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Abstract

This paper focuses on measuring the degrees of market integration (or segmentation) providing a tool for country selection in international portfolio diversification. It develops methodology measuring effective systemic risk as a proxy of market integration (or segmentation) and therefore allows for appropriate country selection in the better-performing stock markets of the world. The empirical evidence is used to clarify the conclusions about internationally integrated versus segmented markets. Some markets appear more integrated than one might have expected based on information of investment restrictions. Other markets appear segmented despite the fact that foreign investors have relatively free access to their capital markets. This is because these markets were less responsive to the world trend than others. Thus, still international diversification allows investors to reduce the risk and increase the expected return, shifting the efficient frontier to the left.

Keywords : *International portfolios, diversification, market integration, Segmentation, systemic risk, capital asset pricing model.*

JEL Classification: F36

1. Introduction

Grubel (1968) developed the international portfolio diversification theory. The theory is based on a simple macroeconomic model in order to examine the benefits for investors obtained by diversifying internationally. It is well documented that segmented markets offer a great deal in terms of both risk reduction and return

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improvement. Since the fortunes of different nations do not always move together, investors can diversify their portfolios by holding assets in several countries. The benefits of international diversification have been recognised for decades. International markets provide the opportunity for diversification. Local market investors may select low-risk low expected return investments. In international markets, investors shift to high-risk high-expected return projects because they are able to diversify their overall risk.

However, in the course of the last two decades many countries have liberalised and deregulated their capital and foreign exchange markets in recent years. Moreover, the recent advancements in computers and telecommunications led to a major reduction in transaction and information costs associated with international investments. Besides, investors might have become aware of the potential gains from international investments. The markets have become more integrated.

The issue of stock market integration is of considerable importance to both investors and corporate managers. As stock markets become more integrated and move increasingly together, the diversification benefits of investing in many countries may well be reduced. Important questions remain: Are there benefits from international portfolio reallocations? Are certain markets integrated or segmented? Should investors have to switch portfolio decompositions in order to achieve efficient portfolios? In what terms countries may be selected in international portfolio diversification?

The paper makes an attempt at answering these questions. The paper develops methodology measuring market integration (or segmentation) and therefore allows country selection in the better-performing stock markets of the world. Investors can choose a country in international portfolio diversification in terms of its effective systemic risk, which may be used as a score for market integration (or segmentation).

The paper is organized as following: Initially the paper presents a brief review of the previous theoretical and empirical research on stock market integration, the asset pricing model and its implementation. Then the model measuring degrees of market integration (or segmentation) is presented in terms of effective systemic risk. Finally, the empirical results are presented and interpreted.

2. Previous Theoretical Research

The literature provides for three broad categories of market integration. Sharp (1964); Lintner (1965) and Black (1972) test the Capital Asset Pricing Model (CAPM) using one country's data came to the conclusion that the US is a segmented market since its market proxy represents a broader world market return. Even if this argument could be broadly acceptable during the seventies, the share of US market value (capitalization) to the world market value decline considerably since then. The first studies on the potential benefits of international diversification were carried out in the early 1970's, using data from 1960's and 1970's. However, in the last two decades, the financial markets worldwide have experienced fundamental changes. Restrictions on foreign investment have been reduced, and modern technology has allowed investors to buy and sell securities worldwide. It is conceivable that this trend towards greater globalisation has caused stronger co-movements among markets, hence reducing the potential benefits of international diversification. As many early studies suggest, if the correlation between international equity markets is

sufficiently high, the benefits of risk reduction in a simple Markowitz sense are outweighed by the costs of diversifying into these markets. Are national markets still segmented?

Other studies derive to the conclusion that international capital markets are perfectly integrated. These studies include a world arbitrage pricing theory (Solnik, 1993), a world consumption based model (Wheatley, 1988), world multi-beta models (Ferson and Harvey, 1994) and world CAPM (Ferson and Harvey, 1991) and CAPM with exchange risk (Dumas and Solnik, 1995). Although the increasing integration of the international markets during the 1980s and the 1990s made these studies particularly acceptable, some deficiencies could be observed. For instance Harvey's study reveals that the asset pricing theory cannot explain the too high conditionally expected returns in Japan during the late 1980s. However, this could be explained, at least partly, by market inefficiency.

A large proportion of literature has suggested that capital markets are neither integrated nor segmented. Bracker *et. al.* (1999) maintain that most markets are 'mildly' segmented. Segmentation is due to different reasons such as the presence of legal barriers. These barriers may involve restrictions on investing abroad, higher rates of tax income from foreign investments in relation to the income from domestic investment, extensive government involvement with listed companies, and other legislated restraints on market activity, particularly on foreign investors (Stulz and Wasserfallen, 1995 and Bailey *et. al.* 1998). However, legal barriers could be overcome: for example, by multinational firms using transfer-pricing techniques can circumvent legal barriers. The literature has shown that a segmented market is not necessarily a market subject to capital controls discriminating against the investor's country of origin.

According to Jorion and Schwartz (1995), a market can also be segmented because of the presence of so-called indirect barriers. Such barriers involve the difficulty of obtaining information on foreign securities and xenophobia. In addition countries are different from each other in terms of industry structure, resource endowments, macroeconomic policies, and have non-synchronous business cycles. Market segmentation creates motives for firms to adopt counter-measures such as dual-listing their stocks on foreign exchanges. The pricing of assets and therefore their expected yields whether they are determined in an international capital market or in domestic segmented markets is key point in international finance.

Many studies have analysed the benefits of international diversification because of the low correlations between markets. Harvey (1995); and Harvey and Bekaert (1997) contribute by noting that the correlation between emerging and developed markets, and between emerging markets themselves, tend to fluctuate quite wildly but do not increase significantly with time. Odier *et. al.* (1995) examined the risk-return characteristics of emerging markets relative to developed markets. They document evidence of significantly higher returns offered by many emerging markets, however these returns are associated with higher levels of market volatility because emerging markets experience volatile economic and political conditions. In emerging markets most of the high total risk is unsystematic in nature. Thus, despite their high individual risks, these markets have low correlations with returns elsewhere, and therefore can reduce portfolio risk.

Mapping efficient frontier for global asset allocation with and without emerging markets, Divecha, *et. al.* (1998) suggested, that shifting away from a portfolio invested 100% in the FT-World Index in favor to one that contains up to 20% invested in the IFC Emerging Market Index, risk is reduced while simultaneously the expected return is increased. Harvey *et. al.* (1998) argued that the correlation between emerging and developed markets does increase if market liberalisations take place in the emerging economies or when world market volatility is high relative to the local market volatility.

The studies that adopt a middle course approach deviate from the two extreme segmented/integrated cases. However, this so-called mild segmentation model is rather static, since it does not take into account that technological and other development increases the degree of market integration over time. (Bekaert and Harvey, 1995) provide a framework, which allows for the degree of market integration to change over time. Their results indicate time-varying market integration for a number of countries, but only a moderate increase in markets integration.

Most of the literature on international portfolio diversification uses the CAPM to test market integration. The domestic version of the CAPM reveals that the expected rate of return of a security is equal to the risk-free interest rate plus a risk premium for the risk, which cannot be, diversified away, the so-called systemic risk. Applying this model at the international level means that although it is better to diversify internationally than not to, the expected returns on assets will merely compensate for their systemic risk when the internationally diversified global portfolio determines this. In other words, in a perfectly integrated international capital market the expected yields on foreign stocks will be associated with the risks of these stocks in an internationally diversified portfolio. However, if assets on the other hand, are placed in fragmented markets, their yields are determined according to the systemic risk of these markets. There is a major implication of this. If investors can circumvent the barriers of the fragmented markets, they can obtain special benefits from international diversification.

Applying the CAPM at the international level is difficult in practice: it requires being able to define a world risk-free interest rate and make assumptions about preferences of investors from different countries that enjoy different real returns. Nevertheless, the international CAPM reveals that prices of assets determined at the international markets compensate only for the systemic risk of a perfectly international diversified portfolio. On the other hand, particular investors and firms that get around the barriers to fragmented markets they can obtain abnormal returns. Large multinational corporations appear to be in this position since they can invest in markets where ordinary investors cannot.

The empirical results on the international portfolio diversification theory have developed three propositions. The first proposition is *not to hedge foreign exchange risk in emerging markets*. The second proposition is that *country selection is better than security selection*. Finally, the third proposition is that *the degree by which a market is segmented from other countries is still considerable*. As a result, these propositions suggest to a manager to select the most segmented countries and do not give importance to foreign exchange risk. In order to evaluate emerging market investments, the measure of market segmentation is the most appropriate tool. However, in the recent years the integration of the national markets has been growing. Are the markets integrated or still segmented? In what terms countries may

be selected in international portfolio diversification?

Measuring the degree of national market integration into the world market is a difficult and subjective exercise. The correlation of the local market return with the world return is rather inappropriate measure of integration since a country may have a low or negative integration despite the fact that the country concerned may be perfectly integrated into the world economy. This is because the national industry mix differs from the national industry mix. Using investment restrictions as a proxy of integration could prove flawed because these restrictions may not be binding. In addition, it is recognized that it is difficult to specify a set of variables that proxy for capital market restrictions or openness (Bekaert, 1995).

3. The Model: Determining Effective Systemic Risk

The approach to country selection in international portfolio diversification developed in this paper is based on developing the term of effective systemic risk and measuring market integration or segmentation for the countries concerned according to this term.

Most of the international finance literature has employed CAPM in testing for financial market integration (Ferson and Harvey, 1991; Bekaert and Harvey, 1995; Dumas and Solnik, 1995; Hardouvelis *et al.* 1999). This literature defines stock markets integration in terms of the type of risk factors investors are exposed and of their reward to risk relationship. Markets are considered as completely integrated if investors are confronted only with common global risk factors and price them identically. Markets are considered as partially integrated if, in addition to common global risk factors, investors are confronted with country specific factors and priced them both. Markets are considered as completely segmented when investors face and price only country specific factors. The model considered is:

$$E_{t-1}(r_{i,t}) = \beta_w \lambda + \beta_{iw} \lambda + \beta_{id} \lambda \quad (1)$$

Where:

$r_{i,t}$ Is the excess return on the local portfolio, -i.e. $r_{i,t} = R_i - R_f$, where:

R_i Are the rate of return on the local portfolio; and R_f the risk-free interest rate

λ Is the market risk premium

β_{iw} Is the risk of portfolio i relative to world portfolio w defined as

$$\beta_{iw} = \text{cov}_{t-1}(r_{i,t}, r_{w,t}) / \text{var}_{t-1}(w_{i,t}) \quad \beta_{iw} = \text{cov}_{t-1}(r_{i,t}, r_{w,t}) / \text{var}_{t-1}(w_{i,t})$$

β_{id} Analogously for the domestic market portfolio d .

In the case of perfect integration the local portfolio i is priced solely in relation to the global portfolio w . Perfect integration incorporates the null hypothesis, which requires $\lambda_d = 0$. Thus the basic intuition of the CAPM is that expected local returns in a perfectly integrated market depend only on non-diversifiable international factors. Thus, in a perfectly integrated market equation (1) becomes as follows:

$$E_{t-1}(r_{i,t}) = \lambda_w \cdot \beta_{iw} \quad (2)$$

Given that the risk-free rate has zero variance, the variance of the portfolio i described in equation (2) is as follows:

$$\text{Var}(R_i) = \text{Var}(R_w) \cdot \beta_{iw}^2 \quad (3)$$

We can express the right-hand side argument as a fraction of total risk by dividing the two sides of the equation (3) with $\text{Var}(R_i)$. Equation (3) is then:

$$1 = \frac{\text{Var}(R_w) \beta_{iw}^2}{\text{Var}(R_i)} \quad (4)$$

Considering the above equation the fraction of the right-hand side, - i.e. the fraction:

$$\text{Var}(R_w) \cdot \beta_{iw}^2 / \text{Var}(R_i) \quad (5)$$

represents the fraction of systemic risk in country i in relation to the global portfolio. This fraction may differ across national markets because the sources of risk are different in each market. In the case of perfect integration, where investors are confronted only with common global risk factors and price them identically, this fraction should equal to 1. In the case of partially integrated markets where, in addition to common global risk factors, investors are confronted with country specific factors and priced them both, this fraction should be less than one. This fraction measures the contribution of the respective market to the global market risk. It could be used as a measure for integration (or segmentation) of the market i with (or from) the global market. The higher and closer to 1 this fraction is the greater are the degrees of integration of the market i with the world market. In contrast, the lower this fraction is, or alternatively, the higher the term $1 - \text{Var}(R_w) \cdot \beta_{iw}^2 / \text{Var}(R_i)$, the greater are the degrees of segmentation. The term $1 - \text{Var}(R_w) \cdot \beta_{iw}^2 / \text{Var}(R_i)$ reflects country specific risk factors.

The fraction of systemic risk in country i in relation to the global portfolio, which measures the contribution of this market to the global market risk can be also used in dynamic terms. A growing such fraction suggests that the market i has become more integrated into the global market since its contribution to worldwide systemic risk increases and *vice-versa*.

However, the fraction of systemic risk in country i *vis-à-vis* the global portfolio is not an appropriate measure of integration of the respective market with the global market. This fraction measures the contribution of this market to the global market risk without taking into consideration the respective market's share in world capitalization. For example two markets may contribute equally to the global market risk but their markets' shares in the total world market value may differ.

Although, the fraction of systemic risk in country i in relation to the global portfolio is an inappropriate measure of integration there is a way for incorporating the respective market's share in the global capitalization. Any country market's systemic risk fraction in relation to the global market should be weighted by the

respective market's share in world capitalization. Systemic risk calculated in this way may be called effective systemic risk.

The country i market's value share in the world market can be expressed as:

$$\frac{MV_i}{MV_w} \quad (6)$$

Where:

MV_i Is the market value (capitalisation) of country i , and

MV_w Is the global market value (capitalisation)

By dividing (5) / (6)

$$\text{Effective systemic risk} = \frac{\text{Var}(R_i) \frac{MV_i}{MV_w}}{\text{Var}(R_w)} \quad (7)$$

If a certain country's market contributes more to global systemic risk in comparison to total world market value, the country concerned should be considered as segmented. As a result this market may be selected in the construction of an efficient international portfolio. On the contrary if a certain country's market contributes more to global market value than to global systemic risk it should be treated as integrated. This market should not be selected in international portfolio diversification. I.e.

- **If effective systemic risk < 1, then the respective market is segmented.**
- **If effective systemic risk > 1, then the respective market is integrated.**

4. Empirical Evidence and Its Interpretation

Using International Monetary Fund monthly share price statistics, returns as logarithmic first differences in share price indexes are obtained. Then, the national markets' fractions of systemic risk against the world market are estimated. The national market's value share in the total world market value is estimated using data obtained from Federation Internationale des Bourses de Valeurs (International Federation of Stock Exchanges). The period under examination is 1995 to 2000. The results are presented in Table 1.

Table 1 Calculation of Effective Systemic Risk in Selected Countries

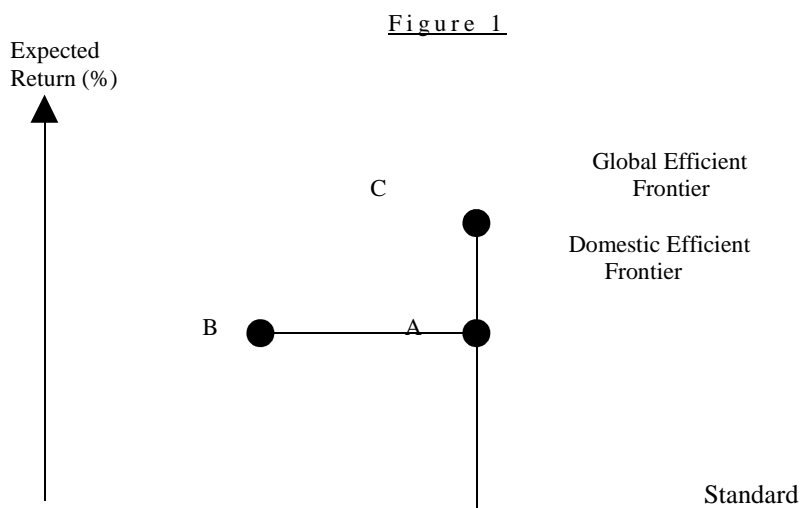
Countries	Variances $V(R_i)$ and $V(R_w)$	Country Betas β_{iw}	Fraction of Systemic Risk $\frac{Var(R_i) \times \beta_{iw}^2}{Var(R_i)}$	Market Share in World Value $\frac{MV_i}{MV_w}$	Effective Systemic Risk $\frac{Var(R_i) \times \beta_{iw}^2}{Var(R_i)}$
Australia	0,0020 98	0,225435	0,036037	0,011736 17	3,0705925
Austria	0,0053 29	0,982327	0,268177	0,000935 33	286,72045
Canada	0,4615 69	-2,383616	0,017775	0,024595 29	0,7226888
Denmark	0,0020 02	0,053009	0,020268	0,003494 19	5,8003783
Finland	0,0121 82	-0,181154	0,003879	0,009174 61	0,4228182
France	0,0035 8	0,261035	0,032376	0,045200 07	0,7162721
Germany	0,0303 7	-0,003925	0,00001	0,039688 74	0,000252
Ireland	0,0033 05	0,0884	0,003414	0,002558 42	1,3345285
Italy	0,0038 02	0,88149	0,306968	0,024007 48	12,786325
Japan	0,0050 64	0,704412	0,14149	0,100074 45	1,4138494
The Netherlands	0,0054 37	0,613511	0,099966	0,020011 05	4,9955439
New Zealand	0,0438 39	0,51866	0,015562	0,000571 19	27,244178
Norway	0,0043 95	0,626244	0,130103	0,002066 59	62,955184
Spain	0,0043 19	0,193531	0,012843	0,015754 39	0,8152149
Sweden	0,0085 13	0,629896	0,100998	0,010290 89	9,8143517
Switzerland	0,0081 35	-0,006611	7,76E-06	0,024727 54	0,0003137
UK	0,0031 12	0,258427	0,03159	0,082192 66	0,3843351
USA	0,4505 88	-1,841393	0,010866	0,479660 79	0,0226541
Venezuela	1,2084 48	4,337678	0,029314	0,000603 46	48,577659
WORLD	0,0014 45			1	

Source: IMF monthly share price indexes; Federation Internationale des Bourses de Valeurs (FIBV); and authors' calculations.

From the tables, it can be observed which markets are either segmented or integrated. Some of the countries, which we took into account, have effective systemic risk less than one, thus their markets are segmented markets. The high degrees of segmentation are interpreted as following: A market with a smaller fraction of systemic risk in relation to its share in global market value is more segmented from the world than a market whose respective fraction is larger. If greater degrees of segmentation may involve greater diversification opportunities, then quantifying the degree of market segmentation becomes an important element of portfolio diversification. International investors can reallocate their portfolios according to the relevant measure of effective systemic risk.

Some countries such as Switzerland, US and Germany experienced lower degrees of market integration than others. For these countries effective systemic risk is less than one. This, however, does not necessarily imply that these markets are completely segmented from the benchmark world portfolio. Rather, the degree of these markets' responsiveness to the global trend was lower in comparison to others; hence, they did not show the same degrees of market integration. Thus, the empirical evidence reveals that a segmented market is not necessarily a market subject to capital controls discriminating against the investor's country of origin or a market characterised by difficulty of obtaining information on foreign securities and xenophobia

The conclusion is therefore inevitable that still international diversification allows investors to reduce the risk and increase the expected return, shifting the efficient frontier to the left. This frontier is the set of portfolios that has the lower risk for its level of expected return and the maximum expected return for a given level of risk (see figure 1). Globally diversified portfolios hold out the very real promise of less risk for the same level of expected return, or more return for the same level of risk, or both than that can be achieved with domestic portfolios.



→ Deviation (%)

5. Conclusion

The fraction of systemic risk in country i vis-à-vis the global portfolio measures the respective market's contribution to the global market risk. However, this fraction is not an appropriate measure of integration of the respective market with the global market because it does not take into account the respective market's share in world capitalization. Although, the fraction of systemic risk in country i in relation to the global portfolio is an inappropriate measure of integration there is a way for incorporating the respective market's share in the global capitalization. Any country market's systemic risk fraction in relation to the global market should be weighted by the respective market's share in world capitalization. Systemic risk calculated in this way may be called effective systemic risk. This term can measure degrees of market integration (or segmentation) and may provide international investors with an appropriate instrument to choose a country in international portfolio diversification

The empirical evidence provides for some interesting conclusions about internationally integrated versus segmented markets. Some markets demonstrate higher degrees of integration than one might have expected based on information of investment restrictions. Other markets appear segmented despite the fact that foreign investors have relatively free access to their capital markets. This is because the degrees of integration (or segmentation) as revealed by the effective systemic risk reflect the responsiveness of these markets to the global market trend rather than the strength of investment restrictions. Thus, still international diversification allows investors to reduce the risk and increase the expected return, shifting the efficient frontier to the left.

Most of the international finance literature on integration versus segmentation issues is rather static. The approach used in this paper may be used to assess the effects of regulatory or institutional changes (e.g. the introduction of euro in the EU) on the degree of market integration. In this case the model should be used twice corresponding to two time periods: one before the implementation these changes and the other afterwards to capture the impact.

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