Portfolio Diversification in the European Union: A Country Beta Approach

Dr. G. N. Naidu and Dr. Askar Choudhury[1]

I. INTRODUCTION

This research study explores the opportunities for investment diversification in EU (European Union) stock markets. All the longstanding members of the Union also established their own stock markets and they are functioning fairly well for the past ten years. Research studies conducted and reported during the last five years showed that the central European stock markets are not yet integrated with the stock markets of the EMU members such as Germany. Gilmore and McManus (2002) conducted co-integration tests on stock markets of Germany, Poland, the Czech Republic and Hungary. They found no long-term relationship between the German market and the three central European markets. Naidu and Choudhury (2004) conducted co-integration tests on stock markets of France and the ten new members of the Union and found that the stock markets are not yet integrated. The lack of integration among the 25 EU stock markets offers an opportunity for investors in and outside of EU to diversify and reduce risk. Gilmore and McManus (2003) examined this very specific issue. They found that the U.S. investors and German investors can reduce risk by diversifying their equity portfolios into the central European equity markets such as Poland, Czechoslovakia, and Hungary.

Naidu and Choudhury (2006) examined the risk/return characteristics in all EU markets. First, they estimated the correlation structure of returns among the 25 EU equity markets. Then by combining the correlation structure and the individual equity market variances, they estimated country betas. Naidu and Choudhury (2006) proposed that country's beta estimate offers a better insight to judge the extent of risk reduction achievable through international diversification.

Therefore, this paper implements Naidu-Choudhury approach of country beta to construct portfolios in EU for French, German, and British investors and examine their performance using Sharpe's Index. The results, based on performance measure, indicate that Naidu-Choudhury approach (country-beta based) is superior to Markowitz approach (correlation based) for all three markets; namely France, German, and Britain. Moreover, Naidu-Choudhury approach produced a portfolio that has positive risk-adjusted return.

II. RESEARCH METHODOLOGIES

The idea that the smaller the degree of correlation the greater the benefit of diversification was popularized by Harry Markowitz (1959). This idea of risk reduction using the correlation structure of returns determines the extent of benefits derived through diversification. However, Sharpe's theory of capital market equilibrium that introduced the concept of beta has a potential for diversification as well. The beta of an asset reflects the variability of its return

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[1] Both G. N. Naidu and Dr. Askar Choudhury are professors at Illinois State University, Normal, IL

relative to the variability of market's return. Thus beta is a relative risk measure. An individual asset's beta is calculated relative to a specific market index, such as S&P500.

Theoretical Background

All national equity markets together create the global capital market environment. Therefore, if we aggregate all the national equity markets we will have a huge world (global) equity market. Each national equity market has its own degree of volatility. However, the volatility relative to each other market will be different. In the same way an equity market's volatility relative to an index of world equity market will be different. Just as one can estimate the risk (beta) of an asset relative to a market index, one can also estimate the risk (beta) of a national equity market relative to world equity market index. This risk estimate of a national equity market is termed as country beta. Thus, a country's beta is the measure of its market's sensitivity to world market variability. Bekaert and Harvey (1997) concluded that market volatility is a function of the openness of its economy. Therefore, a country's beta is indicative of integrator. The smaller the beta, the more segmented is the country's market and hence better will be the gains from diversification. Consequently, international diversification pushes out the efficient frontier further by allowing investors simultaneously to reduce their risk and increase their expected return. Similarly, we can also study the sensitivity of a given equity market to the movements of another equity market of our interest. For example, if we want to know how sensitive the Polish equity market is relative to the movements in German equity market, we can examine this relationship by estimating country beta for Poland with respect to the German equity market. Shapiro (2003) demonstrated this methodology in his book (p.517). A country's market beta is estimated as follows:

Market beta for country, i with respect to France
= [Correlation of market, i with French market] X
[Std. Devn. of market, i / Std.Devn. of French Market.]

$$\beta_i = \rho_{i,F}\left(\frac{\sigma_i}{\sigma_F}\right)$$

where $\rho_{i,F}$ = Correlation coefficient between i^{th} market returns and French market returns

σ_i = Standard deviation of i^{th} market returns

σ_F = Standard deviation of French market returns

A small beta value for a country implies a higher unsystematic risk in that market. Therefore, a smaller country beta offers greater potential for the benefits of diversification. On the contrary, a higher value for a country's beta implies smaller potential for gains from diversification.

Markowitz (1959) theorized that the smaller the degree of correlation the greater is the benefits of diversification. However, this theory looks too simple when it comes to global diversification. In a global market, it is possible for a pair of countries to have the same degree of correlation with a third country and yet have different values for individual market risk. For example,

$$\rho_{F,US} = 0.25 \quad \sigma_F = 28.8\% \quad \beta_F = 0.40$$
$$\rho_{N,US} = 0.25 \quad \sigma_N = 35.5\% \quad \beta_N = 0.50$$

In this example, the difference in individual standard deviations produced different country betas. That means even though France and Norway had the same degree of correlation (0.25) with the U. S. market, their country betas imply that French market offers better gains from diversification than the Norwegian market does. This example demonstrates that gains from diversification can be estimated better by using country betas rather than the simple correlation coefficients.

By generalizing this theory we can develop the following equation:

Market beta for country i with respect to World Market
= [Correlation of market, i with World Market] X
[Std.Devn. of market, i / Std.Devn. of World Market.]

$$\beta_i = \rho_{i,w}\left(\frac{\sigma_i}{\sigma_w}\right)$$

where $\rho_{i,W}$ = Correlation coefficient between i^{th} market returns and World Market returns
σ_i = Standard deviation of i^{th} market returns
σ_W = Standard deviation of World Market returns

Portfolio Diversification

One way to estimate the benefits of portfolio diversification is to consider the expected return and standard deviation of return for a portfolio consisting of a fraction invested in the host country and the remaining fraction invested in several other countries (or markets).

Therefore, the expected return of a portfolio is calculated as,

$$\mu_p = W' \mu$$

and the variance of the portfolio is calculated as,

$$V_p = W' \Sigma W$$

where, W is the vector of portfolio weights (or percentages) for different markets, μ is the mean vector of returns of markets in the portfolio, and Σ is the variance-covariance matrix. For example, the mean and variance of a portfolio with only two markets (assets) can be simplified as,

$$\mu_p = w_1\mu_1 + w_2\mu_2 \qquad V_p = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2\, w_1 w_2 \sigma_{12}\sigma_1\sigma_2 \quad .$$

Where, μ_1 = average return of market-1, μ_2 = average return of market-2, σ_1 = standard deviation of return of market-1, σ_2 = standard deviation of return of market-2, $\sigma_1 \sigma_2$ = covariance of returns between market-1 and market-2.

Performance Measure

To evaluate the performance of a portfolio, both return and risk should be incorporated into the performance measure. William Sharpe (1966) developed a composite (risk-adjusted) measure of portfolio performance called the reward-to-variability ratio (RVAR). This measure is also known as Sharpe's Performance Index (PI), which can be defined as,

$$PI_p = \frac{\mu_p - r}{\sigma_p}$$

Where, σ_p = standard deviation of p^{th} portfolio return, μ_p = average return of p^{th} portfolio, r = risk-free rate for this period. Therefore, the higher the values of the index better the performance of that portfolio on risk-adjusted basis.

The coefficient of variation (CV), which measures relative variability, can also be used to measure the standardized risk with respect to the mean and can be considered as risk-reward ratio of a portfolio's performance. Coefficient of variation of a portfolio is defined as,

$$CV_p = \frac{\sigma_p}{\mu_p} x 100$$

Therefore, the smaller the CV the better is the performance of that portfolio. Thus, a portfolio is considered to be more diversified if the CV is smaller in value and may be a better measure for diversification, since the coefficient of variation is independent of the unit of measurement. Coefficient of variation is essentially a mirror reflection of Sharpe's Index. Hence, an investor's objective is to construct a portfolio with a relatively lower coefficient of variation or higher Sharpe's Index.

III. PORTFOLIO DIVERSIFICATION SCHEME

In this paper, we have constructed portfolios for the purpose of diversification in the EU stock markets for German, French and British investors respectively. First, we identify the opportunity for portfolio diversification using country beta as the criterion instead of the correlation coefficient for selecting the country to invest. For example, a French investor may look at the remaining 24 countries stock markets and select the country with the smallest beta to invest first. The country with the next highest beta could be the second investment to add to the portfolio. Following this process the investor will allocate funds to the markets in an ascending order of the country's beta value --- the smallest beta country will be the first chosen and the highest beta country will be chosen the last. In the process of portfolio allocation, some basic rules are arbitrarily set. First, an equal allocation to each single foreign market is set at 5% of the total funds. Second, the size of the portfolio is arbitrarily set to include only five assets. So a French investor will have 80% of the funds invested in French stock market and 20% outside of France. Following this procedure, the French investor will have five portfolios (five-assets each) as shown in Exhibit-1. Similarly, five portfolios are constructed for the German investor and

five for the British investor. In total, we have 15 portfolios constructed. The risk-return characteristics of these portfolios are estimated for the eight year period, 1995-2002. We hope to demonstrate that country beta based approach to portfolio diversification offers a new way to build globally diversified portfolios. We have built similar portfolios using correlation coefficient (Markowitz approach) as a selection criterion for the purpose of comparison.

IV. EMPIRICAL ANALYSIS

Data for this study were obtained from Global Financial Data, Inc. and SourceOECD. The data covers the period, 1995-2002. The daily data for all the stock market indices of the EU region were obtained. Daily returns were computed and then the daily returns were annualized. Since, the correlation structure of returns has been one of the bases for judging the diversification (risk reduction) potential. We have estimated the correlation structure of annualized daily stock returns among the EU equity markets and presented in Table I, along with mean and standard deviation. As pointed out earlier in the paper, for certain markets the correlation structure does not give us adequate picture of diversification potential when global diversification is sought. However, Naidu and Choudhury (2006)'s proposed approach of country beta has a greater potential for global diversification. Therefore, we estimated country betas for all the EU stock markets by taking three different perspectives. First, a set of betas was estimated by taking the French market's perspective. Then a second set of betas were estimated from the German perspective. While France and Germany are Euro-zone countries, Great Britain is not. We, therefore, estimated a third set of country betas from the British perspective. We have extended this procedure to estimate country betas from the World Market perspective. We have used Morgan Stanley Capital International Index to represent World Equity Market. These country betas are reported in Table II.

The country beta estimates are explained and discussed in great detail by Naidu and Choudhury (2006). The same beta estimates are used here to construct portfolios in this paper. As described earlier in the methodology section, a set of 15 portfolios was created using Markowitz approach. The set of portfolios appears in Exhibit 1. For the purpose of comparison, we have created another set of 15 portfolios using country beta as the basis of selection using Naidu-Choudhury approach. This second set of portfolios is presented in Exhibit 2. As can be seen from these two exhibits, the least correlated country (asset) portfolio (in exhibit 1) and the lowest-beta portfolio (in exhibit 2) are exactly identical in composition. Furthermore, the first portfolio constructed at the lowest risk level is the same regardless of the investors' home market. The identical nature of the portfolio composition changes, however, as the correlation and the beta levels ascend. For example, the portfolio-2 for French investor in Exhibit 1 and that in Exhibit 2 have a slightly different composition. The portfolio-2 for German investor in Exhibit 1 and that in Exhibit 2 have little more divergence in composition. That means, at the second level of screening, using correlation as selection basis produced a portfolio that is different in composition than that produced by the country beta as the selection criterion. The differences are easily discerned as one peruses the two exhibits.

Table III presents the mean, standard deviation, coefficient of variation (CV), and Sharpe's Index for all 15 portfolios constructed using the correlation-based (Markowitz) screening criterion. The portfolios are also plotted in mean-standard deviation space as shown in Fig. 1 and the results are somewhat disappointing. Sharpe's Index values are all negative

implying that all the 15 portfolios constructed using Markowitz approach underperformed the risk-free assets (short-term government debt) in their respective home markets. The degree of underperformance varied greatly among the 15 portfolios. The first set of portfolios delivered a better risk-adjusted performance than the other four sets. In other words, the markets in Latvia, Lithuania, Slovenia, and Slovakia offered the best diversification potential for the French, German, and British investors alike. These investors would have been better off, however, had invested in their own government short-term government debt instruments (risk-free assets).

Table IV displays the mean, standard deviation, coefficient of variation (CV), and Sharpe's Index for all 15 portfolios constructed using the country beta as the basis for screening. The portfolios are also plotted in mean-standard deviation space in Fig. 2. While a majority of portfolios constructed using country beta approach also produced negative values of Sharpe's Index, one set (set No. 4) of portfolios showed uniquely positive values of Sharpe's Index and lower values for coefficient of variation. In other words, the country beta based method of constructing portfolios produced superior performance of risk-adjusted returns, whereas Markowitz method did not. Thus, the stock markets of Denmark, Belgium, Italy, and Turkey offered an opportunity for investors in France, Germany, and Britain to diversify and construct portfolios with superior risk-adjusted performance.

V. CONCLUSION

International portfolio diversification is advocated to earn higher returns with lower risk in a world of less integrated capital markets. Markowitz approach to domestic diversification was simply extended to global diversification by Levy and Sarnat (1970) and Solnik (1974). Little attention has been directed toward the investigation of relative risk measure (beta) for potential diversification gain in international arena. This paper proposes a method of portfolio construction on the basis of country beta criterion suggested by Naidu and Choudhury (2006). Portfolios are constructed using both Naidu-Choudhury (beta) approach and Markowitz (correlation) approach for three different markets (France, Germany, and Britain) and then the performance of these portfolios has been measured. The analysis reveals that Naidu-Choudhury approach produces considerably superior portfolios as opposed to Markowitz approach. Another interesting finding is that the two different approaches produce portfolios with different composition of markets, but the composition of markets stays same for the best diversified portfolio in all three home markets considered in this paper. That means the group of countries' markets with better potential for diversification was identified by the Naidu-Choudhury (country beta) approach, but was completely missed by the Markowitz approach.

Exhibit-1: Correlation Approach (Markowitz)

Exhibit 1

Investor	5% Each	Investor	5% Each	Investor	5% Each
1. French Investor 80% Domestic	Latvia, Lithuania, Slovenia, Slovakia	1. German Investor 80% Domestic	Latvia, Lithuania, Slovenia, Slovakia	1. British Investor 80% Domestic	Latvia, Slovenia, Lithuania, Slovakia
2. French Investor 80% Domestic	Cyprus, Turkey, Greece, Luxemburg	2. German Investor 80% Domestic	Cyprus, Turkey, Greece, Luxemburg	2. British Investor 80% Domestic	Cyprus, Turkey, Greece, Luxemburg
3. French Investor 80% Domestic	Hungary, Czech, Poland, Austria	3. German Investor 80% Domestic	Hungary, Czech, Poland, Ireland	3. British Investor 80% Domestic	Hungary, Poland, Czech, Austria
4. French Investor 80% Domestic	Ireland, Portugal, Denmark, Italy	4. German Investor 80% Domestic	Portugal, Austria, Denmark, Finland	4. British Investor 80% Domestic	Portugal, Ireland, Italy, Denmark
5. French Investor 80% Domestic	Finland, Belgium, Sweden, Germany	5. German Investor 80% Domestic	Italy, Belgium, Sweden, Spain	5. British Investor 80% Domestic	Finland, Belgium, Sweden, Germany

Exhibit-2: Country Beta Approach (Naidu-Choudhury)

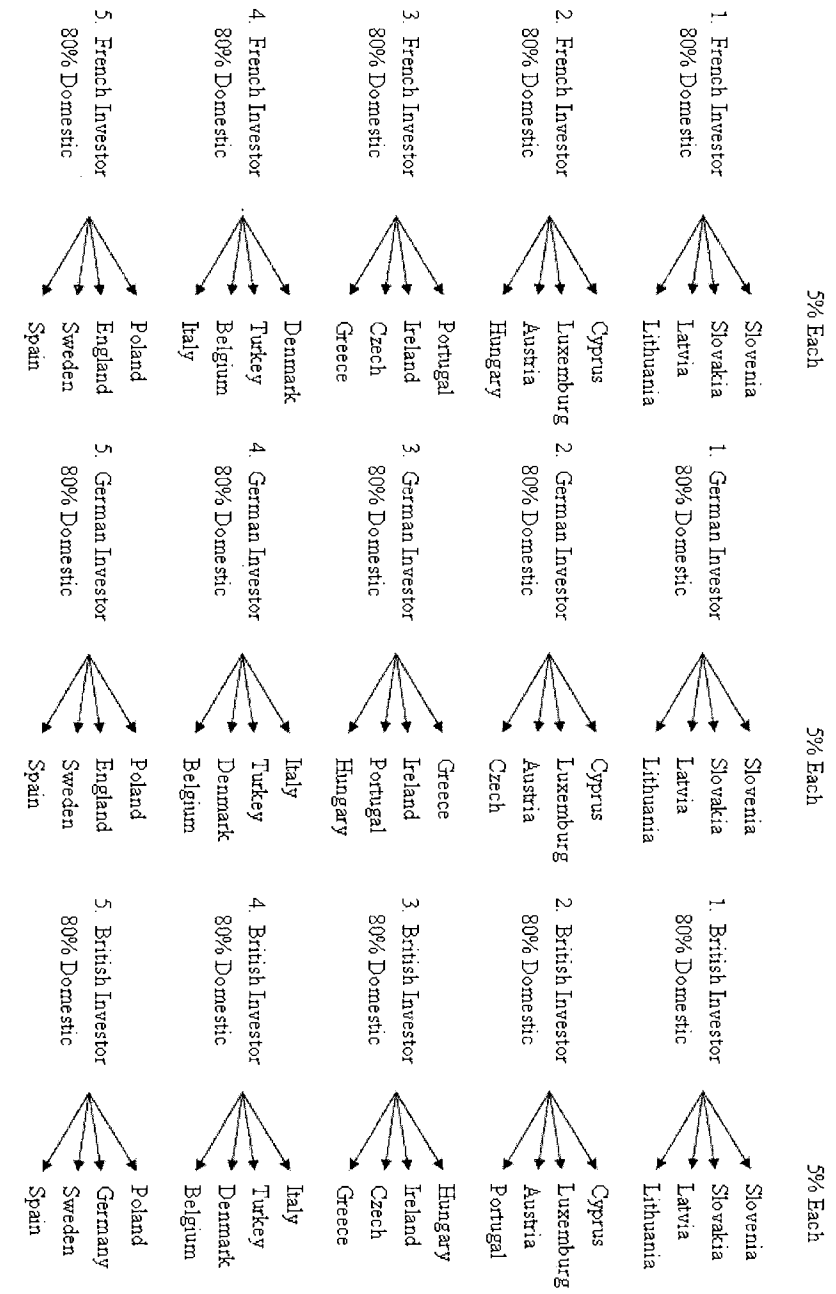


TABLE I

Correlations, Means, and Standard Deviations of Annualized Daily Stock Market Returns (1995-2002)

Country	France (Correlations)	Germany (Correlations)	England (Correlations)	Mean	Std Dev
Cyprus	0.05905	0.04649	0.0522	2.548886	31.61424
Czech	0.3519	0.32458	0.35747	0.840479	15.25584
Estonia	0.02385	0.04555	0.03607	30.84651	826.255
Hungary	0.29627	0.31528	0.31101	1.428562	17.77597
Latvia	0.00888	-0.01817	0.00671	3.682336	32.09027
Lithuania	0.02061	-0.0047	0.02845	2.885802	54.48763
Poland	0.36543	0.37809	0.34637	2.975744	26.76885
Slovak	0.02999	0.02259	0.0367	0.951593	18.09857
Slovenia	0.02069	0.01494	0.02295	1.634605	19.97969
Turkey	0.16319	0.15891	0.15974	9.048344	46.25241
Austria	0.42642	0.4684	0.41176	0.468229	9.771192
Belgium	0.68338	0.64761	0.64296	1.024673	14.19741
Finland	0.62046	0.59926	0.58671	3.905338	29.09374
France	1	0.76984	0.78995	1.64994	18.26091
Germany	0.76984	1	0.70146	1.794359	19.6342
Greece	0.23495	0.23291	0.23689	2.399457	22.49086
Ireland	0.4471	0.43481	0.4691	0.92267	12.63724
Italy	0.60126	0.60368	0.54557	1.408155	15.88367
Luxemburg	0.2613	0.26149	0.2575	0.854859	12.86015
Portugal	0.49529	0.46282	0.44418	0.706565	11.05724
Spain	0.78975	0.69531	0.70376	1.788768	18.33543
Netherlands	0.83558	0.77935	0.78726	1.674792	18.23667
Denmark	0.5684	0.5615	0.56434	0.853833	11.13353
Sweden	0.73566	0.68018	0.69518	1.672451	18.13933
England	0.78995	0.70146	1	0.96971	14.10533

TABLE II

Country Betas of Annualized Daily Stock Market Returns (1995-2002)

Country	France	Germany	England	World
Cyprus	0.10223045	0.07485644	0.11639574	0.258494646
Czech	0.29399026	0.25219975	0.38662721	0.477271254
Estonia	1.07914564	1.91685508	2.1128904	9.849786708
Hungary	0.28840215	0.28544107	0.39194427	0.598394564
Latvia	0.01560501	-0.0296972	0.01526556	0.088257406
Lithuania	0.06149694	-0.0130432	0.10989981	0.089103894
Poland	0.53568739	0.51547978	0.65733483	0.851627098
Slovak	0.02972339	0.02082319	0.04708982	0.10224307
Slovenia	0.02263741	0.01520289	0.03250784	0.008353861
Turkey	0.41333812	0.37434528	0.52379909	0.747343026
Austria	0.22817218	0.23310481	0.28523869	0.306413146
Belgium	0.5313112	0.46828417	0.64715724	0.79953869
Finland	0.98853257	0.88797697	1.21015175	1.567612772
France	1	0.71599451	1.02267762	1.198728021
Germany	0.82773487	1	0.97641139	1.343971131
Greece	0.28937368	0.266797	0.37771954	0.661820377
Ireland	0.30941003	0.27985847	0.42027572	0.467679693
Italy	0.52298691	0.48836498	0.61435321	0.821743392
Luxemburg	0.19810398	0.17127256	0.23476852	0.329195259
Portugal	0.2999051	0.26064274	0.34819493	0.394823656
Spain	0.79297265	0.64931624	0.91481294	1.07516531
Netherlands	0.8344707	0.72387707	1.01784205	1.145625004
Denmark	0.34654904	0.31839748	0.44544144	0.516719221
Sweden	0.73076208	0.62839387	0.89399539	1.110015592
England	0.61018349	0.50393322	1	0.881638953

TABLE – III

Portfolios created using country correlations in ascending order (5% allocation).

Portfolios	MEAN	Standard Deviation	Coefficient of Variation (CV) %	Sharpe's Index	Portfolio of five countries & their % allocation				
French Investor -1	3.301966	26.45472	801.181	**-0.02865**	French-80%	Latvia - 5%	Lithuania-5%	Slovenia-5%	Slovakia -5%
French Investor -2	2.736739	25.85873	944.874	-0.05117	French-80%	Cyprus-5%	Turkey-5%	Greece-5%	Luxemburg -5%
French Investor -3	0.998507	13.80841	1382.906	-0.22171	French-80%	Hungary -5%	Czech-5%	Poland-5%	Austria-5%
French Investor -4	1.514513	16.05709	1060.214	-0.15853	French-80%	Ireland-5%	Portugal-5%	Denmark -5%	Italy-5%
French Investor -5	1.270843	14.08457	1108.285	-0.19803	French-80%	Finland-5%	Belgium -5%	Sweden-5%	Germany-5%
German Investor -1	3.309187	26.42655	798.582	**-0.01517**	German-80%	Latvia-5%	Lithuania -5%	Slovenia -5%	Slovakia-5%
German Investor -2	2.74396	25.85429	942.226	-0.03736	German-80%	Cyprus -5%	Turkey-5%	Greece-5%	Luxemburg -5%
German Investor -3	1.02845	13.87579	1349.195	-0.19325	German-80%	Hungary -5%	Czech-5%	Poland - 5%	Ireland-5%
German Investor -4	0.737588	9.606861	1302.470	-0.30941	German-80%	Portugal -5%	Austria-5%	Denmark -5%	Finland-5%
German Investor -5	1.152925	13.69982	1188.266	-0.18665	German-80%	Italy-5%	Belgium -5%	Sweden-5%	Spain-5%
British Investor -1	3.267954	26.44487	809.218	**-0.10029**	British-80%	Latvia - 5%	Slovenia -5%	Lithuania -5%	Slovakia-5%
British Investor -2	2.702727	25.81906	955.297	-0.12461	British-80%	Cyprus -5%	Turkey-5%	Greece-5%	Luxemburg -5%
British Investor -3	0.964495	13.72044	1422.551	-0.36118	British-80%	Hungary -5%	Poland-5%	Czech - 5%	Austria-5%
British Investor -4	0.935049	11.38743	1217.843	-0.43776	British-80%	Portugal-5%	Ireland-5%	Italy-5%	Denmark-5%
British Investor -5	1.236832	13.89157	1123.158	-0.33712	British-80%	Finland-5%	Belgium -5%	Sweden - 5%	Germany -5%

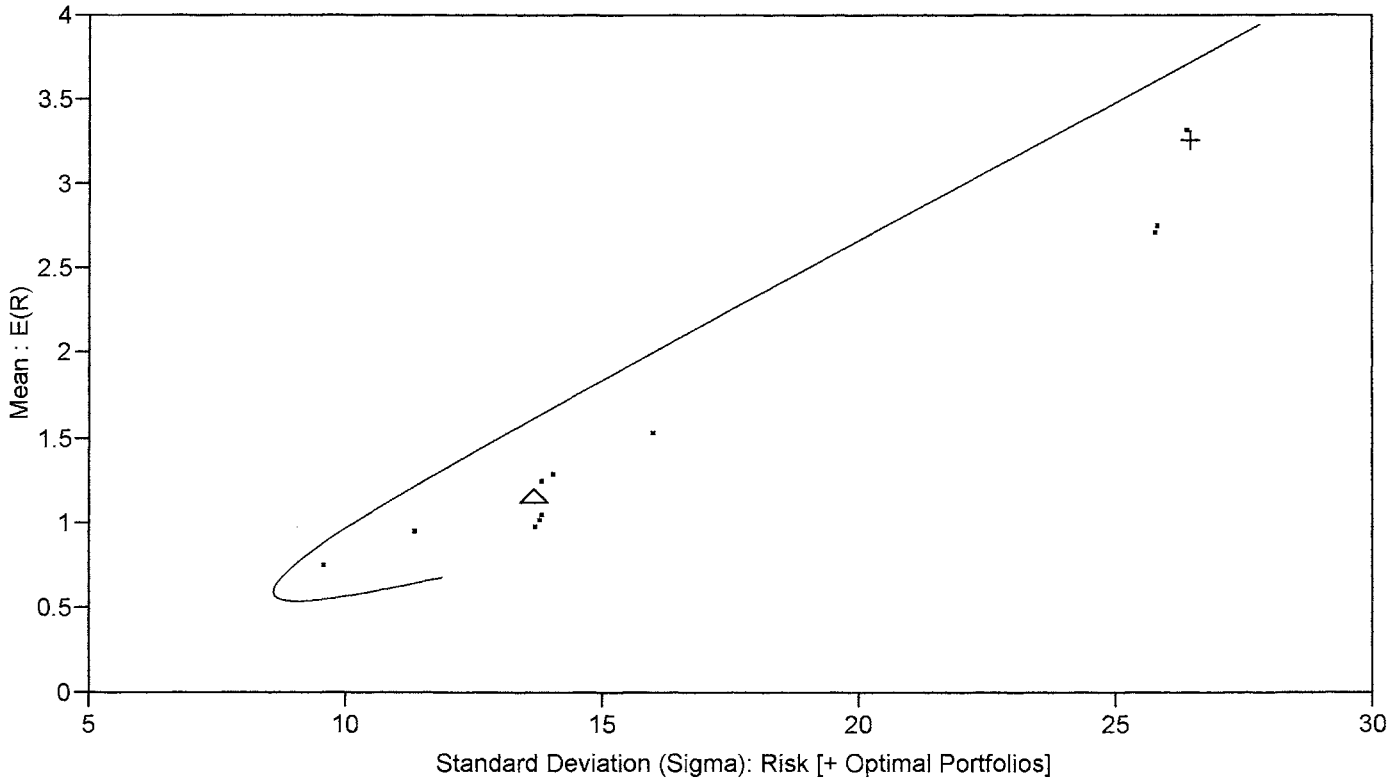
Note: Coefficient of Variation (CV) = (Standard Deviation / Mean) x 100.
Sharpe's Performance Index (PI) =
(average return – risk-free rate) / standard deviation of returns.

TABLE IV

Portfolios created using country betas in ascending order (5% allocation).

Portfolios	MEAN	Standard Deviation	Coefficient of Variation (CV) %	Sharpe's Index	Portfolio of five countries & their % allocation				
French Investor -1	3.301966	26.45472	801.181	-0.02865	French-80%	Slovenia-5%	Slovakia-5%	Latvia-5%	Lithuania-5%
French Investor -2	2.259188	25.6104	1133.611	-0.07032	French-80%	Cyprus-5%	Luxembourg-5%	Austria-5%	Hungary-5%
French Investor -3	0.956315	13.28055	1388.722	-0.23370	French-80%	Portugal-5%	Ireland-5%	Czech-5%	Greece-5%
French Investor -4	7.485506	37.64665	**502.927 (+)**	**0.09099**	French-80%	Denmark-5%	Turkey-5%	Belgium-5%	Italy-5%
French Investor -5	2.684638	22.83002	850.395	-0.06024	French-80%	Poland-5%	England-5%	Sweeden-5%	Spain-5%
German Investor -1	3.309187	26.42655	798.582	-0.01517	German-80%	Slovenia-5%	Slovakia-5%	Latvia-5%	Lithuania-5%
German Investor -2	2.237005	25.59203	1144.031	-0.05756	German-80%	Cyprus-5%	Luxembourg-5%	Austria-5%	Czech-5%
German Investor -3	1.434002	15.38938	1073.177	-0.14789	German-80%	Greece-5%	Ireland-5%	Portugal-5%	Hungary-5%
German Investor -4	7.492726	37.65728	**502.585 (+)**	**0.10045**	German-80%	Italy-5%	Turkey-5%	Denmark-5%	Belgium-5%
German Investor -5	2.691859	22.86657	849.471	-0.04453	German-80%	Poland-5%	England-5%	Sweden-5%	Spain-5%
British Investor -1	3.267954	26.44487	809.218	-0.10029	British-80%	Slovenia-5%	Slovakia-5%	Latvia-5%	Lithuania-5%
British Investor -2	2.189077	25.53854	1166.635	-0.14609	British-80%	Cyprus-5%	Luxembourg-5%	Austria-5%	Portugal-5%
British Investor -3	0.958403	13.52968	1411.690	-0.36672	British-80%	Hungary-5%	Ireland-5%	Czech-5%	Greece-5%
British Investor -4	7.451494	37.59742	**504.562 (+)**	**0.04073**	British-80%	Italy-5%	Turkey-5%	Denmark-5%	Belgium-5%
British Investor -5	2.691859	22.86657	849.471	-0.14117	British-80%	Poland-5%	Germany-5%	Sweden-5%	Spain-5%

FIG-1: Plots for means and standard deviations of Portfolios using country correlations (5% allocation).



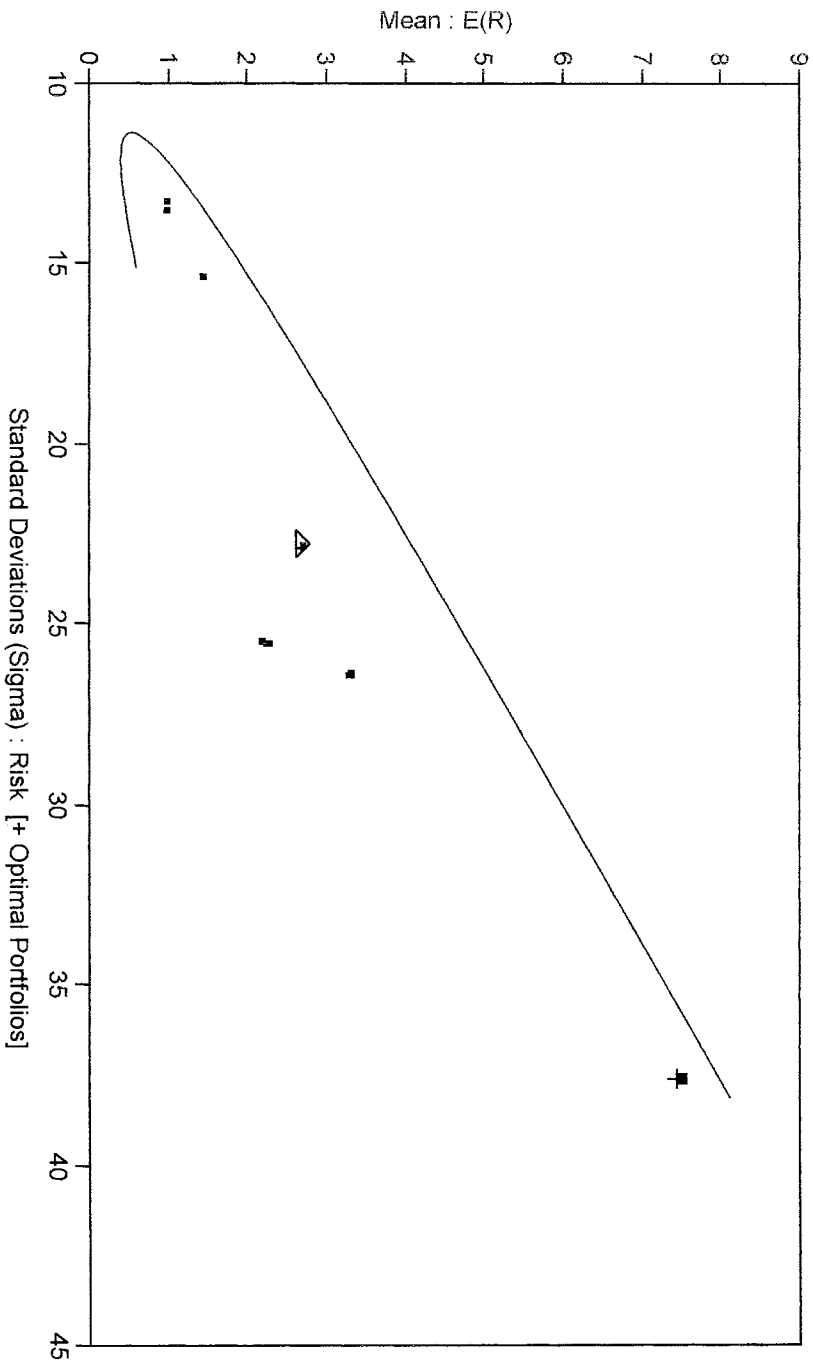


FIG-2: Plots for means and standard deviations of Portfolios using country betas (5% allocation).

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