Nonetheless, comparison of Stein estimated portfolio's Sharpe ratios reveal an increase from 0.29 to 0.40 due to the inclusion of Turkey in the PR portfolio.

The Pacific Rim portfolio 94-95 crisis period country means are smoothed by the minimum variance portfolio mean is 0.011. The lambda and shrinkage factor are derived as 116.5 and 0.83, respectively. The sample means and the re-estimated means are provided in table 6.118 in the Appendix C. It is seen that all of the region countries had positive returns during the 94-95 crisis. The most significant shrinkage is observed for Singapore. The Sharpe ratio of the classic tangency portfolio decreases from 0.024 to 0.011 in the Stein estimated tangency due to the shrinkage. Sharpe ratio falls to from 0.36 to 0.25.

The Pacific Rim including Turkey portfolio 94-95 period sample means are smoothed by the minimum variance portfolio mean (0.010). The lambda and the shrinkage factor used in the estimation are then found as 125.8 and 0.84, respectively.

The sample means and the re-estimated means of the Pacific Rim including Turkey portfolio for the 94-95 crisis period is provided in table 6.119 in the Appendix C. It is observed that during the 94-95 crisis Turkey had negative mean return. However, it is seen that Stein estimation shrunk Turkey's mean towards the minimum variance portfolio mean. Turkey's mean increases from -0.013 to 0.006. The Stein estimated tangency portfolio mean and standard deviation are found to be lower than classic estimation's values and Sharpe ratio decreases slightly to 0.22. While an increase in the Stein Sharpe ratios was observed for the 92-93 period due to the inclusion of Turkey, a decrease is found for the 94-95 period. Sharpe ratio drops from 0.25 to 0.22. On the other hand, the Stein estimation reveals that the estimated risk reduction in the standard deviation of the Pacific Rim including Turkey portfolio by the classic efficient frontier analysis is biased. Turkey fails to decrease the standard deviation of the Pacific Rim portfolio for the 94-95 period.

The 97-98 period sample means of the Pacific Rim portfolio are smoothed by the minimum variance portfolio mean which was -0.005 for the period. The lambda and shrinkage factor are derived as 145.5 and 0.86, respectively. The sample means and the re-estimated means are given in table 6.120 in the Appendix C. The extreme negative sample means of the portfolio are observed to be shrunk towards the minimum variance portfolio mean by the Stein estimation. Accordingly, tangency portfolio mean and standard deviation improves. The Sharpe ratio increases from -0.27 to -0.10 in Stein estimation.

The 97-98 period sample means of Pacific Rim including Turkey portfolio are smoothed by the minimum variance portfolio mean (-0.0056). The lambda and shrinkage factor are found as 88.7 and 0.79, respectively. Inclusion of Turkey results in lower shrinkage factor. The sample means and re-estimated means are provided in table 6.121 in the Appendix C. During the crisis period all of the Pacific Rim countries had negative average returns while Turkish stock market had 1.3% average return. Turkey's sample mean is reduced to -0.0016 due to shrinkage. Extreme negative means of New Zealand and Singapore are increased as well. The mean of tangency portfolio increases slightly after the shrinkage while standard deviation decreases to 0.69. The Sharpe ratio increases slightly to -0.12 in Stein estimation. The Stein estimation also shows that the Pacific Rim including Turkey portfolio and the Pacific Rim portfolio both are more volatile than estimated by the classic optimization. It is also observed that once the estimation bias is minimized the risk reduction achieved by the inclusion of Turkey in the Pacific Rim portfolio becomes more evident.

The following graphs give the respective portfolios' efficient frontiers for the crises periods. Although Stein estimation suggests higher risk for both of the portfolios for the 92-93 period, Turkey is still observed to create a leftward shift. However, PR+T portfolio is observed to be more volatile than the PR portfolio for the 94-95 period. Turkey's contribution is found to diminish once the estimation bias is minimized. On the other hand, for the 97-98 period the inclusion of Turkey is again found to provide a shift in the efficient frontier.

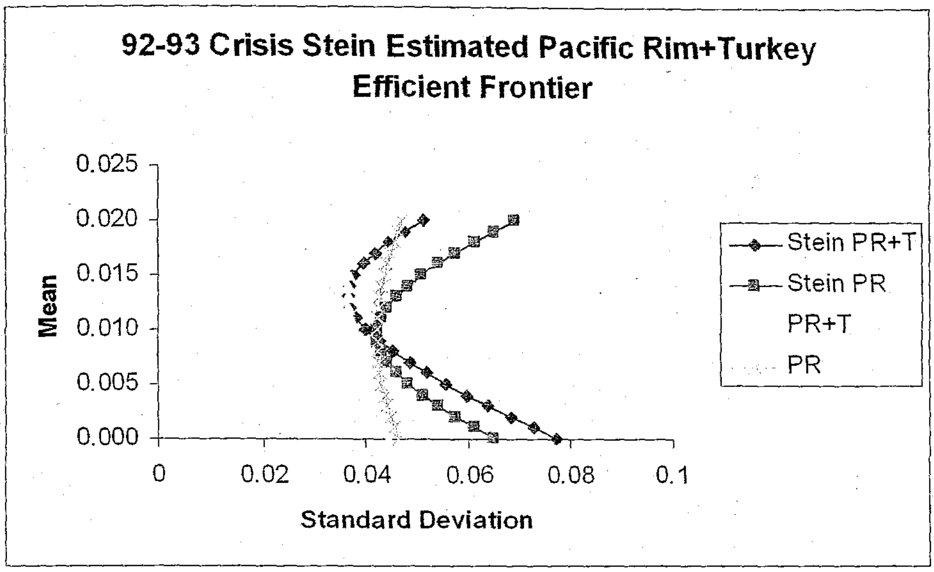

Figure 6.55 92-93 Crisis Stein Estimated PR+Turkey Efficient Frontier

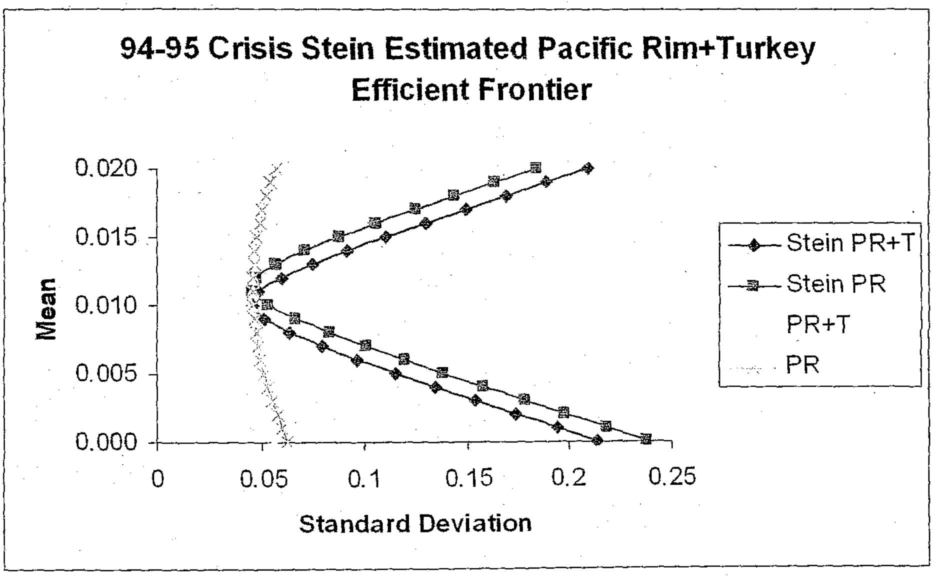

Figure 6.56 94-95 Crisis Stein Estimated PR+Turkey Efficient Frontier

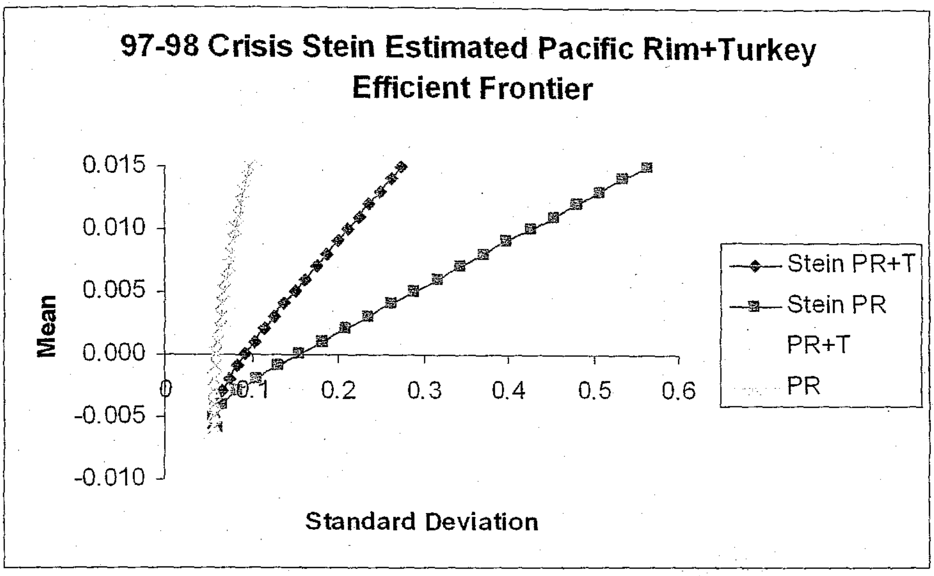

Figure 6.57 97-98 Crisis Stein Estimated PR+Turkey Efficient Frontier

The spanning test reveals that inclusion of Turkey results in 7.17, -0.0007 and 1.50 marginal potential performance for crises periods respectively. However, the test statistics fall below the required F-value of 5.25 with (2, 36) d.f. and fail to reject the null hypothesis at the 1% level for all crises periods. Thus, it is concluded that Turkey's contribution to the Pacific Rim portfolio is negligible for the 92-93, 94-95 and 97-98 crises periods. The spanning test parameters are provided in tables 6.122, 6.123 and 6.124 in the Appendix C.

6.6.2.3 Short-selling Restricted Efficient Frontier Analysis

For the 92-93 period it is found that the short-selling restricted Pacific Rim portfolio is outperformed by the Pacific Rim including Turkey portfolio. Inclusion of Turkey reduces the standard deviation of the portfolio more at the high risk region. On the other hand for the 94-95 period Turkey provides no significant reduction in the risk. For the 97-98 crisis period since all the Pacific Rim countries had negative mean returns no optimal portfolio could be constructed for any given positive expected mean under short-selling restriction. However, the short-selling restricted Pacific Rim including Turkey portfolio produces the following efficient frontier due to Turkey's positive mean return. The inclusion of Turkey is observed to shift the efficient frontier leftward improving the performance of the Pacific Rim portfolio for the 92-93 and 97-98 while failing in the 94-95 period. The graphs below provide the short-selling restricted efficient frontiers of the respective portfolios.

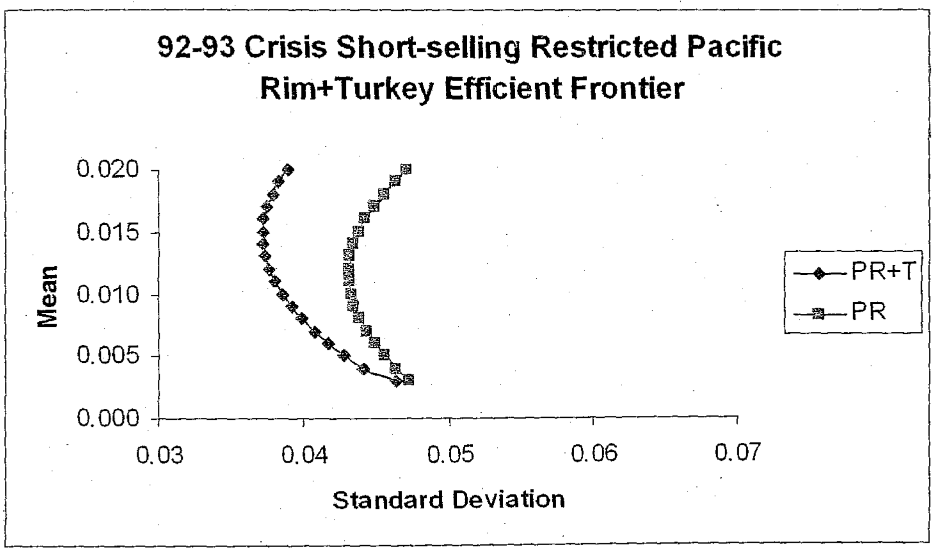

Figure 6.58 92-93 Crisis Short-selling Restricted PR+T Efficient Frontier

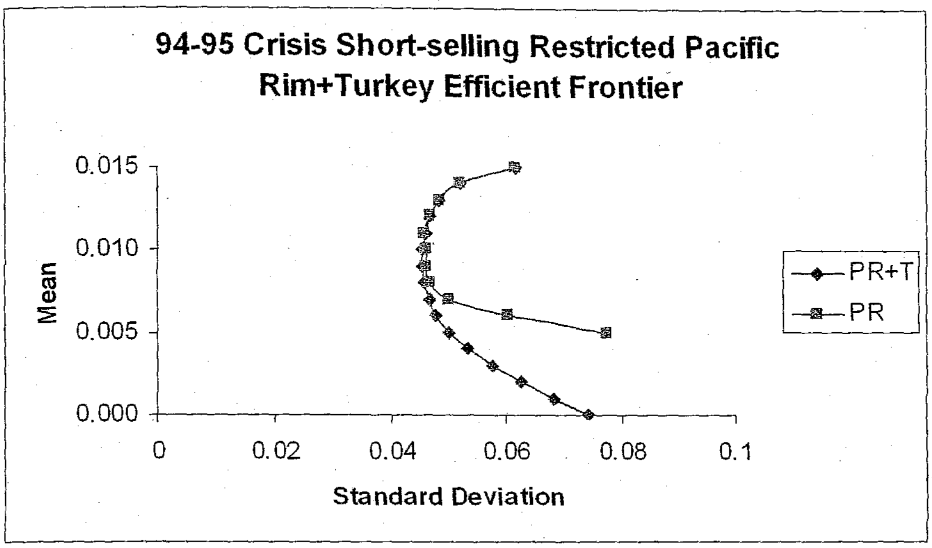

Figure 6.59 94-95 Crisis Short-selling Restricted PR+T Efficient Frontier

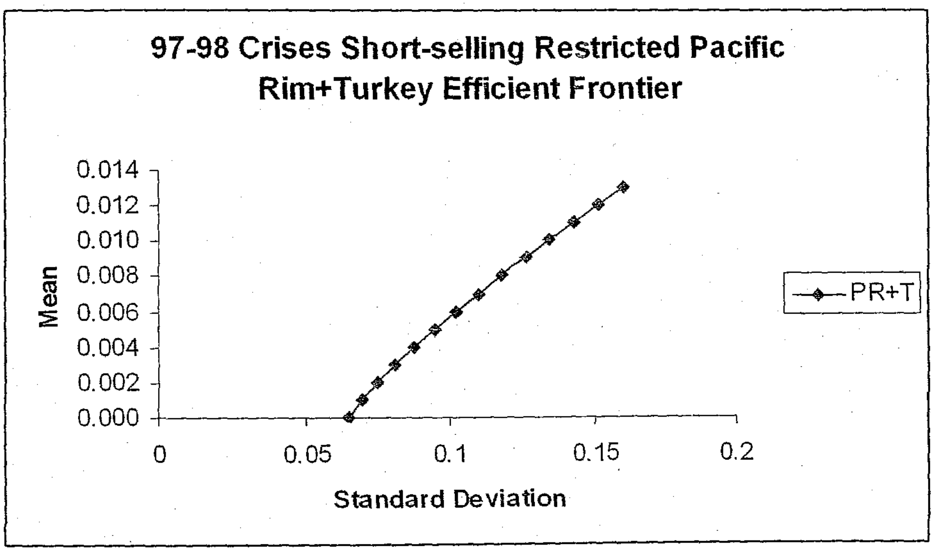

Figure 6.60 97-98 Crisis Short-selling Restricted PR+T Efficient Frontier

6.7 Middle East Region

The Middle East Region portfolio is composed of 5 emerging countries namely Egypt, Israel, Jordan, Morocco and South Africa. The portfolio is constructed from the monthly dollar returns of these countries' respective stock market indexes. The objective of this analysis is to investigate the risk-return attributes of Middle East countries and whether or not Turkey contributes to the ME portfolio. The investigation is made over the full period and then detailed into global crises period of 97-98. For each time period the classic, Stein and short-selling restricted efficient frontier analyses are provided.

6.7.1 Full Period Analysis

The full period analysis of this portfolio is started from 1995:02 due to the available shorter historical data of Egypt and Morocco stock market indexes. A total of 97 monthly observations are used and short-selling is allowed in the construction of efficient portfolios. The following table summarizes the full period findings of the Middle East portfolio.

Table 6.125 Middle East Region Full Period Analyses

FULL PERIOD				
	ME+T	ME		
Minimum Variance Portfolio Mean	0.000622	0.000942		
Minimum Variance Portfolio St. Dev.	0.028796	0.028960		
	ME+T		ME	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.001706	0.029273	0.001103	0.010927
Standard Deviation	0.047697	0.197591	0.031344	0.098652
Sharpe Ratio	0.035763	0.148152	0.035192	0.110766
Asset Set Spanning	Stein	Classic		
Marginal Potential Performance	0.764147	12.539202		
Test Statistic	0.546873	0.981587		

6.7.1.1 Classic Efficient Frontier Analysis

The examination of the correlation matrix reveals that over the full period Turkey had the highest correlation with Israel (0.59) and the lowest correlation with the Morocco (-0.11).

Table 6.126 Middle East Region Full Period Correlation Matrix

	EGY	ISR	JOR	MOR	SOU	TUR
EGYPT	1					
ISRAEL	0.23	1				
JORDAN	0.22	0.02	1			
MOROCCO	0.24	-0.04	0.02	1		
SOUTHAFRICA	0.30	0.32	0.08	0.00	1	
TURKEY	0.27	0.59	0.10	-0.11	0.35	1

The minimum variance portfolio mean and standard deviation of the ME portfolio are found as 0.0009 and 0.028, respectively. The standard deviation of the portfolio ranges from 0.049 to 0.135 for the given expected means. The analysis verify that the inclusion of Turkey in the Middle East portfolio results in a minor decrease in the minimum variance portfolio mean while reducing the standard deviation of it. Sharpe ratio increases from 0.11 to 0.14 due to inclusion of Turkey. The following table demonstrates the risk reduction potential of Turkish stock market due its low correlation with this region. At the high risk region Turkey is estimated to reduce the standard deviation up to 3.3% for the given means.

Table 6.127 Change in St. Dev. of Middle East Portfolio

Mean	St. Dev. ME+T	St. Dev. ME	Change in St. Dev.
0.000	0.029107	0.030295	0.001188
0.001	0.028911	0.028965	0.000054
0.002	0.030292	0.030636	0.000344
0.003	0.033053	0.034879	0.001826
0.004	0.036884	0.040901	0.004017
0.005	0.041491	0.048038	0.006547
0.006	0.046644	0.055864	0.009220
0.007	0.052182	0.064128	0.011946
0.008	0.057994	0.072679	0.014685
0.009	0.064006	0.081428	0.017422
0.010	0.070166	0.090317	0.020151
0.011	0.076439	0.099309	0.022870
0.012	0.082799	0.108378	0.025579
0.013	0.089227	0.117505	0.028278
0.014	0.095710	0.126680	0.030969
0.015	0.102237	0.135891	0.033653

The following graph shows the slight shift of the efficient frontier after the inclusion of Turkey in the Middle East portfolio. However, it is necessary to statistically test if this shift is significant or if it is just a sampling artifact. Therefore, Spanning test of Jobson and Korkie is implemented.

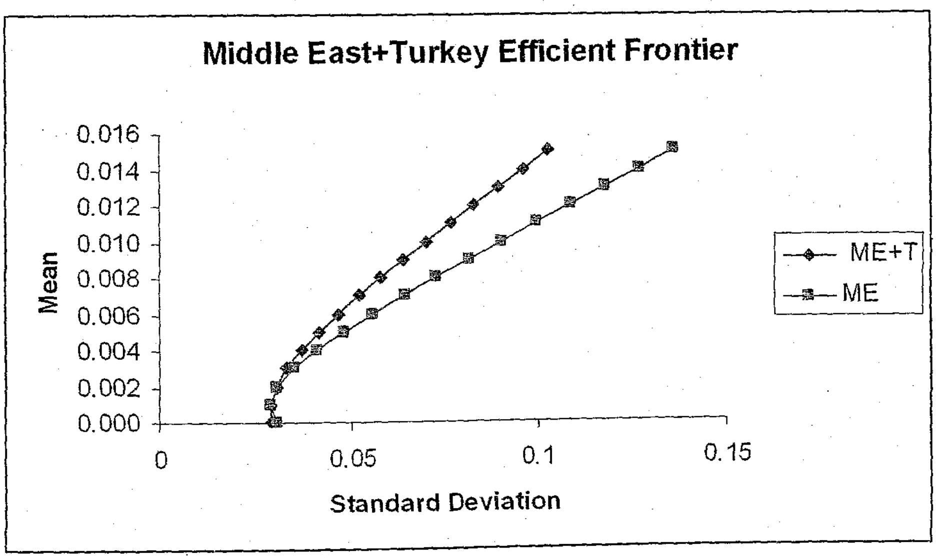

Figure 6.61 Middle East including Turkey Efficient Frontier

Although 12.5 marginal potential performance is achieved with the inclusion of Turkey in the Middle East portfolio, the test statistic falls below the required f-value of 4.71 at 1% significance level with (2, 350) d.f. and hypothesis of zero marginal potential performance is accepted. Thus, it is concluded that Turkey does not significantly improve the performance of the Middle East portfolio over the full period. The contribution of Turkey is negligible. The spanning test parameters are provided in table 6.128 in the Appendix C.

6.7.1.2 Stein Estimated Efficient Frontier Analysis

In the Stein estimated efficient frontier analysis the average sample means of Middle East portfolio are smoothed with the minimum variance portfolio mean of Middle East Region which is 0.0009. The lambda and shrinkage factor are found to be 665.96 and 0.87, respectively. The following re-estimated means are derived:

Table 6.129 Middle East Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
EGYPT	0.001586	0.001024
ISRAEL	0.005526	0.001524
JORDAN	-0.001536	0.000627
MOROCCO	0.003801	0.001305
SOUTHAFRICA	-0.000140	0.000804

The resulting portfolio reveals that actually the Pacific Rim portfolio is much more volatile than estimated by the classic efficient frontier analysis. There is higher risk per return. The standard deviation of the portfolio ranges from 0.028 to 1.04 while it ranged between 0.028 and 0.13 in the Classic Efficient Frontier Analysis. However, shrinkage does not lead to a significant change in the Sharpe ratios of the tangency portfolios.

The ME+T portfolio sample means are smoothed by the minimum variance portfolio mean 0.0006 and the lambda and shrinkage factor are found as 401.68 and 0.80, respectively. The following table provides the sample and the re-estimated means.

Table 6.130 Middle East+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
EGYPT	0.001586	0.000809
ISRAEL	0.005526	0.001576
JORDAN	-0.001536	0.000202
MOROCCO	0.003801	0.001240
SOUTH AFRICA	-0.000140	0.000473
TURKEY	0.019509	0.004296

After the shrinkage Turkey's country mean is observed to drop from 0.019 to 0.004 towards the minimum variance portfolio mean no significant difference is found in Sharpe ratio. However, the Stein estimated efficient frontiers are observed to be flatter than the classic efficient frontiers. The flatness of the Stein estimated frontier reveals the higher risk of the Middle East portfolio. The examination of the following table shows that inclusion of Turkey in the Middle East portfolio reduces the standard deviation of the portfolio for the given means especially at the high risk region. The risk reduction Turkey provides is estimated to reach up to 54% for the given means.

Table 6.131 Change in St. Dev. Of Middle East Portfolio

Mean	St. Dev. Stein ME+T	St. Dev. Stein ME	Change in St. Dev.
0.000	0.036122	0.075708	0.039586
0.001	0.031706	0.029282	-0.002423
0.002	0.056270	0.083783	0.027513
0.003	0.088250	0.155621	0.067371
0.004	0.121944	0.229026	0.107082
0.005	0.156247	0.302860	0.146612
0.006	0.190832	0.376870	0.186039
0.007	0.225568	0.450971	0.225403
0.008	0.260395	0.525124	0.264729
0.009	0.295281	0.599309	0.304028
0.010	0.330207	0.673517	0.343309
0.011	0.365162	0.747739	0.382577
0.012	0.400138	0.821973	0.421835
0.013	0.435130	0.896215	0.461085
0.014	0.470135	0.970464	0.500329
0.015	0.505149	1.044717	0.539568

The following graph provides the classic and the Stein estimated efficient frontiers for both portfolios. It can be easily depicted that Turkey's contribution becomes more visible at the Stein estimated efficient frontier analysis.

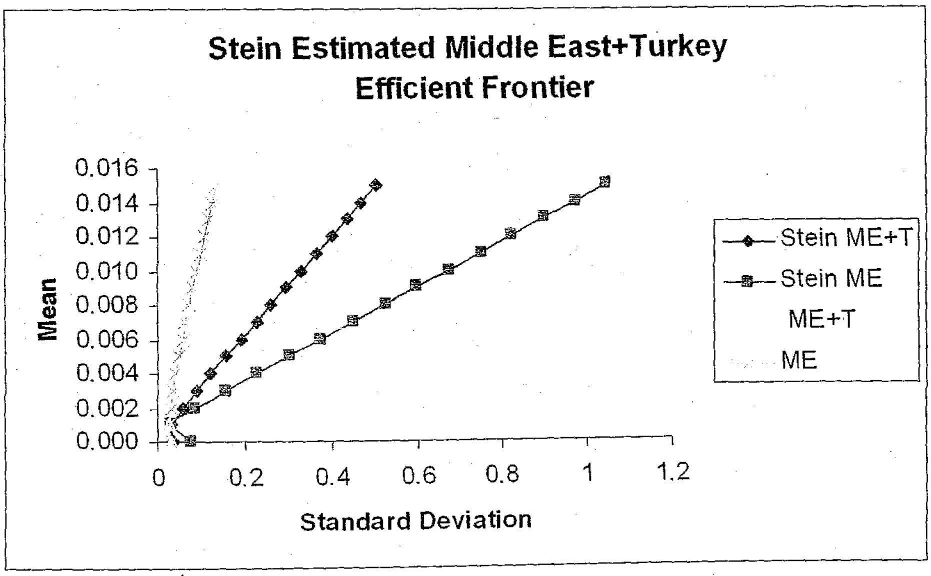

Figure 6.62 Stein Estimated ME+Turkey Efficient Frontier

The marginal potential performance is found as 0.76. The test statistic cannot exceed the required f-value of 4.71 at the 1% significance level with (2, 350) d.f. and hypothesis of zero marginal potential performance is accepted. It is confirmed that inclusion of Turkey in the Middle East portfolio does not significantly shift the efficient frontier in the full period analysis. Turkey's contribution is negligible. The spanning test parameters are provided in table 6.132 in the Appendix C.

6.7.1.3 Short-selling Restricted Efficient Frontier Analysis

The short-selling restricted efficient frontier analysis reveals that inclusion of Turkish stock market to the Middle East portfolio enhances the investment set and extends the efficient frontier beyond what can be achieved with the short-selling restricted Middle East portfolio. No efficient portfolio can be found for the short-selling restricted Middle East portfolio beyond mean 0.005. The contribution of Turkey can be observed from the following graph. At the high risk region its contribution is more pronounced. However, no significant shift is observed in the minimum variance portfolio mean.

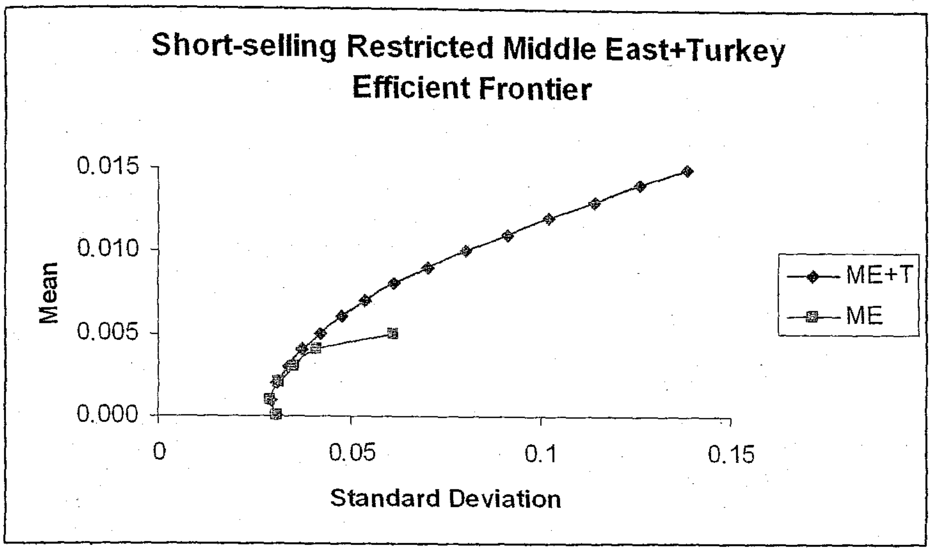

Figure 6.63 Short-selling Restricted ME+Turkey Efficient Frontier

6.7.2 Crises Periods Analyses

Due to the unavailability of the data, ERM crisis and Latin crisis cannot be examined by the researcher. Since the available data for the Middle East Region starts from 1995:02 and extends to 2003:02, the crises periods cannot be fully incorporated into the analysis. While no data is available for the ERM crisis limited number of data is found for the Latin Crisis. However, the analyses concerning the 94-95 crisis period are not provided not only due to limited number of observations but also due to the lack of information. The time period for the 1997-98 Asian and Russian Crises Analysis starts from 1997:01 and extends to 1998:12. A total of 24 monthly observations are put into estimation and short-selling is allowed in the construction of efficient portfolios. The crises period findings are summarized in the following table.

Table 6.133 Middle East Region Crises Periods Analyses

1997-98 PERIOD

	ME+T	ME
Minimum Variance Portfolio Mean	0.000702	0.001419
Minimum Variance Portfolio St. Dev.	0.026920	0.027218

	ME+T		ME	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.073815	0.384129	0.039368	0.178783
Standard Deviation	0.276040	0.629708	0.143384	0.305559
Sharpe Ratio	0.267405	0.610011	0.274561	0.585102

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-0.356367	54.102004
Test Statistic	0.183760	0.414163

6.7.2.1 Classic Efficient Frontier Analysis

Compared to full period correlation matrix it is seen that 97-98 correlations of ME countries have not changed much on average. During the period Morocco had negative correlations with Israel, Jordan and South Africa. The highest correlation is observed between Turkey and Israel (0.60) and the lowest between Turkey and Morocco (-0.18). Compared to full period correlation matrix Turkey's correlation with Morocco and South Africa had been lower during the crises.

Table 6.134 Middle East Region 97-98 Crises Correlation Matrix

	EGY	ISR	JOR	MOR	SOU	TUR
EGYPT	1					
ISRAEL	0.31	1				
JORDAN	0.04	0.37	1			
MOROCCO	0.16	-0.16	-0.11	1		
SOUTHAFRICA	0.25	0.22	0.04	-0.11	1	
TURKEY	0.46	0.60	0.27	-0.18	0.27	1

The minimum variance portfolio mean and standard deviation of ME portfolio are found to be 0.0014 and 0.027, respectively. It is observed that the minimum variance portfolio mean had been higher while the standard deviation had been lower compared to full period values. The inclusion of Turkey in the Middle East portfolio decreases the minimum variance portfolio mean and standard deviation slightly. The mean and standard deviation are found as 0.0007 and 0.026. On the other hand tangency portfolio mean and standard deviation increase. Accordingly, Sharpe ratio increases from 0.58 to 0.61. The estimated change in the standard deviation is found to be minimal. The following graph gives the efficient frontiers of respective portfolios.

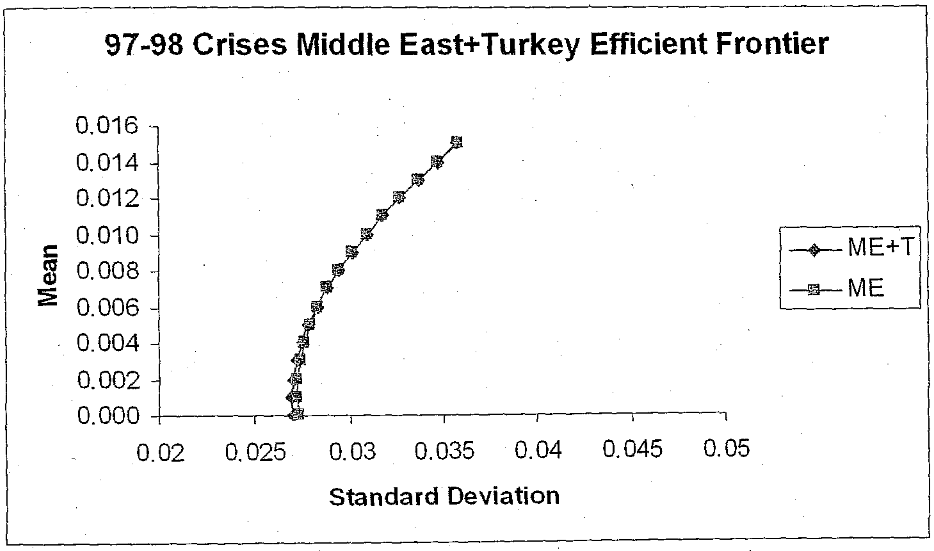

Figure 6.64 97-98 Crises ME+Turkey Efficient Frontier

During the 97-98 period inclusion of Turkey is found to produce 54.1 marginal potential performance. However, the spanning test statistic fails to reject the null hypothesis at the 1% significance level. It is concluded during the Asian and Russian crisis Turkey did not provide significant risk reduction in the Middle East region. Its contribution is negligible. The spanning parameters are provided in table 6.135 in Appendix C.

6.7.2.2 Stein Estimated Efficient Frontier Analysis

The 97-98 period sample means of the Middle East portfolio are smoothed by the minimum variance portfolio mean which was 0.0014 for the period. The lambda and shrinkage factor are derived as 27.88 and 0.53, respectively. The sample means and the re-estimated means are provided in table 6.136 in the Appendix C. It is found that the negative sample means as well as the extreme positive mean of Morocco are shrunk towards the minimum variance portfolio mean by the Stein estimation. It is observed that the tangency portfolio mean and standard deviation decrease slightly. Consequently, Sharpe ratio drops from 0.058 to 0.052. The 97-98 period sample means of Middle East including Turkey portfolio are smoothed by the minimum variance portfolio mean (0.0007). The lambda and shrinkage factor are found as 30.96 and 0.56, respectively. The sample means and re-estimated means are provided in table 6.137 in the Appendix C. It is seen that during the crisis while Turkish stock market had 1.3% average return Morocco had 2.3% and Israel had 0.8% average return. However due to shrinkage Turkey's sample mean is reduced to 0.006. Likewise Morocco's and Israel's means drop to 0.3% and 1%, respectively. The mean of tangency portfolio decreases slightly after the shrinkage while no difference is observed in the standard deviation. Consequently, the Sharpe ratio decreases to 0.026.

The Stein estimation shows that the Middle East including Turkey portfolio and the Middle East portfolio both are more volatile than estimated by the classic optimization. However, it is also observed that once the estimation bias is minimized the risk reduction achieved by the inclusion of Turkey in the Pacific Rim portfolio diminishes.

The graph below provides the classic and Stein estimated efficient frontiers for the two respective portfolios. It is seen that Stein estimated frontiers are flatter implying higher risk than estimated by classic frontiers. However the Middle East including Turkey is observed to be outperformed by the Middle East portfolio for the 97-98 period.

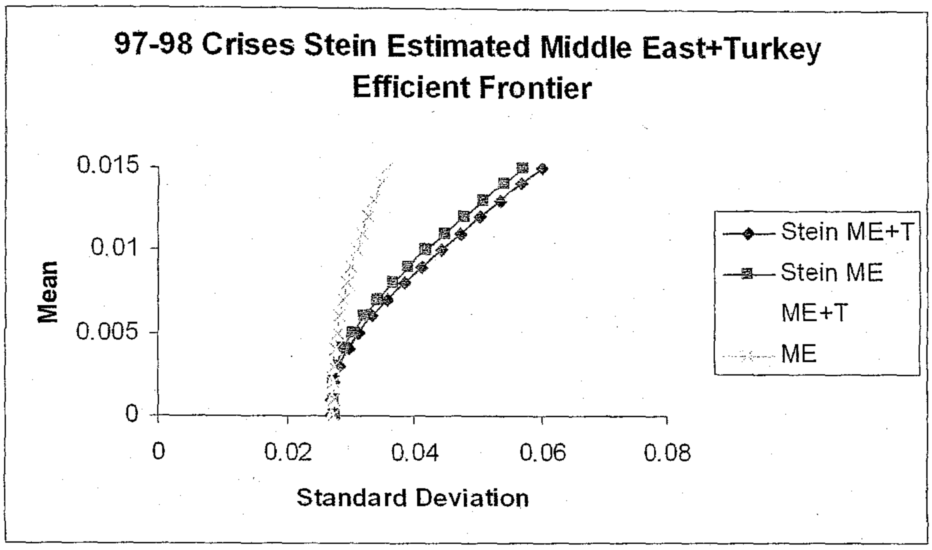

Figure 6.65 97-98 Crises Stein Estimated ME+Turkey Efficient Frontier

For the crises period inclusion of Turkey is found to create negative marginal potential performance. The test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. Thus, it is concluded that efficient frontiers are not statistically different than each other and Middle East portfolio spans the Middle East including Turkey portfolio for the 97-98 crises period. Turkey fails to improve the portfolio performance of Middle East region. The spanning test parameters are provided in table 6.138 in the Appendix C.

6.7.2.3 Short-selling Restricted Efficient Frontier Analysis

No significant change is observed between the short-selling restricted ME+T and ME portfolios for the 97-98 crises period. Under short-selling restriction Turkish stock market enters the Middle East portfolio for expected means above 0.012. The respective portfolios are found to provide the same efficient frontier. The graph below provides the short-selling restricted efficient frontiers of Middle East and Middle East including Turkey portfolios.

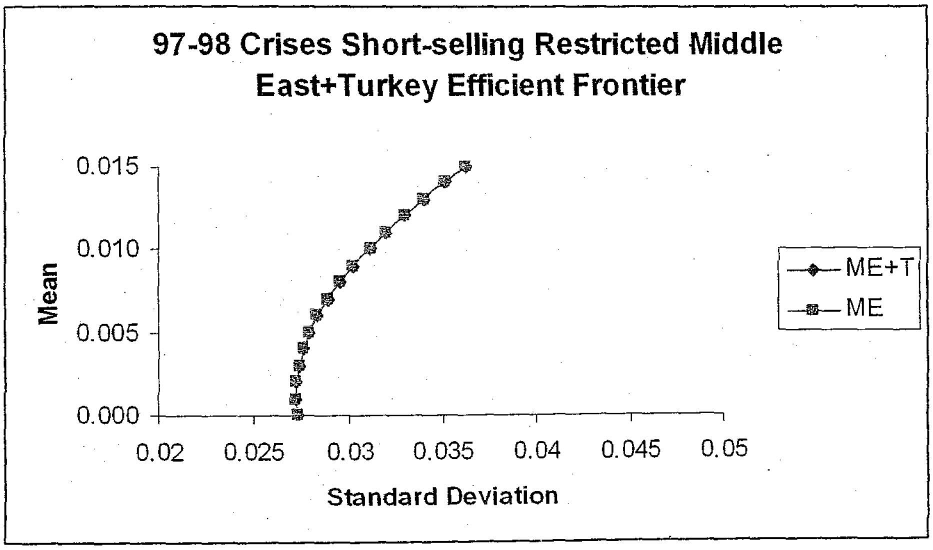

Figure 6.66 97-98 Crises Short-selling Restricted ME+T Efficient Frontier

6.8 G7 Portfolio

The G7 portfolio consists of Canada, France, Germany, Italy, Japan, UK and US stock markets. The portfolio is constructed from the monthly dollar returns of the respective countries stock market indexes. The objective of the analyses is to explore the diversification properties of G7 and how Turkish stock market contributes to the portfolio. The analyses start with the full period analysis and then details into the crises periods. Classic efficient frontier analysis, Stein estimated efficient frontier analysis and short-selling restricted efficient frontier analysis are provided for each time period under investigation.

6.8.1 Full Period Analysis

The full period analysis period start from 1988:02 and extends to 2003:02. Although G7 countries' stock markets have longer histories, to have a comparable time period with Turkish stock market the analysis is started from 1988. A total of 181 observations are put into analysis and short-selling is allowed in the construction of efficient portfolios. The full period analyses are summarized at the following table.

Table 6.139 G7 Portfolio Full Period Analyses

FULL PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.005949	0.005973
Minimum Variance Portfolio St. Dev.	0.039926	0.039928

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.006818	0.013754	0.006709	0.012778
Standard Deviation	0.042744	0.060711	0.042317	0.058402
Sharpe Ratio	0.159502	0.226549	0.158535	0.218797

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.305411	2.279589
Test Statistic	0.050754	0:314829

6.8.1.1 Classic Efficient Frontier Analysis

The examination of the correlation matrix reveals that France and Germany has a strong correlation, the highest correlation is observed between them (0.81). USA and Canada follow them with 0.74 correlation. On the other hand the lowest correlation is found between Turkey and Japan (0.07). Meanwhile over the full period Turkey had the highest correlation with Germany (0.27).

Table 6.140 G7 Full Period Correlation Matrix

	CAN	FRA	GER	ITA	JAP	UK	USA	TUR
CANADA	1							
FRANCE	0.56	1						
GERMANY	0.55	0.81	1					
ITALY	0.45	0.55	0.58	1				
JAPAN	0.39	0.42	0.35	0.34	1			
UK	0.54	0.65	0.61	0.43	0.49	1		
USA	0.74	0.59	0.57	0.38	0.34	0.64	1	
TURKEY	0.21	0.25	0.27	0.15	0.07	0.18	0.21	1

The minimum variance portfolio mean and standard deviation of G7 portfolio are found as 0.006 and 0.039, respectively. The standard deviation of the portfolio ranges between 0.039 and 0.069. It is observed that despite its relatively lower correlation with region countries, inclusion of Turkey leads to a minimal decrease in the mean and the standard deviation of the portfolio. Sharpe ratio slightly increases from 0.21 to 0.22. On the other hand, the following table displays that at the high risk region inclusion of Turkey provides risk reduction up to 0.28% for the given means.

Table 6.141 Change in St. Dev. G7 Portfolio

Mean	St. Dev. G7+T	St. Dev. G7	Change in St. Dev.
0.000	0.053000	0.054713	0.001713
0.001	0.049344	0.050638	0.001294
0.002	0.046145	0.047046	0.000901
0.003	0.043504	0.044056	0.000552
0.004	0.041527	0.041796	0.000270
0.005	0.040311	0.040390	0.000079
0.006	0.039927	0.039929	0.000001
0.007	0.040399	0.040443	0.000044
0.008	0.041696	0.041898	0.000202
0.009	0.043747	0.044201	0.000454
0.010	0.046451	0.047227	0.000777
0.011	0.049701	0.050848	0.001147
0.012	0.053398	0.054946	0.001548
0.013	0.057456	0.059423	0.001967
0.014	0.061804	0.064200	0.002396
0.015	0.066385	0.069214	0.002829

This reduction in the standard deviation of the portfolio can be observed at the following graph where both respective portfolios are provided. The statistical significance of this leftward shift of the efficient frontier is investigated by the spanning test.

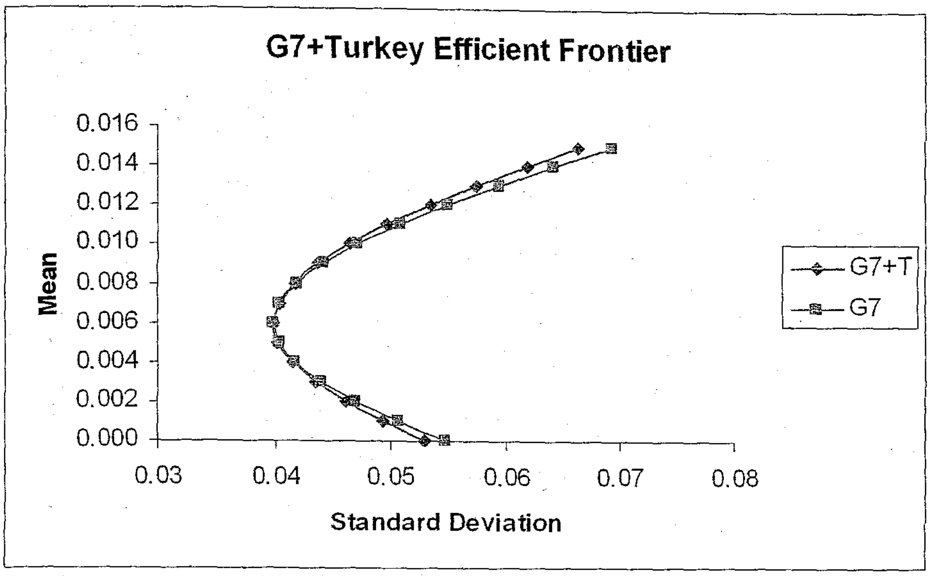

Figure 6.67 G7 including Turkey Efficient Frontier

It is observed that inclusion of Turkey produces 2.28 marginal potential performance. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1% significance level. It is concluded that despite its low correlation with the region countries Turkey's contribution to G7 portfolio is negligible. The spanning test parameters are provided in table 6.142 in the Appendix C.

6.8.1.2 Stein Estimated Efficient Frontier Analysis

In the Stein estimation of the full period data the sample means of the G7 portfolio are smoothed by the minimum variance portfolio mean found as 0.006 in the classic efficient frontier optimization. The lambda and shrinkage factor used in the analysis are calculated as 369.42 and 0.67, respectively. The table below provides the re-estimated sample means.

Table 6.143 G7 Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.005180	0.005712
FRANCE	0.007717	0.006546
GERMANY	0.005801	0.005916
ITALY	0.004358	0.005442
JAPAN	-0.001125	0.003639
UK	0.004622	0.005529
USA	0.007911	0.006610

Since the average means of the G7 countries have already been close to the minimum variance portfolio mean not much difference is observed between the sample means and the re-estimated means of the portfolio except for Japan, whose negative mean increases to 0.003. Sharpe ratio falls slightly.

The full period sample means of G7 including Turkey portfolio is smoothed by the minimum variance portfolio mean 0.0059. Then lambda and the shrinkage factor are derived from the data and found as 361.39 and 0.66, respectively. The sample means and re-estimated means are provided below.

Table 6.144 G7+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.005180	0.005692
FRANCE	0.007717	0.006539
GERMANY	0.005801	0.005899
ITALY	0.004358	0.005418
JAPAN	-0.001125	0.003588
UK	0.004622	0.005506
USA	0.007911	0.006603
TURKEY	0.019457	0.010456

It is observed that Turkey's relatively higher mean is shrunk towards the minimum variance portfolio mean. It decreases from 0.019 to 0.010. The examination of the Sharpe ratios of the tangency portfolios computed with zero risk-free rate reveal that Stein estimation leads to a lower tangency portfolio mean while no change is observed in the standard deviation of it. Sharpe ratio falls slightly from 0.149 to 0.148. On the other hand the following table demonstrates that once the estimation bias is minimized the contribution of Turkish stock market becomes more significant. At the high risk level Turkey is expected to provide up to 1.2% risk reduction.

Table 6.145 Change in St. Dev. of G7 Portfolio

Mean	St. Dev. Stein G7+T	St. Dev. Stein G7	Change in St. Dev.
0.000	0.111819	0.120557	0.008738
0.001	0.095624	0.102780	0.007156
0.002	0.080005	0.085551	0.005546
0.003	0.065379	0.069280	0.003901
0.004	0.052580	0.054826	0.002246
0.005	0.043261	0.044017	0.000756
0.006	0.039937	0.039932	-0.000005
0.007	0.043988	0.044463	0.000475
0.008	0.053774	0.055542	0.001768
0.009	0.066820	0.070130	0.003310
0.010	0.081576	0.086469	0.004893
0.011	0.097269	0.103736	0.006467
0.012	0.113509	0.121535	0.008026
0.013	0.130092	0.139663	0.009571
0.014	0.146902	0.158007	0.011105
0.015	0.163869	0.176500	0.012631

The graph below provides the respective portfolio's classic and Stein estimated efficient frontiers. The Stein estimation points out that both portfolios have higher risk which can be visually observed from the flatter efficient frontiers of Stein estimated portfolios. Compared to classic efficient frontier analysis Turkey is found to be providing higher risk reduction once the Stein estimation smoothes the sample means.

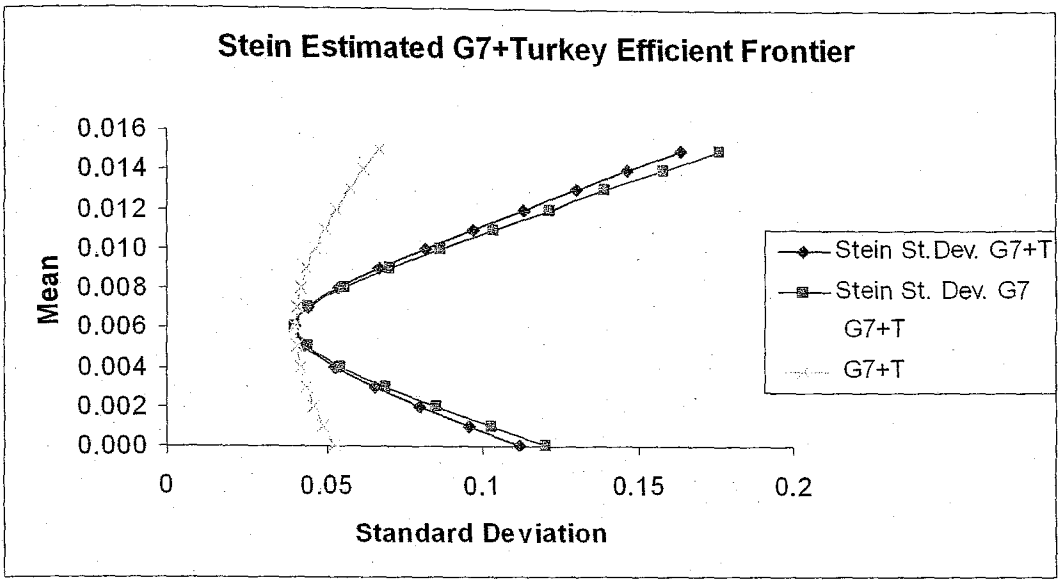

Figure 6.68 Stein Estimated G7+Turkey Efficient Frontier

It is found that inclusion of Turkey into the G7 portfolio generates a very small marginal potential performance (0.35). The test statistics falls short of the required f-value and fails to reject the null hypothesis of zero marginal potential performance. It is concluded that over the full period Turkish stock markets contribution to G7 portfolio is negligible. The spanning test parameters are provided in table 6.146 in the Appendix C.

6.8.1.3 Short-selling Restricted Efficient Frontier Analysis

The analysis reveals that no significant difference is observed between the short-selling restricted G7 portfolio and the short-selling restricted G7 including Turkey portfolio up to mean 0.007. However it is found that inclusion of Turkey extends the efficient frontier beyond the mean 0.007. The graph below gives the short-selling restricted efficient frontiers of the respective portfolios. The extension of the efficient frontier is evident in the graph.

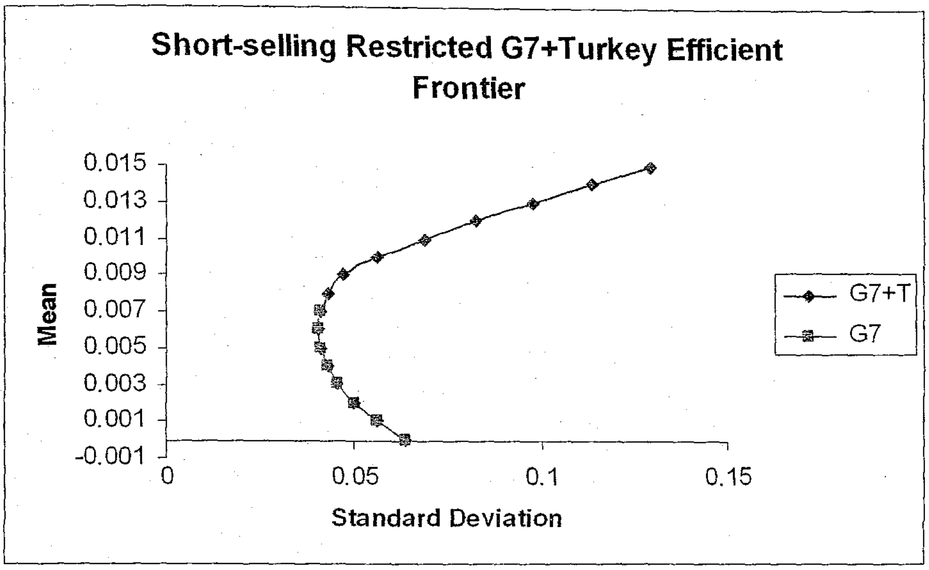

Figure 6.69 Short-selling Restricted G7+Turkey Efficient Frontier

6.8.2 Crises Periods Analyses

In this section the 1992-93 ERM Crisis, 1994-95 Latin Crisis and 1997-98 Asian and Russian Crises are examined in detail. The analyses aim to observe the effect of crisis on the Developed Europe region portfolio and investigate whether Turkish stock market provides risk reduction during the crises. The periods under investigation for the crises are respectively 1992:01 to 1993:12, 1994:01 to 1995:12 and 1997:01 to 1998:12. A total of 24 monthly observations are provided for each crisis period and short-selling is allowed in the analyses unless otherwise stated. The following table summarizes the crises periods findings.

Table 6.147 G7 Portfolio Crises Periods Analyses

1992-93 PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.006538	0.005525
Minimum Variance Portfolio St. Dev.	0.021984	0.023469

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.006617	0.012899	0.005610	0.012594
Standard Deviation	0.022117	0.030881	0.023650	0.035434
Sharpe Ratio	0.299177	0.417714	0.237215	0.355421

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.668840	49.309199
Test Statistic	1.082501	1.200979

1994-95 PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.011395	0.011986
Minimum Variance Portfolio St. Dev.	0.022472	0.023151

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.011430	0.014801	0.012016	0.014919
Standard Deviation	0.022506	0.025611	0.023181	0.025829
Sharpe Ratio	0.507848	0.577909	0.518376	0.577597

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	0.267501	29.810749
Test Statistic	0.121174	0.142691

1997-98 PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.028036	0.028028
Minimum Variance Portfolio St. Dev.	0.037411	0.037411

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.032106	0.051996	0.032682	0.051268
Standard Deviation	0.040035	0.050948	0.040395	0.050597
Sharpe Ratio	0.801957	1.020567	0.809062	1.013249

Asset Set Spanning	Stein	Classic
Marginal Potential Performance	-8.284046	10.399314
Test Statistic	-0.085053	0.079279

6.8.2.1 Classic Efficient Frontier Analysis

The examination of the correlation matrix of G7 reveals that during the crisis period of 92-93 G7 countries had moderate correlations. The highest correlation is observed between France and Germany (0.73). Interestingly the correlation between Canada and USA had been 0.14, quite lower than their full period correlation. On the other hand, Turkey is observed to have negative correlations with the G7 countries. It had the lowest correlation with USA (-0.20) and the highest correlation with Germany (0).

Table 6.148 G7 Portfolio 92-93 Crisis Correlation Matrix

	CAN	FRA	GER	ITA	JAP	UK	USA	TUR
CANADA	1							
FRANCE	0.12	1						
GERMANY	0.28	0.73	1					
ITALY	0.40	-0.06	0.2	1				
JAPAN	0.29	0.25	0.26	0.36	1			
UK	0.20	0.66	0.53	0.08	0.33	1		
USA	0.14	0.44	0.33	-0.01	0.04	0.48	1	
TURKEY	-0.16	-0.09	0.00	-0.03	-0.03	-0.11	-0.20	1

For the 94-95 period the examination of the correlation matrix unveils an increase in the correlations of G7 countries in general. The highest correlation is found between France and UK (0.82) and the lowest is found between Turkey and Italy (-0.33). Turkey had the highest correlation with France. However, it is also observed that compared to 92-93 crisis periods Turkey's correlations have become positive with Canada, France, UK and USA indicating stronger economic and political linkages with these countries.

Table 6.149 G7 Portfolio 94-95 Crisis Correlation Matrix

	CAN	FRA	GER	ITA	JAP	UK	USA	TUR
CANADA	1							
FRANCE	0.47	1						
GERMANY	0.26	0.43	1					
ITALY	0.04	0.19	0.34	1				
JAPAN	0.25	0.38	0.02	0.19	1			
UK	0.57	0.82	0.54	0.15	0.44	1		
USA	0.71	0.44	0.38	-0.02	0.22	0.67	1	
TURKEY	0.18	0.41	-0.01	-0.33	-0.05	0.31	0.14	1

The correlation matrix shows that during the 97-98 crises region countries' correlations reach to their highest values. The highest correlation is found between France and Germany (0.90) while the lowest is between Japan and Italy (0.07). Turkey had the highest correlation with Canada (0.84) and the lowest correlation with Japan (0.14). Although Turkey's correlations are found to be higher compared to previous crises, they are still relatively lower than the G7 countries' correlations with each other.

Table 6.150 G7 Portfolio 97-98 Crises Correlation Matrix

	CAN	FRA	GER	ITA	JAP	UK	USA	TUR
CANADA	1							
FRANCE	0.72	1						
GERMANY	0.73	0.9	1					
ITALY	0.64	0.8	0.65	1				
JAPAN	0.49	0.39	0.46	0.07	1			
UK	0.84	0.75	0.77	0.59	0.58	1		
USA	0.86	0.54	0.57	0.58	0.40	0.69	1	
TURKEY	0.56	0.4	0.38	0.38	0.14	0.39	0.48	1

For the 92-93 period the minimum variance portfolio mean and standard deviation of G7 portfolio are found as 0.0055 and 0.023, respectively. The standard deviation of the portfolio is also found to range between 0.023 and 0.042 for the given means. The inclusion of Turkey in the G7 portfolio increases the minimum variance portfolio mean to 0.0065 while decreasing the standard deviation to 0.0219, shifting the efficient frontier leftward. The standard deviation of the G7+T portfolio is also found to range between 0.021 and 0.036 for the given means. The Sharpe ratio is found to increase from 0.35 to 0.41 due to addition of Turkey.

For the 94-95 period the minimum variance portfolio mean and standard deviation of G7 portfolio are found as 0.012 and 0.023, respectively. It is observed that compared to 92-93 crisis period the mean had increased significantly while standard deviation had experienced a slight decrease. The standard deviation of the portfolio is found to range between 0.023 and 0.038 for the expected means. The inclusion of Turkey in the G7 portfolio decreases the minimum variance portfolio mean and standard deviation to 0.0113 and 0.0224, respectively. However as the tangency portfolio mean and standard deviation do not change Sharpe ratio remains the same. On the other hand, the risk reduction Turkey brings to the G7 portfolio is found to diminish at the high risk region.

For the 97-98 period the minimum variance portfolio mean and standard deviation of G7 portfolio are found as 0.028 and 0.037, respectively. It is observed that compared to previous crises periods the mean and the standard deviation of the G7 portfolio had increased significantly. The standard deviation is observed to range between 0.037 and 0.041 for the given expected means. Over the 97-98 period inclusion of Turkey in the G7 portfolio results in a slight increase in the mean while no difference is observed in the standard deviation of the minimum variance portfolio. The Sharpe ratio increases slightly to 1.02.

The change in the efficient frontiers can be seen at the following graphs where the efficient frontiers of respective portfolios are provided. Inclusion of Turkey is observed to shift the efficient frontier leftward, evidencing the diversification benefit for the 92-93 period. However, respective frontiers are found to overlap during the 94-95 and 97-98 periods.

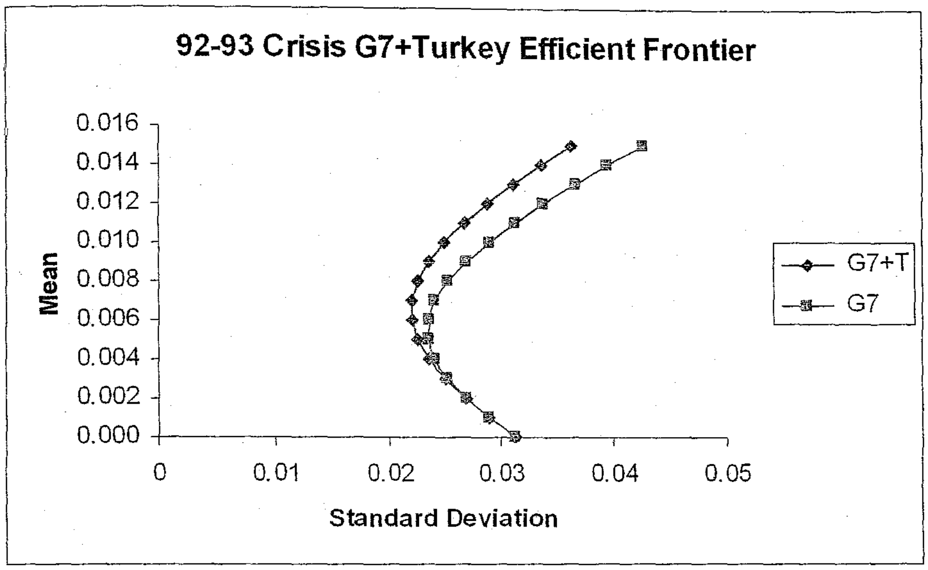

Figure 6.70 92-93 Crisis G7+Turkey Efficient Frontier

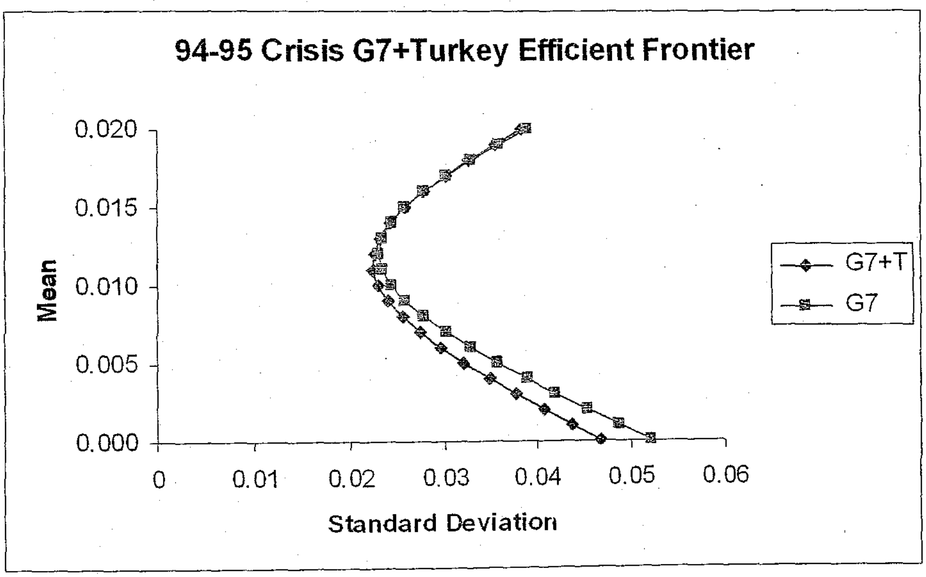

Figure 6.71 94-95 Crisis G7+Turkey Efficient Frontier

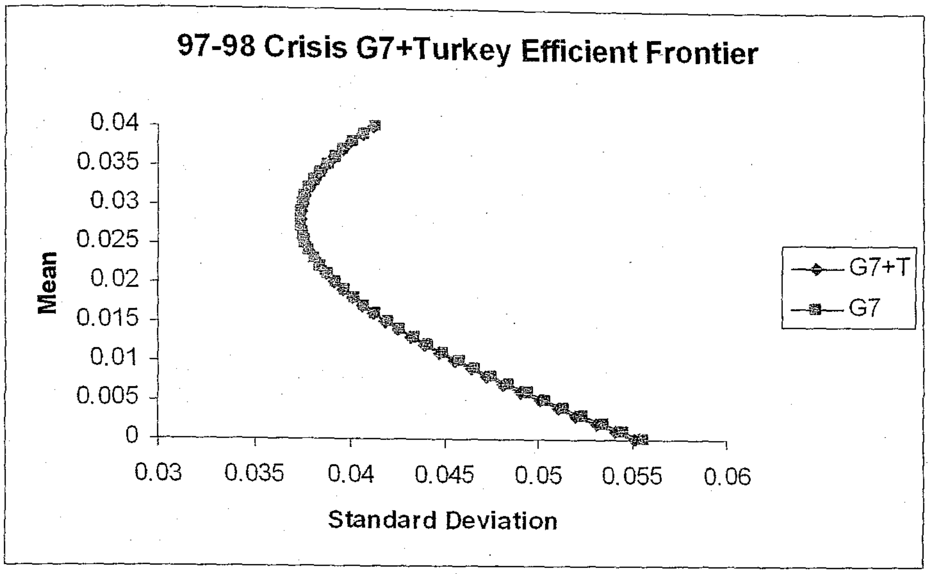

Figure 6.72 97-98 Crisis G7+Turkey Efficient Frontier

The inclusion of Turkey in the G7 portfolio is found to produce 49.3, 29.8 and 10.39 marginal potential performance for the crises of 92-93, 94-95 and 97-98, respectively. However, the spanning test statistics cannot exceed the F-value of 5.34 with (2, 32) d.f. at the 1% level. Thus, the null hypothesis of zero marginal potential performance is accepted at the 1% significance level. It is concluded that G7 portfolio spans G7 including Turkey portfolio. During the mentioned crises Turkey's contribution to G7 portfolio is negligible. The spanning test parameters are provided in tables 6.151, 6.152 and 6.153 in Appendix C.

6.8.2.2 Stein Estimated Efficient Frontier Analysis

The 92-93 crisis period sample means of G7 portfolio are smoothed by the minimum variance portfolio mean of the classic estimation (0.0055). The lambda and shrinkage factor are derived as 194.61 and 0.89, respectively. The sample means and the re-estimated means are provided in table 6.154 in the Appendix C. It is observed that after shrinkage Canada's and Italy's negative means increase to 0.004 and 0.004, respectively. The mean and the standard deviation of the tangency portfolio are observed to be smaller after Stein estimation. Accordingly, Sharpe ratio slightly falls to 0.237.

The 92-93 period sample means of G7 including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.0065). The lambda and shrinkage factor by which sample means are re-estimated are then derived as 190.91 and 0.88, respectively. The sample means and re-estimated means are provided in table 6.155 in the Appendix C. In this respect Turkey's sample mean drops from 0.03 to 0.009 while Canada's and Italy's means increase to 0.005 and 0.005, respectively. Both the tangency portfolio mean and standard deviation of the Stein estimation is found to be slightly lower and consequently Sharpe ratio falls from 0.41 to 0.29. However, comparison of Stein estimated G7 and G7+T tangency portfolios unveil an increase in the Sharpe ratio from 0.23 to 0.29. On the other hand, inclusion of Turkey is found to reduce the risk of the portfolio up to 6.5% at the high risk region. Compared to classic optimization Stein estimation reveals that this risk reduction Turkey provides is actually higher once the estimation bias is minimized.

The 94-95 crisis period sample means of G7 portfolio are smoothed by the minimum variance portfolio mean of the classic estimation (0.012). The lambda and shrinkage factor are derived as 210.38 and 0.89, respectively. The sample means and the re-estimated means are provided in table 6.156 in the Appendix C. It is observed that after shrinkage increases the sample means towards the minimum variance mean while US's mean experiences a slight decrease. The tangency portfolio mean and standard deviation decrease slightly. Accordingly, Sharpe ratio falls to 0.51.

The 94-95 period sample means of G7 including Turkey portfolio is smoothed by the minimum variance portfolio mean (0.0113). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 213.7 and 0.89, respectively. The sample means and re-estimated means are provided in table 6.157 in the Appendix C. Turkey's sample mean increases from -0.013 to 0.008 while US's mean decrease to 0.011. Due to Stein estimation the tangency portfolio mean and standard deviation decrease to 0.011 and 0.022, respectively. Accordingly, a lower Sharpe ratio is found in the Stein estimation. Sharpe ratio decreases from 0.57 to 0.50. Compared to classic optimization Stein estimation reveals that the risk of the G7 including Turkey portfolio is actually higher once the estimation bias is minimized. On the other hand, inclusion of Turkey is found to provide no risk reduction under Stein estimation.

For the 97-98 period the sample means of the G7 portfolio are smoothed by the minimum variance portfolio mean 0.028. The lambda and shrinkage factor used in the analysis are calculated as 29.65 and 0.55, respectively. The re-estimated sample means are provided in table 6.158 in the Appendix C. It is observed that after shrinkage G7 portfolio sample means increase from significantly while Japan's mean increases from -0.009 to 0.011. The Stein tangency mean and standard deviation are found as 0.40 and 0.032, respectively. Consequently, Sharpe ratio decreases from 1.01 to 0.80.

The 97-98 period sample means of G7 including Turkey portfolio are smoothed by the minimum variance portfolio mean (0.028). The lambda and shrinkage factor by which sample means are re-estimated, are then derived as 34.22 and 0.58, respectively. The sample means and re-estimated means are provided in table 6.159 in the Appendix C. It is observed that sample means are shrunk towards the minimum variance portfolio mean. In this respect Turkey's sample mean increases from 0.013 to 0.022 while Japan's mean increases to 0.012. The tangency portfolio mean and standard deviation of the Classic Estimation are found to drop to 0.032 and 0.040, respectively. As a result of Stein estimation the Sharpe ratio falls from 1.20 to 0.80. The Stein estimation confirms the findings of classic efficient frontier analysis that Turkey fails to reduce the risk of the portfolio significantly during the 97-98 period.

The below graphs provide the classic and Stein efficient frontiers of the G7 and G7 including Turkey portfolios over the 92-93, 94-95 and 97-98 crises periods. As can be seen the Stein estimated frontiers are flatter indicating higher risk. It is also evident that during Turkey significantly shifts the efficient frontier leftward but fails to reduce risk in the 94-95 and 97-98 periods.

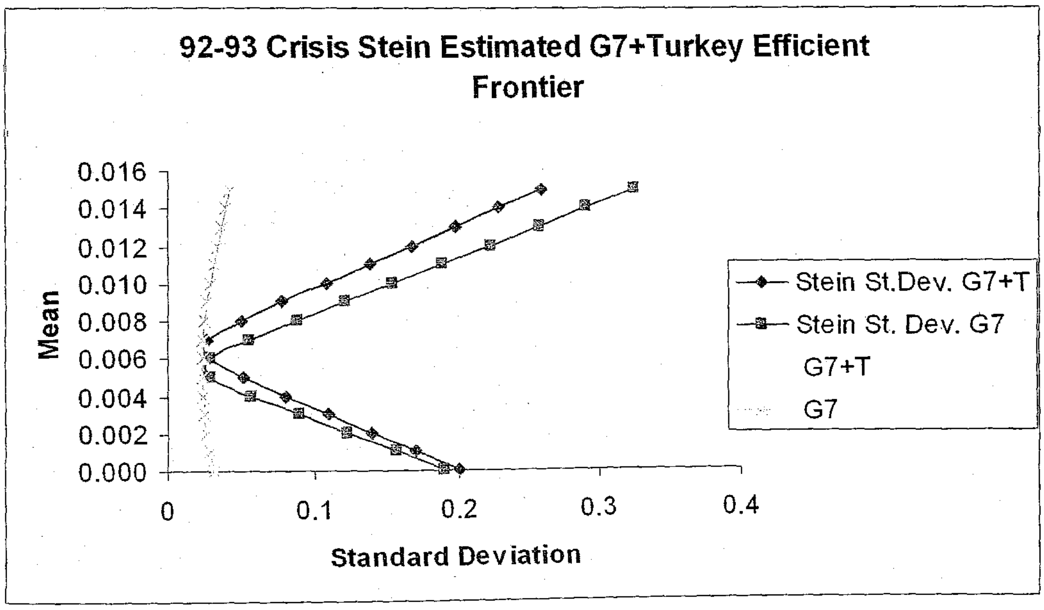

Figure 6.73 92-93 Crises Stein Estimated G7+Turkey Efficient Frontier

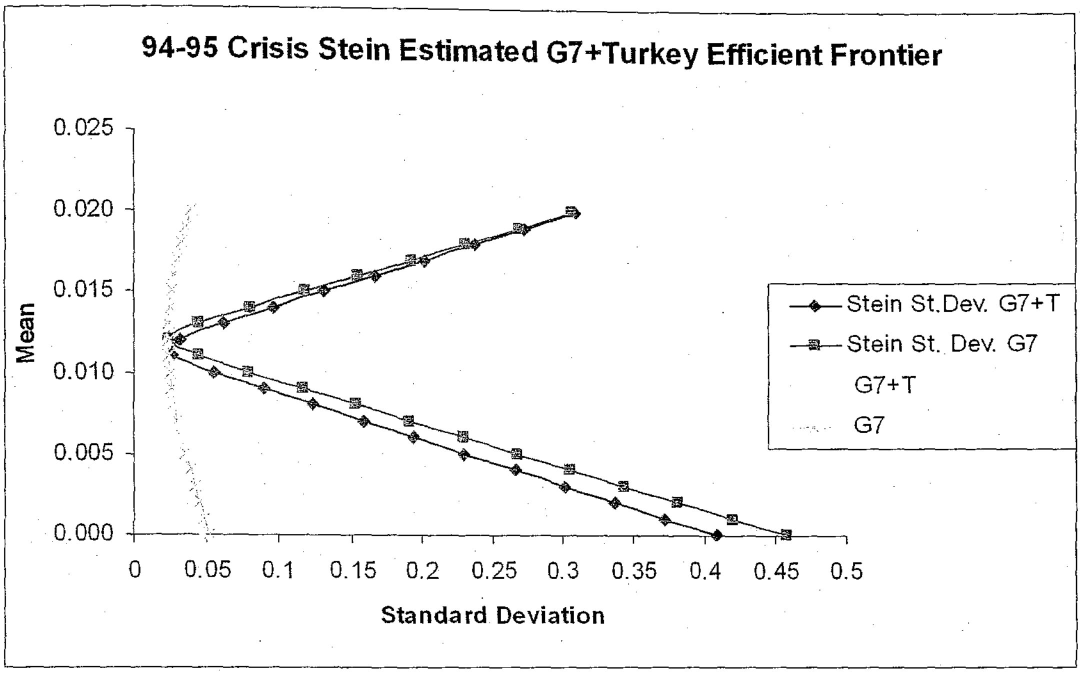

Figure 6.74 94-95 Crises Stein Estimated G7+Turkey Efficient Frontier

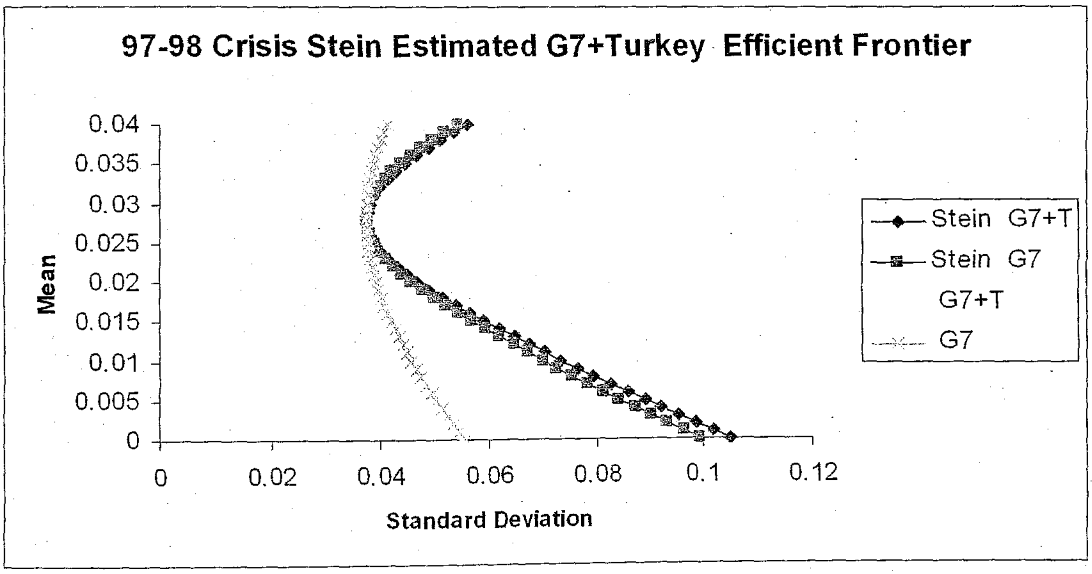

Figure 6.75 97-98 Crises Stein Estimated G7+Turkey Efficient Frontier

Inclusion of Turkey in the G7 portfolio is found to produce minimal marginal potential performances for the 92-93 and 94-95 periods while producing negative marginal potential performance for the 97-98 period. The test statistics fail to reject the null hypothesis of zero marginal potential performance at the 1% significance level. For all crises periods G7 portfolio spans the G7 including Turkey portfolio. Thus, it is concluded that Turkey's contribution to the G7 portfolio is negligible. The spanning test parameters are provided in tables 6.160, 6.161 and 6.162 in the Appendix.

6.8.2.3 Short-selling Restricted Efficient Frontier Analysis

For the 92-93 period the comparison of short-selling restricted efficient frontiers of the G7 including Turkey and the G7 portfolio shows that inclusion of Turkey provides not only risk reduction but also extends the efficient frontier beyond mean 0.008. On the other hand, Turkey provides neither risk reduction nor leads to frontier extension during the 94-95 period. No feasible solution can be found by both portfolios for means below 0.005 and beyond 0.012 during the 94-95 crisis period. The short-selling restricted analysis reveals that Turkey also added no value to the G7 portfolio during the 97-98 crises as the optimization assigns any weight to Turkish stock market in the G7 including Turkey portfolio. Thus, Turkey provides no risk reduction to the G7 portfolio during 97-98 crises under short-selling restriction. The graphs below provide the respective efficient frontiers.

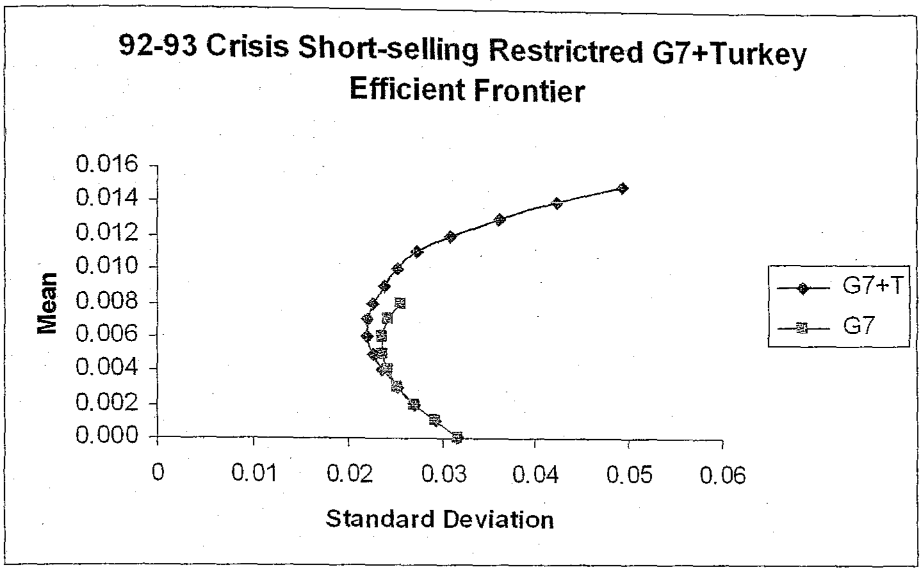

Figure 6.76 92-93 Crisis Short-selling Restricted G7+Turkey Efficient Frontier

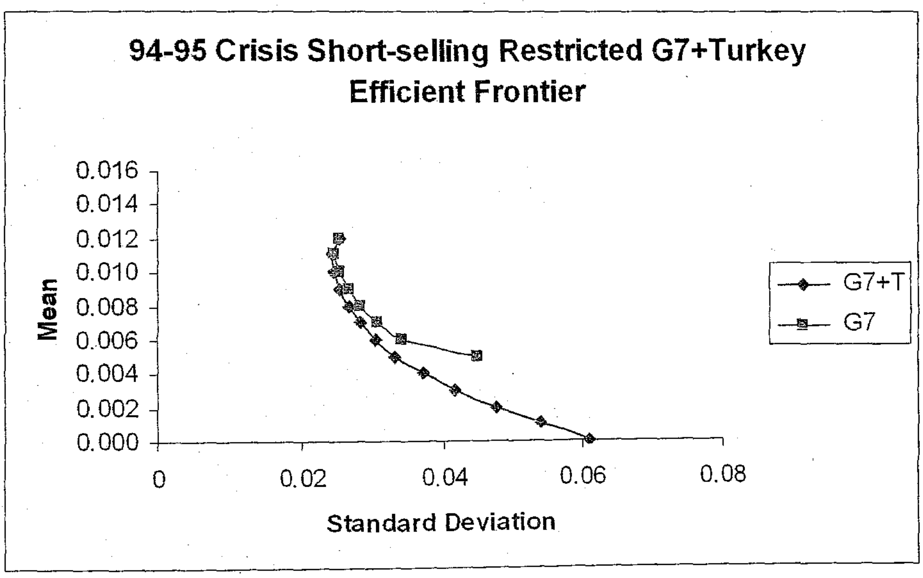

Figure 6.77 94-95 Crisis Short-selling Restricted G7+Turkey Efficient Frontier

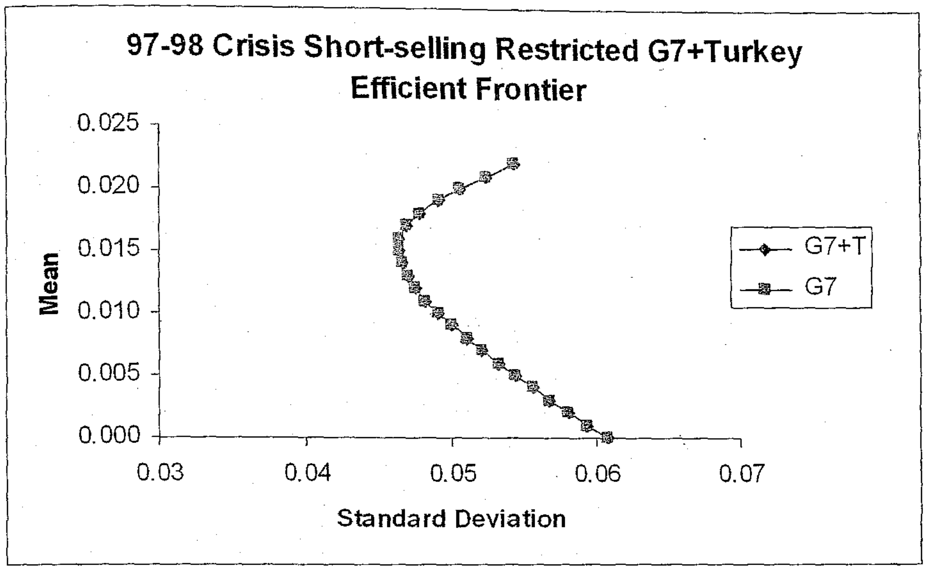

Figure 6.78 97-98 Crisis Short-selling Restricted G7+Turkey Efficient Frontier

7. TURKEY VS. GLOBAL PORTFOLIOS IN THE PRESENCE OF RISKLESS ASSET

The portfolio analyses in the presence of a riskless asset are provided in this chapter. In the analyses the Turkish three month T-bill rate is assumed as the risk free rate. Although the US three month T-bill rates are accepted as the risk free rate for a global investor, Turkish three month T-bill rates are used for documenting the advantages of relatively higher T-bill rates prevailing in the Turkish capital markets. Compared to the US three month T-bill rates, Turkish T-bill rates were found to be significantly higher. The monthly T-bill rate data is derived from the ISE Government Debt Securities Index published by ISE, which starts from January 1996. Despite the index is criticized for being an inferior representative of the real risk free rates, it is chosen for its longer available time series history. On the other hand, the US three month T-bill rates are retrieved from the Federal Reserve website. Turkish T-bill rates are converted to dollar rates with the help of International Fisher Parity as all the portfolio analyses are made in dollar terms. It is found that the average US T-bill rate had been 0.0035 for the 1996:01-2003:02 period while the average Turkish T-bill rate had been 0.0059.

In the following analyses diversification benefit of Turkish stock market is investigated in mean-variance framework in the presence of a riskless asset. The three month Turkish T-bill rate is assumed as the riskless asset. The portfolios including Turkey are compared with the portfolios excluding Turkey on the basis of risk-return attributes. The analyses are provided for the full period starting from 1996:01 and extending to 2003:02. For each time period under investigation Classic Mean- Variance analysis is made. The null hypothesis is Turkish stock market provides significant risk reduction that adding it to the global portfolio shifts the efficient frontier leftward. The statistical significance of the findings is explored with the Asset Set Intersection test of Jobson and Korkie.

The constructed global portfolios are Developed Markets portfolio, Emerging Markets portfolio and World portfolio which is composed of all the stock markets of Developed and Emerging Markets. Then Turkish stock market is added to these portfolios. As before MSCI monthly country stock index data is used and short-selling is allowed in the construction of efficient portfolios.

7.1 Developed Markets Portfolio

The Developed Markets portfolio is constructed from all the developed stock market indexes available in the data. The period under investigation starts from 1996:01 and extends to 2003:02. For the period minimum variance portfolio mean and standard deviation are found as -0.0014 and 0.0313, respectively.

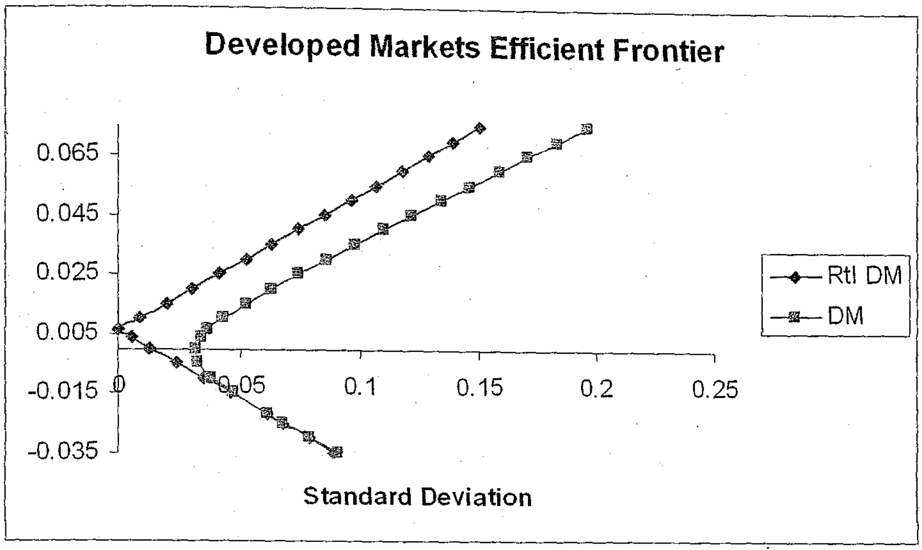

Figure 7.1 Developed Markets Portfolio

It is seen that the two frontiers intersect at the lower portion of the hyperbola as the risk free rate is higher than the minimum variance portfolio mean. The tangency portfolio mean and standard deviation are found as -2.2% and 6.1%, respectively. It is found that the inclusion of the Turkish T-bill rate significantly enhances the investment opportunities. Since the Turkish T-bill rate had been higher than the US T-bill rates on average, it has been more beneficial for a global investor.

Then the Turkish stock market is added to the portfolio of Developed Markets. For the 1996-2003 period, it is found that inclusion of Turkey slightly decreases the minimum variance portfolio mean.

Table 7.1 Developed Markets including Turkey Minimum Variance Portfolio

	DM+T	DM
Minimum Variance Portfolio Mean	-0.001615	-0.001398
Minimum Variance Portfolio Standard Deviation	0.031316	0.031356

Accordingly, the tangency portfolio mean and standard deviation are found to be -2.4% and 6.3%, slightly lower than the Developed Markets portfolio. However, the graph below depicts a slight leftward shift of the efficient frontier due to the inclusion of Turkey in the Developed Markets Portfolio. It is also provided that DM+T portfolio with Turkish T-bill rate provides better investment opportunities than the DM+T portfolio with the US T-bill rate as the riskless asset.

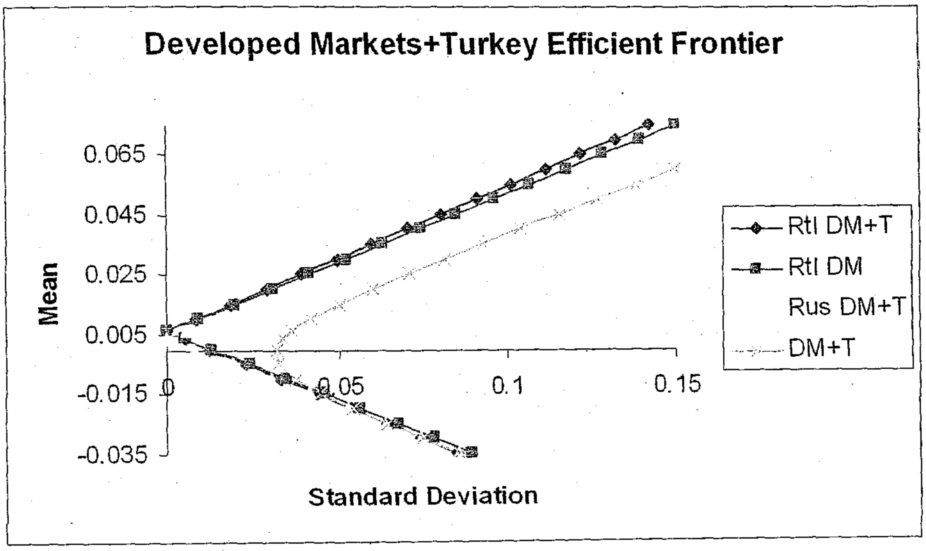

Figure 7.2 Developed Markets including Turkey Efficient Frontier

The intersection test statistic parameters are provided below.

Table 7.2 <u>Developed Markets+Turkey Intersection Analysis</u>

Intersection Test Statistic Parameters	
T	86
N	23
N_1	22
b_f	0.23528
b_{f1}	0.21155
Potential Performance	
b_f	0.23528
b_{f1}	0.21155
Implied marginal potential performance	**0.02372**
Intersection test statistic	**1.23366**

The implied marginal potential performance is found to be very small and the intersection test statistic fails to reject the null hypothesis of zero marginal potential performance at the 1 percent significance level. Thus, it is concluded that two asset sets intersect and inclusion of Turkey does not significantly shift the efficient frontier in the presence of a riskless asset.

7.2 Emerging Markets Portfolio

The Emerging Markets portfolio is composed of the emerging market stock indexes excluding Turkey. For the 1996:01 2003:02 period the emerging markets minimum variance portfolio mean and standard deviation are found as -0.0018 and 0.0241, respectively. For the period the risk free rate had been 0.6 percent. The following graph provides the Emerging Markets excluding Turkey portfolio efficient frontier with and without the risk free rate.

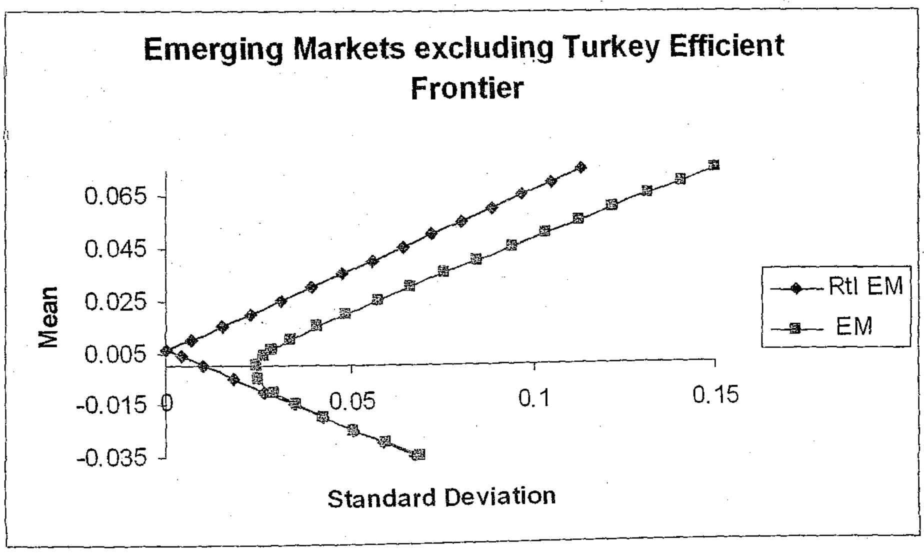

Figure 7.3 Emerging Markets excluding Turkey Efficient Frontier

The tangency portfolio mean and standard deviation are found as -2.2% and 4.5%, respectively. As the risk free rate is higher from the minimum variance portfolio mean, the hyperbola intersects the line at the lower portion.

Turkish stock market is then added to the portfolio in order to investigate its risk reduction potential in the presence of a riskless asset. It is found that for the period inclusion of Turkey slightly decreases the minimum variance mean.

Table 7.3 Emerging Markets including Turkey Minimum Variance Portfolio

	EM+T	EM
Minimum Variance Portfolio Mean	-0.001883	-0.001864
Minimum Variance Portfolio Standard Deviation	0.024036	0.024146

Thus, the hyperbola intersects the line at a lower point. The Emerging markets excluding Turkey portfolio and Emerging markets including Turkey portfolio are found to have the same tangency portfolio mean and standard deviation. The graph below provides the efficient frontiers of the respective portfolios with Turkish T-bill as the riskless asset. EM+T portfolio with the US T-bill as the riskless asset is also provided for comparison.

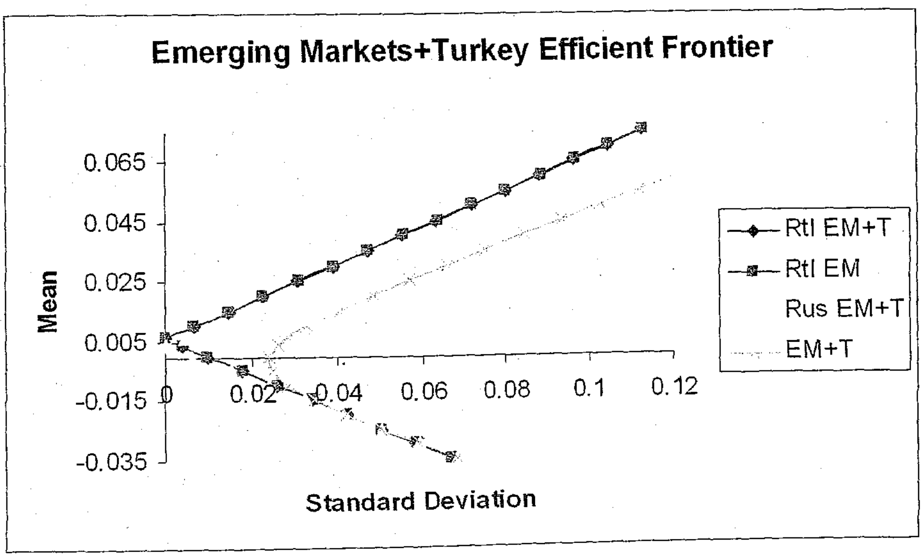

Figure 7.4 Emerging Markets including Turkey Efficient Frontier

It is seen that inclusion of Turkey slightly shifts the efficient frontier of Emerging markets excluding Turkey portfolio leftward and it provides better investment set than the portfolio using US T-bill as the riskless asset. The statistical significance of this shift is analyzed by the intersection test. The test statistic parameters are provided below.

Table 7.4 Emerging Markets+Turkey Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	26
N_1	25
b_f	0.376851
b_{f1}	0.374654
Potential Performance	
b_f	0.376851
b_{f1}	0.374654
Implied marginal potential performance	**0.002197**
Intersection test statistic	**0.095881**

The intersection test statistic fails to reject the zero implies marginal potential performance hypothesis at the 1% significance level. Thus, it is concluded that two asset sets intersect and inclusion of Turkish stock market does not improve the performance of Emerging Markets excluding Turkey portfolio over the full period.

7.3 World Portfolio

The World portfolio is constructed to include all the developed markets and the emerging markets except Turkish stock market. Over the full period the minimum variance portfolio mean and standard deviation are found as -0.0021 and 0.0155, respectively. The following graph provides the World excluding Turkey portfolio efficient frontier with and without the risk free rate.

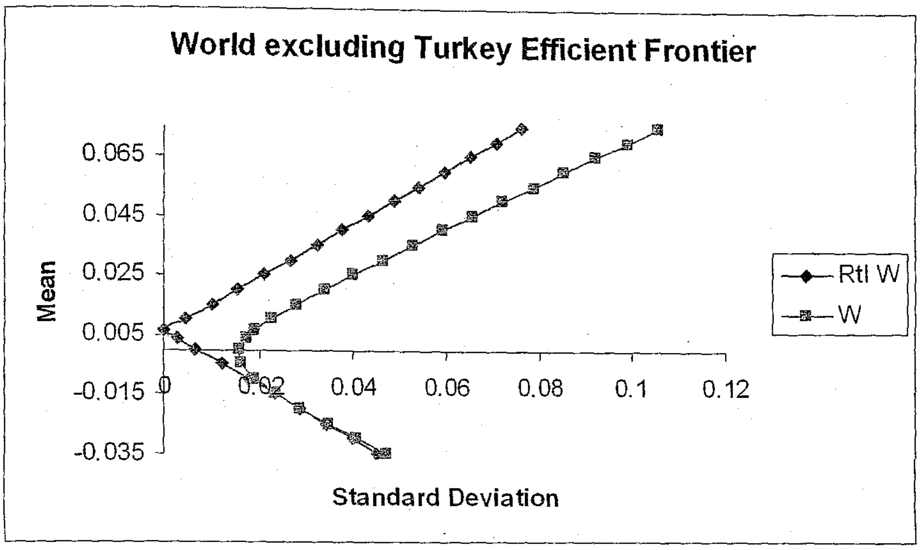

Figure 7.5 World excluding Turkey Efficient Frontier

It is observed that the hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.018 and 0.027, respectively.

The inclusion of Turkish stock market to the World portfolio produces the following results. It is found that minimum variance portfolio mean is reduced to -0.0024 while the standard deviation slightly falls.

Table 7.5 World including Turkey Minimum Variance Portfolio

	W+T	W
Minimum Variance Portfolio Mean	-0.002421	-0.002147
Minimum Variance Portfolio Standard Deviation	0.015271	0.015562

Tangency portfolio mean and standard deviation are found as -1.8% and 2.6%. On the other hand efficient frontier is observed to a shift leftward slightly due to the inclusion of

Turkey in the World portfolio. The graph below gives the respective portfolios' efficient frontiers.

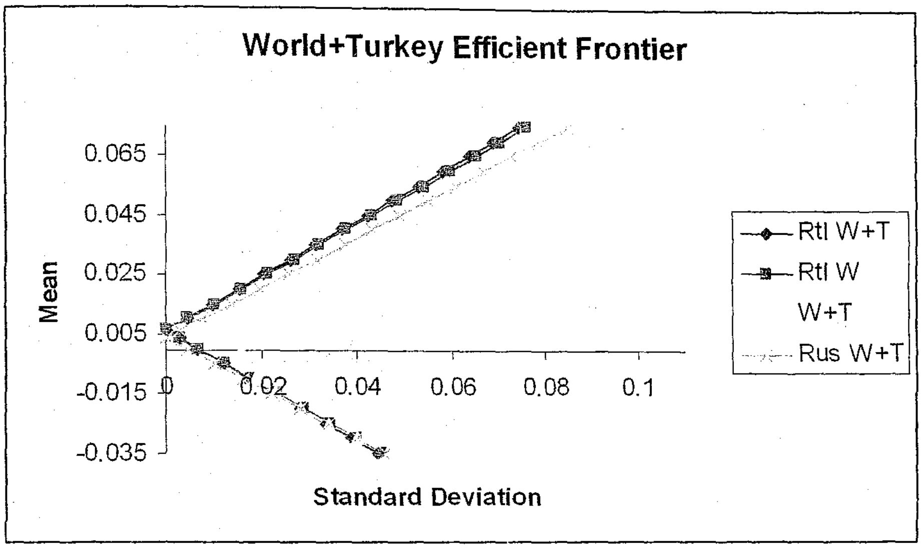

Figure 7.6 World including Turkey Efficient Frontier

The world including Turkey portfolio is observed to dominate World portfolio and even portfolio using US T-bill rate as the riskless asset. The statistical significance of this finding is examined by the intersection test.

Table 7.6 World+ Turkey Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	48
N_1	47
b_f	0.860078
b_{f1}	0.819193
Potential Performance	
b_f	0.23528
b_{f1}	0.211556
Implied marginal potential performance	**0.023725**
Intersection test statistic	**0.854027**

The test statistic fails to exceed the required F-value of 4.75 with (2, 76) d.f. at the 1% significance level. Thus the null hypothesis is accepted. It is concluded that two asset sets intersect and Turkey's contribution to the World portfolio in the presence of a riskless asset had been negligible during the period.

8. TURKEY VS. REGIONAL PORTFOLIOS IN THE PRESENCE OF RISKLESS ASSET

The regional portfolio analyses in the presence of a riskless asset are provided in this chapter. In the analyses the Turkish three month T-bill rate is assumed as the risk free rate. The period under investigation starts from 1996:01 and extends to the 2003:02 due to the limited history of available Turkish T-bill rates derived from the Government Debt Securities Index. In the regional analyses a more detailed investigation is made compared to Global portfolio analyses. The main reasoning for this approach lies in the belief that more information can be obtained about the risk reduction potential of Turkish stock market within smaller portfolios in regional settings. Information could be lost in global portfolios due to greater number of country indexes involved. The regional portfolio analyses are made over two time periods; full period starting from 1996 and crises period of 97-98. For each portfolio and each time period classic mean-variance analyses and Stein estimated mean-variance analyses are made. The statistical significance of the findings is explored with the asset set intersection tests where the regional portfolio including Turkey is defined as the complete asset set and the one excluding Turkey is defined as the asset subset. For the full period the average US T-bill rate had been 0.0035 while the average Turkish T-bill rate had been 0.0059. For the 1997-98 crises period higher rates are observed for both countries. Similar to the 1996-2003 period, Turkish three month T-bill rates are found to be higher than comparative US T-bill rates. The average US T-bill rate is found to be 0.41 percent while average Turkish T-bill rate had been a remarkably higher 1.10 percent. In the analyses Turkish T-bill rate is used as the risk free rate despite the general intuition of using three month US T-bill rate.

The constructed regional portfolios are Developed Europe portfolio, Emerging Europe portfolio, Asia portfolio, North America portfolio, Latin America portfolio, Pacific Rim portfolio, Middle East portfolio and G7 portfolio. Then Turkish stock market is added to these portfolios to investigate the diversification potential of Turkey as an emerging market. Dollar denominated MSCI monthly country stock index returns and dollar values of Turkish T-bill rates are used in the analyses.

8.1 Developed Europe Region

The Developed Europe portfolio is constructed from the country stock indexes of Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and UK. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period. The full period analysis starts from the 1996:01 and extend to 2003:02. A total of 86 monthly observations are put into the analysis. The 97-98 crises analysis starts from the

1997:01 and extend to 1998:12. A total of 24 monthly observations are put into the analysis and short-selling is allowed in the construction of efficient portfolios unless otherwise stated. The following table summarizes the findings of full and crises periods.

Table 8.1 Developed Europe Region Analyses

FULL PERIOD

	DE+T	DE
Minimum Variance Portfolio Mean	-0.000104	0.000263
Minimum Variance Portfolio St. Dev.	0.035327	0.035558

	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.002048	-0.022486	-0.001654	-0.022040
Standard Deviation	0.040571	0.076363	0.041082	0.078668
Sharpe Ratio	-0.198117	-0.372901	-0.186071	-0.356312

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.004628	0.012097
Test Statistic	0.313125	0.751393

1997-98 PERIOD

	DE+T	DE
Minimum Variance Portfolio Mean	0.008654	0.010095
Minimum Variance Portfolio St. Dev.	0.021690	0.023464

	DE+T		DE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.031276	-0.302275	-0.133760	-0.869850
Standard Deviation	0.090568	0.246332	0.284040	0.700489
Sharpe Ratio	-0.467706	-1.272099	-0.509940	-1.257597

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.041290	0.036685
Test Statistic	-0.262150	0.113685

8.1.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Developed Europe portfolio are found as 0.00026 and 0.03555, respectively while the Turkish three month T-bill rate had been 0.6 percent. The following graph provides the

Developed Europe portfolio efficient frontier with and without the risk free rate. Inclusion of a riskless asset significantly enhances the investment set.

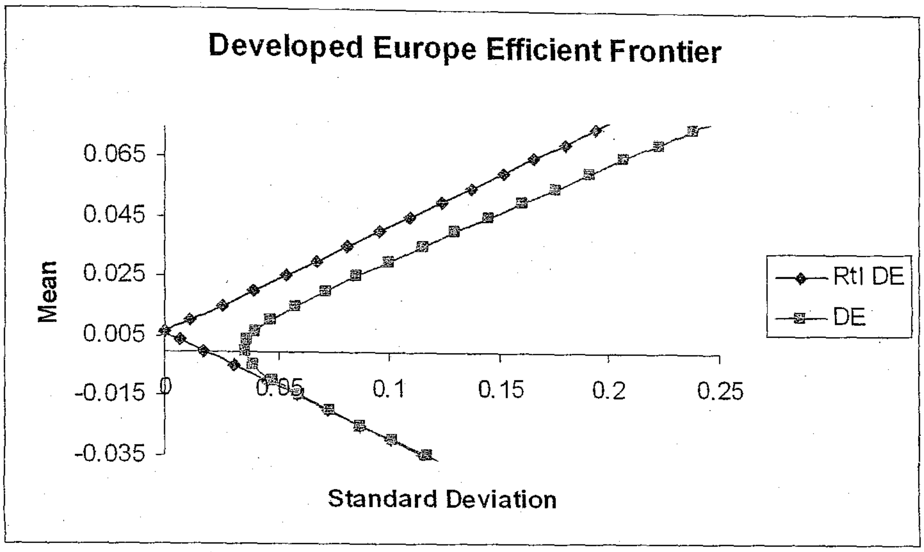

Figure 8.1 Developed Europe Efficient Frontier

It is observed that the Developed Europe hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.022 and 0.079, respectively. Inclusion of Turkish stock market to the Developed Europe portfolio produces the following results. It is found that minimum variance portfolio mean and standard deviation decrease to -0.0001 and 0.03532, respectively. However, no significant change is observed in the tangency portfolio mean while the tangency portfolio standard deviation is found as 7.6%. Accordingly, Developed Europe including Turkey portfolio has a higher Sharpe ratio though negative. Efficient frontier is observed to shift leftward slightly due to the inclusion of Turkey in the Developed Europe portfolio. The graph below gives the respective portfolios' efficient frontiers.

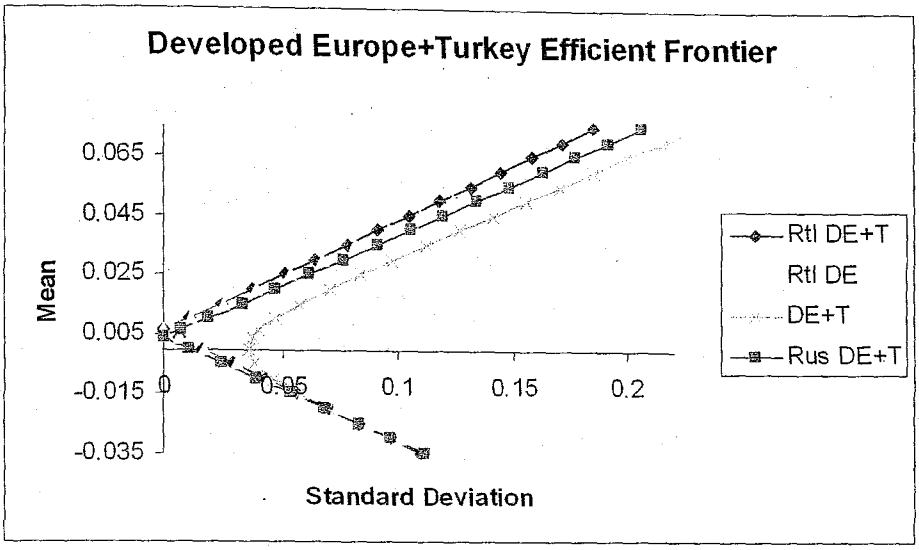

Figure 8.2 Developed Europe including Turkey Efficient Frontier

On the other hand, over the 97-98 crises period the minimum variance portfolio mean and standard deviation of Developed Europe portfolio are found as 1% and 2.3%, respectively while the Turkish three month T-bill rate had been 1.1 percent. The following graph provides the Developed Europe portfolio efficient frontier with and without the risk free rate.

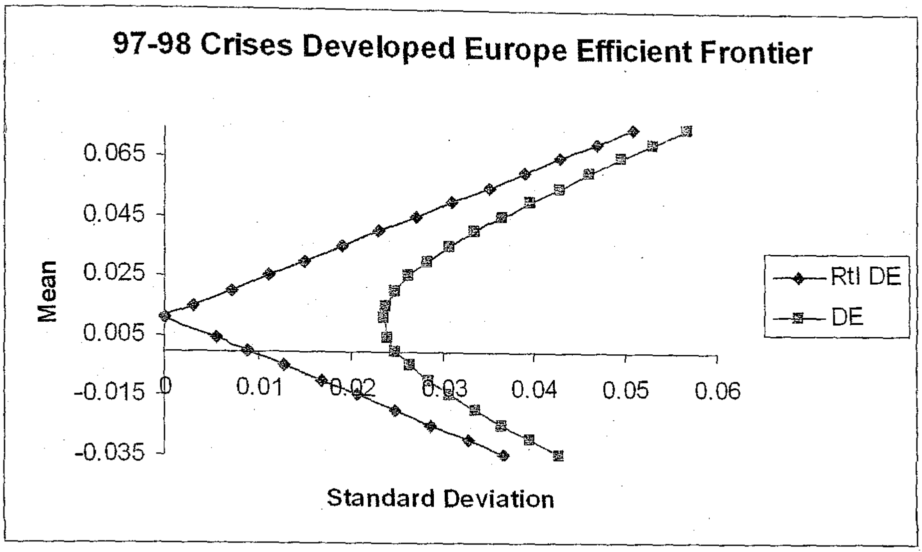

Figure 8.3 97-98 Crises Developed Europe Efficient Frontier

The Developed Europe hyperbola intersects the line at the lower locus and the tangency portfolio mean and standard deviation are found as -0.87 and 0.70, respectively. Inclusion of Turkish stock market to the Developed Europe portfolio produces the following results. It is found that minimum variance portfolio mean decreases to 0.008 while the standard deviation falls to 0.021. The tangency portfolio mean of Developed Europe including Turkey is found as -0.302 while the tangency portfolio standard deviation was 0.24. Accordingly, Sharpe ratio is found as -1.27, lower than Developed Europe portfolio. Meanwhile efficient frontier is observed to shift leftward slightly due to the inclusion of Turkey in the Developed Europe portfolio. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period.

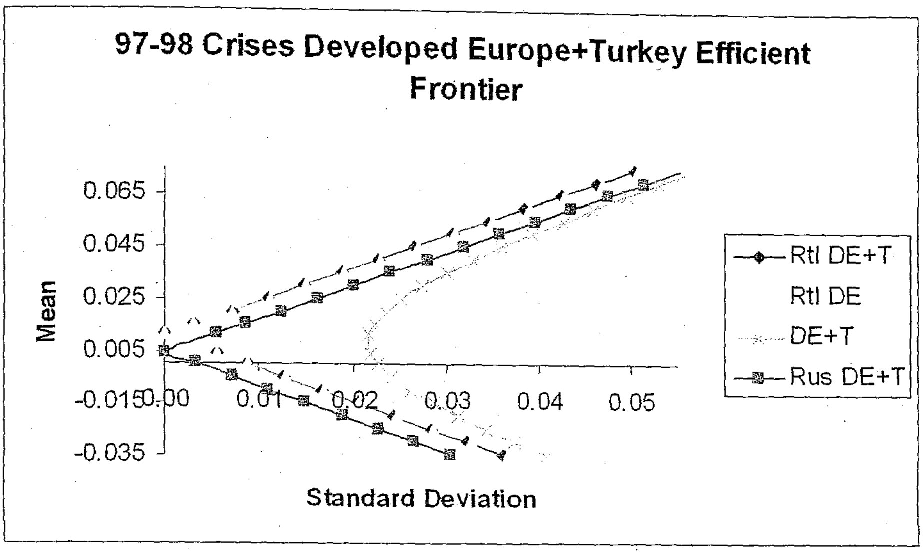

Figure 8.4 97-98 Crises Developed Europe+Turkey Efficient Frontier

In full period the Developed Europe including Turkey portfolio is observed to dominate all portfolios given in the graph. However, during 97-98 period it overlaps with the Developed Europe portfolio assuming Turkish T-bill rate as the riskless asset. Inclusion of Turkey is found to result in 0.012 and 0.036 implied marginal potential performance respectively for full and 97-98 periods. However, the test statistics fail to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance for both time periods. It is concluded that two asset sets intersect and Turkey's contribution to the Developed Europe portfolio in the presence of a riskless asset had been negligible during both the full period and the 97-98 crises. The intersection test parameters are provided in tables 8.2 and 8.3 in the Appendix C.

8.1.2 Stein Estimated Efficient Frontier Analysis

For the full period analysis the country sample means of Developed Europe and Developed Europe including Turkey portfolios are smoothed by their respective minimum variance portfolio means (0.00026 and -0.0001). Once the Stein estimation is performed it is found that both portfolios display higher risk. Compared to classic mean-variance estimation, Stein estimated portfolios' Sharpe ratios are found to be higher though still being negative. However, comparison of Stein estimated portfolios with each other reveals that Portfolio including Turkey had a lower Sharpe ratio, suggesting less reward to risk. The following graph provides the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. DE+T portfolio is observed to dominate the DE portfolio.

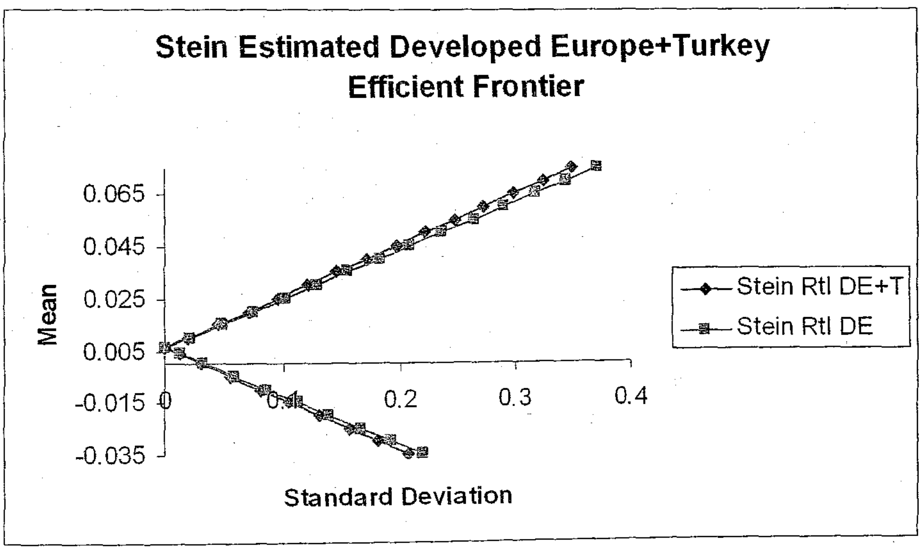

Figure 8.5 Stein Estimated DE+Turkey Efficient Frontier

For the 97-98 period analysis the country sample means of Developed Europe and Developed Europe including Turkey portfolios are smoothed by their respective minimum variance portfolio means (0.01 and 0.008). Compared to classic mean-variance estimation, Stein estimated portfolios' Sharpe ratios are found to be higher. On the other hand comparison of Stein estimated portfolios with each other reveals that Developed Europe including Turkey portfolio had in fact a higher Sharpe ratio though negative. Sharpe ratio improves from -0.50 to -0.46. Although Stein estimation demonstrates higher volatility for both portfolios, inclusion of Turkey in the Developed Europe portfolio is still observed to shift the efficient frontier leftward.

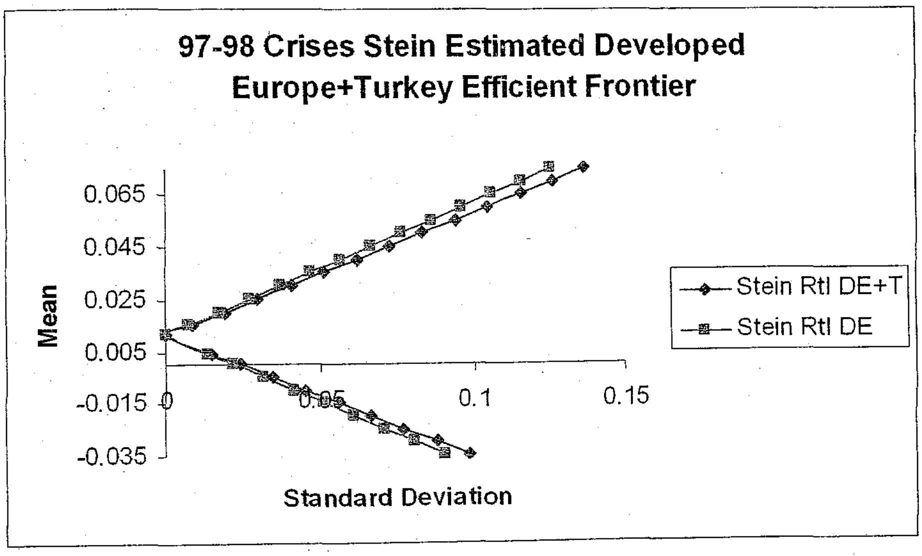

Figure 8.6 97-98 Crises Stein Estimated DE+Turkey Efficient Frontier

Stein estimation shows that in the presence of a riskless asset Developed Europe portfolio dominates the Developed Europe including Turkey portfolio during the crises.

For the full period inclusion of Turkey results in 0.004 implied marginal potential performance while for the 97-98 period a negative implied marginal potential performance value is found. The intersection test statistics fail to reject the null hypothesis at the 1 percent level for both time periods. Thus, it is concluded that Stein estimated efficient frontiers of respective portfolios intersect. It is proven that Turkey's contribution to the Developed Europe portfolio had been negligible for the full and the 97-98 crises period. The intersection test parameters are provided in tables 8.4 and 8.5 in the Appendix C.

8.2 Emerging Europe Region

The Emerging Europe portfolio is constructed from the country stock indexes of Czech, Hungary, Poland and Russia. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period. The following table summarizes the full period and crises period findings.

Table 8.6 Emerging Europe Region Analyses

FULL PERIOD

	EE+T	EE
Minimum Variance Portfolio Mean	0.010044	0.010047
Minimum Variance Portfolio St. Dev.	0.089251	0.089291

	EE+T		EE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.022058	0.105021	0.024848	0.105050
Standard Deviation	0.177679	0.441104	0.192517	0.441236
Sharpe Ratio	0.090433	0.224507	0.097955	0.224506

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.001417	0.000000
Test Statistic	-0.113691	0.000016

1997-98 PERIOD

	EE+T	EE
Minimum Variance Portfolio Mean	0.006457	0.006273
Minimum Variance Portfolio St. Dev.	0.080169	0.080477

	EE+T		EE	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.010602	-0.208527	-0.015684	-0.201140
Standard Deviation	0.173568	0.552356	0.189834	0.534529
Sharpe Ratio	-0.124935	-0.397587	-0.141002	-0.397029

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.004273	0.000444
Test Statistic	-0.079602	0.007285

8.2.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Emerging Europe portfolio are found as 1% and 9%, respectively while the risk free rate had been 0.6 percent. The following graph provides the Emerging Europe portfolio efficient frontier with and without the risk free rate. Inclusion of a riskless asset significantly enhances the investment set.

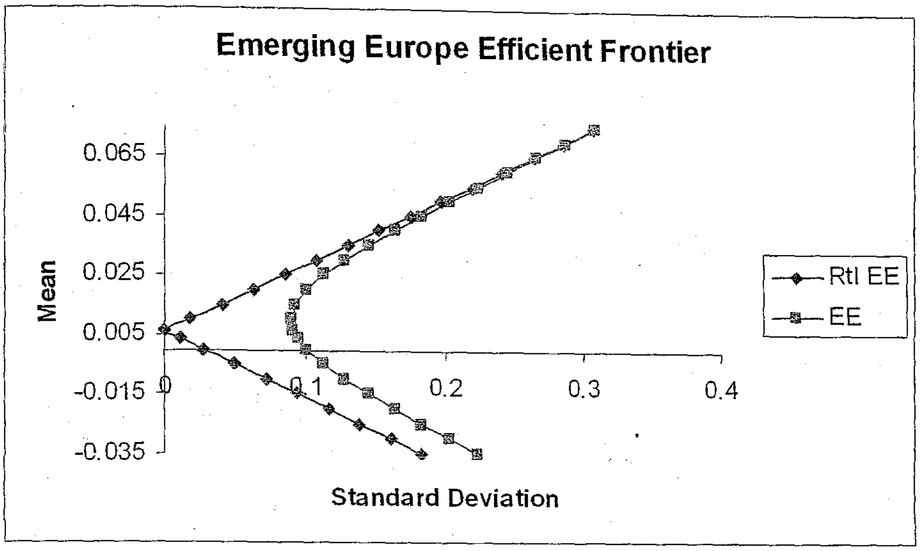

Figure 8.7 Emerging Europe excluding Turkey Efficient Frontier

It is observed that the Emerging Europe hyperbola intersects the line at the upper locus as the minimum variance portfolio mean is greater than the risk free rate. The tangency portfolio mean and standard deviation are found as 0.105 and 0.441, respectively. Inclusion of Turkish stock market to the Emerging Europe portfolio results in no significant change in the minimum variance portfolio as well as the tangency portfolio. Accordingly, Sharpe ratios are found to be the same. This finding can be observed from the following graph where the efficient frontiers overlap. The graph below gives the respective portfolios' efficient frontiers.

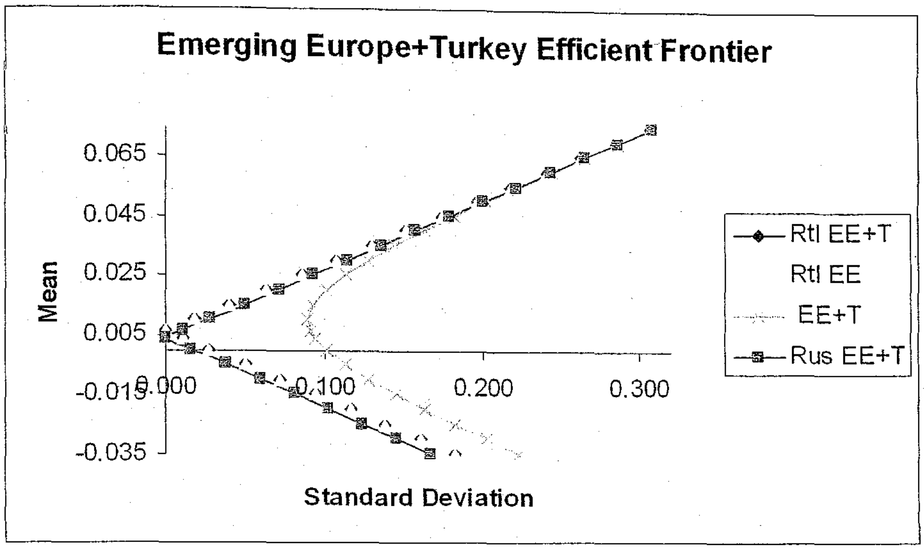

Figure 8.8 Emerging Europe including Turkey Efficient Frontier

The Emerging Europe including Turkey portfolio is observed to overlap not only with Emerging Europe but also with R_{us} Emerging Europe including Turkey portfolio.

Over the 97-98 crises period the minimum variance portfolio mean and standard deviation of Emerging Europe portfolio are found as 0.6% and 8%, respectively while the Turkish three month T-bill rate had been 1.1% on average. The following graph provides the Emerging Europe portfolio efficient frontier with and without the risk free rate.

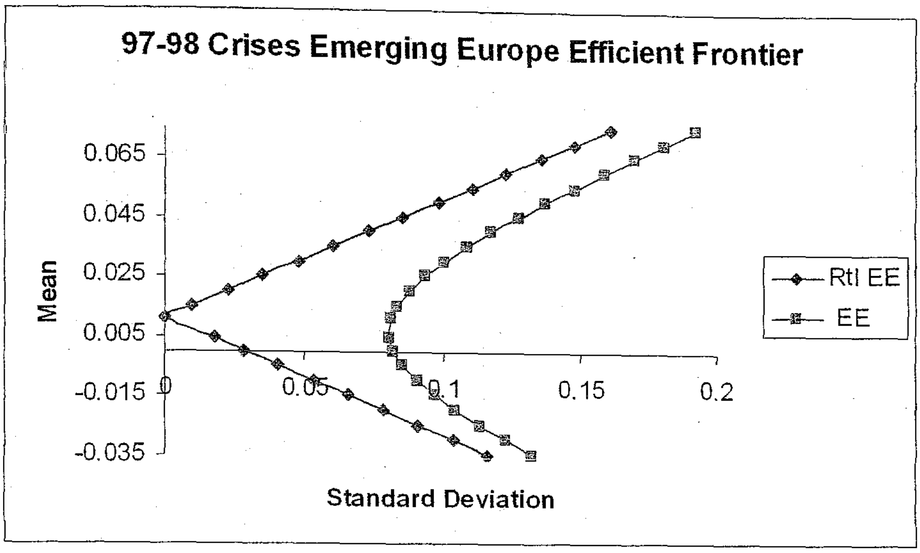

Figure 8.9 97-98 Crises EE excluding Turkey Efficient Frontier

The Emerging Europe hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.201 and 0.53, respectively.

Due to inclusion of Turkey in the portfolio minimum variance portfolio mean is found to increase slightly while the standard deviation declines. The mean and standard deviation are found as 0.0064 and 0.0801. While the tangency portfolio mean is found as -0.208, the tangency portfolio standard deviation had been 0.55. Accordingly, Sharpe ratio of EE+T portfolio is found to be slightly higher than EE portfolio. On the other hand no significant change is observed in the efficient frontier due to the inclusion of Turkey in the Emerging Europe portfolio. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period.

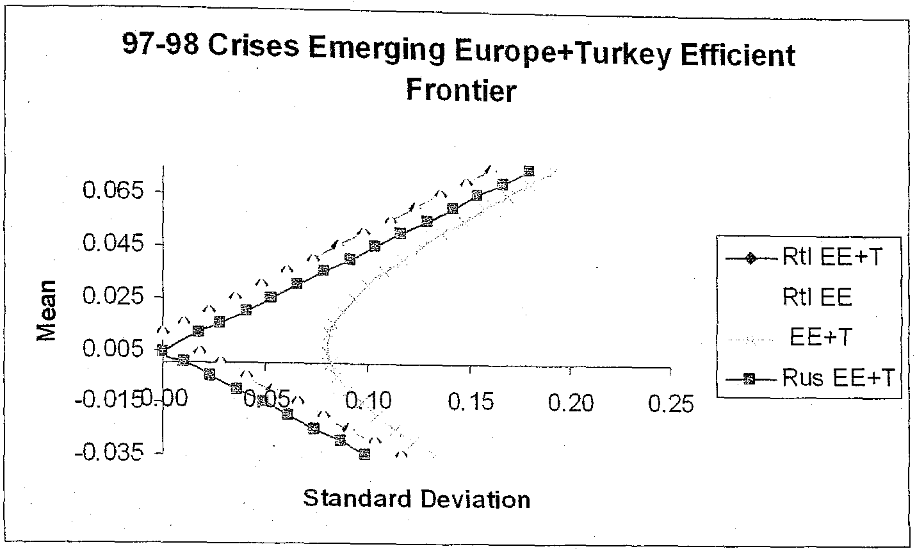

Figure 8.10 97-98 Crises EE+Turkey Efficient Frontier

For the full period it is found that two asset set completely give the same investment set. Implied marginal potential performance is found to be zero. For the crises period a positive but minimal implied marginal potential performance is found. The test statistic fails to reject the null hypothesis at the 1% level of significance for both periods. It is concluded that two asset sets intersect and Turkey fails to improve the performance of Emerging Europe portfolio in the presence of a riskless asset for the time periods. The intersection test parameters are provided in tables 8.7 and 8.8 in the Appendix C.

8.2.2 Stein Estimated Efficient Frontier Analysis

Emerging Europe and Emerging Europe including Turkey portfolios' sample country means are smoothed by their respective minimum variance portfolio means.

Once the Stein estimation is performed it is found that classic estimation had estimated much lower risk for the portfolios. For the full period compared to classic mean-variance estimation, Stein estimation suggests lower Sharpe ratios, indicating less reward to risk. The comparison of Stein estimated EE and EE+T portfolios with each other suggests that inclusion of Turkey drops Sharpe ratio from 0.098 to 0.90 while Classic estimation suggested no change. The following graph provides the full period Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. The graph depicts that Stein estimation demonstrates higher volatility for Emerging Europe including Turkey portfolio. Emerging Europe portfolio is observed to dominate the EE+T portfolio over the full period.

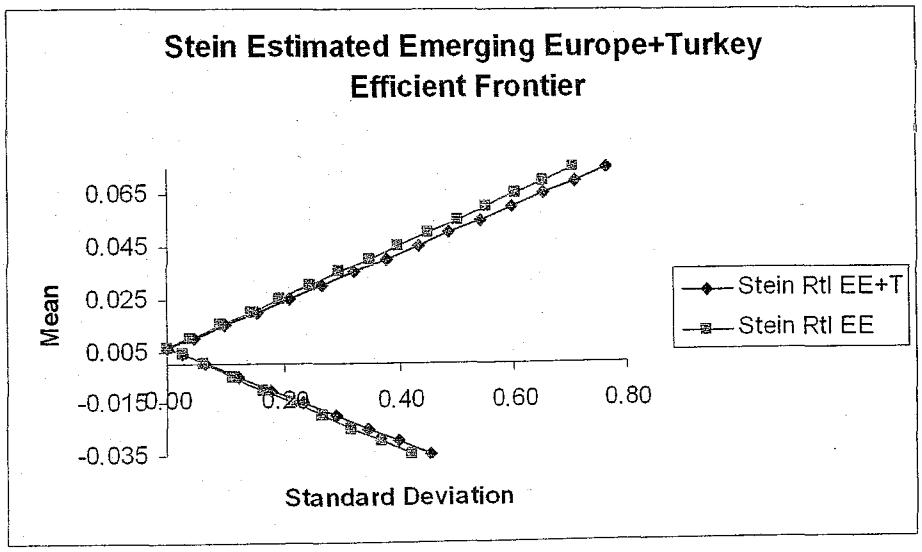

Figure 8.11 Stein Estimated EE+Turkey Efficient Frontier

For the 97-98 period Stein estimated portfolios' Sharpe ratios are found to be higher compared to classic mean-variance estimation. On the other hand comparison of

Stein estimated portfolios with each other reveals that inclusion of Turkey in the Emerging Europe portfolio had in fact increased the Sharpe ratio. Sharpe ratio is found to increase from -0.14 to -0.12 while classic estimation suggested no change. The following graph provides the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. Stein estimation shows that in the presence of a riskless asset Emerging Europe portfolio dominates the Emerging Europe including Turkey portfolio during the crises. The graph depicts that Stein estimation displays higher volatility for Emerging Europe including Turkey portfolio. Emerging Europe portfolio is observed to dominate the EE+T portfolio over the 97-98 period.

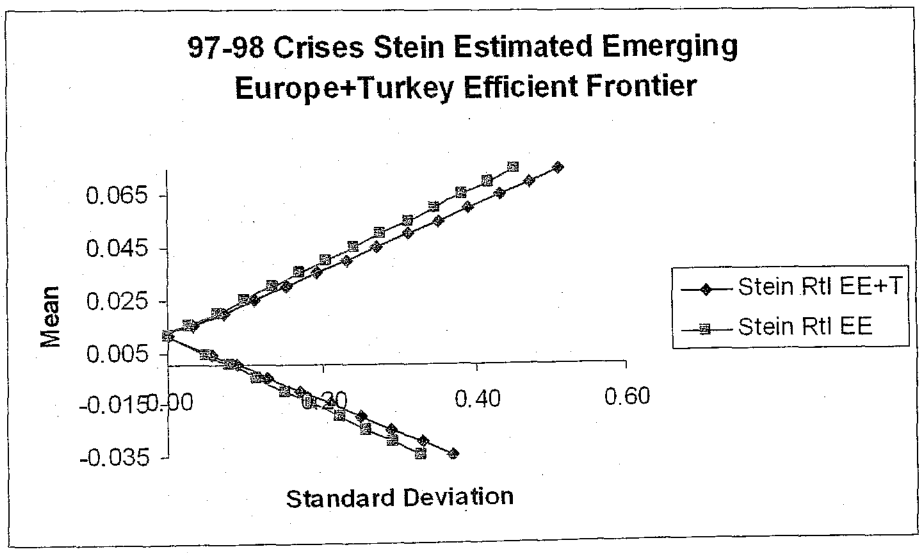

Figure 8.12 97-98 Crises Stein Estimated EE+Turkey Efficient Frontier

The negative implied marginal potential performance values found for the both periods confirm the observed dominance of EE over EE+T portfolio. The intersection test statistic fails to reject the null hypothesis of zero implies marginal potential performance at the 1 percent level. Thus, it is concluded that Stein estimated efficient frontiers of respective portfolios intersect. The Stein estimation confirms the Classic optimization findings that Turkey's contribution to the Emerging Europe portfolio had been negligible for the full and the 97-98 crises period. The intersection test parameters are provided in tables 8.9 and 8.10 in the Appendix C.

8.3 Asia Region

The Asia portfolio is constructed from the country stock indexes of China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Taiwan, and Thailand. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period in detail. The findings of the full and the crises period are summarized in the following table.

Table 8.11 Asia Region Analyses

FULL PERIOD

	A+T	A
Minimum Variance Portfolio Mean	-0.003024	-0.002684
Minimum Variance Portfolio St. Dev.	0.062573	0.062661

	A+T		A	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.004159	-0.024072	-0.003426	-0.019881
Standard Deviation	0.066393	0.114269	0.065284	0.108213
Sharpe Ratio	-0.152860	-0.263085	-0.144229	-0.239071

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.002564	0.012059
Test Statistic	0.193403	0.878347

1997-98 PERIOD

	A+T	A
Minimum Variance Portfolio Mean	0.005538	0.004930
Minimum Variance Portfolio St. Dev.	0.061987	0.062472

	A+T		A	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.010359	-0.228514	-0.002422	-0.207596
Standard Deviation	0.121890	0.407449	0.068961	0.372416
Sharpe Ratio	-0.175915	-0.588042	-0.195837	-0.587190

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.007406	0.001001
Test Statistic	-0.106986	0.011164

8.3.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Asia portfolio are found as -0.0026 and 0.0626, respectively. The following graph provides the Asia portfolio efficient frontier with and without the risk free rate.

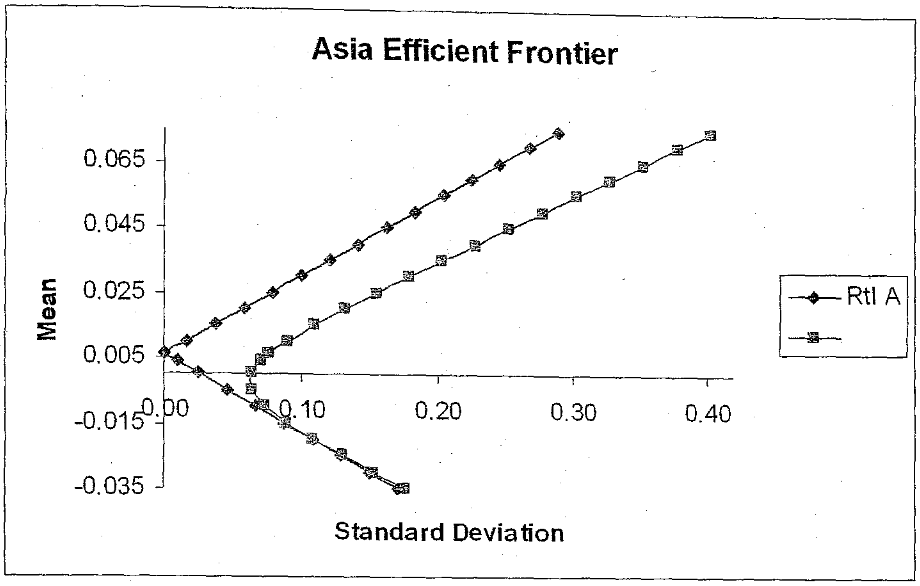

Figure 8.13 Asia Efficient Frontier

The tangency portfolio is located at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.020 and 0.108, respectively. Inclusion of Turkish stock market to the Asia portfolio is found to decrease the minimum variance portfolio mean and standard deviation. Accordingly, the Asia including Turkey tangency portfolio mean and standard deviation are found as -0.024 and 0.114 respectively. The Sharpe ratio drops to -0.26. On the other hand, inclusion of Turkey in the Asia portfolio slightly shifts the efficient frontier leftward. The graph below gives the respective portfolios' efficient frontiers. The Asia including Turkey portfolio is observed to dominate all portfolios given in the graph.

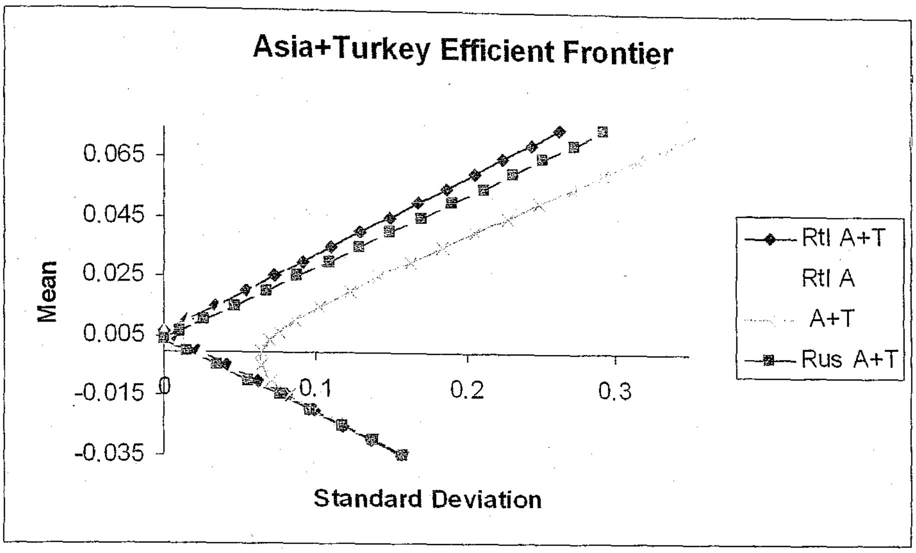

Figure 8.14 Asia including Turkey Efficient Frontier

Over the 97-98 crises period the minimum variance portfolio mean and standard deviation of Asia portfolio are found as 0.5% and 6.2%, respectively while the Turkish three month T-bill rate had been 1.1%. The following graph provides the Asia portfolio efficient frontier with and without the risk free rate. Inclusion of the riskless asset significantly enhances the investment set.

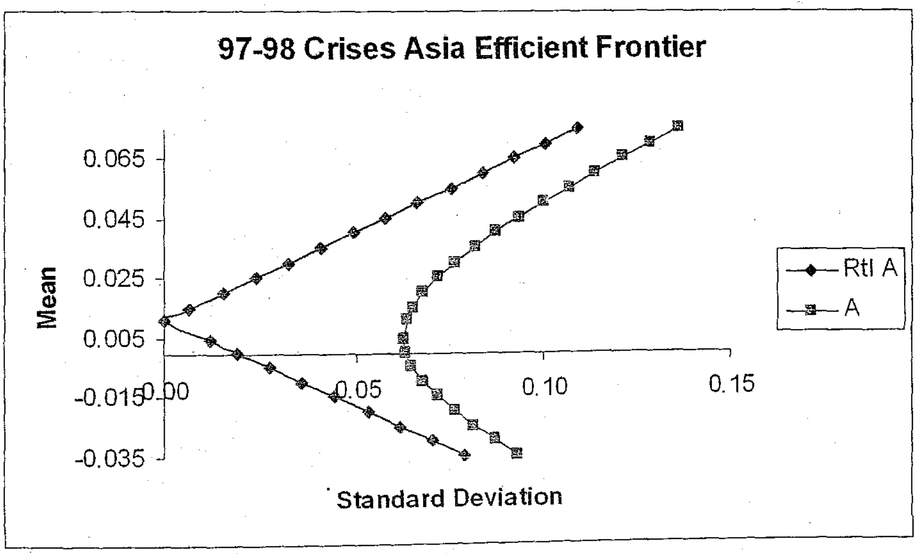

Figure 8.15 97-98 Crises Asia Efficient Frontier

The Asia hyperbola intersects the line at the lower portion as the minimum variance portfolio mean was less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.208 and 0. 372, respectively. It is found that minimum variance portfolio mean increases to 0.0055 while the standard deviation falls to 0.061 due to the inclusion of Turkey in the Asia portfolio. The efficient frontier is observed to shift slightly leftward due to the inclusion of Turkey in the Asia portfolio. The tangency portfolio mean and standard deviation are found as -0.229 and 0.407, respectively. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. The Asia including Turkey portfolio is observed to significantly offer better investment opportunities compared to all the portfolios provided in the graph. However, it is observed to overlap with the Asia portfolio.

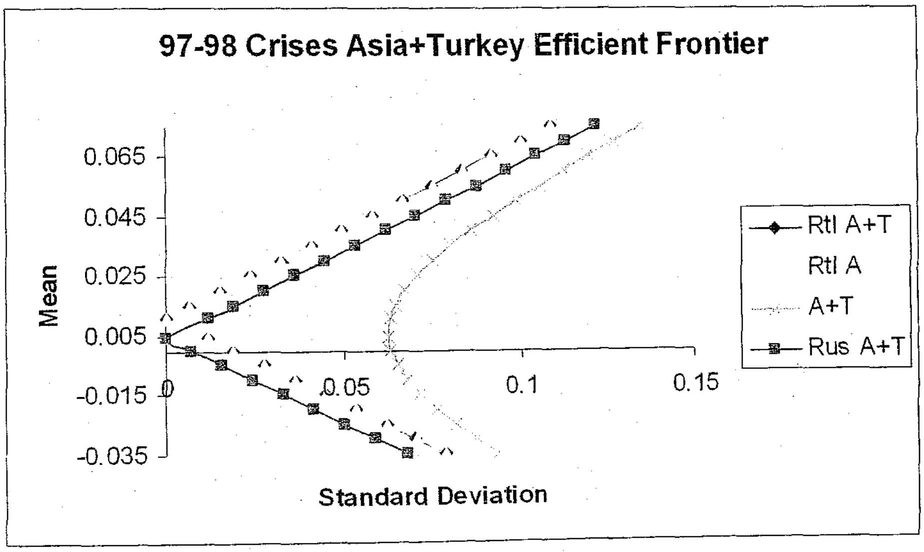

Figure 8.16 97-98 Crises Asia+Turkey Efficient Frontier

For the full and crises periods respectively 0.012 and 0.001 implied marginal potential performance values are found. The test statistic fails to reject the null hypothesis of zero implied marginal potential performance for both time periods investigated at the 1% level of significance. Thus, it is concluded that the two asset sets intersect and Turkey's contribution to the Asia portfolio in the presence of a riskless asset had been negligible during the full period and the 97-98 crises periods. The intersection test parameters are provided in tables 8.12 and 8.13 in the Appendix C.

8.3.2 Stein Estimated Efficient Frontier Analysis

In this analysis the full period and 97-98 period country sample means of Asia and Asia including Turkey portfolios are smoothed by their respective minimum variance portfolio means. Compared to Classic Sharpe ratios, Stein Sharpe ratios are found to be higher for both portfolios in both periods. For the full period the Stein tangency portfolio mean and standard deviation of the Asia and Asia including Turkey portfolios are found as (-0.003, 0.065) and (-0.004, 0.066), respectively while they had been (-0.002, 0.068) and (-0.010, 0.12) for the 97-98 period. In both periods Asia portfolio is found to perform better than the Asia including Turkey portfolio.

The following graph provides the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. Although Stein estimation suggests higher volatility for both portfolios, inclusion of Turkey in the Asia portfolio is still observed to shift the efficient frontier leftward for the full period while Asia portfolio is found to dominate in the 97-98 period.

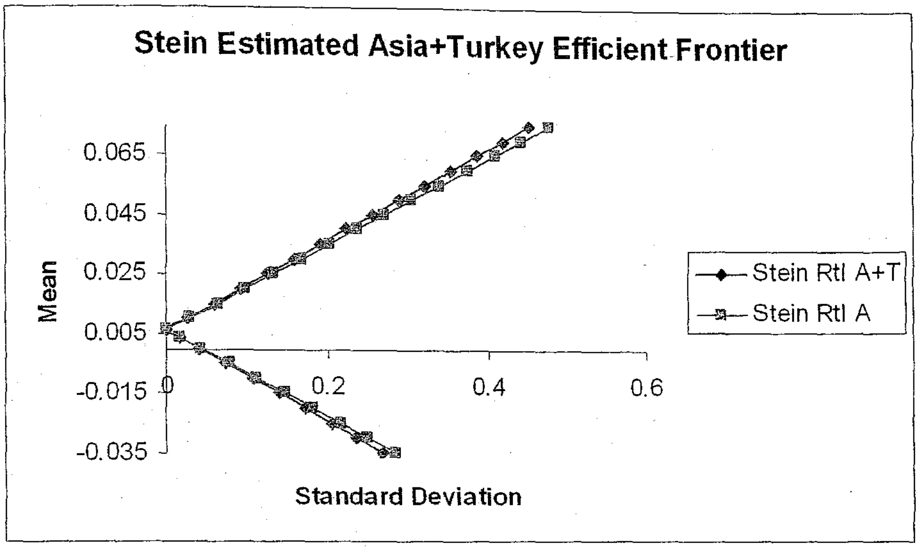

Figure 8.17 Stein Estimated A+Turkey Efficient Frontier

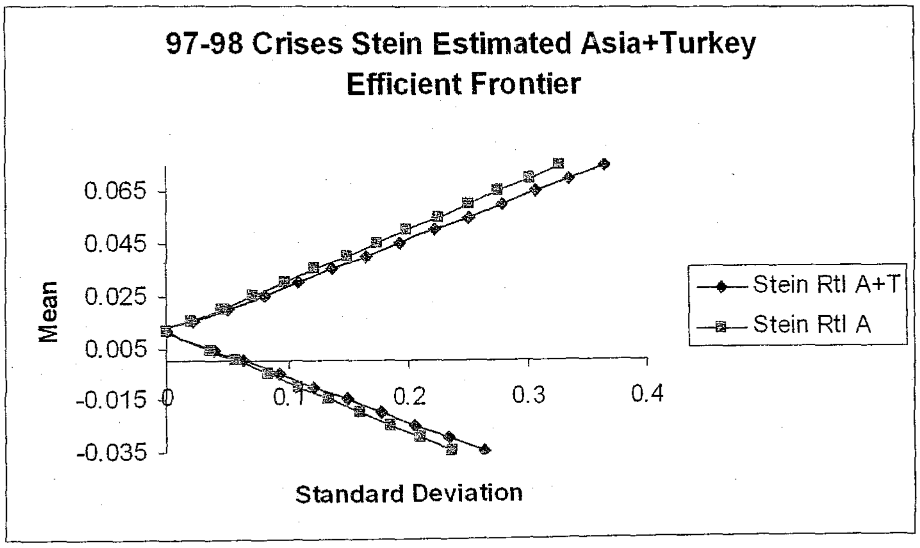

Figure 8.18 97-98 Crises Stein Estimated A+Turkey Efficient Frontier

Respectively 0.002 and -0.007 implied marginal potential performance is found for full and crises periods and test statistic fails to reject the null hypothesis at the 1 percent level. Thus, it is concluded that both portfolios intersect the tangency line at the same point and there is no significant change between the efficient frontiers. Stein estimation confirms the classic estimation's finding; Turkey's contribution to the Asia portfolio in the presence of a riskless asset had been negligible for the full and the 97-98 crises period. The intersection test parameters are provided in tables 8.14 and 8.15 in the Appendix C.

8.4 North America Region

The North America portfolio is constructed from the country stock indexes of Canada, and USA. Turkey is then added to the North America portfolio to explore its diversification benefit. Classic and Stein estimated efficient frontier analyses are provided for North America and North America including Turkey portfolios for the full period and for the 97-98 crises period in detail. The following table summarizes the full and the crises periods findings.

Table 8.16 North America Region Analyses

FULL PERIOD

	NA+T	NA
Minimum Variance Portfolio Mean	0.004500	0.005385
Minimum Variance Portfolio St. Dev.	0.050542	0.051870

	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.004397	-0.006631	0.005384	0.002117
Standard Deviation	0.052259	0.147082	0.051902	0.131240
Sharpe Ratio	-0.030488	-0.085809	-0.011672	-0.029513

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.000793	0.006492
Test Statistic	0.065835	0.538373

1997-98 PERIOD

	NA+T	NA
Minimum Variance Portfolio Mean	0.023945	0.024815
Minimum Variance Portfolio St. Dev.	0.051743	0.052101

	NA+T		NA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.040019	0.082119	0.041739	0.076037
Standard Deviation	0.077610	0.121600	0.077847	0.113315
Sharpe Ratio	0.372845	0.584177	0.393799	0.573218

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.016065	0.012684
Test Statistic	-0.292068	0.200492

8.4.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of North America portfolio are found as 0.0053 and 0.0518, respectively while the Turkish three month T-bill rate, the assumed risk free rate, had been 0.006. The following graph provides the North America portfolio efficient frontier with and without the risk free rate. The efficient frontier shifts leftward due to the riskless asset.

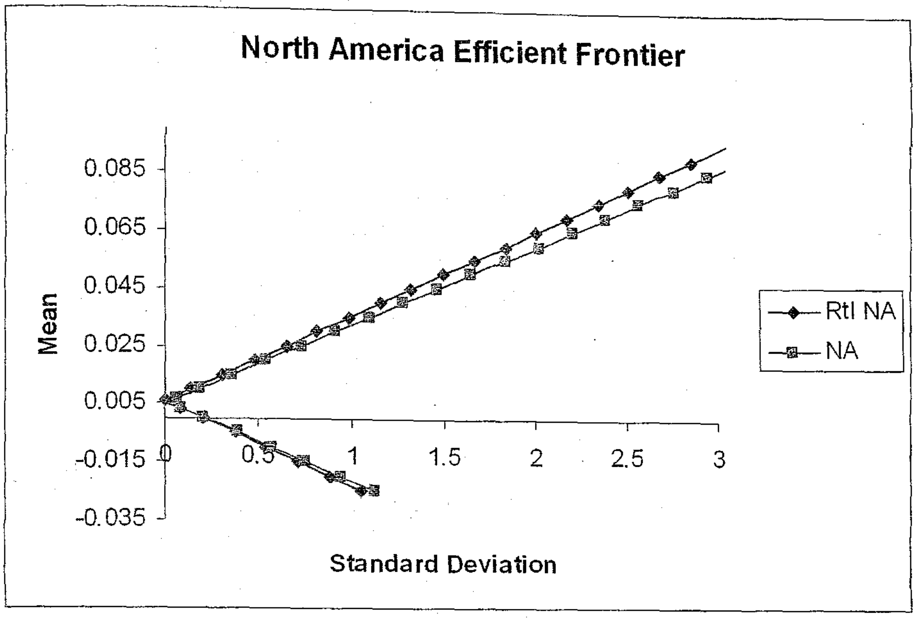

Figure 8.19 North America Efficient Frontier

The tangency portfolio is located at the lower portion of the hyperbola as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as 0.002 and 0.131, respectively. Inclusion of Turkish stock market to the North America portfolio is found to decrease the minimum variance portfolio mean and standard deviation over the full period. The minimum variance portfolio mean becomes 0.0045 while the standard deviation decreases to 0.050. Accordingly, the tangency portfolio mean of NA+T is found to be -0.007 while standard deviation had been 0.147. On the other hand, over the full period inclusion of Turkey in the North America portfolio shifts the efficient frontier leftward. The graph below gives the respective portfolios' efficient frontiers. The North America including Turkey portfolio is observed to dominate all portfolios given in the graph. Contribution of Turkey is more evident in the high risk region.

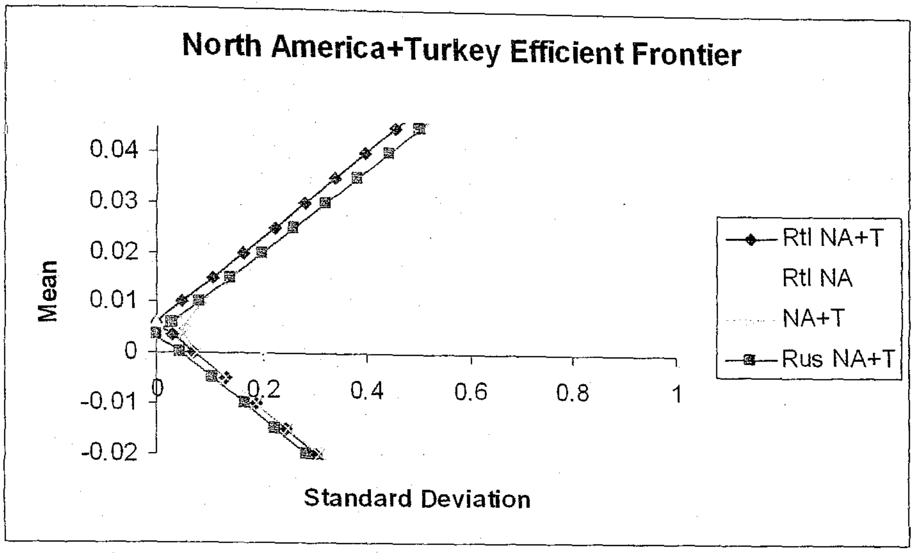

Figure 8.20 North America including Turkey Efficient Frontier

Over the 97-98 crises period the minimum variance portfolio mean and standard deviation of North America portfolio are found as 2.5% and 5.2%, respectively. Compared to full period minimum variance portfolio mean is found to be remarkably higher while no change is observed for the standard deviation. The following graph provides the North America portfolio efficient frontier with and without the risk free rate. Inclusion of the Turkish T-bill significantly enhances the investment set.

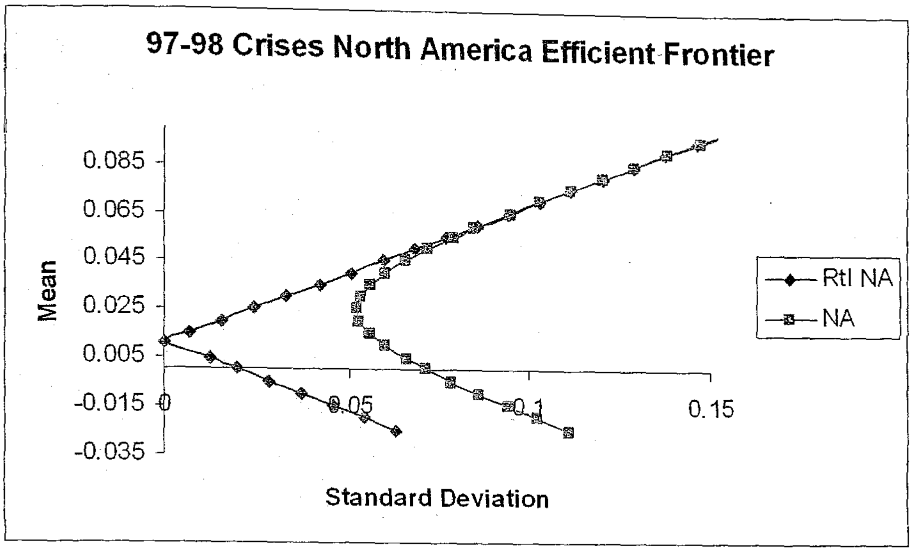

Figure 8.21 97-98 Crises NA+Turkey Efficient Frontier

The North America hyperbola intersects the line at the upper portion as the minimum variance portfolio mean is greater than the risk free rate. For the 97-98 crises period the tangency portfolio mean and standard deviation are found as 0.076 and 0.113, respectively. Inclusion of Turkish stock market to the North America portfolio for the 97-98 crises period produces the following results. It is found that minimum variance portfolio mean and standard deviation decrease to 0.0239 and 0.051, respectively. The efficient frontier is observed to shift slightly leftward due to the inclusion of Turkey in the North America portfolio. The tangency portfolio mean and standard deviation are found as 0.082 and 0.122, respectively. Accordingly, the Sharpe ratio increases from 0.57 to 0.58. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. The North America including Turkey portfolio is observed to offer better investment opportunities compared to all the portfolios provided in the graph. However, it is also observed that at the high risk region all frontiers overlap.

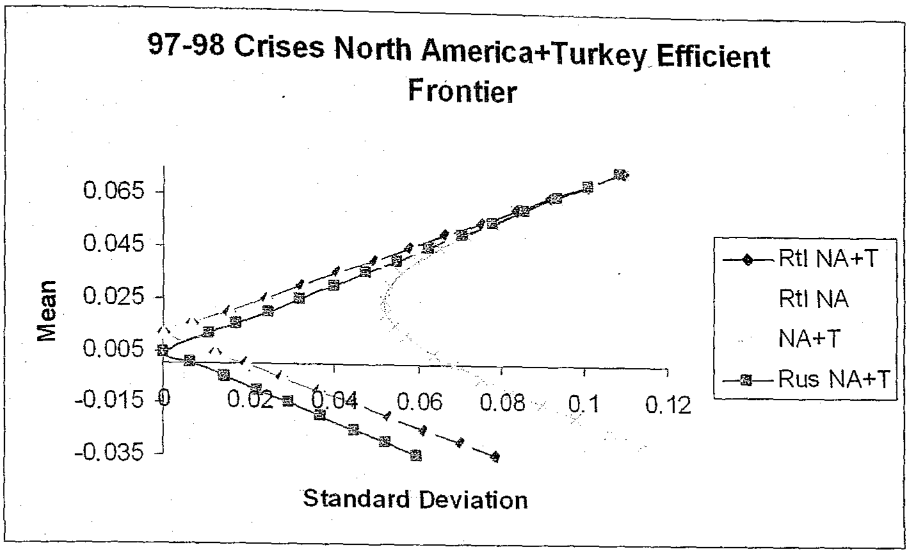

Figure 8.22 97-98 Crises NA+Turkey Efficient Frontier

Despite the shift observed in the graph implied marginal potential performance is found to be almost zero in the full period while it had been negative in the crises period. For both periods the test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance. It is concluded that two asset sets intersect and Turkey's contribution to the North America portfolio in the presence of a riskless asset had been negligible during the full and the crises periods. The intersection test parameters are provided in tables 8.17 and 8.18 in the Appendix C.

8.4.2 Stein Estimated Efficient Frontier Analysis

In this analysis the full period and 97-98 period country sample means of North America and North America including Turkey portfolios are smoothed by their respective minimum variance portfolio means. As the Stein estimation is performed it is found that both portfolios display higher risk than estimated by the classic mean-variance analysis. Also compared to classic mean-variance analysis higher Sharpe ratios are found for both portfolios for the full period. For the full period tangency portfolio mean and standard deviation of the North America and North America including Turkey portfolios are found as (0.005, 0.051) and (0.004, 0.052), respectively. Accordingly, a lower Sharpe Ratio of -0.03 is found for the NA+T portfolio. On the other hand, for the 97-98 period lower tangency portfolio mean is found for the NA+T portfolio. Comparison of the Stein estimated portfolios with each other reveal that North America portfolio had a higher Sharpe ratio of 0.39.

The following graphs provide the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. While inclusion of Turkey is observed to shift the efficient frontier leftward in the full period graph, North America portfolio is observed to dominate the NA+T portfolio in the crises period.

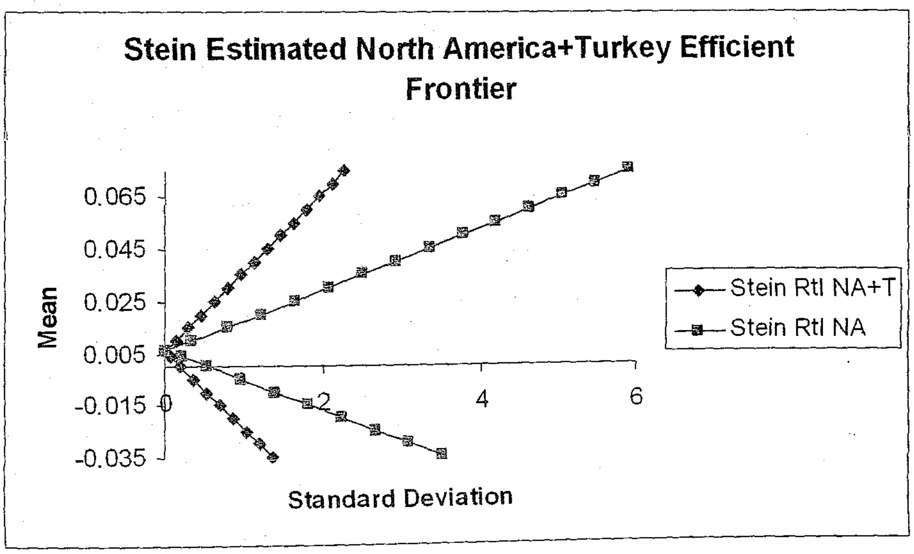

Figure 8.23 Stein Estimated NA+Turkey Efficient Frontier

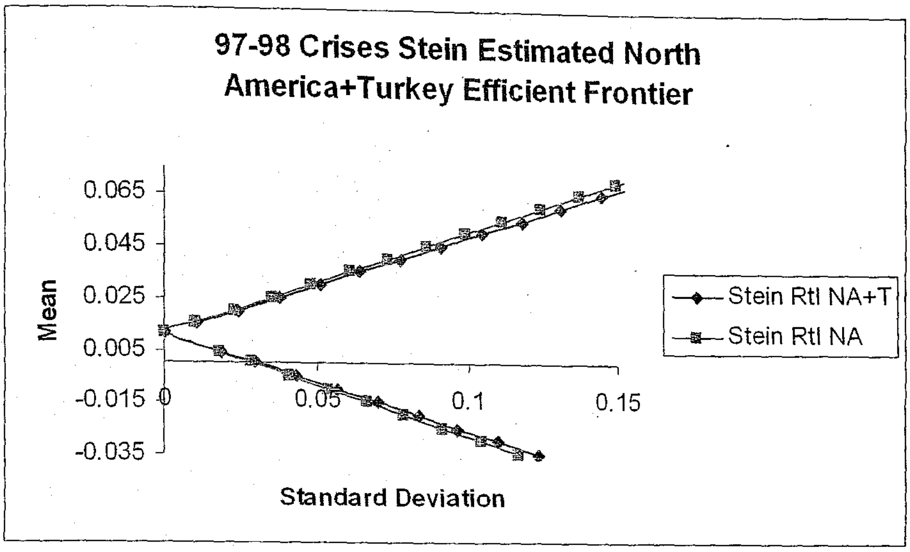

Figure 8.24 97-98 Crises Stein Estimated NA+Turkey Efficient Frontier

The almost zero and negative implied marginal potential performance values of full period and crises period confirm the dominance of North America portfolio. The intersection test statistic fails to reject the null hypothesis at the 1 percent level. Thus, it is found that both portfolios intersect the tangency line at the same point and there is no significant difference between the efficient frontiers. Accordingly, it is concluded that Turkey's contribution to the North America portfolio had been negligible for the full and the 97-98 crises period. The intersection test parameters are provided in tables 8.19 and 8.20 in the Appendix C.

8.5 Latin America Region

The Latin America portfolio is constructed from the country stock indexes of Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Turkey is then added to the Latin America portfolio to investigate whether it provides any risk reduction in the region. Classic and Stein estimated efficient frontier analyses are provided for Latin America and Latin America including Turkey portfolios for the full period and for the 97-98 crises period in detail. The following table summarizes the full and the crises period findings.

Table 8.21 Latin America Region Analyses

FULL PERIOD

	LA+T	LA
Minimum Variance Portfolio Mean	-0.000067	0.003747
Minimum Variance Portfolio St. Dev.	0.060992	0.061267

	LA+T		LA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.003376	-0.035331	-0.000675	-0.042543
Standard Deviation	0.075840	0.159298	0.094319	0.285019
Sharpe Ratio	-0.123494	-0.259394	-0.056348	-0.170278

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.012076	0.038291
Test Statistic	0.938926	2.902524

1997-98 PERIOD

	LA+T	LA
Minimum Variance Portfolio Mean	-0.006464	-0.005715
Minimum Variance Portfolio St. Dev.	0.068768	0.069357

	LA+T		LA	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.006792	-0.019333	-0.005767	-0.017413
Standard Deviation	0.069408	0.090540	0.069463	0.090334
Sharpe Ratio	-0.257534	-0.335942	-0.242569	-0.315453

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.007484	0.013346
Test Statistic	0.113087	0.194213

8.5.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Latin America portfolio are found as 0.0037 and 0.0612, respectively while the Turkish three month T-bill rate, assumed risk free rate, had been 0.006. The following graph gives the Latin America portfolio efficient frontier with and without the risk free rate. The efficient frontier shifts leftward due to the riskless asset.

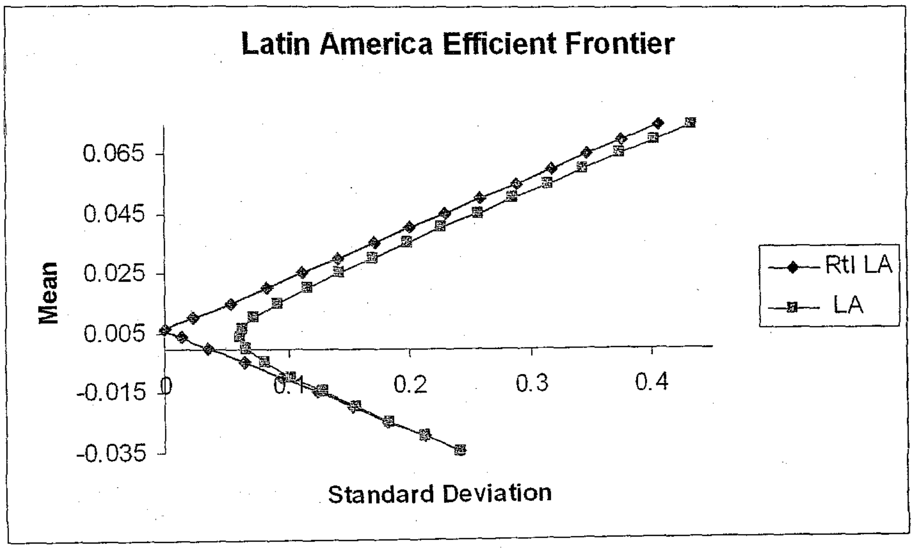

Figure 8.25 Latin America Efficient Frontier

The Latin America hyperbola intersects the line at the lower portion as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.043 and 0.285, respectively. Turkish stock market is then added to the Latin America portfolio to investigate its diversification benefit in the presence of a riskless asset. Inclusion of Turkish stock market to the Latin America portfolio is found to decrease the minimum variance portfolio mean while slightly improving the standard deviation over the full period. The mean decreases to -0.0000067 while standard deviation drops to 0.060992. Accordingly, the Latin America including Turkey tangency portfolio mean and standard deviation are found as -0.035 and 0.159, respectively. The Sharpe ratio drops from -0.17 to -0.25. On the other hand, inclusion of Turkey in the North America portfolio shifts the efficient frontier leftward. The graph below gives the respective portfolios' efficient frontiers. The Latin America including Turkey portfolio is observed to dominate all portfolios given in the graph.

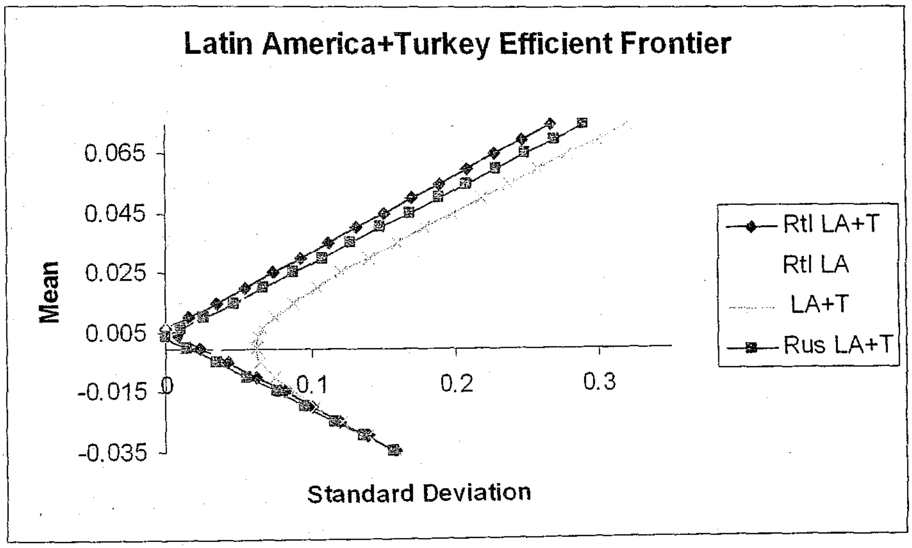

Figure 8.26 Latin America including Turkey Efficient Frontier

Over the 97-98 crises period the minimum variance portfolio mean and standard deviation of Latin America portfolio are found as -0.57% and 6.9%, respectively while the Turkish three month T-bill rate had been 1.1%. The following graph provides the Latin America portfolio efficient frontier with and without the risk free rate.

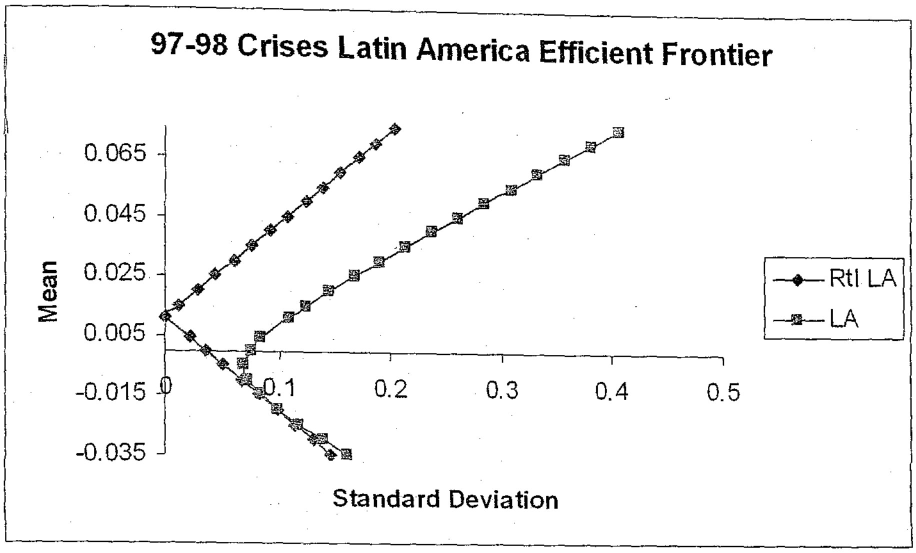

Figure 8.27 97-98 Crises Latin America Efficient Frontier

The Latin America hyperbola is found to intersect the line at the lower part as the minimum variance portfolio mean is found to be less than the risk free rate. For the 97-98 crises period the tangency portfolio mean and standard deviation are found as -0.017 and 0.090, respectively. Inclusion of Turkish stock market to the Latin America portfolio for the 97-98 crises period produces the following results. It is found that minimum variance portfolio mean decreases to -0.006 while the standard deviation falls to 0.068. The efficient frontier is observed to shift slightly leftward due to the inclusion of Turkey in the Latin America portfolio. The tangency portfolio mean and standard deviation are found as -0.019 and 0.091, respectively. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. The Latin America including Turkey portfolio is observed to dominate all the portfolios provided in the graph including the Latin America portfolio with the riskless asset.

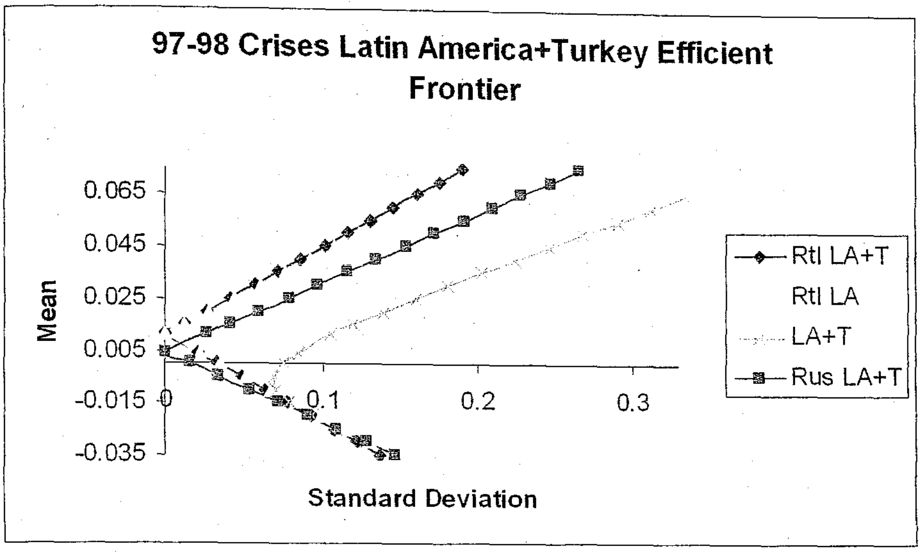

Figure 8.28 97-98 Crises LA+Turkey Efficient Frontier

For the full period the implied marginal potential performance is found as 0.038 while for the 97-98 period it is found as 0.013. However, for the both periods the test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance which corresponds to F-value of 4.75 and 5.15 respectively for the full and the crises period. It is concluded that two asset sets intersect and Turkey's contribution to the Latin America portfolio in the presence of a riskless asset had been negligible. The intersection test parameters are provided in tables 8.22 and 8.23 in the Appendix C.

8.5.2 Stein Estimated Efficient Frontier Analysis

The full period and 97-98 period country sample means of Latin America and Latin America including Turkey portfolios are smoothed by their respective minimum variance portfolio means in an attempt to minimize the estimation bias. It is found that compared to classic mean-variance analysis both portfolios had higher Sharpe ratios over the full period. The tangency portfolio mean and standard deviation for the Latin America and Latin America including Turkey portfolios are found as (-0.0006, 0.094) and (-0.0033, 0.075), respectively. For the 97-98 period the tangency portfolio mean and standard deviation of LA and LA+T portfolios are found as (-0.005, 0.069) and (-0.006, 0.069), respectively. While Stein Sharpe ratios are found to be higher than the Classic Sharpe ratios for both portfolios, comparison of the respective Stein estimated portfolios reveal that LA+T portfolio had a slightly lower Sharpe ratio compared to LA portfolio. The following graphs provide the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. It is seen that under Stein estimation the contribution of Turkey is less pronounced for the 97-98 period.

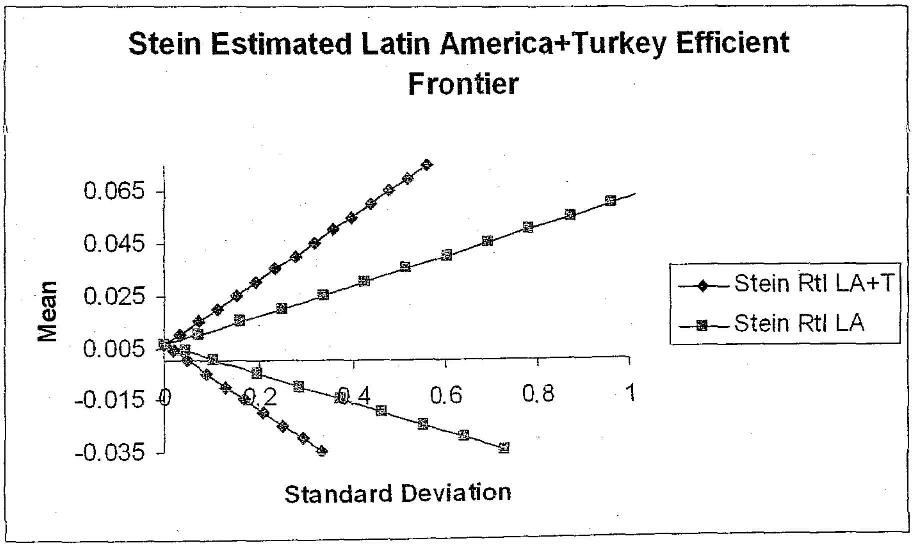

Figure 8.29 Stein Estimated LA+Turkey Efficient Frontier

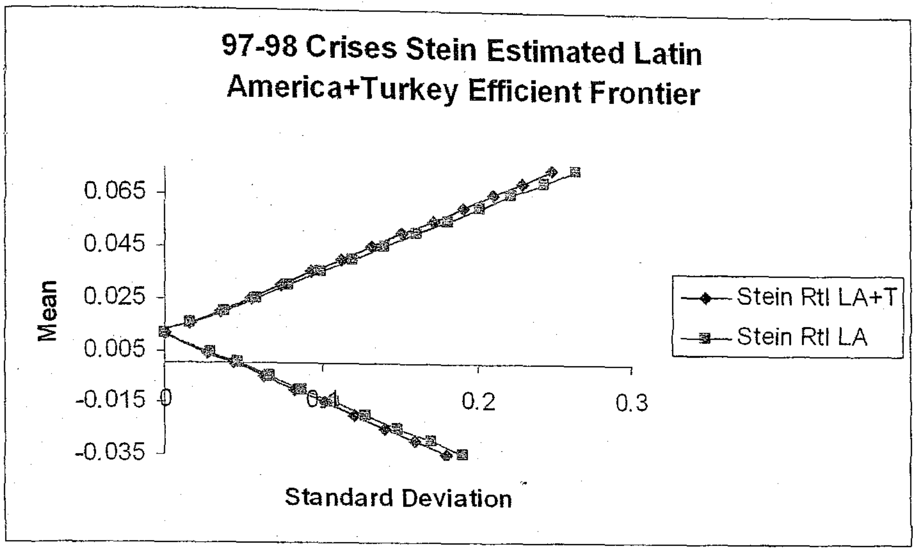

Figure 8.30 97-98 Crises Stein Estimated LA+Turkey Efficient Frontier

Over both periods Turkish stock market is found to provide very little improvement in the implied marginal potential performance and test statistic fails to reject the null hypothesis at the 1 percent level. Thus, it is concluded that Stein estimated efficient frontiers of respective portfolios intersect. Stein estimation confirms the classic estimation's finding that in both the full and the crises periods Turkey's contribution to the Latin America portfolio in the presence of a riskless asset had been negligible. The intersection test parameters are provided in tables 8.24 and 8.25 in the Appendix C.

8.6 Pacific Rim Region

The Pacific Rim portfolio is constructed from the country stock indexes of Australia, Hong Kong, Japan, New Zealand and Singapore. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period. The following table summarizes the full period and the crises period findings.

Table 8.26 Pacific Rim Region Analyses

FULL PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	-0.000503	0.000043
Minimum Variance Portfolio St. Dev.	0.049303	0.049522

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.001864	-0.016287	-0.000659	-0.011672
Standard Deviation	0.054227	0.091325	0.052367	0.085347
Sharpe Ratio	-0.144840	-0.243927	-0.126976	-0.206944

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.004856	0.016674
Test Statistic	0.382299	1.279170

1997-98 PERIOD

	PR+T	PR
Minimum Variance Portfolio Mean	-0.005677	-0.005139
Minimum Variance Portfolio St. Dev.	0.055339	0.055926

	PR+T		PR	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.006752	-0.029375	-0.005499	-0.017506
Standard Deviation	0.057087	0.085980	0.056352	0.073211
Sharpe Ratio	-0.312420	-0.470545	-0.294258	-0.390501

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.011018	0.068922
Test Statistic	0.182528	1.076443

8.6.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Pacific Rim portfolio are found as 0.000043 and 0.049522, respectively. The following graph provides the Pacific Rim portfolio efficient frontier with and without the risk free rate. Inclusion of a riskless asset significantly enhances the investment set.

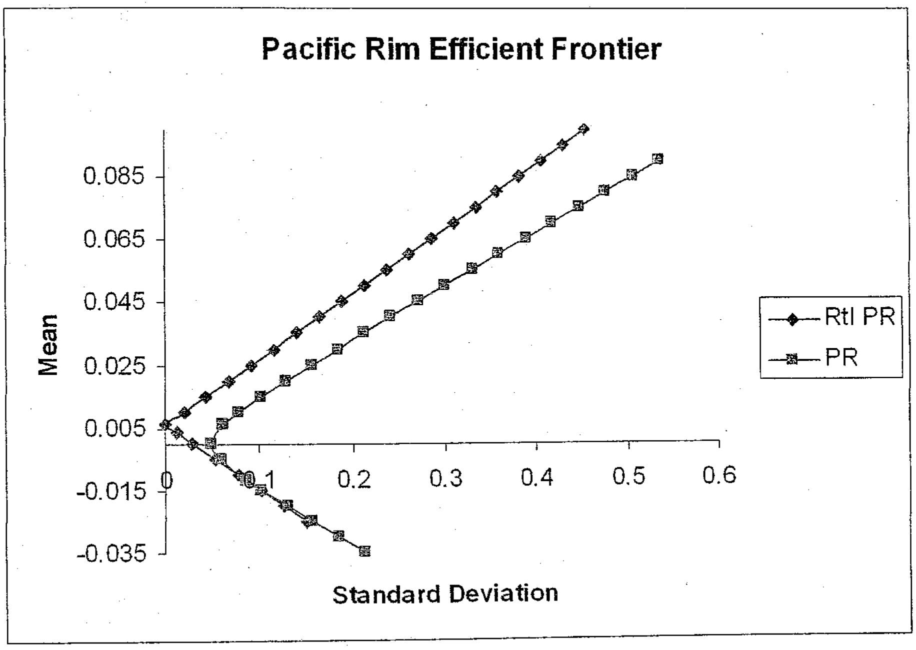

Figure 8.31 Pacific Rim Efficient Frontier

It is observed that the Pacific Rim hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.012 and 0.085, respectively. It is found that inclusion of Turkish stock market to the Pacific Rim portfolio decreases the minimum variance portfolio mean and standard deviation. The tangency portfolio mean and standard deviation are found as -0.016 and 0.091, respectively. Accordingly, Sharpe ratio is found as -0.024. However, efficient frontier is observed to shift leftward slightly due to the inclusion of Turkey in the Pacific Rim portfolio. The graph below gives the respective portfolios' efficient frontiers.

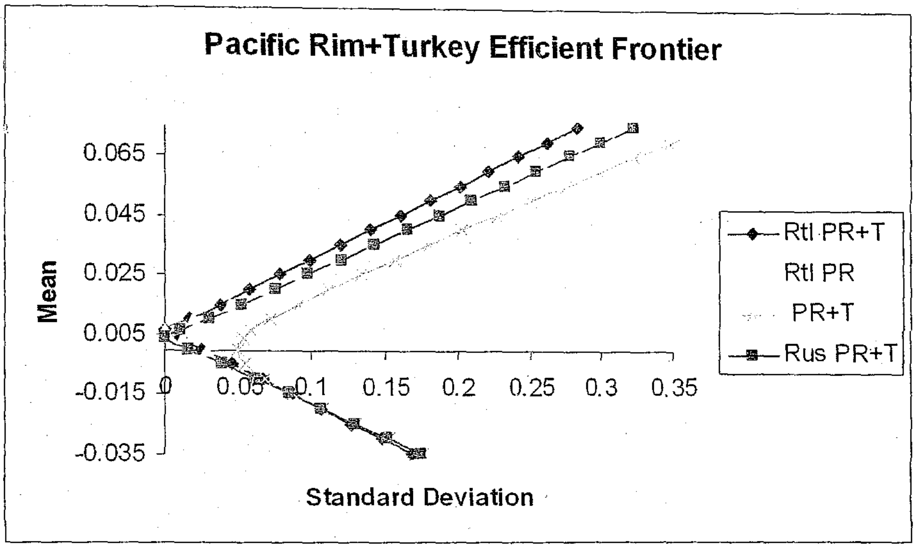

Figure 8.32 Pacific Rim including Turkey Efficient Frontier

Over the crises period the minimum variance portfolio mean and standard deviation of Pacific Rim portfolio are found as -0.52% and 5.5%, respectively while the Turkish three month T-bill rate had been 1.1%. The following graph provides the Pacific Rim portfolio efficient frontier with and without the risk free rate. The efficient frontier is observed to shift leftward due to the inclusion of the riskless asset.

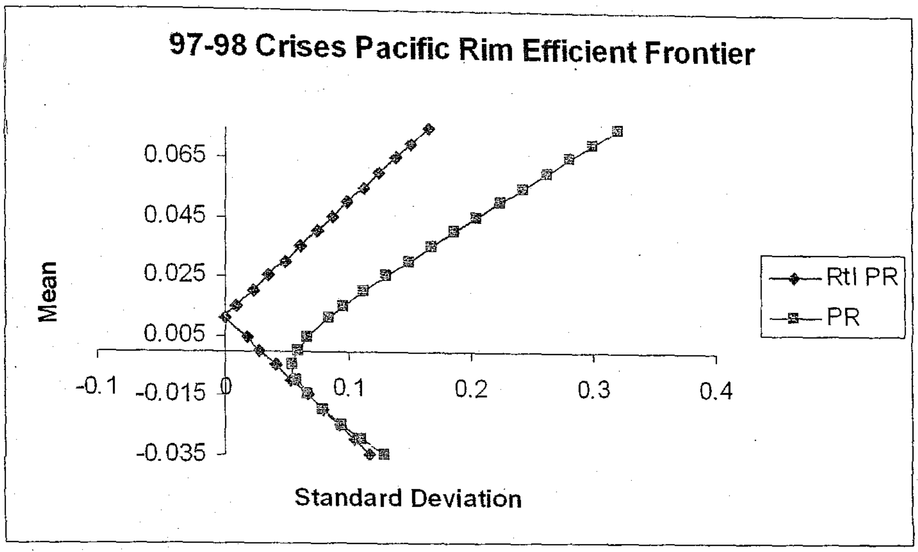

Figure 8.33 97-98 Crises Pacific Rim Efficient Frontier

The Pacific Rim hyperbola intersects the line at the lower portion as the risk free rate is greater than the minimum variance portfolio mean. The tangency portfolio mean and standard deviation are found as -0.018 and 0.073, respectively. Inclusion of Turkish stock market to the Pacific Rim is found to decrease minimum variance portfolio mean to -0.0056 while the standard deviation falls to 0.05533. The tangency portfolio mean and standard deviation are found as -0.029 and 0.086, respectively. Compared to PR portfolio PR+T portfolio's Sharpe ratio is found to be lower. However it is also seen that efficient frontier shifts leftward slightly due to the inclusion of Turkey in the Pacific Rim portfolio. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. Turkish stock market is found to create a slight leftward shift in the 97-98 period like in the full period.

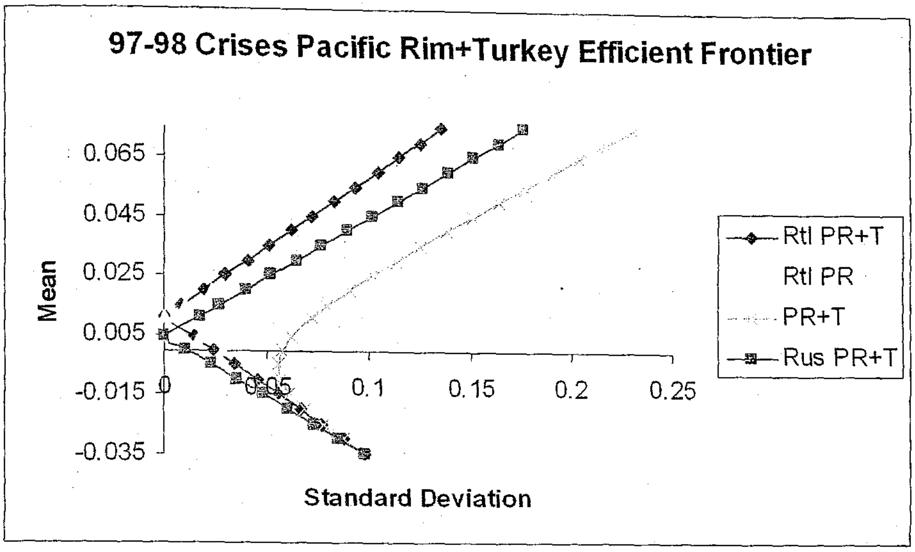

Figure 8.34 97-98 Crises PR+Turkey Efficient Frontier

Inclusion of Turkey is found to result in 0.01 and 0.06 implied marginal potential performances respectively for the full period and the crises period. However, these values fall short of the required F-value and the test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance. It is concluded that two asset sets intersect and Turkey's contribution to the Pacific Rim portfolio in the presence of a riskless asset had been negligible during both time periods investigated. The intersection test parameters are provided in tables 8.27 and 8.28 in the Appendix C.

8.6.2 Stein Estimated Efficient Frontier Analysis

In this analysis the full period and crises period country sample means of Pacific Rim and Pacific Rim including Turkey portfolios are smoothed by their respective minimum variance portfolio means. Once the Stein estimation is performed it is found that both portfolios have higher estimated risk. For both of the periods under investigation compared to Classic portfolios' Sharpe ratios, Stein estimated portfolios' Sharpe ratios are found to be higher though being still negative. However, comparison of Stein estimated portfolios with each other reveals that portfolio including Turkey had a lower Sharpe ratio. 97-98 period analysis also show that Stein estimated portfolios' Sharpe ratios to be less negative, indicating higher reward to risk. On the other hand comparison of Stein estimated portfolios with each other reveals that Pacific Rim including Turkey portfolio in fact had a lower Sharpe ratio (-0.31).

The following graphs provide the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. Although Stein estimation demonstrates higher volatility for both portfolios, inclusion of Turkey in the Pacific Rim portfolio is still observed to shift the efficient frontier leftward. Stein estimation displays that in the presence of a riskless asset adding Turkey to the Pacific Rim portfolio slightly shifts the Pacific Rim portfolio leftward during the crises. However, this shift is less pronounced than the classic optimization shows.

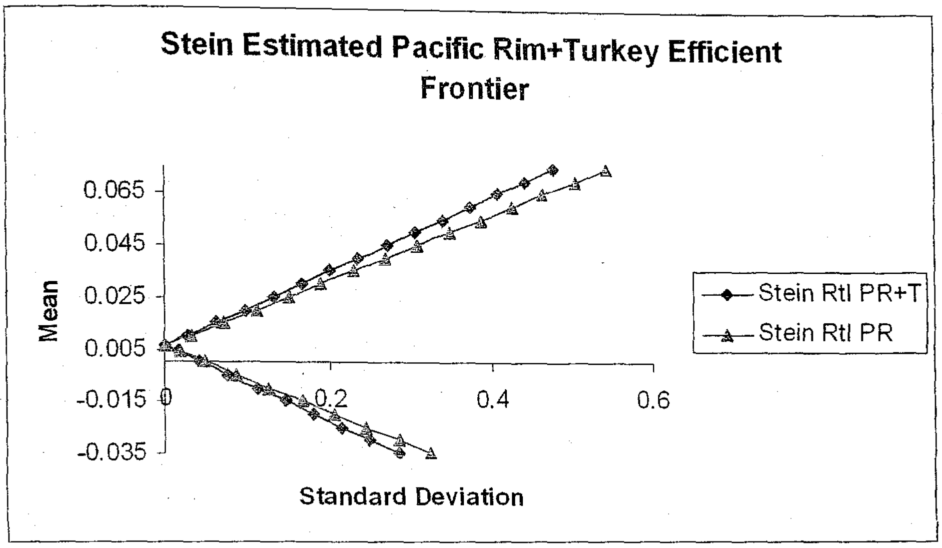

Figure 8.35 Stein Estimated PR+Turkey Efficient Frontier

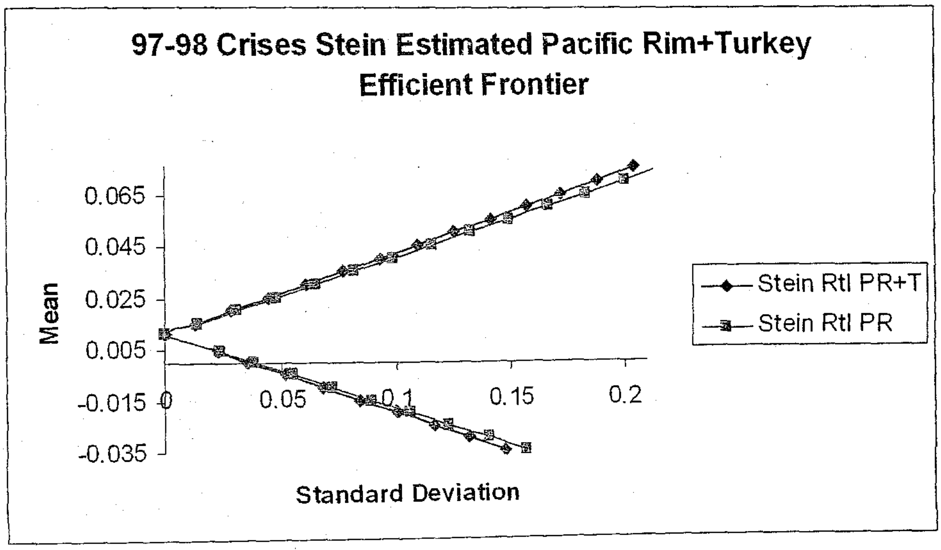

Figure 8.36 97-98 Crises Stein Estimated PR+Turkey Efficient Frontier

Respectively 0.01 and 0.004 implied marginal potential performance values are found for the full and for the crises period and test statistic fails to reject the null hypothesis at the 1 percent level. Thus, it is shown that Stein estimated efficient frontiers of respective portfolios intersect. Stein estimation confirms that Turkey fails to improve the performance of PR portfolio over the full and the 97-98 crises periods. The intersection test parameters are provided in tables 8.29 and 8.30 in the Appendix C.

8.7 Middle East Region

The Middle East portfolio is constructed from the country stock indexes of Egypt, Israel, Jordan, Morocco and South Africa. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period. The table below gives the full period and crises periods summary findings.

Table 8.31 Middle East Region Analyses

FULL PERIOD

	ME+T	ME
Minimum Variance Portfolio Mean	0.000226	0.000305
Minimum Variance Portfolio St. Dev.	0.029014	0.029020

	ME+T		ME	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.000152	-0.002615	0.000299	-0.000724
Standard Deviation	0.029199	0.035450	0.029034	0.031536
Sharpe Ratio	-0.199929	-0.242729	-0.196009	-0.212902

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.001552	0.013590
Test Statistic	0.119580	1.040063

1997-98 PERIOD

	ME+T	ME
Minimum Variance Portfolio Mean	0.000702	0.001419
Minimum Variance Portfolio St. Dev.	0.026920	0.027218

	ME+T		ME	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.004242	-0.025226	-0.004152	-0.024615
Standard Deviation	0.032708	0.050345	0.034173	0.052310
Sharpe Ratio	-0.468548	-0.721211	-0.445813	-0.682430

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.020788	0.054434
Test Statistic	0.312145	0.668494

8.7.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of Middle East portfolio are found as 0.0003 and 0.0290, respectively. The following graph provides the Middle East portfolio efficient frontier with and without the risk free rate.

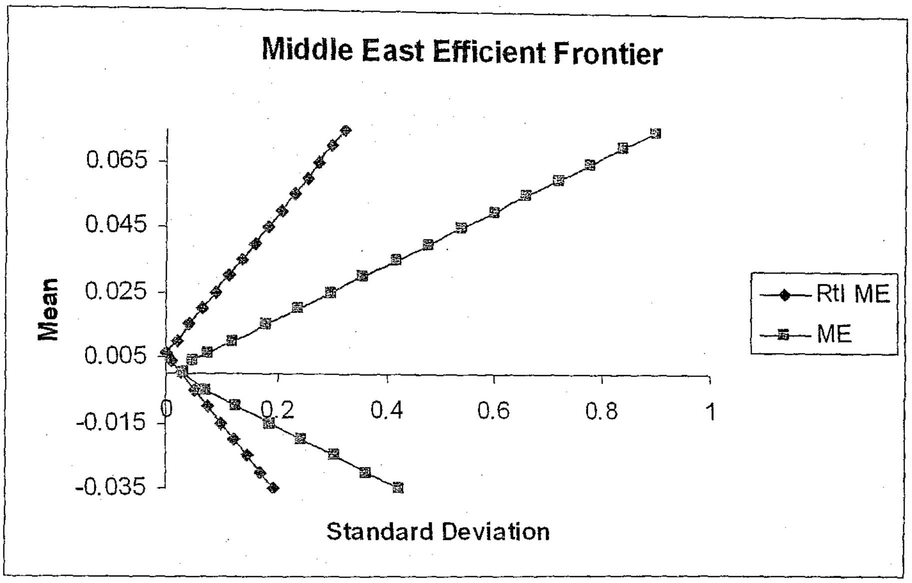

Figure 8.37 Middle East Efficient Frontier

It is observed that the Middle East hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.0007 and 0.031, respectively. However, the inclusion of Turkish stock market to the Middle East portfolio slightly decreases the minimum variance portfolio mean and standard deviation. The Middle East including Turkey's tangency portfolio mean and standard deviation are found as -0.002 and 0.035, respectively. Accordingly, Sharpe ratio is found to be lower than the ME portfolio's Sharpe ratio. The graph below gives the respective portfolios' efficient frontiers where Middle East including Turkey portfolio is observed to dominate all.

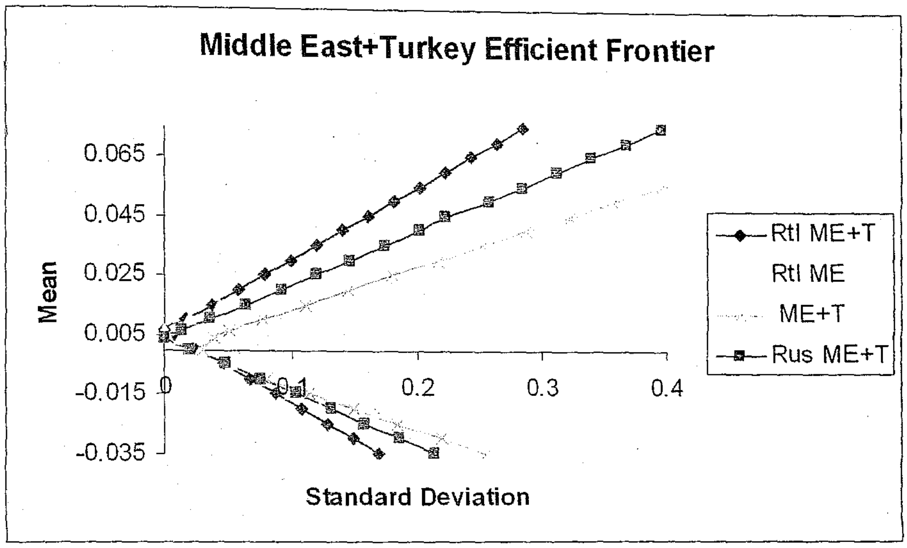

Figure 8.38 Middle East including Turkey Efficient Frontier

Over the 97-98 crises period the minimum variance portfolio mean and standard deviation of Middle East portfolio are found as 0.14% and 2.7%. The following graph provides the Middle East portfolio efficient frontier with and without the risk free rate. The efficient frontier is observed to shift leftward due to the inclusion of the riskless asset.

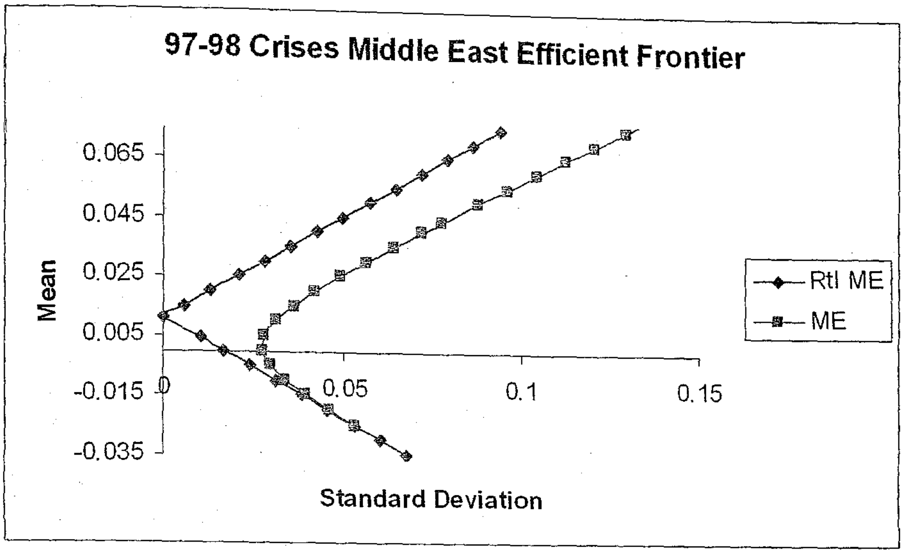

Figure 8.39 97-98 Crises Middle East Efficient Frontier

The Middle East hyperbola intersects the line at the lower part and the tangency portfolio mean and standard deviation are found as -0.024 and 0.052, respectively. Inclusion of Turkish stock market to the Middle East portfolio produces the following results. It is found that minimum variance portfolio mean decreases to 0.0007 while the standard deviation falls to 0.0269. The tangency portfolio mean and standard deviation are found as -0.025 and 0.050, respectively. The Sharpe ratio is found as -0.72. A leftward shift is seen in the efficient frontier due to the inclusion of Turkey in the Middle East portfolio. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. Inclusion of Turkey is shown to shift the Middle East portfolio leftward in the presence of a riskless asset.

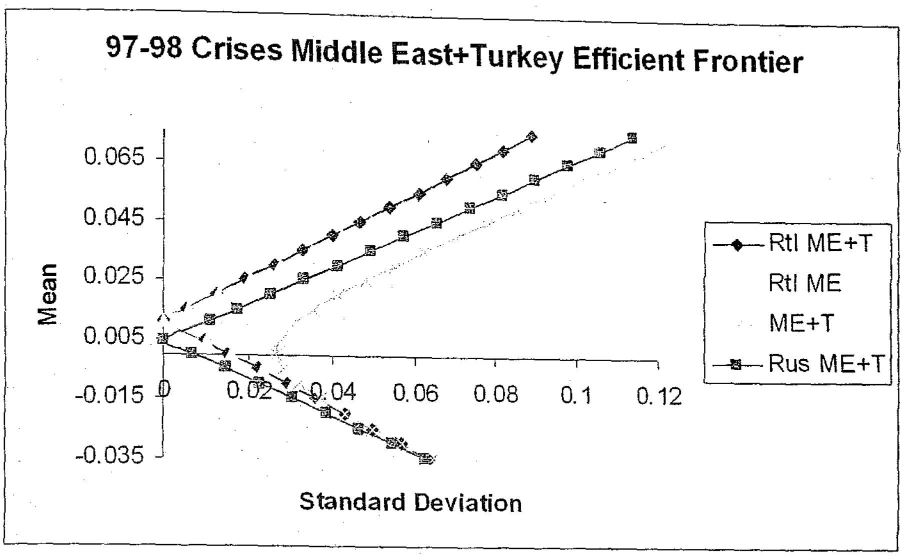

Figure 8.40 97-98 Crises Middle East including Turkey Efficient Frontier

Inclusion of Turkey is found to result in 0.013 implied marginal potential performance for the full period and 0.054 for the crises period. The test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance. It is concluded that two asset sets intersect and Turkey's contribution to the Middle East portfolio in the presence of a riskless asset had been negligible during the full and the 97-98 period. The intersection test parameters are provided in tables 8.32 and 8.33 in the Appendix C.

8.7.2 Stein Estimated Efficient Frontier Analysis

In this analysis the full period and 97-98 period country sample means of Middle East and Middle East including Turkey portfolios are smoothed by their respective minimum variance portfolio means. The estimated risk of the both portfolios is found to be higher than classic approach suggests. Compared to classic mean-variance estimation, Stein estimated portfolios' Sharpe ratios are found to be higher, indicating higher reward to risk. However, comparison of Stein estimated portfolios with each other reveals that portfolio including Turkey had a slightly lower Sharpe ratio (-0.019).

For the 97-98 period re-estimated means of Stein estimation reveal that both portfolios have higher risk than classic approach suggested. On the other hand, Stein estimated portfolios' Sharpe ratios are found to be less negative compared to classic mean-variance estimation, indicating higher reward to risk. Comparison of Stein estimated portfolios with each other however reveals that Middle East including Turkey portfolio in fact had a slightly lower Sharpe ratio.

The following graphs provide the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset for both time periods. While two frontiers are observed to overlap for the full period, Stein estimation shows that in the presence of a riskless asset adding Turkey to the Middle East portfolio slightly shifts the Middle East portfolio leftward during the 97-98 crises period.

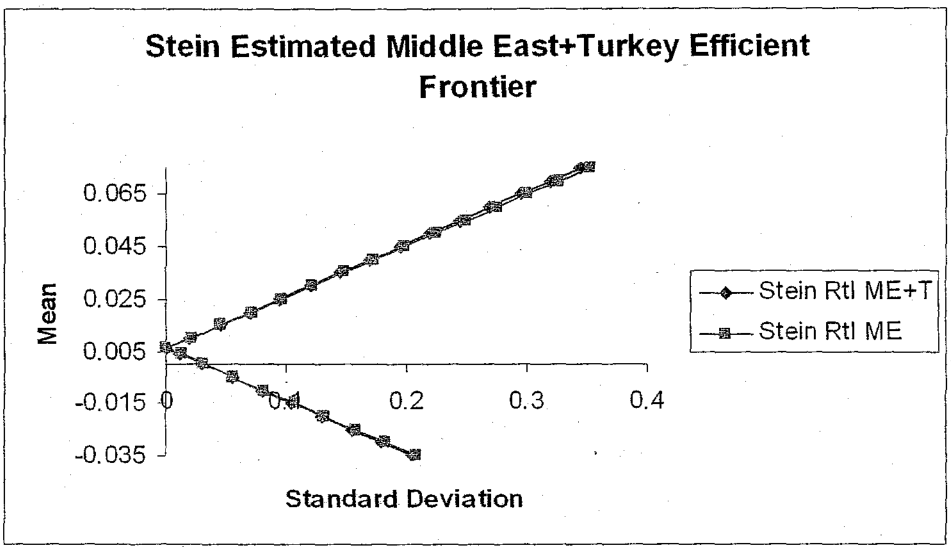

Figure 8.41 Stein Estimated ME+Turkey Efficient Frontier

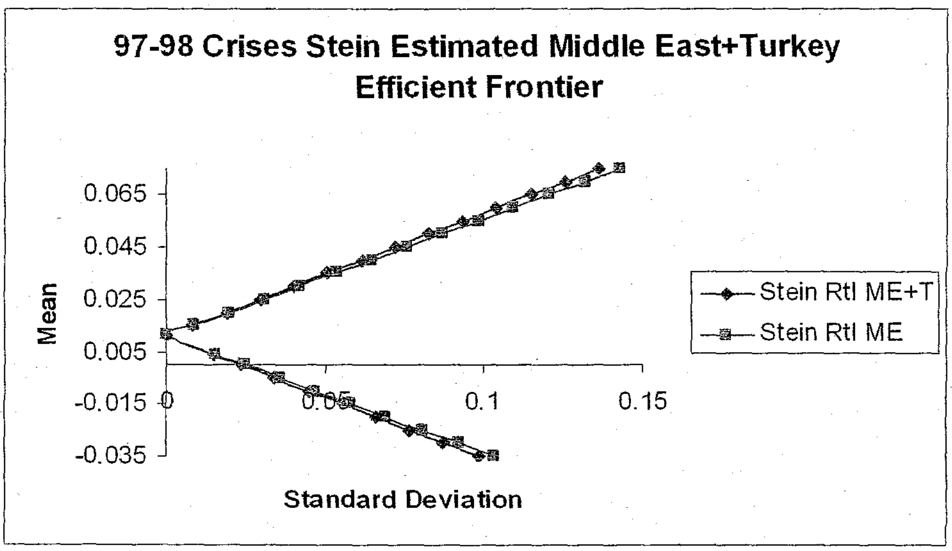

Figure 8.42 97-98 Crises Stein Estimated ME+Turkey Efficient Frontier

For both periods the implied marginal potential performance is found to be very close to zero and test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1 percent level. Thus, it is proven that Stein estimated efficient frontiers of respective portfolios are not statistically different from each other and intersect. Stein estimation confirms the classic estimation finding that Turkey fails to reduce the risk of the Middle East portfolio significantly. The intersection test parameters are provided in tables 8.34 and 8.35 in the Appendix C.

8.8 G7 Portfolio

The G7 portfolio is constructed from the country stock indexes of Canada, France, Germany, Italy, Japan, UK and USA. Classic and Stein estimated efficient frontier analyses are provided for the full period and for the 97-98 crises period. The following table summarizes the full period and the crises periods findings.

Table 8.36 G7 Portfolio Analyses

FULL PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.000790	0.001224
Minimum Variance Portfolio St. Dev.	0.039322	0.040224

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	-0.002532	-0.022599	-0.002842	-0.024588
Standard Deviation	0.050339	0.092200	0.054758	0.101888
Sharpe Ratio	-0.169292	-0.310072	-0.161289	-0.300109

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	0.002646	0.006079
Test Statistic	0.201123	0.434993

1997-98 PERIOD

	G7+T	G7
Minimum Variance Portfolio Mean	0.028036	0.028028
Minimum Variance Portfolio St. Dev.	0.037411	0.037411

	G7+T		G7	
Tangency Portfolio	Stein	Classic	Stein	Classic
Mean	0.034767	0.067660	0.035722	0.066469
Standard Deviation	0.044219	0.068343	0.045106	0.067637
Sharpe Ratio	0.535610	0.827828	0.546244	0.818869

Asset Set Intersection	Stein	Classic
Implied Marginal Potential Performance	-0.011505	0.014752
Test Statistic	-0.141776	0.141293

8.8.1 Classic Efficient Frontier Analysis

Over the full period the minimum variance portfolio mean and standard deviation of G7 portfolio are found as 0.001 and 0.004, respectively. The following graph provides the G7 portfolio efficient frontier with and without the risk free rate, where the riskless asset is found to shift efficient frontier significantly leftward.

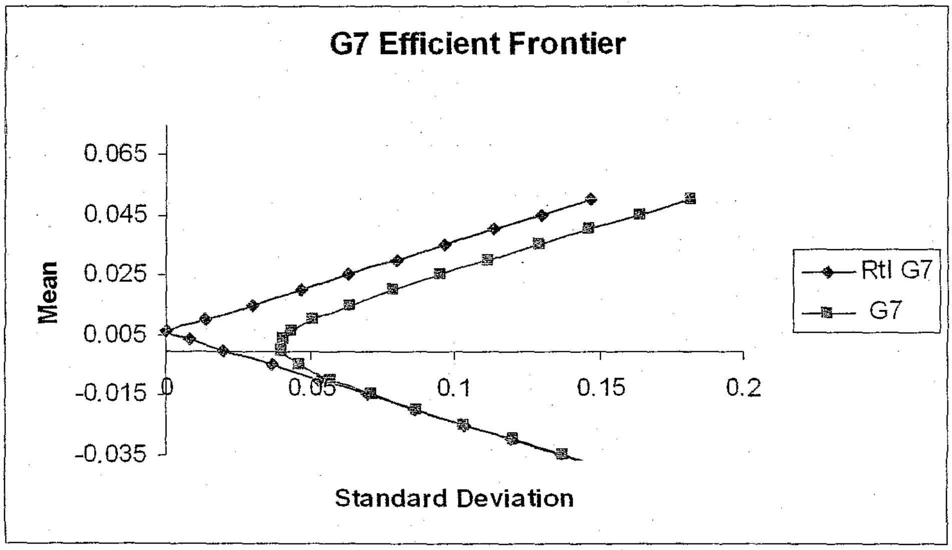

Figure 8.43 G7 Efficient Frontier

It is observed that the Middle East hyperbola intersects the line at the lower locus as the minimum variance portfolio mean is less than the risk free rate. The tangency portfolio mean and standard deviation are found as -0.024 and 0.101, respectively. It is seen that inclusion of Turkish stock market to the G7 portfolio decreases the minimum variance portfolio mean and standard deviation to 0.0008 and 0.0393, respectively. The G7 including Turkey's tangency portfolio mean and standard deviation are then found as -0.023 and 0.092, respectively. Accordingly, Sharpe ratio is found as -0.31. However, efficient frontier is observed to shift leftward slightly due to the inclusion of Turkey in the portfolio. The graph below gives the respective portfolios' efficient frontiers.

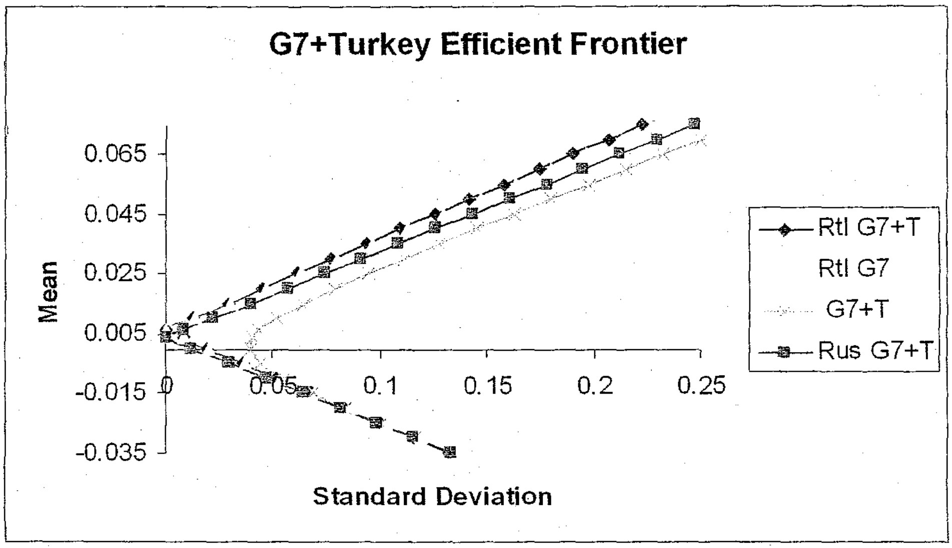

Figure 8.44 G7 including Turkey Efficient Frontier

Over the crises period the minimum variance portfolio mean and standard deviation of G7 portfolio are found as 2.8% and 3.7%, respectively while the Turkish three month T-bill rate had been 1.1% on average. In the following graph the efficient frontier is observed to shift leftward due to the inclusion of the riskless asset.

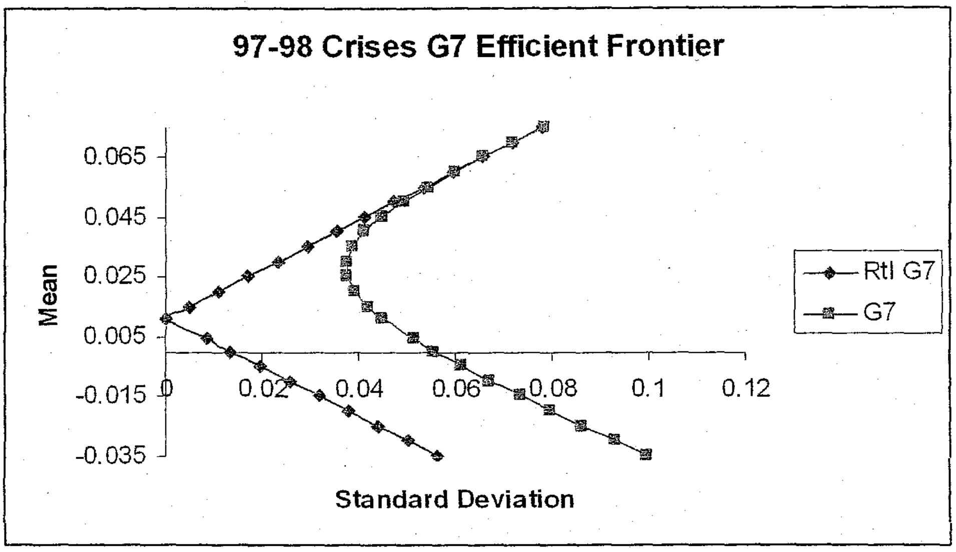

Figure 8.45 97-98 Crises G7 Efficient Frontier

Since the risk free rate is greater than the minimum variance portfolio mean, the G7 hyperbola intersects the line at the lower portion. The tangency portfolio mean and standard deviation are found as 0.066 and 0.068, respectively. Turkish stock market is then added to the G7 portfolio to investigate its diversification potential in the presence of a riskless asset during the 97-98 crises period. It is found that minimum variance portfolio mean increases slightly while the standard deviation remains the same. The tangency portfolio mean and standard deviation are found as 0.068 and 0.068, respectively. Accordingly, Sharpe ratio of G7+T is found slightly higher (0.82) then the G7 portfolio (0.81). Compared to full period higher means and lower standard deviations are observed for both portfolios. The graph below gives the respective portfolios' efficient frontiers for the 97-98 crises period. However, the G7 including Turkey portfolio is observed to overlap with the G7 portfolio suggesting zero diversification benefit for the Turkish stock market. It is also seen that at the high risk region G7+T portfolio overlaps with the G7+T portfolio which assumes US T-bill rate as the riskless asset.

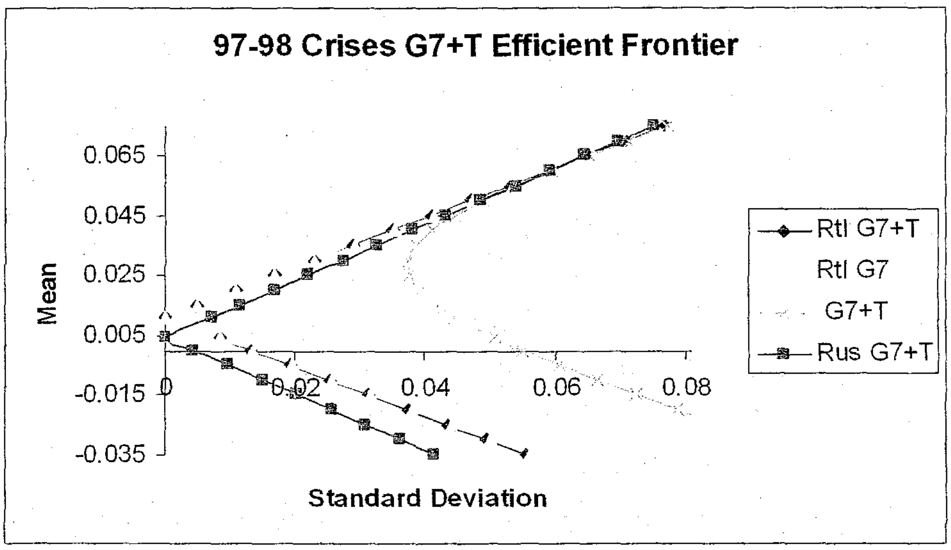

Figure 8.46 97-98 Crises G7+Turkey Efficient Frontier

For the full period inclusion of Turkey is found to result in a 0.006 implied marginal potential performance while for the 97-98 period a slightly higher value is found. However, the test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1% level of significance for both time periods. It is concluded that the respective efficient frontiers intersect and Turkey's contribution to the G7 portfolio in the presence of a riskless asset had been negligible during the full and the crises period. The intersection test parameters are provided in tables 8.37 and 8.38 in the Appendix C.

8.8.2 Stein Estimated Efficient Frontier Analysis

In this analysis full period and 97-98 period minimum variance portfolio means of the of Middle East and Middle East including Turkey portfolios are defined as the common mean and the respective country sample means are shrunk towards them. The estimated risk of the both portfolios is then found to be higher than classic approach suggests. Compared to classic mean-variance estimation, Stein estimated portfolios' Sharpe ratios are also found to be less negative, indicating higher reward to risk for the full period. Comparison of Stein estimated portfolios with each other reveals that portfolio including Turkey had a slightly lower Sharpe ratio. On the other hand, the 97-98 period Stein Sharpe ratios are found to be lower than Classic Sharpe ratios. Comparison of the Stein G7+T with Stein G7 portfolio also unveils a decrease in the Sharpe ratio due to the inclusion of Turkey. Sharpe ratio slightly falls to 0.53.
The following graphs provide the Stein estimated efficient frontiers of both portfolios in the presence of a riskless asset. Stein estimation expresses that in the presence of a riskless asset G7 portfolio slightly dominates the G7+T portfolio during the 97-98 crises period.

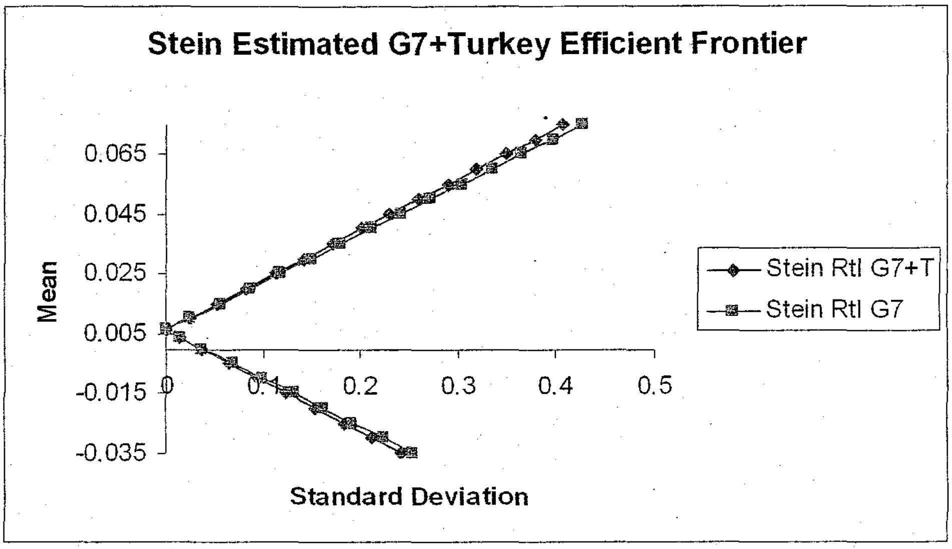

Figure 8.47 Stein Estimated G7+Turkey Efficient Frontier

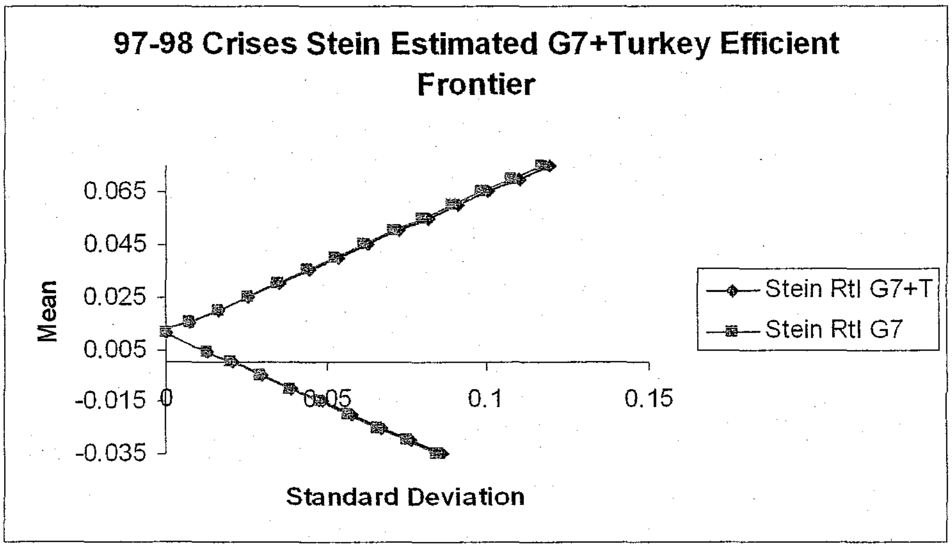

Figure 8.48 97-98 Crises Stein Estimated G7+Turkey Efficient Frontier

For the full period a very small value is found for the implied marginal potential performance while for the crises period a negative value is found. However, the intersection test statistic fails to reject the null hypothesis of zero implied marginal potential performance at the 1 percent level. Thus, it is shown that Stein estimated efficient frontiers of respective portfolios intersect. It is concluded that Turkey's contribution to the G7 portfolio had been negligible for the full period as well as the 97-98 crises period. The intersection test statistics are provided in tables 8.39 and 8.40 in the Appendix C.

9. CONCLUSIONS

The research is based on the analyses of the correlation matrixes of respective efficient portfolios constructed under a mean-variance framework. In this theory, it is known that less than perfect positive correlation is sufficient for portfolio diversification purposes, as it leads to risk reduction. In this respect, international stock markets that have low correlations with each other form the basis of international diversification debate. Portfolio diversification means higher expected return for a given level of risk, or lower risk for a given level of expected return. The main objective of international diversification is the latter part. International diversification idea, first introduced to literature by Solnik in 1974, has extended the portfolio investment opportunities beyond domestic assets, which were then considered as the only asset set for diversification purposes. International diversification, benefits from the low correlations between international markets. Modern portfolio theory suggests that efficient frontier can be pushed leftward by international diversification. Traditionally, investors used to invest either domestically or in other developed markets. However, the recent growth of emerging markets has shifted the attention of many investors as well as academicians to the possible additional diversification benefits of emerging markets.

The objective of this research was to investigate the risk reduction benefit of the Turkish stock market in a global portfolio. The diversification benefit of the Turkish stock market is investigated in globally and regionally constructed portfolios, for the full period starting from 1988:01 and for the selected global crises periods.

For the global portfolios classic mean-variance analyses in the absence and in the presence of a riskless asset are provided only for the full period. The examination of the constructed global portfolios show that despite the low correlations Turkey had with the developed and the emerging markets, it fails to reduce the risk of the respective portfolios in the absence as well as in the presence of the riskless asset at the 1% significance level. Meanwhile in the absence of a riskless asset it is found to have a significant contribution in the world portfolio. However, the further examination of this finding with the Stein estimation unfortunately fails to verify the statistical significance of it. Thus, it is concluded that Turkey's contribution to the global portfolios had been insignificant in the long term.

On the other hand, compared to global portfolios, the regional portfolios are studied in more detail. For each regional portfolio classic mean-variance, Stein estimated mean-variance and short-selling restricted analyses are provided. The contribution of Turkey to these regional portfolios is searched in the full period and in the crises periods of 92-93, 94-95 and 97-98 as long as the available data allows. The examination of the three-year rolling correlation matrix, provided in table 9.1 in Appendix B, evinces an increase in the general level of correlations. The very low and even negative correlations Turkey had during the 92-93 period are found to be positive and higher in the 97-98 period for all regional portfolios. However, long term average correlations are found to be still at relatively lower levels compared to within regional correlations of respective countries of Developed Europe, North America, Pacific Rim and G7 portfolios. Among the emerging countries, Turkey is found to be much correlated with Emerging Europe and Latin America portfolios especially during the 97-98 crises, while it had relatively lower correlations with the Asia portfolio. However, the long term average correlations of Turkey with these regions had been again lower than their 97-98 crises averages. Meanwhile the 94-95 period had been a transition period for Turkey in a sense as the negative and almost zero correlations had turned into positive but had remained lower than the averages in general. Over the full period Turkey had 1.9 % average return and 20.2 % standard deviation while having the following means and standard deviations respectively for ERM, Latin, Asia and Russia crises periods; (0.030, 0.173), (-0.013, 0.177), and (0.013, 0.164).

In the absence of the riskless asset, Turkey is found to provide the highest marginal potential performance for the Middle East and the Asia portfolios over the full period, respectively 12.53 and 3.28 under classic approach, while providing the highest value for the Developed Europe portfolio under Stein approach. On the other hand, in the 92-93 period it provided the highest marginal potential performance for the Developed Europe and the Pacific Rim portfolios, respectively 352 and 68 under classic approach, while providing the highest for North America and the Pacific Rim portfolios, respectively 7.17 and 7.12 under Stein approach. In the 94-95 period its highest contribution is observed for the Latin America and the G7 portfolios with respectively 47 and 29 marginal potential performance values under classic approach. However under stein approach it has provided 2.60 and 0.79 marginal potential performance for the Latin America and the North America portfolios respectively. Finally in the 97-98 period, the highest marginal potential performance is achieved for the Developed Europe and the Middle East portfolios, respectively 543 and 54 while Stein estimation suggests that the highest marginal potential performance value is achieved for the Pacific Rim portfolio. However, the spanning test statistic fails to reject the null hypothesis of zero marginal potential performance for all regions in all time periods investigated. The asset

set intersection tests made in the presence of the riskless asset also fail to reject the null hypothesis of zero implied marginal potential performance. Thus, it is concluded that the Turkish stock market fails to reduce the risk of the regional portfolios both in full and crises periods. However, it is also seen that due to higher risk free rates prevailing in the Turkish stock market, it has been beneficial for an international investor to invest in the Turkish T-bill rather than investing in the US T-bill as a riskless asset.

The possible reasons of the failure of the Turkish stock market to provide significant risk reduction lie in the fact that Turkey is an emerging market. Consistent with the theory, the higher returns of the Turkish stock market had been accompanied by extreme volatility, resulting in huge losses during the bear markets. Over the full period, Turkey had experienced four major crises; the local currency crisis of 1994, the Russian crisis, and the local 2000:11 and 2001:02 currency crises. In the first 5 months of 1994, Turkey had four bear markets and had -0.20 average return, while having -0.02 return over the year. However, the Latin crises that had come out in late 1994 and continued in 1995 had not affected Turkey that severely. Over the year, the Turkish stock market has had positive but very small 0.001 average return with 0.16 standard deviation. During the 94-95 periods the Turkish stock market have had -0.013 average return with 0.17 standard deviation over all and it has been found to provide no significant risk reduction to the international portfolios. Meanwhile when only 1995 period is put into mean-variance analysis, the contribution of the Turkish stock market is found to have a positive marginal potential performance yet still insignificant. The Asian crisis had started in mid-1997 due to the speculative attack on Thai baht and has led to a huge decrease in international capital markets. However, Turkey had managed to stay unaffected and has had 0.05 average return with 0.15 standard deviation over the year.

Contrary to what is observed in the Asian crisis, in the Russian crisis that has followed in 1998 Turkey had been severely affected. It had experienced 5 bear markets and had -0.032 average return and 0.17 standard deviation over the year. The huge drops observed had been mainly attributed to the contagion. Thus, over the 97-98 period the Turkish stock market has had 0.013 average return but yet no significant risk reduction due to the inclusion of Turkey to the international portfolios has been evinced. Even when only 1997 period is studied, Turkey's positive marginal potential performance had been insignificant and thus negligible despite its high average return. Especially during Russian and local crises periods, the Turkish stock market had witnessed serious capital flights accompanied with devaluation of the local currency. The Turkish Lira has devalued over 22% in the 1994 crisis, 3.6% in Russian crisis, and 11% in the period from 2000:10 to 2001:04. These devaluations combined with extreme volatility had magnified the loss for the international investors. This extreme volatility mainly stems from the short-term speculative capital flows to which Turkish economy and stock market had been very vulnerable, due to the insufficient volume of the market. Therefore, the Turkish stock market had been open to speculative short-term moves, highly manipulated and extremely volatile. As a result of the extreme volatility and inflation pressure of Turkish economy on the Turkish stock market, the foreign capital flows had been mainly short-term instead of turning into long term investments. The political instability combined with the exchange rate risk, amplifies the speculative behavior of capital flows. This in return increases the volatility and destabilizes the Turkish stock market while creating side effects on the Turkish economy. In this respect the Turkish stock market is used as a short-term profit maximizing speculative market, leading to the elimination of possible long term benefits. As a result, this issue may constitute one of the major reasons of long-term insignificancy of the contribution of the Turkish stock market to global portfolios. Accordingly, over the full period and over the crises periods, the Turkish stock market's contribution to international portfolios in terms of international diversification benefit is found negligible.

In this study, a long term investigation is made using the monthly MSCI country index data. While no significant contribution is evidenced, inclusion of the Turkish stock market to global/regional portfolios is found to result in positive marginal potential performance. Despite the increased correlations in time, it is believed that a closer examination of the crises periods with higher frequency data could present significant diversification benefit, considering the short-term speculative usage of the Turkish stock market. Another intended research is elaborating the economic determinants of the correlation structure. The studies on this topic reveal that, actually correlation structure cannot only be modeled by economic determinants but can also be forecasted. The economic fundamentals of the countries are found to contain information about the correlation structure of countries' stock markets. The world market volatility, exchange rate volatility, bilateral trade, industrial production growth rate differential and regional trade variables had been significant factors in explaining the daily return correlation of the respective countries' stock markets. In this respect, the economic models of the correlation structure can be used to not only analyze but also predict the effect of possible changes in the economic variables by employing different scenarios. Furthermore, these models can help in the international portfolio diversification strategies to optimize the diversification benefits of a country by exploring the vulnerability of a country to contagion and its stock market interdependence with its strategic partners.

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APPENDIX A Autocorrelation Test Results

ARGENTINA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.023	0.023	0.100	0.752
.|. |	.|. |	2	-0.054	-0.054	0.630	0.730
.|. |	.|. |	3	-0.018	-0.016	0.693	0.875
.|. |	.|. |	4	0.019	0.017	0.763	0.943
.|. |	.|. |	5	-0.026	-0.029	0.893	0.971
.|. |	.|. |	6	0.037	0.041	1.159	0.979
.|. |	.|. |	7	0.041	0.037	1.482	0.983
*|. |	*|. |	8	-0.062	-0.062	2.228	0.973
.|. |	.|. |	9	0.018	0.028	2.289	0.986
.|. |	.|. |	10	0.032	0.024	2.488	0.991
.|. |	.|. |	11	-0.048	-0.050	2.931	0.992
.|. |	.|. |	12	0.038	0.049	3.215	0.994
.|* |	.|* |	13	0.089	0.077	4.769	0.980
.|. |	.|. |	14	-0.034	-0.035	4.998	0.986
*|. |	.|. |	15	-0.072	-0.054	6.045	0.979

AUSTRALIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	1	-0.065	-0.065	1.029	0.310
*|. |	*|. |	2	-0.069	-0.073	2.186	0.335
.|. |	.|. |	3	0.002	-0.007	2.187	0.534
.|. |	*|. |	4	-0.056	-0.062	2.951	0.566
*|. |	*|. |	5	-0.105	-0.116	5.696	0.337
.|. |	.|. |	6	0.039	0.014	6.066	0.416
.|. |	*|. |	7	-0.045	-0.060	6.568	0.475
.|. |	.|. |	8	-0.013	-0.024	6.613	0.579
.|. |	.|. |	9	0.034	0.010	6.903	0.647
.|. |	.|. |	10	0.017	0.008	6.978	0.728
.|. |	.|. |	11	0.019	0.023	7.065	0.794
*|. |	*|. |	12	-0.088	-0.100	9.056	0.698
.|. |	*|. |	13	-0.055	-0.066	9.831	0.708
.|. |	.|. |	14	-0.004	-0.024	9.836	0.774
.|. |	.|. |	15	0.015	0.003	9.896	0.826

AUSTRIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.099	0.099	2.405	0.121
.|. |	.|. |	2	-0.011	-0.022	2.437	0.296
.|. |	.|. |	3	-0.019	-0.016	2.527	0.471
.|* |	.|* |	4	0.094	0.099	4.712	0.318
.|* |	.|* |	5	0.156	0.138	10.707	0.058
.|. |	.|. |	6	-0.003	-0.030	10.709	0.098
.|. |	.|. |	7	0.048	0.062	11.294	0.126
.|. |	.|. |	8	-0.038	-0.052	11.651	0.167
.|. |	.|. |	9	0.043	0.028	12.127	0.206
.|* |	.|* |	10	0.144	0.126	17.360	0.067
.|. |	.|. |	11	0.009	-0.024	17.379	0.097
.|. |	.|. |	12	-0.018	-0.021	17.461	0.133
.|. |	.|. |	13	-0.009	0.012	17.482	0.178
.|. |	.|. |	14	0.024	-0.016	17.632	0.224
.|. |	*|. |	15	-0.026	-0.060	17.801	0.273

BELGIUM

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.024	0.024	0.142	0.706
.|* |	.|* |	2	0.096	0.095	2.375	0.305
*|. |	*|. |	3	-0.102	-0.108	4.945	0.176
.|. |	.|. |	4	0.012	0.009	4.980	0.289
.|. |	.|. |	5	-0.037	-0.018	5.321	0.378
.|. |	.|. |	6	0.030	0.019	5.538	0.477
.|* |	.|* |	7	0.164	0.173	12.209	0.094
.|* |	.|* |	8	0.090	0.073	14.253	0.075
.|* |	.|. |	9	0.091	0.064	16.322	0.060
.|. |	.|. |	10	0.037	0.054	16.662	0.082
.|. |	.|. |	11	0.007	0.004	16.673	0.118
.|. |	.|. |	12	-0.016	0.000	16.735	0.160
.|. |	.|. |	13	0.009	0.014	16.754	0.211
.|. |	.|. |	14	0.052	0.028	17.448	0.233
.|. |	*|. |	15	-0.048	-0.084	18.047	0.260

BRAZIL

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	1	-0.181	-0.181	6.031	0.014
.|. |	.|. |	2	0.040	0.008	6.332	0.042
*|. |	*|. |	3	-0.091	-0.085	7.860	0.049
*|. |	*|. |	4	-0.080	-0.115	9.044	0.060
.|. |	.|. |	5	0.040	0.008	9.352	0.096
*|. |	*|. |	6	-0.064	-0.064	10.130	0.119
.|* |	.|. |	7	0.087	0.048	11.588	0.115
.|. |	.|. |	8	-0.054	-0.035	12.153	0.145
.|* |	.|* |	9	0.113	0.094	14.605	0.102
*|. |	.|. |	10	-0.080	-0.045	15.853	0.104
.|. |	.|. |	11	0.018	0.003	15.916	0.144
.|* |	.|* |	12	0.071	0.087	16.899	0.153
.|* |	.|* |	13	0.081	0.133	18.180	0.151
.|. |	.|. |	14	-0.043	-0.031	18.554	0.183
.|. |	.|. |	15	-0.033	-0.012	18.767	0.224

CANADA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.081	0.081	1.606	0.205
.|. |	*|. |	2	-0.052	-0.059	2.259	0.323
.|. |	.|. |	3	0.000	0.009	2.259	0.520
*|. |	*|. |	4	-0.125	-0.130	6.116	0.191
.|. |	.|. |	5	0.012	0.035	6.150	0.292
.|. |	.|. |	6	0.009	-0.011	6.169	0.404
.|. |	.|. |	7	0.036	0.043	6.493	0.484
.|. |	.|. |	8	-0.023	-0.049	6.629	0.577
.|. |	.|. |	9	0.014	0.033	6.679	0.671
.|. |	.|. |	10	0.064	0.055	7.717	0.656
.|. |	.|. |	11	0.038	0.042	8.074	0.707
*|. |	*|. |	12	-0.105	-0.121	10.875	0.540
*|. |	.|. |	13	-0.081	-0.052	12.555	0.483
*|. |	*|. |	14	-0.076	-0.070	14.054	0.446
*|. |	*|. |	15	-0.085	-0.068	15.899	0.389

CHILE

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.149	0.149	4.074	0.044
*|. |	*|. |	2	-0.078	-0.103	5.212	0.074
.|. |	.|. |	3	0.002	0.031	5.213	0.157
.|. |	.|. |	4	-0.037	-0.052	5.463	0.243
.|. |	.|. |	5	0.029	0.048	5.617	0.345
.|. |	.|. |	6	-0.009	-0.031	5.631	0.466
.|* |	.|* |	7	0.161	0.184	10.568	0.159
.|. |	.|. |	8	0.060	-0.007	11.260	0.187
.|. |	.|. |	9	-0.038	-0.008	11.537	0.241
.|. |	.|. |	10	-0.053	-0.057	12.077	0.280
.|* |	.|* |	11	0.078	0.118	13.265	0.276
.|* |	.|. |	12	0.096	0.042	15.059	0.238
.|. |	.|* |	13	0.056	0.067	15.681	0.267
*|. |	*|. |	14	-0.059	-0.113	16.380	0.291
.|. |	.|* |	15	0.037	0.088	16.653	0.340

CHINA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.087	0.087	0.936	0.333
.|. |	.|. |	2	0.037	0.030	1.109	0.574
*|. |	*|. |	3	-0.147	-0.154	3.846	0.279
**|. |	**|. |	4	-0.248	-0.230	11.670	0.020
*|. |	.|. |	5	-0.088	-0.046	12.663	0.027
.|. |	.|. |	6	0.018	0.029	12.703	0.048
.|. |	.|. |	7	0.056	-0.006	13.119	0.069
.|. |	.|. |	8	0.055	-0.026	13.523	0.095
.|. |	.|. |	9	0.062	0.036	14.031	0.121
.|. |	.|. |	10	0.026	0.037	14.120	0.168
*|. |	*|. |	11	-0.120	-0.119	16.068	0.139
.|. |	.|. |	12	-0.023	0.005	16.139	0.185
*|. |	*|. |	13	-0.100	-0.063	17.514	0.177
.|. |	.|. |	14	-0.012	-0.016	17.534	0.229
*|. |	*|. |	15	-0.107	-0.170	19.148	0.207

COLOMBIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.076	0.076	0.717	0.397
*|. |	*|. |	2	-0.071	-0.078	1.354	0.508
*|. |	*|. |	3	-0.146	-0.136	4.031	0.258
.|* |	.|* |	4	0.071	0.090	4.675	0.322
.|* |	.|* |	5	0.128	0.100	6.775	0.238
.|* |	.|* |	6	0.112	0.089	8.404	0.210
.|. |	.|. |	7	-0.013	0.008	8.427	0.296
**|. |	*|. |	8	-0.190	-0.163	13.166	0.106
*|. |	*|. |	9	-0.111	-0.087	14.811	0.096
.|* |	.|. |	10	0.075	0.046	15.558	0.113
.|* |	.|. |	11	0.109	0.036	17.170	0.103
*|. |	*|. |	12	-0.059	-0.071	17.653	0.127
*|. |	.|. |	13	-0.120	-0.047	19.627	0.105
*|. |	.|. |	14	-0.062	-0.003	20.163	0.125
*|. |	*|. |	15	-0.104	-0.138	21.690	0.116

CZHECH

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.037	-0.037	0.136	0.712
. | . |	.*| . |	2	-0.057	-0.059	0.466	0.792
.*| . |	.*| . |	3	-0.172	-0.178	3.499	0.321
.*| . |	.*| . |	4	-0.067	-0.089	3.963	0.411
. | . |	. | . |	5	0.041	0.012	4.142	0.529
. |*. |	. |*. |	6	0.115	0.081	5.548	0.476
. | . |	. | . |	7	0.061	0.052	5.944	0.546
.*| . |	. | . |	8	-0.076	-0.056	6.573	0.583
. | . |	. | . |	9	-0.009	0.029	6.581	0.681
. |*. |	. |*. |	10	0.118	0.152	8.114	0.618
.*| . |	.*| . |	11	-0.133	-0.145	10.097	0.522
. | . |	. | . |	12	-0.014	-0.038	10.118	0.606
.*| . |	.*| . |	13	-0.125	-0.115	11.906	0.535
.*| . |	.*| . |	14	-0.064	-0.109	12.374	0.576
. |*. |	. |*. |	15	0.168	0.131	15.683	0.403

DENMARK

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>*|. |</td><td>*|. |</td><td>1</td><td>-0.113</td><td>-0.113</td><td>3.086</td><td>0.079</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>0.023</td><td>0.011</td><td>3.216</td><td>0.200</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>3</td><td>0.047</td><td>0.051</td><td>3.753</td><td>0.289</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>4</td><td>0.091</td><td>0.103</td><td>5.775</td><td>0.217</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>5</td><td>0.014</td><td>0.035</td><td>5.823</td><td>0.324</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>6</td><td>0.078</td><td>0.079</td><td>7.316</td><td>0.293</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>7</td><td>0.099</td><td>0.110</td><td>9.757</td><td>0.203</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>8</td><td>-0.048</td><td>-0.038</td><td>10.336</td><td>0.242</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>9</td><td>0.022</td><td>-0.005</td><td>10.460</td><td>0.315</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>10</td><td>-0.097</td><td>-0.126</td><td>12.834</td><td>0.233</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>0.044</td><td>-0.005</td><td>13.315</td><td>0.273</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>12</td><td>-0.129</td><td>-0.136</td><td>17.560</td><td>0.130</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>0.049</td><td>0.012</td><td>18.169</td><td>0.151</td></tr>
<tr><td>*|. |</td><td>*|. |</td><td>14</td><td>-0.142</td><td>-0.128</td><td>23.325</td><td>0.055</td></tr>
<tr><td>.|. |</td><td>*|. |</td><td>15</td><td>-0.051</td><td>-0.063</td><td>23.989</td><td>0.065</td></tr>
</table>

EGYPT

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>1</td><td>0.150</td><td>0.150</td><td>2.256</td><td>0.133</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>2</td><td>0.197</td><td>0.178</td><td>6.166</td><td>0.046</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>3</td><td>0.091</td><td>0.042</td><td>7.012</td><td>0.072</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>4</td><td>0.003</td><td>-0.051</td><td>7.013</td><td>0.135</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>5</td><td>0.074</td><td>0.058</td><td>7.581</td><td>0.181</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>6</td><td>0.081</td><td>0.075</td><td>8.274</td><td>0.219</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>7</td><td>-0.045</td><td>-0.089</td><td>8.491</td><td>0.291</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>8</td><td>-0.099</td><td>-0.130</td><td>9.548</td><td>0.298</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>9</td><td>-0.015</td><td>0.035</td><td>9.571</td><td>0.386</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>10</td><td>-0.023</td><td>0.032</td><td>9.630</td><td>0.474</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>11</td><td>0.150</td><td>0.158</td><td>12.147</td><td>0.353</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>12</td><td>-0.110</td><td>-0.174</td><td>13.507</td><td>0.333</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>13</td><td>-0.021</td><td>-0.028</td><td>13.557</td><td>0.406</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>14</td><td>-0.084</td><td>-0.031</td><td>14.377</td><td>0.422</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>15</td><td>-0.087</td><td>-0.048</td><td>15.265</td><td>0.433</td></tr>
</table>

FINLAND

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>1</td><td>0.150</td><td>0.150</td><td>2.256</td><td>0.133</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>2</td><td>0.197</td><td>0.178</td><td>6.166</td><td>0.046</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>3</td><td>0.091</td><td>0.042</td><td>7.012</td><td>0.072</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>4</td><td>0.003</td><td>-0.051</td><td>7.013</td><td>0.135</td></tr>
<tr><td>. |*. |</td><td>. | . |</td><td>5</td><td>0.074</td><td>0.058</td><td>7.581</td><td>0.181</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>6</td><td>0.081</td><td>0.075</td><td>8.274</td><td>0.219</td></tr>
<tr><td>. | . |</td><td>.*| . |</td><td>7</td><td>-0.045</td><td>-0.089</td><td>8.491</td><td>0.291</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>8</td><td>-0.099</td><td>-0.130</td><td>9.548</td><td>0.298</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>9</td><td>-0.015</td><td>0.035</td><td>9.571</td><td>0.386</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>10</td><td>-0.023</td><td>0.032</td><td>9.630</td><td>0.474</td></tr>
<tr><td>. |*. |</td><td>. |*. |</td><td>11</td><td>0.150</td><td>0.158</td><td>12.147</td><td>0.353</td></tr>
<tr><td>.*| . |</td><td>.*| . |</td><td>12</td><td>-0.110</td><td>-0.174</td><td>13.507</td><td>0.333</td></tr>
<tr><td>. | . |</td><td>. | . |</td><td>13</td><td>-0.021</td><td>-0.028</td><td>13.557</td><td>0.406</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>14</td><td>-0.084</td><td>-0.031</td><td>14.377</td><td>0.422</td></tr>
<tr><td>.*| . |</td><td>. | . |</td><td>15</td><td>-0.087</td><td>-0.048</td><td>15.265</td><td>0.433</td></tr>
</table>

FRANCE

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|. |</td><td>.|. |</td><td>1</td><td>-0.016</td><td>-0.016</td><td>0.066</td><td>0.797</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>2</td><td>0.001</td><td>0.001</td><td>0.066</td><td>0.967</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>3</td><td>0.083</td><td>0.083</td><td>1.742</td><td>0.628</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>4</td><td>0.040</td><td>0.043</td><td>2.138</td><td>0.710</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>5</td><td>0.018</td><td>0.020</td><td>2.222</td><td>0.818</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>6</td><td>-0.005</td><td>-0.012</td><td>2.228</td><td>0.898</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>7</td><td>0.094</td><td>0.087</td><td>4.430</td><td>0.729</td></tr>
<tr><td>.|* |</td><td>.|* |</td><td>8</td><td>0.077</td><td>0.077</td><td>5.918</td><td>0.656</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>9</td><td>-0.028</td><td>-0.025</td><td>6.117</td><td>0.728</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>10</td><td>0.044</td><td>0.029</td><td>6.612</td><td>0.762</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>11</td><td>0.057</td><td>0.041</td><td>7.428</td><td>0.763</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>12</td><td>-0.032</td><td>-0.035</td><td>7.696</td><td>0.808</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>13</td><td>0.000</td><td>-0.007</td><td>7.696</td><td>0.863</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>14</td><td>0.006</td><td>-0.010</td><td>7.706</td><td>0.904</td></tr>
<tr><td>.|. |</td><td>.|. |</td><td>15</td><td>-0.037</td><td>-0.052</td><td>8.058</td><td>0.921</td></tr>
</table>

GERMANY

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.025	-0.025	0.153	0.696
.|. |	.|. |	2	0.027	0.026	0.325	0.850
.|. |	.|. |	3	0.028	0.030	0.521	0.914
.|* |	.|* |	4	0.076	0.077	1.952	0.745
.|. |	.|. |	5	-0.045	-0.043	2.457	0.783
.|* |	.|* |	6	0.095	0.089	4.704	0.582
.|* |	.|* |	7	0.091	0.095	6.779	0.452
.|* |	.|* |	8	0.078	0.077	8.301	0.405
*|. |	*|. |	9	-0.113	-0.114	11.500	0.243
.|. |	.|. |	10	0.051	0.021	12.157	0.275
.|* |	.|* |	11	0.088	0.089	14.102	0.227
.|. |	.|. |	12	-0.024	-0.027	14.247	0.285
.|. |	.|. |	13	-0.028	-0.035	14.441	0.344
.|. |	*|. |	14	-0.028	-0.073	14.637	0.403
*|. |	*|. |	15	-0.064	-0.067	15.694	0.403

HONG KONG

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.003	-0.003	0.002	0.961
.|. |	.|. |	2	-0.050	-0.050	0.616	0.735
.|. |	.|. |	3	-0.046	-0.046	1.128	0.770
*|. |	*|. |	4	-0.097	-0.101	3.456	0.485
*|. |	*|. |	5	-0.086	-0.094	5.295	0.381
.|. |	.|. |	6	0.016	0.000	5.355	0.499
.|* |	.|* |	7	0.141	0.125	10.316	0.171
.|. |	.|. |	8	0.052	0.041	10.988	0.202
.|. |	.|. |	9	0.022	0.022	11.106	0.269
.|* |	.|* |	10	0.092	0.108	13.254	0.210
*|. |	*|. |	11	-0.108	-0.074	16.203	0.134
*|. |	*|. |	12	-0.101	-0.066	18.787	0.094
*|. |	*|. |	13	-0.070	-0.070	20.047	0.094
.|. |	.|. |	14	0.020	0.002	20.149	0.126
.|. |	.|. |	15	0.007	-0.021	20.161	0.166

HUNGARY

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.029	-0.029	0.085	0.771
**| . |	**| . |	2	-0.221	-0.222	5.036	0.081
. |*. |	. |*. |	3	0.077	0.066	5.643	0.130
. | . |	.*| . |	4	-0.026	-0.075	5.712	0.222
. | . |	. | . |	5	-0.012	0.019	5.728	0.334
. | . |	.*| . |	6	-0.028	-0.059	5.809	0.445
. |*. |	. |*. |	7	0.153	0.172	8.311	0.306
.*| . |	.*| . |	8	-0.079	-0.109	8.983	0.344
. | . |	. |*. |	9	0.033	0.130	9.101	0.428
. |*. |	. | . |	10	0.096	0.018	10.111	0.431
. | . |	. | . |	11	-0.030	0.053	10.210	0.512
. | . |	. | . |	12	0.060	0.059	10.622	0.562
. | . |	. |*. |	13	0.058	0.092	11.004	0.610
. | . |	.*| . |	14	-0.049	-0.060	11.286	0.663
.*| . |	. | . |	15	-0.093	-0.038	12.300	0.656

INDIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.083	0.083	0.853	0.356
.|* |	.|* |	2	0.104	0.098	2.211	0.331
*|. |	*|. |	3	-0.089	-0.107	3.208	0.361
.|. |	.|. |	4	-0.045	-0.040	3.461	0.484
.|. |	.|. |	5	-0.001	0.028	3.461	0.629
.|* |	.|* |	6	0.167	0.170	7.064	0.315
*|. |	*|. |	7	-0.098	-0.144	8.308	0.306
*|. |	*|. |	8	-0.125	-0.155	10.364	0.240
.|. |	.|. |	9	-0.055	0.033	10.770	0.292
.|. |	.|* |	10	0.057	0.107	11.204	0.342
.|. |	.|. |	11	0.037	-0.016	11.387	0.411
.|* |	.|* |	12	0.147	0.075	14.345	0.279
*|. |	*|. |	13	-0.114	-0.094	16.143	0.241
*|. |	*|. |	14	-0.114	-0.086	17.945	0.209
*|. |	*|. |	15	-0.168	-0.143	21.898	0.111

INDONESIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.146	0.146	3.918	0.048
*|. |	*|. |	2	-0.080	-0.104	5.108	0.078
.|. |	.|. |	3	-0.033	-0.006	5.317	0.150
.|* |	.|* |	4	0.071	0.071	6.265	0.180
.|* |	.|. |	5	0.076	0.052	7.359	0.195
.|* |	.|* |	6	0.095	0.090	9.067	0.170
.|. |	.|. |	7	0.064	0.053	9.845	0.198
.|** |	.|** |	8	0.201	0.208	17.563	0.025
.|. |	.|. |	9	0.011	-0.043	17.589	0.040
*|. |	.|. |	10	-0.082	-0.056	18.883	0.042
*|. |	*|. |	11	-0.120	-0.121	21.681	0.027
.|. |	.|. |	12	0.006	-0.020	21.688	0.041
.|. |	*|. |	13	-0.027	-0.094	21.828	0.058
*|. |	*|. |	14	-0.065	-0.098	22.656	0.066
*|. |	*|. |	15	-0.067	-0.057	23.556	0.073

IRELAND

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.036	-0.036	0.238	0.626
*|. |	*|. |	2	-0.074	-0.076	1.261	0.532
.|. |	.|. |	3	-0.051	-0.057	1.744	0.627
.|. |	.|. |	4	0.009	-0.001	1.760	0.780
.|. |	.|. |	5	0.034	0.026	1.975	0.853
*|. |	*|. |	6	-0.085	-0.086	3.352	0.764
.|. |	.|. |	7	0.045	0.044	3.746	0.809
*|. |	*|. |	8	-0.077	-0.085	4.872	0.771
.|* |	.|* |	9	0.153	0.148	9.358	0.405
.|* |	.|* |	10	0.075	0.078	10.440	0.403
.|* |	.|* |	11	0.085	0.118	11.861	0.374
*|. |	*|. |	12	-0.123	-0.105	14.830	0.251
*|. |	*|. |	13	-0.107	-0.084	17.086	0.195
.|* |	.|. |	14	0.070	0.029	18.068	0.204
.|. |	.|* |	15	0.053	0.068	18.626	0.231

ISRAEL

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.008	0.008	0.008	0.927
*|. |	*|. |	2	-0.085	-0.086	0.922	0.631
.|. |	.|. |	3	0.019	0.021	0.969	0.809
.|. |	.|. |	4	0.055	0.047	1.351	0.853
*|. |	*|. |	5	-0.142	-0.141	3.936	0.559
.|. |	.|. |	6	0.018	0.031	3.977	0.680
.|. |	.|. |	7	0.050	0.025	4.305	0.744
.|** |	.|** |	8	0.219	0.230	10.626	0.224
*|. |	*|. |	9	-0.157	-0.157	13.899	0.126
.|. |	.|. |	10	-0.013	0.010	13.920	0.177
.|* |	.|* |	11	0.163	0.146	17.510	0.094
.|. |	.|. |	12	0.020	0.006	17.563	0.130
*|. |	*|. |	13	-0.175	-0.096	21.776	0.059
*|. |	*|. |	14	-0.094	-0.170	23.008	0.060
*|. |	*|. |	15	-0.084	-0.118	24.006	0.065

ITALY

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.037	0.037	0.341	0.559
.|. |	.|. |	2	-0.001	-0.003	0.342	0.843
.|* |	.|* |	3	0.091	0.092	2.389	0.496
.|* |	.|* |	4	0.079	0.072	3.911	0.418
.|* |	.|* |	5	0.087	0.084	5.793	0.327
.|. |	.|. |	6	0.062	0.051	6.761	0.344
.|. |	.|. |	7	-0.011	-0.026	6.791	0.451
.|* |	.|* |	8	0.142	0.127	11.870	0.157
.|* |	.|* |	9	0.097	0.070	14.234	0.114
.|. |	.|. |	10	-0.026	-0.039	14.400	0.155
.|* |	.|* |	11	0.107	0.087	17.331	0.098
.|* |	.|. |	12	0.069	0.034	18.539	0.100
.|. |	.|. |	13	-0.024	-0.051	18.690	0.133
.|. |	.|. |	14	0.015	-0.019	18.745	0.175
.|. |	*|. |	15	-0.040	-0.062	19.155	0.207

JAPAN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.037	0.037	0.341	0.559
.|. |	.|. |	2	-0.016	-0.018	0.405	0.817
.|* |	.|* |	3	0.072	0.073	1.675	0.643
.|. |	.|. |	4	0.011	0.005	1.706	0.790
.|* |	.|* |	5	0.085	0.087	3.479	0.627
.|. |	.|. |	6	-0.001	-0.012	3.479	0.747
.|. |	.|. |	7	-0.005	-0.002	3.486	0.837
.|* |	.|* |	8	0.101	0.090	6.045	0.642
.|* |	.|* |	9	0.168	0.164	13.142	0.156
.|. |	.|. |	10	0.058	0.048	13.992	0.173
.|* |	.|* |	11	0.103	0.101	16.661	0.118
.|. |	.|. |	12	0.033	0.011	16.942	0.152
.|. |	.|. |	13	-0.029	-0.048	17.151	0.192
.|. |	.|. |	14	0.045	0.010	17.669	0.222
.|. |	.|. |	15	-0.032	-0.044	17.930	0.266

JORDAN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.037	0.037	0.257	0.612
.|. |	.|. |	2	0.036	0.035	0.502	0.778
.|. |	.|. |	3	0.025	0.023	0.622	0.891
.|* |	.|* |	4	0.115	0.112	3.093	0.542
.|. |	.|. |	5	0.012	0.003	3.120	0.681
*|. |	*|. |	6	-0.074	-0.084	4.157	0.656
.|. |	.|. |	7	0.028	0.029	4.309	0.744
.|. |	.|. |	8	0.045	0.036	4.696	0.790
.|* |	.|* |	9	0.164	0.165	9.866	0.361
.|. |	.|. |	10	-0.030	-0.028	10.039	0.437
.|. |	*|. |	11	-0.043	-0.065	10.404	0.494
.|. |	.|. |	12	-0.014	-0.035	10.443	0.577
.|* |	.|* |	13	0.127	0.109	13.613	0.402
*|. |	*|. |	14	-0.115	-0.111	16.219	0.300
.|. |	.|* |	15	0.055	0.097	16.819	0.330

KOREA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.076	0.076	1.064	0.302
*|. |	*|. |	2	-0.088	-0.095	2.504	0.286
.|* |	.|* |	3	0.074	0.090	3.518	0.318
.|. |	*|. |	4	-0.037	-0.061	3.776	0.437
.|. |	.|* |	5	0.054	0.081	4.329	0.503
.|* |	.|* |	6	0.122	0.096	7.166	0.306
.|. |	.|. |	7	-0.036	-0.036	7.412	0.387
.|. |	.|. |	8	0.046	0.065	7.825	0.451
.|* |	.|* |	9	0.129	0.103	11.032	0.274
.|. |	.|. |	10	-0.007	-0.005	11.041	0.354
.|. |	.|. |	11	0.046	0.049	11.450	0.406
*|. |	*|. |	12	-0.106	-0.145	13.637	0.324
*|. |	*|. |	13	-0.153	-0.116	18.273	0.147
.|. |	.|. |	14	0.003	-0.035	18.275	0.195
*|. |	*|. |	15	-0.064	-0.099	19.079	0.210

MALAYSIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|** |	.|** |	1	0.215	0.215	8.540	0.003
.|* |	.|* |	2	0.129	0.087	11.632	0.003
.|. |	.|. |	3	-0.004	-0.051	11.636	0.009
.|. |	.|. |	4	0.045	0.047	12.015	0.017
*|. |	*|. |	5	-0.102	-0.120	13.980	0.016
.|. |	.|. |	6	0.010	0.048	14.000	0.030
.|. |	.|. |	7	-0.004	0.012	14.003	0.051
.|. |	.|. |	8	0.063	0.050	14.762	0.064
.|* |	.|* |	9	0.123	0.121	17.671	0.039
.|* |	.|* |	10	0.142	0.071	21.552	0.018
*|. |	*|. |	11	-0.064	-0.135	22.358	0.022
.|. |	.|. |	12	-0.018	-0.001	22.421	0.033
.|. |	.|. |	13	-0.015	0.015	22.464	0.049
.|. |	.|. |	14	0.005	0.016	22.469	0.069
*|. |	*|. |	15	-0.100	-0.080	24.450	0.058

MEXICO

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.093	0.093	1.601	0.206
.|. |	.|. |	2	-0.042	-0.051	1.924	0.382
.|. |	.|. |	3	0.026	0.035	2.052	0.562
.|. |	.|. |	4	-0.010	-0.018	2.071	0.723
*|. |	*|. |	5	-0.091	-0.087	3.639	0.602
.|. |	.|. |	6	0.006	0.022	3.646	0.724
*|. |	*|. |	7	-0.090	-0.103	5.194	0.636
.|* |	.|* |	8	0.120	0.151	7.970	0.436
.|* |	.|. |	9	0.098	0.059	9.817	0.365
.|* |	.|* |	10	0.118	0.120	12.511	0.252
.|. |	.|. |	11	-0.025	-0.051	12.638	0.318
.|. |	.|. |	12	0.053	0.055	13.183	0.356
**|. |	**|. |	13	-0.191	-0.203	20.403	0.086
.|. |	.|. |	14	-0.012	0.047	20.432	0.117
.|. |	.|. |	15	-0.029	-0.027	20.602	0.150

MOROCCO

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.092	0.092	0.846	0.358
. | . |	. | . |	2	0.040	0.032	1.005	0.605
. |*. |	. |*. |	3	0.071	0.066	1.526	0.676
.*| . |	.*| . |	4	-0.061	-0.076	1.916	0.751
. |*. |	. |*. |	5	0.118	0.129	3.378	0.642
. |*. |	. |*. |	6	0.188	0.170	7.108	0.311
. | . |	. | . |	7	0.034	0.006	7.234	0.405
. | . |	. | . |	8	0.017	-0.021	7.263	0.509
. |*. |	. |*. |	9	0.167	0.172	10.312	0.326
.*| . |	.*| . |	10	-0.112	-0.139	11.689	0.306
. |** |	. |** |	11	0.256	0.256	18.983	0.061
. |*. |	. | . |	12	0.124	0.027	20.734	0.054
. |*. |	. |*. |	13	0.079	0.106	21.441	0.065
. |*. |	. | . |	14	0.132	0.034	23.443	0.053
. | . |	. |*. |	15	0.063	0.073	23.912	0.067

NETHERLANDS

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	1	-0.116	-0.116	3.275	0.070
.|. |	.|. |	2	0.039	0.026	3.642	0.162
.|. |	.|. |	3	-0.031	-0.024	3.875	0.275
.|. |	.|. |	4	-0.023	-0.030	4.001	0.406
.|. |	.|. |	5	-0.027	-0.032	4.178	0.524
.|. |	.|. |	6	0.027	0.022	4.362	0.628
.|. |	.|. |	7	0.056	0.063	5.157	0.641
.|* |	.|* |	8	0.105	0.117	7.923	0.441
.|. |	.|. |	9	0.032	0.057	8.188	0.515
.|* |	.|* |	10	0.085	0.097	10.000	0.441
.|. |	.|. |	11	-0.018	0.014	10.084	0.523
.|* |	.|* |	12	0.075	0.086	11.518	0.485
.|. |	.|. |	13	-0.027	0.004	11.704	0.552
.|. |	.|. |	14	0.018	0.010	11.787	0.623
*|. |	*|. |	15	-0.097	-0.107	14.193	0.511

NEWZEALAND

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.018	0.018	0.077	0.781
.|. |	.|. |	2	-0.038	-0.038	0.431	0.806
.|* |	.|* |	3	0.107	0.108	3.226	0.358
.|. |	.|. |	4	-0.017	-0.023	3.296	0.510
*|. |	.|. |	5	-0.058	-0.050	4.135	0.530
.|* |	.|* |	6	0.077	0.068	5.620	0.467
.|. |	.|. |	7	0.021	0.018	5.735	0.571
.|. |	.|. |	8	0.016	0.032	5.803	0.669
.|** |	.|* |	9	0.204	0.191	16.271	0.061
.|. |	.|. |	10	0.064	0.056	17.315	0.068
.|. |	.|. |	11	0.034	0.054	17.608	0.091
*|. |	*|. |	12	-0.105	-0.149	20.408	0.060
.|. |	.|. |	13	-0.028	-0.030	20.604	0.081
.|. |	.|. |	14	-0.030	-0.032	20.835	0.106
.|. |	.|. |	15	-0.055	-0.055	21.606	0.119

NORWAY

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.014	0.014	0.047	0.828
*|. |	*|. |	2	-0.081	-0.081	1.649	0.439
.|* |	.|* |	3	0.101	0.104	4.157	0.245
*|. |	*|. |	4	-0.104	-0.116	6.803	0.147
*|. |	*|. |	5	-0.089	-0.068	8.762	0.119
.|. |	.|. |	6	0.036	0.012	9.087	0.169
.|. |	.|. |	7	-0.007	0.000	9.100	0.246
.|. |	.|. |	8	-0.043	-0.036	9.563	0.297
.|. |	.|. |	9	0.062	0.043	10.521	0.310
.|* |	.|. |	10	0.071	0.064	11.811	0.298
.|. |	.|. |	11	0.045	0.062	12.314	0.340
*|. |	*|. |	12	-0.060	-0.075	13.240	0.352
.|. |	.|. |	13	-0.017	-0.013	13.311	0.424
.|. |	.|. |	14	-0.041	-0.039	13.733	0.470
*|. |	*|. |	15	-0.111	-0.085	16.931	0.323

PAKISTAN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.034	-0.034	0.144	0.704
.|* |	.|* |	2	0.070	0.069	0.764	0.682
.|. |	.|. |	3	0.000	0.005	0.764	0.858
.|. |	.|. |	4	-0.007	-0.012	0.770	0.942
.|. |	.|. |	5	-0.014	-0.015	0.794	0.977
.|. |	.|. |	6	0.034	0.035	0.943	0.988
.|. |	.|. |	7	-0.054	-0.050	1.326	0.988
.|* |	.|* |	8	0.073	0.066	2.035	0.980
.|. |	.|. |	9	-0.043	-0.032	2.280	0.986
.|* |	.|. |	10	0.072	0.062	2.977	0.982
*|. |	*|. |	11	-0.116	-0.111	4.795	0.941
.|. |	*|. |	12	-0.051	-0.067	5.155	0.953
.|. |	.|. |	13	-0.057	-0.043	5.595	0.960
.|. |	.|. |	14	0.025	0.027	5.682	0.974
*|. |	*|. |	15	-0.159	-0.149	9.247	0.864

PERU

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.186	0.186	4.309	0.038
*|. |	*|. |	2	-0.113	-0.153	5.893	0.053
*|. |	*|. |	3	-0.141	-0.093	8.386	0.039
*|. |	*|. |	4	-0.086	-0.059	9.325	0.053
*|. |	*|. |	5	-0.164	-0.177	12.762	0.026
.|. |	.|. |	6	-0.027	0.005	12.859	0.045
.|** |	.|** |	7	0.253	0.221	21.209	0.003
.|* |	*|. |	8	0.067	-0.076	21.796	0.005
.|* |	.|* |	9	0.066	0.118	22.380	0.008
.|. |	.|. |	10	-0.017	-0.023	22.419	0.013
.|. |	.|. |	11	-0.049	-0.021	22.748	0.019
*|. |	.|. |	12	-0.082	0.023	23.669	0.023
*|. |	*|. |	13	-0.097	-0.095	24.960	0.023
.|* |	.|* |	14	0.177	0.195	29.320	0.009
.|* |	.|. |	15	0.104	0.012	30.846	0.009

PHILIPPINES

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.193	0.193	6.881	0.009
.|* |	.|. |	2	0.069	0.032	7.750	0.021
.|. |	.|. |	3	-0.013	-0.033	7.781	0.051
.|. |	.|. |	4	-0.031	-0.026	7.960	0.093
.|. |	.|. |	5	-0.036	-0.024	8.207	0.145
.|. |	.|. |	6	0.015	0.030	8.248	0.221
.|. |	.|. |	7	-0.043	-0.051	8.598	0.283
.|* |	.|* |	8	0.096	0.113	10.351	0.241
.|. |	.|. |	9	0.006	-0.031	10.357	0.322
*|. |	*|. |	10	-0.070	-0.083	11.308	0.334
.|. |	.|. |	11	-0.042	-0.009	11.654	0.390
.|* |	.|* |	12	0.152	0.184	16.211	0.182
.|. |	*|. |	13	-0.037	-0.102	16.484	0.224
.|. |	*|. |	14	-0.044	-0.059	16.862	0.264
.|. |	.|. |	15	-0.056	-0.015	17.477	0.291

POLAND

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.070	0.070	0.608	0.435
.|* |	.|* |	2	0.113	0.109	2.210	0.331
.|* |	.|* |	3	0.099	0.086	3.445	0.328
.|. |	.|. |	4	-0.024	-0.048	3.517	0.475
.|. |	.|. |	5	0.062	0.047	4.005	0.549
.|* |	.|* |	6	0.100	0.096	5.309	0.505
.|* |	.|* |	7	0.098	0.086	6.570	0.475
.|. |	*|. |	8	-0.036	-0.080	6.737	0.565
.|* |	.|* |	9	0.154	0.134	9.879	0.360
*|. |	*|. |	10	-0.111	-0.133	11.520	0.318
*|. |	*|. |	11	-0.075	-0.086	12.286	0.343
.|. |	*|. |	12	-0.052	-0.071	12.656	0.395
*|. |	*|. |	13	-0.159	-0.122	16.158	0.241
.|* |	.|* |	14	0.127	0.161	18.413	0.189
*|. |	**|. |	15	-0.172	-0.191	22.566	0.094

PORTUGAL

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.018	0.018	0.061	0.804
.|. |	.|. |	2	0.008	0.008	0.073	0.964
.|. |	.|. |	3	0.021	0.021	0.156	0.984
*|. |	*|. |	4	-0.155	-0.156	4.680	0.322
.|. |	.|. |	5	0.001	0.007	4.680	0.456
.|. |	.|. |	6	-0.011	-0.009	4.704	0.582
.|* |	.|* |	7	0.115	0.125	7.216	0.407
.|. |	.|. |	8	0.064	0.036	8.003	0.433
.|. |	.|. |	9	-0.027	-0.031	8.145	0.520
.|. |	.|. |	10	0.060	0.051	8.835	0.548
.|. |	.|* |	11	0.062	0.098	9.577	0.569
*|. |	*|. |	12	-0.117	-0.110	12.254	0.426
.|* |	.|* |	13	0.087	0.085	13.729	0.393
.|. |	.|. |	14	-0.008	-0.013	13.742	0.469
*|. |	*|. |	15	-0.101	-0.090	15.791	0.396

RUSSIA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*. |	. |*. |	1	0.087	0.087	0.750	0.386
.*| . |	.*| . |	2	-0.159	-0.168	3.308	0.191
. | . |	. | . |	3	0.027	0.059	3.380	0.337
. | . |	. | . |	4	0.007	-0.030	3.385	0.496
.*| . |	. | . |	5	-0.066	-0.051	3.835	0.573
. | . |	. | . |	6	-0.045	-0.039	4.053	0.670
. | . |	. | . |	7	0.014	0.004	4.073	0.771
. |*. |	. |*. |	8	0.076	0.068	4.704	0.789
.*| . |	.*| . |	9	-0.114	-0.131	6.115	0.728
. |*. |	. |*. |	10	0.097	0.153	7.159	0.710
.*| . |	**| . |	11	-0.137	-0.239	9.254	0.598
. | . |	. |*. |	12	-0.030	0.093	9.356	0.672
. |*. |	. | . |	13	0.125	0.046	11.134	0.600
. | . |	. | . |	14	0.040	0.034	11.315	0.661
**| . |	**| . |	15	-0.196	-0.199	15.799	0.396

SINGAPORE

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.000	0.000	0.000	1.000
.|. |	.|. |	2	0.063	0.063	0.729	0.694
*|. |	*|. |	3	-0.121	-0.122	3.461	0.326
.|. |	.|. |	4	-0.005	-0.009	3.466	0.483
.|. |	.|. |	5	-0.004	0.011	3.469	0.628
.|. |	.|. |	6	0.050	0.037	3.947	0.684
.|* |	.|* |	7	0.078	0.077	5.097	0.648
.|* |	.|* |	8	0.077	0.073	6.221	0.623
.|. |	.|. |	9	-0.044	-0.044	6.585	0.680
.|. |	.|. |	10	0.021	0.031	6.668	0.756
*|. |	*|. |	11	-0.111	-0.091	9.089	0.614
.|* |	.|* |	12	0.110	0.100	11.470	0.489
.|. |	.|. |	13	-0.030	-0.022	11.649	0.557
.|. |	.|. |	14	0.037	-0.009	11.915	0.613
*|. |	*|. |	15	-0.120	-0.108	14.796	0.466

SOUTH AFRICA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.036	0.036	0.163	0.686
*|. |	*|. |	2	-0.140	-0.141	2.604	0.272
.|. |	.|. |	3	-0.019	-0.008	2.649	0.449
*|. |	**|. |	4	-0.180	-0.203	6.793	0.147
*|. |	*|. |	5	-0.090	-0.084	7.830	0.166
.|* |	.|* |	6	0.125	0.076	9.837	0.132
.|. |	.|. |	7	0.037	-0.001	10.017	0.188
.|. |	.|. |	8	0.055	0.051	10.417	0.237
.|* |	.|* |	9	0.110	0.090	12.016	0.212
.|. |	.|. |	10	-0.017	0.026	12.055	0.281
.|. |	.|* |	11	0.004	0.066	12.057	0.359
.|. |	.|. |	12	-0.034	-0.021	12.216	0.428
.|. |	.|* |	13	0.050	0.110	12.558	0.483
.|. |	.|. |	14	-0.007	-0.014	12.565	0.561
.|. |	.|. |	15	0.041	0.059	12.800	0.618

SPAIN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.066	0.066	1.044	0.307
*|. |	*|. |	2	-0.097	-0.101	3.326	0.190
*|. |	.|. |	3	-0.059	-0.046	4.166	0.244
.|. |	.|. |	4	0.042	0.040	4.593	0.332
.|. |	.|. |	5	0.007	-0.009	4.603	0.466
.|. |	.|* |	6	0.065	0.071	5.636	0.465
.|. |	.|. |	7	0.049	0.044	6.228	0.513
.|. |	.|. |	8	-0.005	0.000	6.234	0.621
.|. |	.|* |	9	0.056	0.074	7.016	0.635
.|* |	.|* |	10	0.166	0.161	13.962	0.175
.|. |	.|. |	11	0.040	0.030	14.360	0.214
*|. |	.|. |	12	-0.062	-0.032	15.339	0.223
.|. |	.|. |	13	0.011	0.032	15.368	0.285
.|. |	.|. |	14	0.006	-0.018	15.378	0.353
.|. |	.|. |	15	0.060	0.052	16.320	0.361

SWEDEN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.043	0.043	0.444	0.505
.|. |	.|. |	2	-0.038	-0.040	0.790	0.674
.|* |	.|* |	3	0.090	0.093	2.757	0.431
.|. |	*|. |	4	-0.049	-0.060	3.352	0.501
.|. |	.|. |	5	0.036	0.050	3.669	0.598
.|* |	.|* |	6	0.130	0.115	7.889	0.246
.|. |	*|. |	7	-0.057	-0.058	8.709	0.274
.|. |	.|. |	8	0.044	0.052	9.186	0.327
.|. |	.|. |	9	-0.012	-0.041	9.221	0.417
.|. |	.|. |	10	0.024	0.055	9.368	0.498
.|* |	.|. |	11	0.082	0.054	11.093	0.435
.|. |	.|. |	12	-0.021	-0.030	11.209	0.511
.|. |	.|. |	13	-0.031	-0.019	11.456	0.573
.|. |	*|. |	14	-0.033	-0.058	11.745	0.627
*|. |	*|. |	15	-0.147	-0.129	17.300	0.301

SWITZERLAND

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.005	0.005	0.006	0.938
.|. |	.|. |	2	-0.040	-0.040	0.397	0.820
.|. |	.|. |	3	-0.009	-0.009	0.418	0.937
.|. |	.|. |	4	-0.018	-0.020	0.500	0.974
.|* |	.|* |	5	0.147	0.147	5.870	0.319
.|. |	.|. |	6	-0.018	-0.022	5.947	0.429
.|. |	.|. |	7	0.007	0.019	5.958	0.545
.|* |	.|* |	8	0.140	0.143	10.831	0.211
.|. |	.|. |	9	0.047	0.053	11.376	0.251
.|. |	.|. |	10	0.020	0.009	11.472	0.322
.|. |	.|. |	11	-0.010	0.004	11.498	0.403
.|. |	.|. |	12	-0.044	-0.041	11.985	0.447
.|. |	.|. |	13	0.037	-0.002	12.338	0.500
*|. |	*|. |	14	-0.158	-0.180	18.744	0.175
.|. |	*|. |	15	-0.055	-0.067	19.518	0.191

TAIWAN

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.123	0.123	2.807	0.094
.|. |	.|. |	2	-0.006	-0.022	2.814	0.245
.|. |	.|. |	3	0.052	0.057	3.321	0.345
.|. |	.|. |	4	0.008	-0.005	3.334	0.504
*|. |	*|. |	5	-0.067	-0.067	4.179	0.524
*|. |	*|. |	6	-0.093	-0.081	5.834	0.442
.|. |	.|. |	7	-0.013	0.006	5.866	0.556
*|. |	*|. |	8	-0.104	-0.102	7.943	0.439
.|* |	.|* |	9	0.089	0.129	9.468	0.395
.|* |	.|* |	10	0.099	0.068	11.355	0.331
.|. |	.|. |	11	0.007	-0.010	11.363	0.413
.|. |	.|. |	12	-0.030	-0.047	11.541	0.483
.|. |	*|. |	13	-0.049	-0.067	12.008	0.527
.|* |	.|* |	14	0.085	0.094	13.430	0.493
.|. |	.|. |	15	-0.047	-0.040	13.869	0.536

THAILAND

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.100	0.100	1.832	0.176
.|. |	.|. |	2	-0.006	-0.016	1.840	0.399
.|. |	.|. |	3	-0.006	-0.004	1.848	0.605
**|. |	**|. |	4	-0.189	-0.190	8.559	0.073
*|. |	*|. |	5	-0.155	-0.123	13.083	0.023
.|* |	.|* |	6	0.084	0.110	14.411	0.025
.|* |	.|* |	7	0.126	0.116	17.442	0.015
.|* |	.|. |	8	0.083	0.034	18.745	0.016
.|* |	.|* |	9	0.159	0.103	23.608	0.005
.|. |	.|. |	10	0.058	0.052	24.252	0.007
*|. |	*|. |	11	-0.151	-0.104	28.676	0.003
.|. |	.|* |	12	0.043	0.109	29.038	0.004
.|. |	.|. |	13	-0.003	0.025	29.040	0.006
.|. |	.|. |	14	-0.024	0.005	29.157	0.010
.|* |	.|. |	15	0.074	0.012	30.235	0.011

TURKEY

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.036	0.036	0.238	0.626
*|. |	*|. |	2	-0.070	-0.071	1.142	0.565
.|* |	.|* |	3	0.081	0.087	2.361	0.501
.|* |	.|* |	4	0.093	0.083	3.992	0.407
*|. |	*|. |	5	-0.136	-0.134	7.486	0.187
.|. |	.|. |	6	-0.023	-0.006	7.585	0.270
.|. |	.|. |	7	0.060	0.031	8.261	0.310
.|. |	.|. |	8	0.017	0.024	8.314	0.403
.|. |	.|. |	9	0.013	0.044	8.346	0.500
.|* |	.|. |	10	0.068	0.048	9.245	0.509
*|. |	*|. |	11	-0.108	-0.131	11.537	0.399
.|. |	.|. |	12	0.020	0.044	11.617	0.477
*|. |	*|. |	13	-0.146	-0.180	15.836	0.258
*|. |	*|. |	14	-0.153	-0.130	20.508	0.115
.|. |	.|. |	15	-0.056	-0.032	21.126	0.133

UK

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.050	-0.050	0.611	0.435
*|. |	*|. |	2	-0.062	-0.064	1.541	0.463
.|. |	.|. |	3	-0.040	-0.047	1.940	0.585
.|. |	.|. |	4	0.052	0.043	2.601	0.627
.|. |	.|. |	5	-0.017	-0.018	2.675	0.750
.|. |	.|. |	6	-0.038	-0.036	3.032	0.805
.|. |	.|. |	7	0.037	0.036	3.378	0.848
.|. |	.|. |	8	-0.003	-0.008	3.381	0.908
.|. |	.|. |	9	0.013	0.016	3.424	0.945
.|* |	.|* |	10	0.075	0.083	4.848	0.901
.|* |	.|* |	11	0.094	0.101	7.109	0.790
*|. |	.|. |	12	-0.060	-0.038	8.012	0.784
.|. |	.|. |	13	-0.008	0.007	8.030	0.842
.|. |	.|. |	14	0.015	0.010	8.087	0.885
.|. |	.|. |	15	0.004	-0.004	8.092	0.920

USA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.021	-0.021	0.107	0.744
.|. |	.|. |	2	-0.005	-0.006	0.113	0.945
.|. |	.|. |	3	-0.031	-0.031	0.345	0.951
*|. |	*|. |	4	-0.074	-0.075	1.688	0.793
.|* |	.|* |	5	0.089	0.086	3.655	0.600
.|. |	.|. |	6	-0.006	-0.004	3.664	0.722
.|* |	.|* |	7	0.070	0.067	4.889	0.674
.|. |	.|. |	8	-0.014	-0.012	4.941	0.764
.|. |	.|. |	9	0.012	0.026	4.979	0.836
.|* |	.|* |	10	0.098	0.096	7.423	0.685
.|* |	.|* |	11	0.068	0.084	8.592	0.659
.|. |	.|. |	12	-0.014	-0.022	8.642	0.733
.|. |	.|. |	13	0.029	0.043	8.860	0.783
.|. |	.|. |	14	0.034	0.048	9.164	0.820
*|. |	*|. |	15	-0.088	-0.094	11.185	0.739

VENEZUELA

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	1	-0.078	-0.078	0.755	0.385
*|. |	*|. |	2	-0.092	-0.099	1.814	0.404
.|. |	.|. |	3	-0.035	-0.051	1.965	0.580
.|. |	*|. |	4	-0.052	-0.070	2.312	0.679
.|* |	.|* |	5	0.086	0.068	3.255	0.661
.|* |	.|* |	6	0.069	0.071	3.875	0.694
.|* |	.|* |	7	0.102	0.130	5.237	0.631
*|. |	.|. |	8	-0.077	-0.039	6.017	0.645
.|* |	.|* |	9	0.091	0.124	7.125	0.624
*|. |	*|. |	10	-0.098	-0.087	8.402	0.590
.|. |	.|. |	11	-0.033	-0.033	8.549	0.663
.|. |	.|. |	12	0.011	-0.044	8.566	0.740
*|. |	*|. |	13	-0.074	-0.093	9.319	0.748
.|. |	*|. |	14	-0.037	-0.098	9.504	0.797
.|. |	.|. |	15	0.064	0.049	10.075	0.815

APPENDIX B

Table 5.1 Developed Markets Full Period Correlation Matrix

	AUST	AUS	BEL	CAN	DEN	FIN	FRA	GER	HONG	IRE	ITA	JAP	NET	NEW	NOR	POR	SIN	SPA	SWE	SWIT	UK	USA	TUR
AUST	1.00																						
AUS	0.28	1.00																					
BEL	0.29	0.44	1.00																				
CAN	0.57	0.30	0.41	1.00																			
DEN	0.34	0.42	0.59	0.49	1.00																		
FIN	0.43	0.22	0.24	0.52	0.40	1.00																	
FRA	0.41	0.45	0.69	0.56	0.61	0.46	1.00																
GER	0.39	0.58	0.67	0.55	0.69	0.48	0.81	1.00															
HONG	0.46	0.35	0.30	0.58	0.32	0.34	0.37	0.39	1.00														
IRE	0.45	0.44	0.53	0.43	0.55	0.40	0.50	0.55	0.39	1.00													
ITA	0.27	0.38	0.44	0.45	0.53	0.46	0.55	0.58	0.26	0.40	1.00												
JAP	0.38	0.22	0.38	0.39	0.34	0.36	0.42	0.35	0.34	0.44	0.34	1.00											
NET	0.48	0.53	0.72	0.61	0.67	0.50	0.76	0.78	0.46	0.62	0.53	0.45	1.00										
NEW	0.66	0.33	0.26	0.42	0.24	0.31	0.25	0.27	0.37	0.40	0.23	0.34	0.43	1.00									
NOR	0.50	0.47	0.49	0.55	0.57	0.46	0.52	0.52	0.42	0.57	0.44	0.35	0.62	0.46	1.00								
POR	0.30	0.41	0.45	0.39	0.46	0.34	0.49	0.51	0.31	0.50	0.44	0.32	0.57	0.36	0.41	1.00							
SIN	0.47	0.41	0.36	0.51	0.39	0.35	0.38	0.43	0.72	0.47	0.33	0.39	0.52	0.50	0.50	0.26	1.00						
SPA	0.47	0.43	0.55	0.52	0.59	0.48	0.65	0.63	0.45	0.62	0.58	0.46	0.65	0.44	0.56	0.66	0.46	1.00					
SWE	0.52	0.30	0.41	0.62	0.60	0.68	0.63	0.68	0.42	0.54	0.53	0.45	0.65	0.43	0.59	0.54	0.48	0.71	1.00				
SWIT	0.36	0.51	0.63	0.48	0.58	0.34	0.63	0.63	0.34	0.52	0.42	0.46	0.72	0.40	0.48	0.52	0.42	0.58	0.52	1.00			
UK	0.55	0.47	0.57	0.54	0.60	0.48	0.65	0.61	0.49	0.69	0.43	0.49	0.76	0.43	0.62	0.48	0.51	0.64	0.60	0.68	1.00		
USA	0.49	0.26	0.52	0.74	0.49	0.51	0.59	0.57	0.50	0.55	0.38	0.34	0.65	0.33	0.51	0.35	0.52	0.56	0.61	0.55	0.64	1.00	
TUR	0.11	0.28	0.11	0.21	0.17	0.26	0.25	0.27	0.19	0.24	0.15	0.07	0.24	0.16	0.20	0.32	0.27	0.19	0.31	0.17	0.18	0.21	1.00

Full sample correlations from 1988:02 to 2003:02

Table 5.5 Emerging Markets Full Period Correlation Matrix

	ARG	BRA	CHI	CHN	COL	CZE	EGY	HUN	IND	INDO	ISR	JOR	KOR	MAL	MEX	MOR	PAK	PER	PHI	POL	RUS	SOU	TAI	THA	TUR	VEN
ARG	1.00																									
BRA	0.38	1.00																								
CHI	0.43	0.70	1.00																							
CHN	0.15	0.30	0.39	1.00																						
COL	0.26	0.18	0.35	0.22	1.00																					
CZE	0.19	0.39	0.34	0.11	0.09	1.00																				
EGY	0.20	0.23	0.37	-0.04	-0.15	0.05	1.00																			
HUN	0.20	0.45	0.33	0.14	0.09	0.67	0.26	1.00																		
IND	0.25	0.34	0.37	-0.06	-0.09	0.30	0.46	0.36	1.00																	
INDO	0.05	0.18	0.26	0.37	0.34	0.11	0.21	0.22	0.08	1.00																
ISR	0.38	0.53	0.47	0.21	-0.05	0.31	0.26	0.47	0.38	0.08	1.00															
JOR	0.02	-0.11	0.05	-0.18	0.08	-0.07	0.33	0.11	0.17	0.13	-0.21	1.00														
KOR	0.31	0.61	0.63	0.62	0.20	0.34	0.29	0.51	0.38	0.50	0.41	0.13	1.00													
MAL	0.28	0.29	0.46	0.31	0.43	0.17	0.15	0.22	0.20	0.53	0.14	0.06	0.41	1.00												
MEX	0.43	0.69	0.63	0.38	0.24	0.21	0.33	0.43	0.40	0.45	0.57	0.00	0.70	0.38	1.00											
MOR	-0.11	0.11	0.14	-0.16	-0.28	-0.02	0.25	0.14	0.13	-0.02	0.05	0.16	0.08	0.01	-0.06	1.00										
PAK	0.14	0.33	0.18	-0.01	0.17	0.42	0.05	0.40	0.36	0.06	0.11	0.15	0.22	0.11	0.21	-0.16	1.00									
PER	0.22	0.34	0.43	0.12	0.37	0.38	0.12	0.32	0.25	0.36	0.17	-0.12	0.28	0.35	0.44	-0.05	0.24	1.00								
PHI	0.24	0.32	0.39	0.30	0.36	0.07	0.31	0.23	0.19	0.70	0.16	0.05	0.48	0.42	0.49	0.10	0.07	0.40	1.00							
POL	0.28	0.60	0.53	0.18	0.03	0.51	0.43	0.68	0.44	0.25	0.46	0.08	0.55	0.26	0.56	0.05	0.35	0.27	0.34	1.00						
RUS	0.22	0.40	0.57	0.39	0.36	0.17	0.30	0.24	0.27	0.40	0.39	0.10	0.47	0.44	0.57	-0.15	0.26	0.22	0.43	0.42	1.00					
SOU	0.12	0.55	0.56	0.40	0.30	0.25	0.48	0.45	0.36	0.47	0.40	0.06	0.58	0.30	0.60	0.20	0.27	0.40	0.53	0.57	0.55	1.00				
TAI	0.39	0.55	0.70	0.45	0.32	0.34	0.24	0.34	0.41	0.27	0.34	0.14	0.70	0.59	0.59	0.06	0.24	0.38	0.38	0.50	0.53	0.48	1.00			
THA	0.24	0.40	0.52	0.46	0.52	0.16	0.36	0.27	0.18	0.70	0.12	0.23	0.60	0.63	0.49	0.01	0.13	0.42	0.72	0.45	0.54	0.60	0.51	1.00		
TUR	0.27	0.36	0.50	0.33	0.24	0.34	0.25	0.46	0.25	0.15	0.65	0.02	0.48	0.21	0.46	-0.14	0.34	0.10	0.24	0.41	0.56	0.41	0.44	0.33	1.00	
VEN	0.30	0.35	0.20	0.27	0.30	0.37	0.03	0.36	-0.03	0.30	0.38	-0.32	0.24	0.15	0.44	-0.12	0.01	0.44	0.32	0.25	0.15	0.33	0.18	0.28	0.27	1.00

Full sample correlations from 1995:02 to 2003:02

Table 5.9 World Full Period Correlation Matrix

	ARG	AUST	AUS	BEL	BRA	CAN	CHI	CHIN	COL	CZE	DEN	EGY	FIN	FRA	GER	HONG	HUN	IND	INDO	IRE	ISR	ITA	JAP	JOR	KOR	MAL	MEX
ARG	1.00																										
AUST	0.27	1.00																									
AUS	0.18	0.37	1.00																								
BEL	0.18	0.39	0.63	1.00																							
BRA	0.46	0.56	0.38	0.35	1.00																						
CAN	0.37	0.65	0.47	0.44	0.59	1.00																					
CHI	0.50	0.36	0.36	0.20	0.68	0.52	1.00																				
CHIN	0.23	0.41	0.31	0.08	0.29	0.42	0.38	1.00																			
COL	0.23	0.13	0.20	0.00	0.25	0.20	0.40	0.13	1.00																		
CZE	0.19	0.27	0.19	0.13	0.40	0.34	0.33	0.18	0.12	1.00																	
DEN	0.32	0.48	0.54	0.65	0.54	0.65	0.37	0.23	0.08	0.28	1.00																
EGY	0.19	0.23	-0.01	0.03	0.21	0.31	0.28	0.08	0.01	0.13	0.19	1.00															
FIN	0.26	0.48	0.21	0.28	0.44	0.56	0.30	0.24	-0.03	0.20	0.46	0.29	1.00														
FRA	0.38	0.51	0.48	0.68	0.54	0.71	0.41	0.19	0.00	0.32	0.72	0.23	0.61	1.00													
GER	0.30	0.55	0.52	0.65	0.56	0.70	0.38	0.23	0.13	0.33	0.77	0.16	0.59	0.85	1.00												
HONG	0.33	0.57	0.41	0.28	0.48	0.62	0.46	0.62	0.17	0.25	0.40	0.10	0.32	0.40	0.45	1.00											
HUN	0.29	0.45	0.43	0.43	0.53	0.61	0.43	0.24	0.16	0.57	0.55	0.20	0.38	0.52	0.55	0.40	1.00										
IND	0.17	0.27	0.07	0.00	0.29	0.27	0.36	0.10	0.02	0.28	0.27	0.35	0.28	0.25	0.20	0.18	0.25	1.00									
INDO	0.10	0.38	0.33	0.27	0.23	0.40	0.36	0.30	0.37	0.20	0.17	0.12	0.15	0.21	0.24	0.43	0.33	0.12	1.00								
IRE	0.26	0.56	0.53	0.56	0.40	0.54	0.43	0.24	0.26	0.33	0.55	0.21	0.42	0.55	0.62	0.43	0.45	0.11	0.23	1.00							
ISR	0.40	0.39	0.18	0.20	0.49	0.57	0.44	0.16	0.09	0.22	0.49	0.23	0.60	0.58	0.55	0.24	0.40	0.30	0.11	0.31	1.00						
ITA	0.34	0.40	0.40	0.52	0.53	0.50	0.43	0.10	0.14	0.28	0.61	0.14	0.49	0.70	0.62	0.22	0.51	0.29	0.14	0.44	0.53	1.00					
JAP	0.17	0.55	0.27	0.35	0.38	0.49	0.28	0.33	-0.07	0.17	0.25	0.08	0.39	0.47	0.37	0.42	0.21	0.09	0.34	0.33	0.17	0.26	1.00				
JOR	0.11	0.15	0.07	0.12	0.02	0.06	0.19	-0.03	0.14	-0.06	0.08	0.22	-0.03	-0.01	0.02	0.13	0.12	0.20	0.14	0.11	0.02	0.07	0.10	1.00			
KOR	0.21	0.53	0.24	0.29	0.33	0.42	0.36	0.34	0.16	0.30	0.24	0.07	0.42	0.36	0.35	0.40	0.29	0.19	0.46	0.38	0.21	0.25	0.58	0.20	1.00		
MAL	0.18	0.32	0.33	0.21	0.23	0.38	0.31	0.28	0.34	0.19	0.22	0.12	0.16	0.31	0.32	0.38	0.22	0.23	0.61	0.27	0.13	0.20	0.32	0.21	0.52	1.00	
MEX	0.57	0.57	0.30	0.26	0.69	0.56	0.61	0.38	0.23	0.27	0.43	0.20	0.46	0.47	0.44	0.48	0.48	0.26	0.26	0.42	0.49	0.44	0.42	0.10	0.33	0.19	1.00
MOR	-0.13	-0.09	0.15	0.25	-0.08	-0.10	-0.06	-0.17	-0.20	-0.10	0.10	0.24	-0.15	0.12	0.11	-0.14	-0.10	0.05	-0.18	0.13	-0.04	0.00	-0.09	0.02	-0.07	-0.12	-0.23
NET	0.30	0.55	0.62	0.76	0.52	0.66	0.36	0.28	0.10	0.27	0.77	0.13	0.56	0.82	0.81	0.48	0.49	0.23	0.29	0.65	0.44	0.62	0.46	0.06	0.39	0.35	0.50
NEW	0.25	0.60	0.45	0.44	0.37	0.47	0.37	0.24	0.19	0.19	0.38	0.22	0.27	0.37	0.37	0.42	0.42	0.06	0.44	0.49	0.10	0.25	0.42	0.28	0.42	0.31	0.38
NOR	0.41	0.59	0.57	0.51	0.59	0.65	0.58	0.32	0.17	0.38	0.63	0.31	0.46	0.58	0.56	0.45	0.52	0.28	0.29	0.61	0.41	0.55	0.40	0.08	0.34	0.19	0.58
PAK	0.05	0.14	-0.07	-0.22	0.21	0.08	0.09	0.08	0.24	0.14	0.05	0.08	0.13	-0.01	0.01	0.18	0.13	0.37	0.11	-0.07	0.11	0.08	0.01	0.17	0.10	0.18	0.14
PER	0.35	0.27	0.17	0.04	0.52	0.32	0.56	0.10	0.40	0.25	0.19	0.11	0.04	0.21	0.22	0.15	0.37	0.18	0.27	0.14	0.30	0.28	0.11	0.14	0.07	0.23	0.52
PHI	0.30	0.48	0.47	0.34	0.34	0.47	0.40	0.39	0.19	0.22	0.27	0.12	0.23	0.35	0.34	0.54	0.44	0.12	0.63	0.37	0.16	0.27	0.37	0.10	0.47	0.54	0.40
POL	0.25	0.57	0.30	0.35	0.56	0.56	0.45	0.24	0.09	0.58	0.38	0.27	0.49	0.45	0.50	0.43	0.70	0.20	0.27	0.50	0.32	0.34	0.33	0.08	0.44	0.24	0.45
POR	0.24	0.41	0.46	0.58	0.41	0.56	0.25	0.05	-0.08	0.39	0.63	0.16	0.44	0.70	0.69	0.34	0.64	0.30	0.19	0.50	0.38	0.56	0.28	0.02	0.29	0.19	0.27
RUS	0.29	0.32	0.45	0.22	0.43	0.54	0.57	0.33	0.37	0.33	0.26	0.19	0.36	0.37	0.33	0.49	0.49	0.23	0.49	0.37	0.30	0.26	0.34	0.03	0.30	0.41	0.47
SIN	0.36	0.56	0.45	0.36	0.46	0.54	0.51	0.55	0.28	0.22	0.36	0.09	0.33	0.40	0.41	0.78	0.41	0.17	0.61	0.45	0.27	0.26	0.38	0.15	0.42	0.48	0.49
SOU	0.30	0.57	0.49	0.33	0.54	0.61	0.59	0.45	0.24	0.31	0.42	0.30	0.31	0.49	0.43	0.49	0.51	0.29	0.39	0.45	0.32	0.34	0.40	0.08	0.46	0.32	0.56
SPA	0.34	0.57	0.54	0.62	0.60	0.63	0.47	0.21	0.11	0.35	0.67	0.12	0.50	0.74	0.74	0.46	0.57	0.21	0.26	0.66	0.49	0.67	0.38	0.04	0.36	0.26	0.44
SWE	0.37	0.57	0.33	0.41	0.55	0.72	0.44	0.23	0.11	0.31	0.67	0.30	0.74	0.77	0.82	0.43	0.45	0.36	0.24	0.54	0.68	0.59	0.39	0.02	0.43	0.31	0.50
SWIT	0.14	0.43	0.58	0.71	0.38	0.53	0.31	0.14	0.03	0.27	0.60	0.05	0.38	0.67	0.65	0.35	0.44	0.05	0.29	0.55	0.24	0.44	0.43	0.02	0.34	0.22	0.24
TAI	0.41	0.42	0.27	0.19	0.47	0.49	0.59	0.47	0.31	0.36	0.25	0.23	0.29	0.42	0.43	0.52	0.31	0.34	0.29	0.39	0.27	0.35	0.36	0.12	0.46	0.45	0.44
THA	0.27	0.54	0.34	0.21	0.35	0.36	0.36	0.40	0.25	0.21	0.20	0.10	0.21	0.26	0.27	0.50	0.24	0.12	0.47	0.34	0.03	0.22	0.42	0.14	0.67	0.60	0.37
TUR	0.31	0.36	0.23	0.16	0.38	0.44	0.42	0.24	0.25	0.34	0.30	0.27	0.49	0.48	0.41	0.34	0.44	0.18	0.18	0.37	0.59	0.33	0.23	0.10	0.27	0.20	0.39
UK	0.34	0.61	0.59	0.68	0.51	0.68	0.40	0.31	0.09	0.29	0.71	0.22	0.56	0.76	0.68	0.55	0.49	0.19	0.32	0.71	0.41	0.54	0.48	0.11	0.41	0.30	0.53
USA	0.33	0.62	0.41	0.57	0.59	0.78	0.46	0.42	0.18	0.17	0.64	0.26	0.61	0.67	0.70	0.55	0.54	0.16	0.29	0.66	0.50	0.52	0.42	0.04	0.42	0.27	0.55
VEN	0.24	0.23	0.16	0.02	0.33	0.30	0.34	0.30	0.29	0.26	0.33	0.07	0.14	0.26	0.22	0.29	0.24	0.20	0.19	0.29	0.25	0.28	0.06	-0.03	0.13	0.09	0.35
WORLD	0.38	0.72	0.51	0.66	0.64	0.83	0.51	0.41	0.13	0.27	0.71	0.24	0.67	0.83	0.80	0.60	0.57	0.22	0.35	0.70	0.54	0.61	0.63	0.07	0.52	0.36	0.62

Full sample from 1995:02 to 2003:02

MOR	NET	NEW	NOR	PAK	PER	PHI	POL	POR	RUS	SIN	SOU	SPA	SWE	SWIT	TAI	THA	TUR	UK	USA	VEN	WORLD
1.00																					
0.08	1.00																				
-0.08	0.48	1.00																			
0.01	0.65	0.58	1.00																		
-0.15	0.01	-0.04	-0.02	1.00																	
-0.11	0.11	0.20	0.28	0.14	1.00																
-0.13	0.41	0.52	0.40	-0.02	0.23	1.00															
-0.10	0.45	0.52	0.54	0.06	0.33	0.39	1.00														
0.13	0.64	0.36	0.49	0.00	0.20	0.34	0.50	1.00													
-0.20	0.41	0.41	0.48	0.14	0.29	0.52	0.40	0.37	1.00												
-0.18	0.51	0.56	0.53	0.17	0.23	0.70	0.42	0.28	0.50	1.00											
0.00	0.48	0.51	0.60	0.14	0.39	0.54	0.53	0.38	0.52	0.56	1.00										
0.07	0.71	0.44	0.63	-0.08	0.33	0.42	0.53	0.74	0.43	0.44	0.45	1.00									
-0.01	0.70	0.39	0.61	0.06	0.27	0.31	0.48	0.62	0.39	0.40	0.42	0.72	1.00								
0.11	0.75	0.49	0.54	-0.16	0.03	0.38	0.39	0.63	0.40	0.40	0.41	0.64	0.50	1.00							
0.02	0.35	0.29	0.39	0.20	0.27	0.40	0.37	0.29	0.47	0.46	0.44	0.40	0.49	0.25	1.00						
-0.13	0.30	0.50	0.32	0.11	0.17	0.70	0.37	0.20	0.37	0.60	0.58	0.31	0.29	0.25	0.45	1.00					
-0.11	0.38	0.28	0.42	0.24	0.23	0.22	0.39	0.34	0.40	0.41	0.35	0.35	0.51	0.28	0.36	0.19	1.00				
0.04	0.82	0.47	0.64	-0.03	0.13	0.42	0.48	0.60	0.45	0.50	0.49	0.74	0.64	0.72	0.38	0.33	0.44	1.00			
-0.02	0.70	0.40	0.57	0.08	0.14	0.38	0.49	0.45	0.39	0.52	0.50	0.65	0.68	0.59	0.46	0.34	0.43	0.74	1.00		
-0.11	0.29	0.20	0.35	0.06	0.24	0.19	0.17	0.16	0.16	0.27	0.32	0.24	0.26	0.18	0.22	0.21	0.20	0.29	0.27	1.00	
-0.02	0.83	0.50	0.66	0.05	0.21	0.46	0.55	0.59	0.47	0.58	0.57	0.76	0.77	0.71	0.52	0.41	0.48	0.85	0.93	0.28	1.00

Table 9.1 Three-year Rolling Correlations of Turkey

DEVELOPED EUROPE REGIOI	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
AUSTRALIAPI	-0.074	-0.058	0.081	-0.694	-0.207	0.141	0.116	0.049	0.271	0.225	0.226	0.513	0.527
BELGIUMPI	0.032	0.228	0.127	-0.097	-0.105	0.703	0.429	0.397	0.295	0.075	0.079	0.073	0.195
DENMARKPI	0.020	0.071	0.141	0.098	0.014	0.322	0.242	0.399	0.478	0.308	0.120	0.313	0.349
FINLANDPI	-0.014	0.057	0.046	-0.312	-0.245	-0.048	-0.088	0.135	0.378	0.417	0.474	0.601	0.617
FRANCEPI	0.008	0.116	0.062	-0.037	0.039	0.878	0.813	0.642	0.425	0.231	0.285	0.550	0.600
GERMANYPI	0.164	0.240	0.263	-0.314	-0.091	0.158	0.212	0.167	0.365	0.198	0.354	0.540	0.574
IRELANDPI	0.182	0.140	0.221	-0.088	-0.003	0.069	0.127	0.087	0.446	0.309	0.252	0.371	0.444
ITALYPI	0.077	0.187	0.117	0.096	-0.219	0.040	0.108	0.316	0.340	0.255	0.189	0.443	0.518
NETHERLANDSPI	0.122	0.111	0.161	-0.268	-0.084	0.468	0.336	0.232	0.394	0.278	0.312	0.490	0.486
NORWAY	0.177	0.077	0.103	-0.530	-0.203	0.068	0.040	0.316	0.579	0.483	0.374	0.431	0.529
PORTUGALPI	0.566	0.507	0.144	-0.181	-0.198	0.622	0.488	0.603	0.488	0.301	0.153	0.256	0.377
SPAINPI	0.053	0.055	-0.048	-0.005	-0.006	-0.020	0.122	0.196	0.385	0.263	0.229	0.452	0.502
SWEDENPI	0.101	0.148	0.263	-0.362	-0.251	-0.107	0.011	0.216	0.496	0.441	0.444	0.618	0.611
SWITZERLANDPI	0.058	0.085	0.101	-0.194	0.045	0.430	0.150	0.244	0.387	0.321	0.135	0.323	0.329
UKPI	0.000	-0.049	0.050	-0.212	0.055	0.705	0.364	0.205	0.313	0.359	0.339	0.528	0.554

EMERGING EUROPE REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
CZHECHPI						-0.166	-0.097	0.088	0.479	0.289	0.310	0.304	0.512
HUNGARYPI						0.351	0.374	0.464	0.591	0.396	0.333	0.446	0.603
POLANDPI				-0.191	0.131	0.179	0.306	0.296	0.536	0.315	0.322	0.411	0.552
RUSSIAPI						-0.215	-0.172	0.081	0.499	0.616	0.601	0.619	0.573

ASIA REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
CHINAPI				0.307	0.449	0.286	0.341	0.014	0.039	0.003	0.122	0.341	0.468
INDIAPI				0.005	0.080	0.154	0.058	0.056	0.047	0.063	0.126	0.288	0.295
INDONESIAPI	-0.066	0.042	0.183	0.018	0.336	-0.022	0.236	0.113	0.279	0.199	0.206	0.142	0.220
KOREAPI	-0.204	-0.203	-0.137	-0.089	-0.112	0.429	0.276	0.186	0.071	0.048	0.075	0.415	0.564
MALAYSIAPI	0.231	0.260	0.160	-0.345	0.290	0.154	0.247	0.156	0.245	0.181	0.309	0.233	0.314
PAKISTANPI				-0.137	0.049	-0.091	0.065	0.282	0.139	0.232	0.269	0.560	0.374
PHILIPPINESPI	-0.126	0.009	-0.003	-0.524	0.057	0.104	0.136	0.251	0.258	0.235	0.129	0.224	0.260
TAIWANPI	0.028	0.109	0.102	-0.174	0.134	0.193	0.072	0.044	0.198	0.211	0.281	0.378	0.497
THAILANDPI	0.105	0.272	0.368	-0.480	0.149	0.101	0.176	0.172	0.076	0.079	0.192	0.389	0.400

NORTH AMERICA REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
CANADAPI	-0.191	-0.204	-0.122	-0.494	-0.092	0.366	0.276	0.311	0.503	0.415	0.340	0.464	0.515
USAPI	-0.120	-0.185	-0.155	-0.319	0.016	0.076	0.288	0.269	0.482	0.308	0.279	0.520	0.573

LATIN AMERICA REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
ARGENTINAPI	0.521	0.310	-0.191	0.035	0.182	0.437	0.330	0.333	0.424	0.361	0.227	0.289	0.316
BRAZILPI	0.125	0.106	0.141	0.047	0.047	0.023	0.120	0.262	0.604	0.472	0.377	0.422	0.466
CHILEPI	0.239	0.094	0.025	-0.025	-0.004	0.396	0.248	0.307	0.368	0.447	0.379	0.486	0.552
COLOMBIAPI				-0.125	-0.304	-0.517	-0.300	-0.045	0.467	0.544	0.409	0.253	0.189
MEXICOPI	0.108	-0.018	-0.188	-0.359	0.111	0.203	0.138	0.201	0.458	0.496	0.412	0.459	0.502
PERUPI				-0.129	-0.199	0.392	0.309	0.310	0.454	0.467	0.353	0.084	0.121
VENEZUELAPI				0.095	0.018	0.231	0.178	0.152	0.181	0.137	0.105	0.182	0.372

PACIFIC RIM REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
AUSTRALIAPI	-0.074	-0.058	0.081	-0.694	-0.207	0.141	0.116	0.049	0.271	0.225	0.226	0.513	0.527
HONGKONGPI	-0.009	0.025	-0.160	-0.409	0.198	0.237	0.336	0.224	0.220	0.279	0.262	0.442	0.505
JAPANPI	0.002	-0.010	-0.071	-0.213	-0.257	0.456	0.376	0.104	0.151	0.126	0.265	0.354	0.294
NEWZELANDPI	0.067	0.103	0.098	-0.624	-0.157	0.608	0.394	0.351	0.438	0.365	0.301	0.328	0.267
SINGAPOREPI	0.039	0.073	0.175	0.085	0.104	0.180	0.305	0.353	0.349	0.340	0.401	0.518	0.555

MIDDLE EAST REGION	1988:01 1990:12	1989:01 1991:12	1990:01 1992:12	1991:01 1993:12	1992:01 1994:12	1993:01 1995:12	1994:01 1996:12	1995:01 1997:12	1996:01 1998:12	1997:01 1999:12	1998:01 2000:12	1999:01 2001:12	2000:01 2002:12
EGYPTPI						0.382	0.059	0.294	0.356	0.283	0.239	0.318	0.345
ISRAELPI				0.230	0.175	0.197	0.128	0.404	0.490	0.558	0.413	0.632	0.655
JORDANPI	0.245	0.156	0.146	0.330	0.195	0.622	0.247	0.253	0.125	0.186	0.179	0.055	0.010
MOROCCOPI						0.406	0.153	-0.004	-0.206	-0.260	-0.250	-0.194	-0.109
SOUTHAFRICAPI				0.068	0.143	0.698	0.440	0.368	0.258	0.272	0.273	0.556	0.465

APPENDIX C

1. ANALYSES IN THE ABSENCE OF RISKLESS ASSET

DEVELOPED EUROPE REGION

Table 6.4 Full Period DE+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	181
N	16
N_1	15
c	587.9404
c_1	587.8872
Potential Performance	
P_0	32.43407
P_{01}	29.59587
Marginal potential performance	**2.83820**
Spanning test statistic	**0.385861**

Table 6.8 Full Period Stein DE+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	STEIN
T	181
N	16
N_1	15
c	587.9404
c_1	587.8872
Potential Performance	
P_0	5.22242
P_{01}	3.18634
Marginal potential performance	**2.03608**
Spanning test statistic	**0.291358**

Table 6.13 92-93 Period DE+Turkey Portfolio Spanning Analysis

92-93Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	16
N_1	15
c	2888.796
c_1	2670.717
Potential Performance	
P_0	485.458
P_{01}	580.138
Marginal potential performance	**-94.679**
Spanning test statistic	**0.150423**

Table 6.14 94-95 Period DE +Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	16
N_1	15
c	1659.311
c_1	1656.269
Potential Performance	
P_0	2511.179
P_{01}	2505.221
Marginal potential performance	**5.957**
Spanning test statistic	**0.008646**

Table 6.15 97-98 Period DE +Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	16
N_1	15
c	2125.67
c_1	1816.31
Potential Performance	
P_0	3413.172
P_{01}	2869.361
Marginal potential performance	**543.811**
Spanning test statistic	**0.697888**

Table 6.16 92-93 Period DE Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.003467	0.004466
BELGIUM	0.007723	0.006107
DENMARK	-0.001348	0.002609
FINLAND	0.019439	0.010625
FRANCE	0.008754	0.006505
GERMANY	0.008273	0.006319
IRELAND	0.005639	0.005304
ITALY	-0.001223	0.002658
NETHERLANDS	0.012598	0.007987
NORWAY	0.007839	0.006152
PORTUGAL	0.007673	0.006088
SPAIN	-0.000374	0.002985
SWEDEN	0.005499	0.005249
SWITZERLAND	0.022287	0.011723
UK	0.006114	0.005487

Table 6.17 92-93 Period DE +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.003467	0.004866
BELGIUM	0.007723	0.006306
DENMARK	-0.001348	0.003238
FINLAND	0.019439	0.010268
FRANCE	0.008754	0.006654
GERMANY	0.008273	0.006491
IRELAND	0.005639	0.005601
ITALY	-0.001223	0.003280
NETHERLANDS	0.012598	0.007954
NORWAY	0.007839	0.006345
PORTUGAL	0.007673	0.006288
SPAIN	-0.000374	0.003567
SWEDEN	0.005499	0.005553
SWITZERLAND	0.022287	0.011231
UK	0.006114	0.005761
TURKEY	0.030399	0.013974

Table 6.18 94-95 Period DE Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	-0.002790	-0.000243
BELGIUM	0.011015	0.005195
DENMARK	0.010055	0.004817
FINLAND	0.031737	0.013357
FRANCE	0.004728	0.002718
GERMANY	0.009132	0.004453
IRELAND	0.014184	0.006443
ITALY	0.007678	0.003880
NETHERLANDS	0.013783	0.006285
NORWAY	0.013655	0.006235
PORTUGAL	0.002549	0.001860
SPAIN	0.009018	0.004408
SWEDEN	0.025337	0.010836
SWITZERLAND	0.018221	0.008033
UK	0.007407	0.003774

Table 6.19 94-95 Period DE +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	-0.002790	-0.000057
BELGIUM	0.011016	0.004705
DENMARK	0.010056	0.004374
FINLAND	0.031737	0.011851
FRANCE	0.004729	0.002536
GERMANY	0.009132	0.004055
IRELAND	0.014185	0.005797
ITALY	0.007679	0.003554
NETHERLANDS	0.013784	0.005659
NORWAY	0.013656	0.005615
PORTUGAL	0.002550	0.001785
SPAIN	0.009019	0.004016
SWEDEN	0.025338	0.009644
SWITZERLAND	0.018221	0.007190
UK	0.007408	0.003460
TURKEY	-0.013569	-0.003774

Table 6.20 97-98 Period DE Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.004174	0.007700
BELGIUM	0.022513	0.015116
DENMARK	0.014341	0.011811
FINLAND	0.039486	0.021978
FRANCE	0.018167	0.013358
GERMANY	0.019422	0.013866
IRELAND	0.015297	0.012198
ITALY	0.028613	0.017582
NETHERLANDS	0.014040	0.011689
NORWAY	-0.007379	0.003029
PORTUGAL	0.029261	0.017844
SPAIN	0.031082	0.018580
SWEDEN	0.012026	0.010875
SWITZERLAND	0.023531	0.015527
UK	0.013390	0.011427

Table 6.21 97-98 Period DE +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRIA	0.004174	0.007048
BELGIUM	0.022514	0.013621
DENMARK	0.014342	0.010692
FINLAND	0.039486	0.019703
FRANCE	0.018168	0.012063
GERMANY	0.019422	0.012513
IRELAND	0.015298	0.011035
ITALY	0.028613	0.015806
NETHERLANDS	0.014040	0.010584
NORWAY	-0.007380	0.002908
PORTUGAL	0.029261	0.016039
SPAIN	0.031082	0.016691
SWEDEN	0.012026	0.009862
SWITZERLAND	0.023532	0.013985
UK	0.013390	0.010351
TURKEY	0.013489	0.010387

Table 6.22 92-93 Period Stein DE+Turkey Portfolio Spanning Analysis

92-93Crisis Spanning Test Statistic Parameters	**STEIN**
T	24
N	16
N_1	15
c	2888.796
c_1	2670.717
Potential Performance	
P_0	485.458
P_{01}	580.138
Marginal potential performance	**-94.679**
Spanning test statistic	**0.150423**

Table 6.23 94-95 Period Stein DE +Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	**STEIN**
T	24
N	16
N_1	15
c	1659.311
c_1	1656.269
Potential Performance	
P_0	298.6535
P_{01}	388.7097
Marginal potential performance	**-90.0562**
Spanning test statistic	**-0.17205**

Table 6.24 97-98 Period Stein DE +Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	**STEIN**
T	24
N	16
N_1	15
c	2125.67
c_1	1816.31
Potential Performance	
P_0	438.3201
P_{01}	469.0877
Marginal potential performance	**-30.7676**
Spanning test statistic	**0.473595**

EMERGING EUROPE PORTFOLIO

Table 6.28 Full Period EE+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	97
N	5
N_1	4
c	133.1322
c_1	132.787
Potential Performance	
P_0	3.907424
P_{01}	3.812942
Marginal potential performance	**0.094481**
Spanning test statistic	**0.14793**

Table 6.32 Full Period EE+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	STEIN
T	97
N	5
N_1	4
c	133.1322
c_1	132.787
Potential Performance	
P_0	0.297733
P_{01}	0.356041
Marginal potential performance	**-0.05831**
Spanning test statistic	**0.099052**

Table 6.35 97-98 Period EE+Turkey Portfolio Spanning Analysis

97-98 Crises Spanning Test Statistic Parameters	
T	24
N	5
N_1	4
c	155.591
c_1	132.787
Potential Performance	
P_0	24.0770
P_{01}	3.8129
Marginal potential performance	**20.2641**
Spanning test statistic	**2.7903**

Table 6.36 97-98 Period EE Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CZECH	-0.007716	0.001721
HUNGARY	0.031646	0.014528
POLAND	-0.006933	0.001976
RUSSIA	0.014667	0.009004

Table 6.37 97-98 Period EE+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CZECH	-0.007716	-0.003008
HUNGARY	0.031646	0.023278
POLAND	-0.006933	-0.002485
RUSSIA	0.014667	0.011939
TURKEY	0.013489	0.011153

Table 6.38 97-98 Period EE+Turkey Portfolio Spanning Analysis

97-98 Crises Spanning Test Statistic Parameters	**STEIN**
T	24
N	5
N_1	4
c	155.591
c_1	132.787
Potential Performance	
P_0	1.91045
P_{01}	2.51808
Marginal potential performance	**-0.60763**
Spanning test statistic	**1.49930**

ASIA REGION

Table 6.42 Full Period Asia+Turkey Portfolio Spanning Analyses

Spanning Test Statistic Parameters	
T	121
N	10
N_1	9
c	256.1422
c_1	256.1111
Potential Performance	
P_0	10.74998
P_{01}	7.468169
Marginal potential performance	**3.281809**
Spanning test statistic	**0.695399**

Table 6.46 Full Period Asia+Turkey Portfolio Spanning Analyses

Spanning Test Statistic Parameters	STEIN
T	121
N	10
N_1	9
c	256.1422
c_1	256.1111
Potential Performance	
P_0	0.828782
P_{01}	0.385572
Marginal potential performance	**0.443209**
Spanning test statistic	**0.102584**

Table 6.50 94-95 Period Asia+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	10
N_1	9
c	532.509
c_1	523.826
Potential Performance	
P_0	180.7997
P_{01}	176.9929
Marginal potential performance	**3.8067**
Spanning test statistic	**0.124192**

Table 6.51 97-98 Period Asia+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	10
N_1	9
c	260.2519
c_1	256.2318
Potential Performance	
P_0	87.91034
P_{01}	85.86067
Marginal potential performance	**2.04967**
Spanning test statistic	**0.12365**

Table 6.52 94-95 Period Asia Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINA	-0.023816	-0.001683
INDIA	-0.009328	0.002578
INDONESIA	-0.004634	0.003959
KOREA	0.015117	0.009768
MALAYSIA	0.000615	0.005502
PAKISTAN	-0.015173	0.000859
PHILIPPINES	0.004847	0.006747
TAIWAN	0.008214	0.007738
THAILAND	0.002251	0.005983

Table 6.53 94-95 Period Asia+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINA	-0.023816	-0.000399
INDIA	-0.009328	0.003392
INDONESIA	-0.004634	0.004620
KOREA	0.015117	0.009786
MALAYSIA	0.000615	0.005993
PAKISTAN	-0.015173	0.001862
PHILIPPINES	0.004847	0.007100
TAIWAN	0.008214	0.007981
THAILAND	0.002251	0.006421
TURKEY	-0.013569	0.002282

Table 6.54 97-98 Period Asia Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINA	-0.022203	-0.003004
INDIA	-0.003000	0.002611
INDONESIA	-0.035173	-0.006796
KOREA	-0.007978	0.001155
MALAYSIA	-0.054318	-0.012395
PAKISTAN	-0.016730	-0.001404
PHILIPPINES	-0.024140	-0.003570
TAIWAN	-0.004856	0.002068
THAILAND	-0.032050	-0.005883

Table 6.55 97-98 Period Asia+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CHINA	-0.022203	-0.001692
INDIA	-0.003000	0.003313
INDONESIA	-0.035173	-0.005072
KOREA	-0.007978	0.002015
MALAYSIA	-0.054318	-0.010062
PAKISTAN	-0.016730	-0.000266
PHILIPPINES	-0.024140	-0.002197
TAIWAN	-0.004856	0.002829
THAILAND	-0.032050	-0.004258
TURKEY	0.013489	0.007610

Table 6.56 94-95 Period Asia+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	10
N_1	9
c	532.509
c_1	523.826
Potential Performance	
P_0	12.37329
P_{01}	15.31147
Marginal potential performance	**-2.93818**
Spanning test statistic	**0.074379**

Table 6.57 97-98 Period Asia+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	10
N_1	9
c	260.2519
c_1	256.2318
Potential Performance	
P_0	5.97089
P_{01}	7.34103
Marginal potential performance	**-1.37013**
Spanning test statistic	**0.07020**

NORTH AMERICA REGION

Table 6.61 Full Period NA+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	181
N	3
N_1	2
c	544.9621
c_1	547.9559
Potential Performance	
P_0	5.575447
P_{01}	3.301786
Marginal potential performance	**2.273661**
Spanning test statistic	**-0.1163**

Table 6.65 Full Period NA+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	STEIN
T	181
N	3
N_1	2
c	544.9621
c_1	547.9559
Potential Performance	
P_0	0.394065
P_{01}	0.147597
Marginal potential performance	**0.246469**
Spanning test statistic	**-0.44667**

Table 6.70 92-93 Period NA +Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	
T	24
N	3
N_1	2
c	1987.59
c_1	1725.17
Potential Performance	
P_0	156.7893
P_{01}	102.9475
Marginal potential performance	**53.8417**
Spanning test statistic	**1.74407**

Table 6.71 94-95 Period NA +Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	3
N_1	2
c	1373.887
c_1	1373.603
Potential Performance	
P_0	87.43576
P_{01}	66.98225
Marginal potential performance	**20.45352**
Spanning test statistic	**0.150612**

Table 6.72 97-98 Period NA +Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	3
N_1	2
c	373.4997
c_1	368.3913
Potential Performance	
P_0	104.3824
P_{01}	95.4556
Marginal potential performance	**8.9266**
Spanning test statistic	**0.3153**

Table 6.73 92-93 Period NA Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	-0.001613	0.003510
US	0.008939	0.006015

Table 6.74 92-93 Period NA +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	-0.001613	0.004428
US	0.008939	0.006942
TURKEY	0.030399	0.012055

Table 6.75 94-95 Period NA Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.006324	0.011156
US	0.012340	0.012376

Table 6.76 94-95 Period NA +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.006324	0.011126
US	0.012340	0.012339
TURKEY	-0.013569	0.007118

Table 6.77 97-98 Period NA Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.001073	0.011168
US	0.019799	0.021932

Table 6.78 97-98 Period NA +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.001073	0.011923
US	0.019799	0.021766
TURKEY	0.013489	0.018449

Table 6.79 92-93 Period North America+Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	3
N_1	2
c	1987.59
c_1	1725.17
Potential Performance	
P_0	8.90093
P_{01}	1.78003
Marginal potential performance	**7.12090**
Spanning test statistic	**1.57945**

Table 6.80 94-95 Period North America+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	3
N_1	2
c	1373.887
c_1	1373.603
Potential Performance	
P_0	3.550153
P_{01}	2.755354
Marginal potential performance	**0.794799**
Spanning test statistic	**0.008231**

Table 6.81 97-98 Period North America+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	3
N_1	2
c	373.4997
c_1	368.3913
Potential Performance	
P_0	28.84206
P_{01}	31.53947
Marginal potential performance	**-2.69741**
Spanning test statistic	**0.063206**

LATIN AMERICA REGION

Table 6.85 Full Period Latin America+Turkey Spanning Analysis

Spanning Test Statistic Parameters	
T	121
N	8
N_1	7
c	238.4285
c_1	238.3674
Potential Performance	
P_0	7.230207
P_{01}	4.153138
Marginal potential performance	**3.077069**
Spanning test statistic	**0.72875**

Table 6.89 Full Period Latin America+Turkey Spanning Analysis

Spanning Test Statistic Parameters	**STEIN**
T	121
N	8
N_1	7
c	238.4285
c_1	238.3674
Potential Performance	
P_0	0.464265
P_{01}	0.133675
Marginal potential performance	**0.330589**
Spanning test statistic	**0.092753**

Table 6.93 94-95 Period Latin America+Turkey Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	8
N_1	7
c	414.7945
c_1	304.0501
Potential Performance	
P_0	176.912
P_{01}	129.541
Marginal potential performance	**47.370**
Spanning test statistic	**2.6910**

Table 6.94 97-98 Period Latin America+Turkey Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	8
N_1	7
c	211.4564
c_1	207.8838
Potential Performance	
P_0	10.09714
P_{01}	8.49221
Marginal potential performance	**1.60492**
Spanning test statistic	**0.19029**

Table 6.95 94-95 Period LA Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.001874	-0.002564
BRAZIL	0.024117	0.006903
CHILE	0.018999	0.004724
COLOMBIA	-0.003029	-0.004651
MEXICO	-0.017550	-0.010831
PERU	0.034647	0.011384
VENEZUELA	-0.008793	-0.007104

Table 6.96 94-95 Period LA +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.001874	-0.003274
BRAZIL	0.024117	0.005265
CHILE	0.018999	0.003300
COLOMBIA	-0.003029	-0.005156
MEXICO	-0.017550	-0.010730
PERU	0.034647	0.009307
VENEZUELA	-0.008793	-0.007369
TURKEY	-0.013569	-0.009202

Table 6.97 97-98 Period LA Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.002264	-0.005186
BRAZIL	-0.001412	-0.005430
CHILE	-0.010178	-0.006011
COLOMBIA	-0.005093	-0.005674
MEXICO	0.002280	-0.005185
PERU	-0.008189	-0.005879
VENEZUELA	-0.011698	-0.006112

Table 6.98 97-98 Period LA +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
ARGENTINA	0.002264	-0.004427
BRAZIL	-0.001412	-0.005285
CHILE	-0.010178	-0.007331
COLOMBIA	-0.005093	-0.006144
MEXICO	0.002280	-0.004423
PERU	-0.008189	-0.006866
VENEZUELA	-0.011698	-0.007686
TURKEY	0.013489	-0.001807

Table 6.99 94-95 Period Latin America+Turkey Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	**STEIN**
T	24
N	8
N_1	7
c	414.7945
c_1	304.0501
Potential Performance	
P_0	26.07083
P_{01}	23.46522
Marginal potential performance	**2.60561**
Spanning test statistic	**2.56338**

Table 6.100 97-98 Period Latin America+Turkey Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	8
N_1	7
c	211.4564
c_1	207.8838
Potential Performance	
P_0	0.550097
P_{01}	0.037365
Marginal potential performance	**0.512731**
Spanning test statistic	**0.156423**

PACIFIC RIM REGION

Table 6.104 Full Period PR+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	181
N	6
N_1	5
c	404.1639
c_1	398.9219
Potential Performance	
P_0	9.443412
P_{01}	7.404789
Marginal potential performance	**2.038623**
Spanning test statistic	**1.560886**

Table 6.108 Full Period PR+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	STEIN
T	181
N	6
N_1	5
c	404.1639
c_1	398.9219
Potential Performance	
P_0	1.07188
P_{01}	0.74373
Marginal potential performance	**0.32814**
Spanning test statistic	**1.21527**

Table 6.113 92-93 Period Pacific Rim+Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	
T	24
N	6
N_1	5
c	748.4247
c_1	563.9169
Potential Performance	
P_0	207.5823
P_{01}	139.5402
Marginal potential performance	**68.0421**
Spanning test statistic	**2.983804**

Table 6.114 94-95 Period Pacific Rim+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	6
N_1	5
c	488.9468
c_1	475.5632
Potential Performance	
P_0	44.6908
P_{01}	33.6202
Marginal potential performance	**11.0706**
Spanning test statistic	**0.4271**

Table 6.115 97-98 Period Pacific Rim+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	6
N_1	5
c	326.5369
c_1	326.2573
Potential Performance	
P_0	42.3488
P_{01}	21.3008
Marginal potential performance	**21.0479**
Spanning test statistic	**0.54405**

Table 6.116 92-93 Period PR Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.002677	0.006881
HONGKONG	0.035289	0.019449
JAPAN	0.002122	0.006667
NEW ZEALAND	0.013956	0.011228
SINGAPORE	0.018885	0.013127

Table 6.117 92-93 Period PR +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.002677	0.009299
HONGKONG	0.035289	0.021256
JAPAN	0.002122	0.009096
NEW ZEALAND	0.013956	0.013435
SINGAPORE	0.018885	0.015241
TURKEY	0.030399	0.019463

Table 6.118 94-95 Period PR Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.009369	0.010904
HONGKONG	0.004253	0.010030
JAPAN	0.008644	0.010780
NEW ZEALAND	0.014865	0.011842
SINGAPORE	0.015075	0.011878

Table 6.119 94-95 Period PR +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	0.009369	0.010006
HONGKONG	0.004253	0.009187
JAPAN	0.008644	0.009890
NEW ZEALAND	0.014865	0.010887
SINGAPORE	0.015075	0.010921
TURKEY	-0.013569	0.006332

Table 6.120 97-98 Period PR Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	-0.003196	-0.004973
HONGKONG	-0.008224	-0.005684
JAPAN	-0.009908	-0.005923
NEW ZEALAND	-0.019480	-0.007278
SINGAPORE	-0.016180	-0.006811

Table 6.121 97-98 Period PR +Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
AUSTRALIA	-0.003196	-0.005148
HONGKONG	-0.008224	-0.006219
JAPAN	-0.009908	-0.006578
NEW ZEALAND	-0.019480	-0.008617
SINGAPORE	-0.016180	-0.007914
TURKEY	0.013489	-0.001594

Table 6.122 92-93 Period Pacific Rim+Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	6
N_1	5
c	748.4247
c_1	563.9169
Potential Performance	
P_0	27.9015
P_{01}	20.7263
Marginal potential performance	**7.1751**
Spanning test statistic	**2.7419**

Table 6.123 94-95 Period Pacific Rim+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	6
N_1	5
c	488.9468
c_1	475.5632
Potential Performance	
P_0	1.14687
P_{01}	1.15474
Marginal potential performance	**-0.00787**
Spanning test statistic	**0.25077**

Table 6.124 97-98 Period Pacific Rim+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	6
N_1	5
c	326.5369
c_1	326.2573
Potential Performance	
P_0	1.921444
P_{01}	0.417074
Marginal potential performance	**1.504370**
Spanning test statistic	**0.049082**

MIDDLE EAST REGION

Table 6.128 Full Period ME+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	97
N	6
N_1	5
c	1205.977
c_1	1192.364
Potential Performance	
P_0	25.9077
P_{01}	13.3685
Marginal potential performance	**12.5392**
Spanning test statistic	**0.981587**

Table 6.132 Full Period ME+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	**STEIN**
T	97
N	6
N_1	5
c	1205.977
c_1	1192.364
Potential Performance	
P_0	0.98022
P_{01}	0.21608
Marginal potential performance	**0.76414**
Spanning test statistic	**0.54687**

Table 6.135 97-98 Period Middle East+T Portfolio Spanning Analysis

97-98 Crises Spanning Test Statistic Parameters	
T	24
N	6
N_1	5
c	1379.953
c_1	1349.881
Potential Performance	
P_0	512.559
P_{01}	458.457
Marginal potential performance	**54.102**
Spanning test statistic	**0.414163**

Table 6.136 97-98 Period Middle East Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
EGYPT	-0.001674	-0.000012
ISRAEL	0.008099	0.004509
JORDAN	-0.009379	-0.003576
MOROCCO	0.023370	0.011572
SOUTH AFRICA	-0.012490	-0.005015

Table 6.137 97-98 Period Middle East+T Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
EGYPT	-0.001674	-0.000335
ISRAEL	0.008099	0.003932
JORDAN	-0.009379	-0.003700
MOROCCO	0.023370	0.010600
SOUTH AFRICA	-0.012490	-0.005059
TURKEY	0.013489	0.006286

Table 6.138 97-98 Period Middle East+T Portfolio Spanning Analysis

97-98 Crises Spanning Test Statistic Parameters	STEIN
T	24
N	6
N_1	5
c	1379.953
c_1	1349.881
Potential Performance	
P_0	97.73605
P_{01}	98.09242
Marginal potential performance	**-0.35637**
Spanning test statistic	**0.18376**

G7 PORTFOLIO

Table 6.142 Full Period G7+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	
T	181
N	8
N_1	7
c	627.3099
c_1	627.2462
Potential Performance	
P_0	18.27161
P_{01}	15.99202
Marginal potential performance	**2.27958**
Spanning test statistic	**0.314829**

Table 6.146 Full Period G7+Turkey Portfolio Spanning Analysis

Spanning Test Statistic Parameters	**STEIN**
T	181
N	8
N_1	7
c	627.3099
c_1	627.2462
Potential Performance	
P_0	2.034713
P_{01}	1.729302
Marginal potential performance	**0.305411**
Spanning test statistic	**0.050754**

Table 6.151 92-93 Period G7+Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	
T	24
N	8
N_1	7
c	2069.033
c_1	1815.513
Potential Performance	
P_0	178.0436
P_{01}	128.7344
Marginal potential performance	**49.3092**
Spanning test statistic	**1.200979**

Table 6.152 94-95 Period G7+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	
T	24
N	8
N_1	7
c	1980.302
c_1	1865.739
Potential Performance	
P_0	152.1901
P_{01}	122.3793
Marginal potential performance	**29.8107**
Spanning test statistic	**0.570766**

Table 6.153 97-98 Period G7+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	
T	24
N	8
N_1	7
c	714.5027
c_1	714.5003
Potential Performance	
P_0	342.9287
P_{01}	332.5293
Marginal potential performance	**10.39931**
Spanning test statistic	**0.079279**

Table 6.154 92-93 Period G7 Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	-0.001613	0.004741
FRANCE	0.008754	0.005879
GERMANY	0.008273	0.005827
ITALY	-0.001223	0.004784
JAPAN	0.002122	0.005151
UK	0.006114	0.005589
USA	0.008939	0.005900

Table 6.155 92-93 Period G7+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	-0.001613	0.005628
FRANCE	0.008754	0.006785
GERMANY	0.008273	0.006731
ITALY	-0.001223	0.005671
JAPAN	0.002122	0.006045
UK	0.006114	0.006490
USA	0.008939	0.006806
TURKEY	0.030399	0.009202

Table 6.156 94-95 Period G7 Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.006324	0.011406
FRANCE	0.004729	0.011243
GERMANY	0.009132	0.011694
ITALY	0.007679	0.011545
JAPAN	0.008644	0.011644
UK	0.007408	0.011517
USA	0.012340	0.012022

Table 6.157 94-95 Period G7+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.006324	0.010883
FRANCE	0.004729	0.010722
GERMANY	0.009132	0.011166
ITALY	0.007679	0.011020
JAPAN	0.008644	0.011117
UK	0.007408	0.010992
USA	0.012340	0.011490
TURKEY	-0.013569	0.008875

Table 6.158 97-98 Period G7 Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.001073	0.015975
FRANCE	0.018168	0.023621
GERMANY	0.019422	0.024183
ITALY	0.028613	0.028294
JAPAN	-0.009908	0.011062
UK	0.013390	0.021485
USA	0.019799	0.024351

Table 6.159 97-98 Period G7+Turkey Portfolio Stein Estimated Means

	Sample Means	Re-estimated Means
CANADA	0.001073	0.016923
FRANCE	0.018168	0.023968
GERMANY	0.019422	0.024486
ITALY	0.028613	0.028274
JAPAN	-0.009908	0.012397
UK	0.013390	0.022000
USA	0.019799	0.024641
TURKEY	0.013489	0.022040

Table 6.160 92-93 Period G7+Turkey Portfolio Spanning Analysis

92-93 Crisis Spanning Test Statistic Parameters	**STEIN**
T	24
N	8
N_1	7
c	2069.033
c_1	1815.513
Potential Performance	
P_0	2.22031
P_{01}	1.55147
Marginal potential performance	**0.66884**
Spanning test statistic	**1.082501**

Table 6.161 94-95 Period G7+Turkey Portfolio Spanning Analysis

94-95 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	8
N_1	7
c	1980.302
c_1	1865.739
Potential Performance	
P_0	1.550593
P_{01}	1.283092
Marginal potential performance	**0.267501**
Spanning test statistic	**0.484695**

Table 6.162 97-98 Period G7+Turkey Portfolio Spanning Analysis

97-98 Crisis Spanning Test Statistic Parameters	STEIN
T	24
N	8
N_1	7
c	714.5027
c_1	714.5003
Potential Performance	
P_0	58.25604
P_{01}	66.54008
Marginal potential performance	**-8.28405**
Spanning test statistic	**-0.08505**

2. ANALYSES IN THE PRESENCE OF RISKLESS ASSET

DEVELOPED EUROPE REGION

Table 8.2 Full Period DE+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	16
N_1	15
b_f	0.13905
b_{f1}	0.12695
Potential Performance	
b_f	0.13905
b_{f1}	0.12695
Implied marginal potential performance	**0.0121**
Intersection test statistic	**0.7514**

Table 8.3 97-98 Period DE+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	16
N_1	15
b_f	1.618235
b_{f1}	1.581549
Potential Performance	
b_f	1.618235
b_{f1}	1.581549
Implied marginal potential performance	**0.036685**
Intersection test statistic	**0.113685**

Table 8.4 Full Period DE+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	STEIN
T	86
N	16
N_1	15
b_f	0.03925
b_{f1}	0.03462
Potential Performance	
b_f	0.03925
b_{f1}	0.03462
Implied marginal potential performance	**0.00462**
Intersection test statistic	**0.31312**

Table 8.5 97-98 Period DE+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	STEIN
T	24
N	16
N_1	15
b_f	0.21874
b_{f1}	0.26003
Potential Performance	
b_f	0.21874
b_{f1}	0.26003
Implied marginal potential performance	**-0.04129**
Intersection test statistic	**-0.26215**

EMERGING EUROPE REGION

Table 8.7 Full Period EE+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	5
N_1	4
b_f	0.05040
b_{f1}	0.05040
Potential Performance	
b_f	0.05040
b_{f1}	0.05040
Implied marginal potential performance	0.00000
Intersection test statistic	0.00000

Table 8.8 97-98 Period EE+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	5
N_1	4
b_f	0.158076
b_{f1}	0.157632
Potential Performance	
b_f	0.158076
b_{f1}	0.157632
Implied marginal potential performance	**0.000444**
Intersection test statistic	**0.007285**

Table 8.9 Full Period EE+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	STEIN
T	86
N	5
N_1	4
b_f	0.00817
b_{f1}	0.00959
Potential Performance	
b_f	0.00817
b_{f1}	0.00959
Implied marginal potential performance	**-0.00142**
Intersection test statistic	**-0.11369**

Table 8.10 97-98 Period EE+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	STEIN
T	24
N	5
N_1	4
b_f	0.01560
b_{f1}	0.01988
Potential Performance	
b_f	0.01560
b_{f1}	0.01988
Implied marginal potential performance	**-0.00427**
Intersection test statistic	**-0.07960**

ASIA REGION

Table 8.12 Full Period Asia+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	9
N_1	8
b_f	0.069214
b_{f1}	0.057155
Potential Performance	
b_f	0.069214
b_{f1}	0.057155
Implied marginal potential performance	**0.012059**
Intersection test statistic	**0.878347**

Table 8.13 97-98 Period Asia+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	9
N_1	8
b_f	0.345793
b_{f1}	0.344792
Potential Performance	
b_f	0.345793
b_{f1}	0.344792
Implied marginal potential performance	**0.001001**
Intersection test statistic	**0.011164**

Table 8.14 Full Period Asia+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	**STEIN**
T	86
N	9
N_1	8
b_f	0.023366
b_{f1}	0.020802
Potential Performance	
b_f	0.023366
b_{f1}	0.020802
Implied marginal potential performance	**0.002564**
Intersection test statistic	**0.193403**

Table 8.15 97-98 Period Asia+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	**STEIN**
T	24
N	9
N_1	8
b_f	0.03094
b_{f1}	0.03835
Potential Performance	
b_f	0.03094
b_{f1}	0.03835
Implied marginal potential performance	**-0.00741**
Intersection test statistic	**-0.10699**

NORTH AMERICA REGION

Table 8.17 Full Period NA+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	3
N_1	2
b_f	0.007363
b_{f1}	0.000871
Potential Performance	
b_f	0.007363
b_{f1}	0.000871
Implied marginal potential performance	**0.006492**
Intersection test statistic	**0.538373**

Table 8.18 97-98 Period NA+Turkey Portfolio Intersection Analysis

97-98 Crisis Intersection Test Statistic Parameters	
T	24
N	3
N_1	2
b_f	0.341263
b_{f1}	0.328579
Potential Performance	
b_f	0.341263
b_{f1}	0.328579
Implied marginal potential performance	**0.012684**
Intersection test statistic	**0.200492**

Table 8.19 Full Period NA+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	**STEIN**
T	86
N	3
N_1	2
b_f	0.00093
b_{f1}	0.00013
Potential Performance	
b_f	0.00093
b_{f1}	0.00013
Implied marginal potential performance	**0.00079**
Intersection test statistic	**0.06583**

Table 8.20 97-98 Period NA+Turkey Portfolio Intersection Analysis

97-98 Crisis Intersection Test Statistic Parameters	**STEIN**
T	24
N	3
N_1	2
b_f	0.13901
b_{f1}	0.15507
Potential Performance	
b_f	0.13901
b_{f1}	0.15507
Implied marginal potential performance	**-0.01606**
Intersection test statistic	**-0.29207**

LATIN AMERICA REGION

Table 8.22 Full Period LA+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	8
N_1	7
b_f	0.067285
b_{f1}	0.028995
Potential Performance	
b_f	0.067285
b_{f1}	0.028995
Implied marginal potential performance	**0.038291**
Intersection test statistic	**2.902524**

Table 8.23 97-98 Period LA+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	8
N_1	7
b_f	0.112857
b_{f1}	0.099511
Potential Performance	
b_f	0.112857
b_{f1}	0.099511
Implied marginal potential performance	**0.013346**
Intersection test statistic	**0.194213**

Table 8.24 Full Period LA+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	**STEIN**
T	86
N	8
N_1	7
b_f	0.015251
b_{f1}	0.003175
Potential Performance	
b_f	0.015251
b_{f1}	0.003175
Implied marginal potential performance	**0.012076**
Intersection test statistic	**0.938926**

Table 8.25 97-98 Period LA+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	**STEIN**
T	24
N	8
N_1	7
b_f	0.06632
b_{f1}	0.05884
Potential Performance	
b_f	0.06632
b_{f1}	0.05884
Implied marginal potential performance	**0.00748**
Intersection test statistic	**0.11308**

PACIFIC RIM REGION

Table 8.27 Full Period PR+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	6
N_1	5
b_f	0.0595
b_{f1}	0.0428
Potential Performance	
b_f	0.0595
b_{f1}	0.0428
Implied marginal potential performance	**0.0166**
Intersection test statistic	**1.27917**

Table 8.28 97-98 Period PR+Turkey Portfolio Intersection Analysis

97-98 Crisis Intersection Test Statistic Parameters	
T	24
N	6
N_1	5
b_f	0.221413
b_{f1}	0.152491
Potential Performance	
b_f	0.221413
b_{f1}	0.152491
Implied marginal potential performance	**0.068922**
Intersection test statistic	**1.076443**

Table 8.29 Full Period PR+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	**STEIN**
T	86
N	6
N_1	5
b_f	0.020979
b_{f1}	0.016123
Potential Performance	
b_f	0.020979
b_{f1}	0.016123
Implied marginal potential performance	**0.004856**
Intersection test statistic	**0.382299**

Table 8.30 97-98 Period PR+Turkey Portfolio Intersection Analysis

97-98 Crisis Intersection Test Statistic Parameters	**STEIN**
T	24
N	6
N_1	5
b_f	0.097606
b_{f1}	0.086588
Potential Performance	
b_f	0.097606
b_{f1}	0.086588
Implied marginal potential performance	**0.011018**
Intersection test statistic	**0.182528**

MIDDLE EAST REGION

Table 8.32 Full Period ME+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	6
N_1	5
b_f	0.05891
b_{f1}	0.04532
Potential Performance	
b_f	0.05891
b_{f1}	0.04532
Implied marginal potential performance	**0.01359**
Intersection test statistic	**1.04006**

Table 8.33 97-98 Period ME+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	6
N_1	5
b_f	0.52014
b_{f1}	0.46571
Potential Performance	
b_f	0.52014
b_{f1}	0.46571
Implied marginal potential performance	**0.05443**
Intersection test statistic	**0.66849**

Table 8.34 Full Period ME+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	STEIN
T	86
N	6
N_1	5
b_f	0.03997
b_{f1}	0.03842
Potential Performance	
b_f	0.03997
b_{f1}	0.03842
Implied marginal potential performance	**0.00155**
Intersection test statistic	**0.11958**

Table 8.35 97-98 Period ME+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	STEIN
T	24
N	6
N_1	5
b_f	0.21953
b_{f1}	0.19875
Potential Performance	
b_f	0.21953
b_{f1}	0.19875
Implied marginal potential performance	**0.02078**
Intersection test statistic	**0.31214**

G7 PORTFOLIO

Table 8.37 Full Period G7+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	
T	86
N	8
N_1	7
b_f	0.096145
b_{f1}	0.090066
Potential Performance	
b_f	0.096145
b_{f1}	0.090066
Implied marginal potential performance	**0.006079**
Intersection test statistic	**0.434993**

Table 8.38 97-98 Period G7+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	
T	24
N	8
N_1	7
b_f	0.685299
b_{f1}	0.670546
Potential Performance	
b_f	0.685299
b_{f1}	0.670546
Implied marginal potential performance	**0.014752**
Intersection test statistic	**0.141293**

Table 8.39 Full Period G7+Turkey Portfolio Intersection Analysis

Intersection Test Statistic Parameters	**STEIN**
T	86
N	8
N_1	7
b_f	0.02866
b_{f1}	0.02601
Potential Performance	
b_f	0.02866
b_{f1}	0.02601
Implied marginal potential performance	**0.00264**
Intersection test statistic	**0.20112**

Table 8.40 97-98 Period G7+Turkey Portfolio Intersection Analysis

97-98 Crises Intersection Test Statistic Parameters	STEIN
T	24
N	8
N_1	7
b_f	0.286878
b_{f1}	0.298383
Potential Performance	
b_f	0.286878
b_{f1}	0.298383
Implied marginal potential performance	**-0.0115**
Intersection test statistic	**-0.14178**