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A Note on International Portfolio Diversification with Short Selling

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Abstract. In this paper, the diversification benefits of using stock index futures are examined. Empirical evidence shows that traditional diversification in international equity markets does not produce a risk adjusted performance superior to the US market. An explanation for this result is that restrictions on short selling prohibit the best allocation of resources when overseas stock markets are riskier and have worse returns. However, when such restrictions are eased for short selling in index futures markets, investors are enabled to both allocate their investments more efficiently and to construct a superior portfolio.

Key words: international investment, portfolio diversification, shorting selling, index futures

JEL Classification: G11, G15

1. Introduction

Since the pioneering work of Grubel (1968), many studies (e.g., Levy and Sarnat, 1970; Solnik, 1974; Lessard, 1976; and Biger, 1979) have shown that international diversification can result in a lower level of risk for a given level of expected return. In addition, effectiveness of various international diversification strategies have also been examined extensively (e.g., Errunza, 1977; Errunza and Padmanabhan, 1988; Eun and Resnick, 1988; and Mathur and Hanagan, 1983). More recently, Bailey and Stulz (1990), Odier and Solnik (1993), Doukas and Yung (1993), Chang et al. (1995); Solnik (1995), Akdogan (1996), Michaud et al. (1996), Solnik (1997) and Griffin and Karolyi (1998) have shown that an internationally diversified portfolio is more efficient than other market portfolios in developed markets. In summary, extant empirical evidence in the past thirty years generally shows that global diversification is a viable strategy to pursue.

Nevertheless, the increasing integration of financial markets, and the current superior performance of the US market, challenges the benefits gained from international diversification.

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Many studies, e.g., Longin and Solnik (1995) and Solnik et al. (1996) show that correlation among international stock markets has increased. From the perspective of US investors, this observation suggests that global diversification is losing its effectiveness, especially when many foreign securities are listed on the US market (Errunza et al., 1999).

Thus, when the performance of foreign markets is expected to be inferior to the domestic market, the best strategy for US investors would be not to diversify internationally. This means that the weight of other national markets in the international portfolio would be zero and global diversification does not justify the effort. In other words, the efficient portfolio would be the US market if investors must allocate non-negative weights in their portfolios and cannot short sell shares. Short selling stocks internationally is costly and is subject to many restrictions. For example, it was not until January 1994 that short selling of common stocks was allowed in Hong Kong. Therefore, previous studies, e.g., Errunza (1977), had to impose the restriction that individual market weight must be greater than or equal to zero.

However, developments in financial engineering have relaxed this short sale restriction. International stock index futures markets can allow short selling with minimal transaction costs. Therefore, for US investors, the benefits of international diversification can still be retained through short selling even though foreign markets deliver higher risk and lower returns.

The objective of this research note is to explore the potential diversification benefits of using stock index futures. As a contribution to the literature, we extend previous studies by allowing negative weights on each national market in the investment portfolio. Empirical findings here suggest that short selling index futures allows better allocation of capital and a more efficient portfolio can be formed. Hence, international diversification can still be a valuable strategy to US investors even though the US market is expected to outperform other foreign markets.

The remainder of this manuscript is organised as follows. The following section discusses portfolio diversification and examines the benefits of diversification in international futures markets. Results are presented in Section 3. Concluding remarks are given in the final section.

2. Short-selling index futures and international diversification

2.1. Portfolio diversification and short-sales

Consider a portfolio consisting of n international stock markets. The Markowitz (1952) portfolio optimization is to find the set of weights W_i, which minimizes the objective function:

$$\sigma_p^2 = \sum_{i=1}^{n} W_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{j=1, j\neq i}^{n} W_i W_j \rho_{ij} \sigma_i \sigma_j, \tag{1}$$

subject to the constraint $R_p = \sum_{i=1}^{n} W_i R_i = g$, where R_p and σ_p^2 are the expected return and variance of the portfolio, R_i and σ_i^2 are, respectively, the expected return and

variance of individual markets, W_i is the weight of funds in the portfolio placed in market i such that $\sum_{i=1}^{n} W_i = 1$, g is the target return of the portfolio, and ρ_{ij} is the correlation coefficient between markets i and j. Traditionally, the constraint of the nonnegativity of W_i (i.e., $W_i \geq 0 \; \forall \; i$), is imposed because short sales are very costly, if not restricted, in stock markets. However, if the non-negativity restriction is relaxed, a negative weight, together with higher positive weights on high return index futures, can result in a better risk-return relationship. Suppose W_k is negative and W_j's, $j \neq k$, are nonnegative, the higher the correlation coefficient ρ_{kj}, the more negative the second term of equation (1) will be, and the portfolio risk will be smaller. Therefore, although market k can be ignored by investors diversifying internationally because it has ***low return, high risk*** and ***high correlation*** with other markets, it plays an important role in the futures markets where short selling is allowed.

2.2. *Diversifying in international futures markets*

The benefits of diversification in international futures markets are investigated by using monthly dollar returns for the following actively traded index futures contracts: (i) The Australian (AU) All Ordinaries futures traded on the Sydney Futures Exchange; (ii) The Canadian (CA) TSE 35 futures traded on the Toronto Futures Exchange; (iii) The French (FR) CAC 40 futures traded on the Marche á Terme International de France; (iv) The German (GE) DAX futures traded on the Deutsche Terminboürse; (v) The Hong Kong (HK) Hang Seng futures traded on the Hong Kong Futures Exchange; (vi) The Japanese (JP) Nikkei 225 futures traded on the Chicago Mercantile Exchange; (vii) The U.K. (UK) FTSE 100 futures traded on the London International Financial Futures and Options Exchange; and, (viii) The US (US) S&P 500 futures traded on the Chicago Mercantile Exchange.

Hereafter, for brevity, AU represents the Australian All Ordinaries futures and so on. All these futures contracts, except the Nikkei 225 futures, are traded in the same country as the underlying stocks. The Nikkei 225 futures are also traded on the Osaka and Singapore futures exchanges. The Chicago (CME) Nikkei futures are used because they are denominated in dollars while the other two are in Japanese yen and the CME has the lowest transaction costs. For simplicity, the Chicago Nikkei futures market is also described as a foreign futures market (see Bacha and Vila, 1994; and Booth, Lee and Tse, 1996).

Trading costs of futures contracts are much lower than those of spot markets, making futures markets attractive candidates for diversification purposes. Table 1 compares the trading mechanisms and transaction costs of the futures contracts used in this study. As is clearly shown from this table, when compared with the spot market, stock index futures offer lower transaction costs. Holding the market portfolios of individual national markets is costly because buying and selling individual stocks incurs huge transaction costs. However, having a long position in the index futures is essentially the same as holding the market portfolios and, in addition, this strategy can substantially simplify portfolio trading. When compared with individual stocks, transaction costs are incurred several times a year when futures are rolled over into the next-nearest futures. However, futures do not have to bear

Table 1. Details of costs of futures tradings in other markets

	Transaction Cost		Trading Mechanism	
Markets	Futures Market	Spot Market	Futures Market	Spot Market
Australia	Exchange fee: A$0.99 per side; Commission: negotiable	Stamp duty: 0.3%; Commission: negotiable, vary from 0.2% to 2.5%	Screen trading	Computerized
Canada	Exchange fee: CA$0.72 per contract	Commission: negotiable	Screen trading	Computerized
France	Up to 1,500.00: 0.15/trans; From 1,500.01 to 150,000.00:0.005%; From 150,000.01 to 500,000.00:0.003%	Stamp duty: 0.03% of transactions up to Ffr1 million and 0.15% thereafter per side; An allowance on stamp duty of Ffr150 for each transaction; A ceiling of Ffr4,000; Commission: negotiable	Screen trading	Computerized
Germany	Exchange fee: 0.50	Exchange fees: 0.04% for DAX shares; 0.08% for all other shares Commission: 1%	Screen trading	Computerized
Hong Kong	Exchange fee: HK$11.50 per side; Minimum commission: Day trade: HK$60 per side; Overnight trade: HK$100 per side	Stamp duty: HK$1.25 per HK$1,000 per side; Transaction levy: 0.011%; Commission: no less than 0.25%; Minimum charge: HK$50	Screen trading	Computerized
Japan	Exchange fee: JPY100 per contract	Commission: negotiable	Screen trading	Computerized
U.K.	Exchange fee: GBP0.28 per side per lot	Stamp duty: 0.5%; Commission: negotiable	Open outcry with after hours electronic trading	Computerized
U.S.	Exchange fee: US$0.70 per side	Commission: negotiable	Open outcry with after hours electronic trading	Computerized; Open outcry

custody costs as foreign stocks do, and are not subject to withholding taxes as foreign stocks are. In addition, the depth of futures markets also allows investors to make asset allocation changes much faster than in the spot markets. Furthermore, individual stocks may have infrequent trading problems, which do not exist in the futures markets, as the futures markets are of higher liquidity. Therefore, total trading costs of futures are still much lower than those of investing directly in equity markets.

The data for the nearest futures contracts until the first day of delivery months were collected from Datastream for the sample period July 1992 to May 1999. This sample period was chosen because foreign index futures contracts were not all approved by the Commodity Futures Trading Commission for US investors until early 1992 (Jorion and Roisenberg, 1993). Following Shapiro (1999), returns of futures in dollars are calculated by:

$$R_t = [1 + (F_t - F_{t-1})/F_{t-1}] * [1 + (e_t - e_{t-1})/e_{t-1}] - 1, \tag{2}$$

where e_t and F_t are, respectively, the exchange rate of the US dollar per unit of foreign currency and price of the futures contracts at time t. Results are qualitatively the same when futures returns are calculated as compound returns, i.e., $\ln[e_t F_t/(e_{t-1}F_{t-1})]$. The following discussion is based on the results calculated defined in equation (2).

3. Empirical results and discussions

3.1. Descriptive statistics

Table 2 summarizes the annualized returns of spot and futures markets, both in local currencies and in the US dollar, the standard deviations, and their Sharpe measures. As futures and spot prices are related by the cost-of-carry principle, correlation between futures and spot prices are high and empirical results of using both markets' indices are similar. The analysis below is based on results using futures returns.

To formally measure the risk return performance, the Sharpe Measure (SHP) is used. The SHP is the ratio of excess return to standard deviation, or the reward-to-variability ratio. Mathematically, the Sharpe measure for market $j (SHP_j)$ is defined as:

$$SHP_j = (R_j - r_f)/\sigma_j, \tag{3}$$

where R_j and σ_j are, respectively, the return and the standard deviation of market j, and r_f is the risk-free rate, which is proxied by the 3-month Treasury-Bill (T-Bill) rate, 4.477%, throughout the sample period. Interpretation of the SHP is that it is the reward per unit of risk. The Sharpe measure is now a common criterion for tracking the performance of professionally managed portfolios: the higher the measure, the better the performance. The last column of Table 2 shows that the US market has the largest Sharpe measure of 1.018, and is much greater than the others, and the JP, AU, and CA have the lowest measures, 0.052, 0.203, and 0.274, respectively. These preliminary results suggest that all the above foreign markets performed more poorly than the US market. As mentioned in the introductory

Table 2. Summary statistics of stock index futures returns

Panel A: Returns in domestic currency

Market	Return (%)		Standard Deviation (%)		Sharpe Measure		Spot-Futures Correlation
	Spot	Futures	Spot	Futures	Spot	Futures	
Japan (JP)	3.932	3.776	21.766	21.780	−0.025	−0.032	0.986
U.K. (UK)	13.684	13.651	13.048	13.668	0.706	0.671	0.988
U.S. (US)	17.574	17.600	12.582	12.898	1.041	1.018	0.990
Australia (AU)	9.534	9.591	13.634	14.826	0.371	0.345	0.980
Hong Kong (HK)	16.250	16.979	33.186	35.431	0.355	0.353	0.995
Germany (GE)	17.130	16.748	19.763	19.266	0.640	0.637	0.986
France (FR)	13.750	13.811	19.594	20.263	0.473	0.461	0.994
Canada (CA)	12.439	12.440	15.730	16.451	0.506	0.484	0.991

Panel B: Returns in US dollars

Japan (JP)	5.905	5.763	24.807	24.853	0.058	0.052	0.989
U.K. (UK)	11.381	11.338	12.831	13.359	0.538	0.514	0.988
U.S. (US)	17.574	17.600	12.582	12.898	1.041	1.018	0.990
Australia (AU)	8.363	8.462	18.518	19.596	0.210	0.203	0.988
Hong Kong (HK)	16.202	16.932	33.220	35.468	0.353	0.351	0.995
Germany (GE)	14.166	13.798	17.725	17.240	0.547	0.541	0.983
France (FR)	10.817	10.855	17.451	18.053	0.363	0.353	0.993
Canada (CA)	9.641	9.638	18.252	18.821	0.283	0.274	0.993

Data are collected from Datastream for the period July 1992 to July 1999. Return and standard deviation are annualized and are measured in percentage terms. The risk free rate, 4.477%, used in the calculation of the Sharpe measure, is the average Three-month T-bill rate for the sample period. Spot-Futures Correlation is the correlation coefficient between returns of spot and futures markets of the same national market.

section, the superior US Sharpe measure shows that international diversification was not worth the effort during the sample period.

These results are in contrast with those for the period of 1973 to 1982 as documented in Eun and Resnick (1987). They found that the US Sharpe measure is smaller than all the above foreign indices, except the AU. Accordingly, diversification through international investment can yield better results. However, results here show that while investing abroad *without short sales* may have been a good strategy in the 1970s and the 1980s, it was not in the 1990s.

Table 3 shows the correlation coefficients among futures returns for these markets. The last column lists the average correlations of index futures with other futures contracts. All the futures contracts have high average correlations with other markets, while the JP has the lowest correlation (0.285). When we look at the Sharpe measure, markets like the AU, the FR, the HK and the CA are the worst in the context of traditional risk diversification having both a low Sharpe measure and a high correlation with other markets. If short sales are not permitted as in the spot market, AU, FR, HK and CA should not be included in the portfolio. However, as shown in the following section, short selling AU, FR, HK and CA

Table 3. Correlation matrix of returns different index futures returns in US dollars

	JP	UK	US	AU	HK	GE	FR	AVERAGE
JP								0.285
UK	0.199							0.533
US	0.317	0.567						0.553
AU	0.372	0.639	0.601					0.572
HK	0.202	0.538	0.534	0.605				0.479
GE	0.286	0.622	0.570	0.605	0.477			0.552
FR	0.301	0.667	0.528	0.577	0.397	0.774		0.534
CA	0.320	0.500	0.754	0.602	0.601	0.529	0.496	0.543

All the correlation coefficients are statistically significant at 1%. AVERAGE is the average correlation with other markets. See Table 1 for abbreviations of the markets.

in the futures markets turns out to be an attractive strategy to minimize risk or maximize returns.

3.2. *Ex-post efficient portfolio*

The benefits of diversification are investigated by examining the decrease in the standard deviation (relative to that of the US) with the same returns as the US. The results are reported in Table 4. Panel A of this table shows that the efficient portfolio when short sales are restricted and where the same US return (17.600%) is used as the benchmark. As the US market gives the optimal risk-return tradeoff, it is not surprising to find that the efficient portfolio is indeed the US market. If the efficient portfolio mirrors the US market, this result suggests that all investment capital should be allocated to the US market. Thus, restrictions on short selling limit investors' choice in portfolio diversification in times when the US market outperforms other national markets both in terms of risk and returns.

In Panel B, the efficient portfolio without the limitation of short selling is presented. Using the same US return again, the efficient portfolio offers a standard deviation of 11.313%, which corresponds to a decrease of 12.29% over that of the efficient portfolio calculated under short sales restrictions. In this case, four markets (AU, HK, FR and CA) are sold short and the weights of the CA and the FR are the most negative: −25.193% in the CA and −8.767% in the FR. The results are consistent with the earlier discussion that futures having ***low*** Sharpe measures and ***high*** correlations with other markets are good candidates for short sales in diversifying risk and maximizing returns. Note that although JP has a low Sharp measure, its low correlation makes it a less favourable candidate for short selling. The above results show that short sales can play an important role in minimizing risk and maximizing return. These findings indicate that US investors should not invest in foreign stock spot markets when foreign markets are expected to be riskier and do not produce higher returns, as the efficient portfolio exactly mirrors the US market, where short sales are very costly or not permitted.

Table 4. Efficient portfolios with return of US market as benchmark: For the time period July 1992 to May 1999

Panel A: With restrictions on short sales

Weights of Respective Markets in the Efficient Portfolio (%)							
JP	UK	US	AU	HK	GE	FR	CA
0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000

Standard Deviation = 12.898%
Decrease in risk (%) = 0.000
Sharpe Ratio = 1.018

Panel B: Without restrictions on short sales

Weights of Respective Market in the Efficient Portfolio (%)							
JP	UK	US	AU	HK	GE	FR	CA
5.023	38.068	93.858	−8.106	−5.261	10.377	−8.767	−25.193

Standard Deviation = 11.313%
Decrease in risk (%) = 12.290%
Sharpe Ratio = 1.160

The US Return 17.600% is used as the benchmark. A negative weight in Panel B indicates that the market is being sold short. See Table 1 for the abbreviations of the markets.

3.3. Ex-ante portfolio performance

Up to now the discussion is all ex-post. As suggested in Michaud et al. (1996), marketplace evidence indicates that thoughtful international equity diversification can improve the risk return characteristics of investors' portfolios and active management can show potential improvement in return. Recently, Eun and Resnick (1997) have shown that the optimal weight of a portfolio changes over time. Hence, the ex-post results are not useful for investors since they make their decisions ex-ante.

In this section, we split the data and use the past performance of the markets to estimate the optimal portfolio weights, and to compare the performances of strategies of both with and without short selling. The determination of the estimation period, however, is rather ad-hoc and there is no fixed rule. If the estimation period is too short, we have too few observations for estimation and the estimation will be easily biased by one or two extreme data points. If the estimation period is too long, then the number of ex-ante portfolios will be too few to generate enough samples to evaluate the performance of the strategy. Thus, the choice of estimation period resembles a balance between the time varying portfolio weight and the number of months used in the estimation. For illustrative purposes, we use the past 24 months ($t = 1, 2, \ldots, 24$) as the estimation period.

To find the optimal portfolio weights at $t = 25$, the optimisation problem outlined in Section 2.1 is run, using the mean return of the US market in the estimation period ($t = 1$ to

Table 5. Ex-ante portfolio performance of the short selling strategy

	Mean (%)	Standard Deviation (%)	Sharpe Ratio
Panel A: Results from 24 month estimation period Number of ex-ante portfolio monthly returns = 60			
With Short Sale Restriction	19.477	13.390	1.120
Without Short Sale Restriction	23.446	13.097	1.448
Panel B: Results from 30 month estimation period Number of ex-ante portfolio monthly returns = 54			
With Short Sale Restriction	17.649	9.927	1.327
Without Short Sale Restriction	17.859	8.139	1.644
Panel C: Results from 36 month estimation period Number of ex-ante portfolio monthly returns = 48			
With Short Sale Restriction	16.068	9.827	1.179
Without Short Sale Restriction	19.689	7.412	2.052
Panel D: Results from 48 month estimation period Number of ex-ante portfolio monthly returns = 36			
With Short Sale Restriction	11.262	8.841	0.767
Without Short Sale Restriction	13.535	7.710	1.175

The monthly risk free rate used is 4.477%, proxied by the average return of 3 month US T-bills.

$t = 24$) as the benchmark. Hence, the portfolio constructed at $t = 25$ is based on past performance and it is not necessary that it be the efficient portfolio at that time. Then we move the estimation window a month forward ($t = 2$ to $t = 25$) and estimate the portfolio weights at $t = 26$. Following this estimation procedure, 60 ex-ante portfolios are generated for a 24-month estimation period. To compare the effects of short sales on portfolio performance, we estimate the ex-ante portfolios both with and without short sales with the results presented in Table 5. Results are robust if different estimation periods (30, 36 and 48 months) are used and the following discussion is based on results using an estimation period of 24 months. Nevertheless, results from other estimation periods are reported in the same table for comparison.

Panel A of Table 5 shows that when short sales are restricted, performance of this investment strategy only yields a return of 19.477% with a risk of 13.390%. The benefits of short sales can be demonstrated by the dramatic improvement in the diversification benefits. When the short selling restriction is lifted, the portfolio constructed under this strategy yields a mean return of 23.446%, which is better than the "no short sale" strategy, and the standard deviation of the return is only 13.097%. When we compare the Sharpe Measures of these two investment strategies, lifting the short sales restriction will increase the Sharpe ratio by 29.29%. These results show that when the restrictions on short selling are relaxed, diversification benefits through investing internationally are regained. The important

implication is that traditional diversification benefits through equity markets is limited during periods when the US dollar is strong, and that short sales restrictions do not lead to an optimal investment strategy. In contrast, using stock index futures can provide significant benefits in the formulation of a more efficient portfolio.

4. Conclusions

This paper shows that the US market had a much higher Sharpe measure for the period of July 1992 to May 1999. Accordingly, international diversification would not have given investors any reduction in risk if short sales were not allowed. Thus, if short sales were very costly or not allowed, the best strategy would have been to invest domestically. In contrast, futures markets have no constraints on short selling. The benefits of diversification into foreign futures markets would have been substantial: a 12.29% decrease in risk. An important implication is that US investors would have included foreign stock index futures that have low Sharpe measures and high correlations (e.g., the Hong Kong, Canadian, French and Australian index futures) into their portfolios through short sales.

Since Sharpe measures and correlations are not constant over time, the weights of portfolios vary. In international stock markets, Eun and Resnick (1997) have reported that the ex-post optimal investment weights calculated from prior subperiods are not likely to be optimal in subsequent subperiods. Nevertheless, we have employed this strategy to estimate ex-ante diversification benefits and find superior performance when compared with the "no-short sales" strategy. The current study draws investors' attention to the role of futures markets in risk diversification. The introduction of the CME and SIMEX Taiwan stock index futures contracts in January 1997 further encourages investors to diversify into Pacific Basin markets other than Japan and Hong Kong.

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