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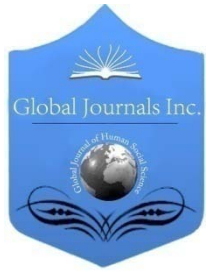

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An Empirical Validation of a Home Bias Model

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In summary, our empirical analysis suggests that U.S. investors should diversify their portfolios by including home equities traded abroad selected in developed and emerging markets. This result corroborates that of Salehizadeh (2003).

Since U.S. MNCs could not substitute indices returns, home bias problem will continue to exist because, on the one hand, foreign investment has risks that are absent in home portfolios and on the other hand, U.S. institutional investors have an information advantage as well as higher international returns.

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I. Introduction

During the past two decades, investment in international portfolios has become widespread among American investors. Economic reforms and liberalization of markets including those related to the United States have developed more attractive international markets. This change has prompted individual and institutional investors based in the United States to place a greater share of their respective portfolios in overseas markets. Such investments have been approved by theoretical foundations and empirical evidence in the literature that supports international diversification.

At the same time, although previous studies (Ahearne, Griever and Warnock (2001), Rowland (1999) and Suh (2000)) showed that the continued existence of a number of factors, including some risks (e.g political and exchange rate factors), differences in transaction costs (which are significantly higher in the European Union and many other countries other than the United States), restrictions on foreign ownership and information asymmetries arising from poor quality and low credibility of financial information in several countries, may cause a home bias for U.S. investors while investing their equities.

Under ideal conditions, the international model of asset pricing predicts that individuals hold equities in proportion of the global market capitalization of each stock. However, estimates have revealed that holdings of U.S. investors in foreign stocks constitute almost 12% of their total holdings. This puzzle can be expected to influence the method selected by investors to maximise the benefits of international diversification.

Investors who have direct access to foreign markets can purchase overseas equities or equivalent American Depository Receipts (ADRs) if they are available. For others, investment in diversified international mutual funds (including country funds) offers a semi-direct alternative.

However, these two methods (especially investments that target the equities of companies based in emerging economies) suffered significant reversals of capital flows following a series of economic and financial crises (currency) that took place in the second half of 1990s.

Therefore, for most investors based in the United States who continue to exhibit a home bias, it appears that there is a safer way to achieve the benefits of international diversification through investments in multinational corporations (MNC) based on U.S. territory.

However, empirical research has generated mixed results for the previous hypothesis. Some studies argue that U.S. MNC behave more like home firms with their respective share prices that vary in tandem with U.S. indices instead of international indices. U.S. investors who hold equities in home and multinational companies are cited as the main force that leads to such behavior in share price.

These results combined with additional evidence indicating low correlation between home and foreign indices lead us to include international share in a well diversified U.S. portfolio. On the other hand, some researchers have drawn conclusions in favour of diversified portfolios in home equities (composite MNC equities and other exchanged U.S. assets) that mimic the gains from investments in foreign equities.

Moreover, some previous empirical studies that put focus on the increasing levels of financial and economic interdependence in the world have shown that several sectors have gradually become global leaders through synchronized movements of equities and prices and have found increasing correlation between U.S. indices and foreign indices.

In this section, we will try to test the relationship between U.S. indices and other international indices, which will measure the benefits of international

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diversification, and then, we will explain home bias among U.S. investors.

II. Methodology and Hypotheses

We will follow the methodology adopted by Salehizadeh (2003). The author used techniques based on cointegration (like in Dickey, Jansen and Thornton (1991) and Hamilton (1994)) to examine degree of integration between U.S. and foreign markets indices.

Methods of cointegration have been used by Ely and Salehizadeh (2001) and Jiang (1998) to test the presence of a long-term equilibrium relationship between indices. More specifically, a time series vector of order $(n \times 1)$ is called cointegrated if each of its elements is individually integrated of order 1 (denoted $I(1)$).It is then non-stationary with a unit root and there is a nonzero vector ∀ of order $(n \times 1)$ such that $\forall' y_1$ is stationary. In this case, ∀is called a co-integrating vector.

Cointegration means that one (or more) linear combinations of variables is stationary even if these variables are not individually stationary. Since stock prices and indices are considered non-stationary variables that are frequently a $I(1)$ process, the cointegration test is specified to determine any long-term relationship between such variables.

The empirical approach consists in the following steps. First, it should be ensured that the variables are non-stationary and have the same order of integration. The unit root tests (using ADF [1]) are conducted on the y_t^1 series (degrees) and y_t^1 series (at first difference). Then, if we accept the hypothesis of integration of order 1 for each variable, then cointegration of y_t can be tested using Johansen's likelihood ratio test. The procedure is based on the estimation of the following regression equation (in vector form):

$$\Delta y_t = \pi + \Pi_1 \Delta y_{t-1} + \cdots + \Pi_{k-1} \Delta y_{t-(k-1)} + \Gamma y_{t-k} + u_t \qquad (1)$$

Where k is the number of shifts for the assumed VAR process, π is a vector of constant terms Π_t and Γ represent (n × n) matrices of OLS coefficients and u_t denotes the (n × 1) vector of OLS residuals. The likelihood ratio test is used to test the null hypothesis which states that there are no co-integrating relationships against the alternative hypothesis of n co-integrating relationships (where n is the number of elements of y_t).

For series found not cointegrated, we use several other tests based using the bivariate causality model proposed by Granger (1969) and Sims (1972):

$$S_t = c + \sum_{j=1}^{p} \alpha_j S_{t-j} + \sum_{j=1}^{p} \beta_j M_{t-j} + \eta_t, \qquad (2)$$

$$M_t = d + \sum_{j=1}^{p} \delta_j S_{t-j} + \sum_{j=1}^{p} \gamma_j M_{t-j} + \mu_t, \qquad (3)$$

Where S and M are two different market indices observed at time t, where p denotes lag length and η and μ are assumed to be uncorrelated in series with a zero mean and a finite covariance matrix.

For the M index to be Granger causally linked to S, the β coefficient should be different from zero in equation (2) and the δ coefficient should be zero in equation (3). The opposite is checked in order for S to be Granger causally related to M.

a) The Hypotheses

Our empirical study aims at testing the validity of one of these two hypotheses:

- *Hypothesis 1:* Investment should be made in foreign markets in order to diversify well portfolios and consequently reduce risk and increase home portfolio efficiency.
- *Hypothesis 2:* Investment in foreign markets does not increase home portfolio returns.

b) Presentation of data

Data are daily frequency. We will select ten indices namely: Euro (developed European countries index) EAFE Index (twenty-one developed countries) [2], WOR (index of all developed markets in the world: twenty three countries), WORE (the world without Europe Index) WORU (the world without the United States of America index), NA (North American countries index: the United States of America and Canada), LA (index of Latin American countries), EM (Emerging Markets Index: twenty six countries) EMEURO (European Emerging Markets Index) and Amasya (Asian emerging markets index). Then, we will consider four U.S. indices: the Dow Jones Industrial Average, NYSE, NASDAQ and SP 500. Daily closing values are taken from YAHOO-Finance.

International equity markets indices are in USD. They are taken from Morgan Stanley Capital International (MSCI). These indices consist of weighted data largely representative of equities of different countries. They are weighted with respect to equities with larger capitalization.

From these rates, which are end of period values , we will calculate returns. The study period stretches from 5 July 2006 until 04 July 2011.

[1] Augmented Dickey-Fuller

[2] Europe, Australia and far East countries.

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III. Empirical Results and Interpretations

a) Descriptive statistics of time series

Table (1) gives us the descriptive statistics of the examined fourteen markets indices:

Table 1 : Descriptive statistics

Characteristics	DJIA	NDX	NYSE	SP500	EURO	EAFE	WOR	WORE	WORU	NA	LA	EM	EMEURO	EMASIA
Mean	0,000178	0,000397	0,000123	0,000136	0,000113	0,000058	0,000095	0,000111	0,000079	0,000176	0,000725	0,000455	0,0003406	0,0004858
maximum	0,110803	0,125799	0,122162	0,115800	0,118935	0,085650	0,095232	0,089991	0,086183	0,109907	0,166070	0,105976	0,204435	0,1348689
minimum	-0,07873	-0,10519	-0,09725	-0,09034	-0,09852	-0,08436	-0,07063	-0,07167	-0,08492	-0,09066	-0,13980	-0,09511	-0,180667	0,0825948
skeweness	0,249645	0,133010	-0,06890	0,010163	0,262667	-0,12166	-0,20171	-0,20137	-0,12409	-0,12234	-0,02646	-0,22937	0,112817	-0,0781775
kurtosis	12,55622	10,35265	11,05516	11,85019	9,25394	9,329154	10,75433	11,68819	9,477472	11,7901	11,52433	10,10751	13,63196	9,514398
Median	0,000594	0,001219	0,000824	0,000873	0,000525	0,000809	0,000913	0,000851	0,000769	0,000677	0,001340	0,001177	0,0015274	0,0011615
Standard Deviation	0,014227	0,016460	0,016530	0,015581	0,018866	0,144772	0,013035	0,012749	0,014389	0,015347	0,022575	0,015993	0,0245579	0,0167308

In this table, we note that the average American indices (DJIA, NDX, NYSE and SP500) are generally higher than the average of other markets (except indices containing only emerging countries: LA, EM, EMEURO and EMASIA). Concerning standard deviation, we note that the U.S. markets have relatively inferior values than others especially those of only emerging countries. The maximum and minimum values explain this trend.

Pearson Kurtosis indicates that all distributions have an interesting kurtosis excess. Skeweness indicates that most indices returns distributions have longer left tails: left-tailed distributions. This indicates that most observations lay to the right of the median, with the exception of five indices whose distributions are right-tailed, i.e. most of the observations lie to the left of the mean.

Observed trends of the descriptive statistics show that the U.S. markets have higher and mixed values than those of developed markets but lower than those emerging markets. This conclusion contrasts that of Salehizade (2003) where the study period spans from January 1995 to May 2001. Consequently, we can locate a significant reversal in world markets which can induce changes in investor behavior.

However, standard deviations exhibit high volatility in all markets and especially the European markets (developed and emerging). This volatility is mainly due to financial crises.

b) The results and interpretations

i. *Correlation of returns*

Correlations of returns are given in table (2). The correlation of returns between the U.S. market index and another world index MSCI tells us about the extent of the benefits of international diversification. The lower the correlation, the greater the potential gains of a U.S. investor. Therefore, the inclusion of foreign equity in a diversified U.S. portfolio is highly recommended. This result is consistent with those of Kanas (1998), Longin and Solnik (1995) and Solnik (1996).

As expected, the largest correlations (possible winning month) are between the U.S. indices. However, although some markets include U.S. firms (NA and WOR), correlations with U.S. markets are very low. This can be explained by the decreasing capitalization of U.S. firms relative to foreign firms in the world index and the weak correlation between prices of the same U.S. firms in different markets.

Examining the DJIA index, which is small in terms of number of firms, but large in terms of capitalization, we find a very low correlation (-0.0004) with the WORE index (implying the greatest potential gain for U.S. investors). Then, we see that correlations for the LA, WOR, EURO and NA indices are -0.0008, -0.0033, -0.0050 and 0.0172 respectively with the DJIA.

In summary, investment in any foreign index will induce significant gains, especially the five indices that are less correlated with DJIA: WORE, LA, WOR, EURO and NA. This is in contrast to research that states that a high correlation is needed to obtain potential gains: Ammer and Mei (1996), Brooks and Catão (2000), Cheng (1998) and Kaplanis (1988). Table (2) shows the correlations between the different studied indices:

Table 2 : Correlation matrix between the different studied indices

	DJIA	NDX	NYSE	SP500	EURO	EAFE	WOR	WORE	WORU	NA	LA	EM	EMEURO	EMASIA
DJIA	1,0000													
NDX	0,9098	1,0000												
NYSE	0,9698	0,9064	1,0000											
SP500	0,9861	0,9321	0,9873	1,0000										
EURO	-0,0050	-0,0179	-0,0087	-0,0024	1,0000									
EAFE	-0,0291	-0,0481	-0,0360	-0,0280	0,9311	1,0000								
WOR	-0,0033	-0,0177	-0,0190	-0,0084	0,8527	0,8412	1,0000							
WORE	-0,0004	-0,0134	-0,0207	-0,0096	0,6569	0,6618	0,9504	1,0000						
WORU	-0,0280	-0,0468	-0,0363	-0,0275	0,9334	0,9967	0,8671	0,6979	1,0000					
NA	0,0172	0,0093	-0,0026	0,0079	0,5912	0,5163	0,8972	0,9652	0,5601	1,0000				
LA	-0,0008	0,0147	-0,0124	-0,0040	0,7381	0,7090	0,8379	0,7749	0,7383	0,7487	1,0000			
EM	-0,0335	-0,0543	-0,0424	-0,0365	0,7343	0,8362	0,7659	0,6662	0,8434	0,5292	0,7836	1,0000		
EMEURO	-0,0377	-0,0676	-0,0472	-0,0440	0,7690	0,7883	0,7135	0,5737	0,7987	0,4876	0,6943	0,8216	1,0000	
EMASIA	-0,0402	-0,0545	-0,0452	-0,0415	0,4923	0,6684	0,5248	0,4590	0,6609	0,2828	0,4727	0,8964	0,5869	1,0000

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ii. *Cointegration and causality test*

To examine the long-term relationships between the remaining indices, we will perform cointegration tests. First, each time series of a variable will be checked by the unit root test. Table (3) reports the ADF test results of the remaining indices:

Table 3 : The Augmented Dikey-Fuller test

Index	Statistic
DJIA	-35,361
NDX	-35,094
NYSE	-35,415
SP500	-35,351
WORE	-36,673
LA	-36,591
WOR	-36,882
EURO	-36,224
NA	-36,935

The ADF statistics show that all series are non-stationary and integrated at first order, implying that the returns are stationary. Then, we will apply the Johansen trace test for cointegration on the y_t vector of equation (1). This test will be applied to each pair of indices. Table (4) reports the different statistics:

Table 4 : Johansen's cointegration tests (Trace Statistic)

	WORE	LA	WOR	EURO	NA
DJIA	512,391	511,8536	522,6881	531,0546	508,7223
NDX	504,7409	509,4754	512,1067	525,9046	505,3028
NYSE	512,6021	512,3334	522,7783	529,0053	508,8457
SP500	512,5072	512,7601	520,6628	528,7656	509,7517

We used two lag intervals in the VAR and cointegration equations. The critical value at the 5% level starts at 15.41%. The values of the Trace statistics show that the hypothesis of non-existence of cointegration cannot be rejected for all pairs of indices and at all significance levels.

Then we will conduct Granger causality Wald tests for each pair of indices. Lag length is 1. The following table shows the different relationships between pairs and decisions on hypotheses:

Table 5 : The Granger Causality Wald test

Null Hypothesis	Chi2	Decision
DJIA is not causally related to WORE	7,2688	Accepted
DJIA is not causally related to LA	2,6368	Rejected
DJIA is not causally related to WOR	4,4929	Accepted
DJIA is not causally related to EURO	0,50922	Rejected
DJIA is not causally related to NA	7,2724	Accepted
NDX is not causally related to WORE	5,4069	Accepted
NDX is not causally related to LA	2,4532	Rejected
NDX is not causally related to WOR	3,4822	Rejected
NDX is not causally related to EURO	0,53134	Rejected
NDX is not causally related to NA	5,9313	Accepted
NYSE is not causally related to WORE	8,0091	Accepted
NYSE is not causally related to LA	2,8495	Rejected
NYSE is not causally related to WOR	5,0159	Accepted
NYSE is not causally related to EURO	0,66927	Rejected
NYSE is not causally related to NA	8,1122	Accepted
SP500 is not causally related to WORE	7,6743	Accepted
SP500 is not causally related to LA	3,058	Rejected
SP500 is not causally related to WOR	4,7494	Accepted
SP500 is not causally related to EURO	0,59431	Rejected
SP500 is not causally related to NA	7,73	Accepted

The failure to show the presence of a long-run equilibrium relationship between the four U.S. indices and the other indices support correlation and hence the potential gains from international diversification. To better understand the relationship between the non co-integrated pairs, we applied the Granger causality test as indicated by equations (2) and (3).

Table 5 shows that the hypothesis of non-existence of a Granger causality relationship between U.S. indices and LA is always rejected. The same is true for EURO. Concerning WORE, WOR (except its relationship with NDX) and NA, the hypothesis is always accepted. We can then conclude that the U.S. indices have no influence on European and Latin American markets. Consequently, a U.S. investor needs to

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diversify their portfolio by investing in these indices. It should be noted that these results are logical because WORE, WOR and NA contain U.S. firms.

iii. *Portfolio of U.S. multinational corporations (MNCs)*

Errunza et al. (1999) indicated that the inclusion of U.S. multinational corporations (MNC) in a diversified home portfolio can have a positive effect on returns. These researchers examined monthly data and thirty MNCs. Their study period ends in 1993.

Salehizadeh (2003) used daily data of forty seven MNCs from different sectors. The study period runs from January 1995 until May 2001. His findings corroborate those of Errunza et al. (1999).

Like Salehizadeh (2003), we will use the SP500 index as a home benchmark. It consists of five hundred selected stocks based on the criteria of size, liquidity and industry. It is an index weighted by market value (share price multiplied by outstanding equities). Each weighting of a stock in the index is proportionate to its market value.

Then, we will build a diversified home portfolio that includes 46 MNCs to test the possible substitution of foreign equities by U.S. MNCs. We will calculate portfolio correlation with world indices and the correlation of the combination of SP500 and the portfolio with these indices (equal weights combination).

Table (6) reports the correlation of daily returns between the home portfolio (SP500), MNCs portfolio and the combined portfolio on the one hand, and the five market indices previously used (WORE, LA, WOR, EURO and NA) on the other hand:

Table 6 : Correlation of portfolios

Portfolio	WORE	EURO	WOR	LA	NA
SP500	-0,0096	-0,0024	-0,0084	-0,0040	0,0079
MNC	-0,0176	0,0192	-0,0031	0,0009	-0,0212
Mixed	-0,0170	0,0197	-0,0026	0,0026	-0,0209

Correlations reported in this table leads to conflicting conclusions. If we reason in absolute value, we note that the MNC portfolio is more correlated with the world indices of WORE, EURO and NA. This can be explained by the presence of these MNCs in these indices. However, the SP500 portfolio is better correlated with WOR and LA. More precisely, we know that WORE is the world index without Europe, LA is the Latin American markets index and NA is the North American markets index. Then, the incorporation of MNCs increased portfolio correlation with the selected five markets. However, this correlation remains low and hence we can conclude that it is necessary to diversify home portfolio by purchasing foreign equities.

For the WOR and EURO indices, the incorporation of MNCs in the home portfolio had a negative effect on the correlation with world markets. U.S. multinational corporations have failed to follow the potential equity additional returns. Therefore, there is a need to invest in foreign markets in order to diversify well the portfolio and consequently reduce the risk and increase the home portfolio efficiency. Accordingly, and as proposed by Errunza et al. (1999) and Salehizadeh (2003), we confirm the first hypothesis.

In summary, U.S. investors have missed opportunities to maximize returns on their portfolios and minimize home-bias risk. This bias is caused mainly, first, by information asymmetry, second, by hunting down returns phenomenon and thirdly, by investors' preference for geographic proximity.

Since 1980, economic reforms and liberalization of world markets have attracted U.S. investors. Therefore, researchers assumed that international diversification is beneficial. However, the continued existence of risks and international barriers produced home bias in these investors who trusted more U.S. MNCs to acquire more gains from international diversification.

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