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Diversification effect of ship investment funds in South Korea

Jae-Boong Lee
Global Marine Financing Co., Ltd, Seoul, Korea
Su-Han Woo
Department of International Logistics, Chung-Ang University, Seoul, Korea
Jeong Seok Song
College of Economics, Chung-Ang University, Seoul, Korea
Byeongchan Seong
Department of Applied Statistics, Chung-Ang University, Seoul, Korea, and
Keun-Sik Park
Department of International Logistics, Chung-Ang University, Seoul, Korea

Abstract
Purpose – The purpose of this paper is to examine the diversification effect of the Korean Ship Investment Fund (KSF) under Markowitz portfolio theory by analyzing short-term and long-term relationships with stocks and bonds.
Design/methodology/approach – For this purpose, unit root, correlation and cointegration tests are performed. Monthly data from 2004 to 2015 for stocks, bonds and KSFs are obtained for this study.
Findings – The correlation coefficients indicate that KSFs are uncorrelated with stocks and negatively correlated with bonds, and no long-term equilibrium relationships exist with all three variables by the Johansen and Engle-Granger cointegration tests.
Research limitations/implications – This paper makes contribution to the literature as follows: first, whereas the previous literature investigated diversification effect of ship investment using freight indices or freight rates which are not able to represent returns from ship investment, this study is the first study to use actual stock prices of the KSFs to the authors' best knowledge; and second, diversification effect of ship investment represented by KSFs is empirically verified in the both short term and long term.
Practical implications – Policy-makers and managers of shipping companies can have sound ground that the KSFs are alternative and attractive assets to investors. It is also shown that the KSFs have potential to improve risk and return structure of investors on their own regardless of existence of incentives. Therefore, decisions of policy-makers can be made free from expectations for stronger incentives provided by the government. In addition, those countries that do not have such a ship investment platform may consider introducing a similar ship investment fund in order to revitalize the capital markets of the country.
Originality/value – This study holds its significance in investigating diversification properties of the KSFs for the first time in Korea since the KSFs were introduced.

Keywords Portfolio theory, Cointegration, Diversification effect, Ship investment funds
Paper type Research paper

Introduction
The Korean Government introduced the Ship Investment Company scheme in 2002, which is a ship investment fund similar to the German KG fund and Norwegian KS fund (Drobetz and Tegtmeier, 2013). Under the scheme, a ship investment company, which is invested in by investors in the Korean capital market, owns a ship in combination with bank loans and charters the ship to a shipping company by either a capital lease or an operating lease. The purpose of the Korean Ship Investment Fund (KSF) scheme is to strengthen the competitiveness of Korean shipping companies by providing a variety of ship financing sources, as well as to introduce a new ship investment fund to the Korean capital market,

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providing investors with opportunities to invest in ships. Since maritime transportation take a considerable portion of international multimodal transportation which physically implements international trade, such scheme would be beneficial to international trade from/ to Korea as well. For the ten years since its inception in 2002, 134 commercial ships were financed under the KSF, amounting to $7.1b in total. Depending on ship operating plans, the KSF is either publicly placed to individual investors by listing on the Korea Stock Exchange (KSE) or privately placed mainly to institutional investors.

Markowitz (1952) introduced the theoretical foundation of the portfolio theory, which has been developed and reinforced further by other economists. According to the portfolio theory, investors can reduce portfolio risks by holding combinations of investment assets that are not perfectly positively correlated. This is generally known as the portfolio effect or diversification effect. In other words, investors can diminish their exposure to individual asset risk simply by holding a diversified investment portfolio consisting of assets with correlation coefficients less than +1. Diversification may allow for either the same expected return with reduced risk or improved expected return with the same level of risk. Expecting the portfolio effect, investors may consider alternative investment assets such as hedge funds, real estate funds and private equity funds as part of their balanced investment portfolio (Bessler *et al.*, 2008). As such, investors may consider the KSF as a new alternative investment asset class if adding KSFs to their investment portfolio can enhance the diversification potential of a traditional stock and bond portfolio.

However, the diversification effect of ship funds such as the KSF has not been sufficiently investigated even though the significance of understanding the relationships between ship funds and other investment tools to investors has been emphasized (Bessler *et al.*, 2008). Previous literature has examined the diversification effect of different vessel type portfolios using freight rates or returns (e.g. Jia and Adland, 2002; Tsolakis, 2005; Köseoğlu and Karagülle, 2013; Población and Serna, 2017), and the behavior of shipping companies' stocks and the risk structure of shipping stock investments (e.g. Kavussanos and Marcoulis, 1997; Gong *et al.*, 2006). Several studies investigated the diversification effect of investing in shipping stocks (e.g. Grelck *et al.*, 2009; Syriopoulos and Roumpis, 2009). However, shipping funds have not been directly tested as an investment alternative to traditional investment assets such as stocks and bonds. This may be due to the limited availability of market values of ship funds (Bessler *et al.*, 2008), which is attributed to the non-tradable property of ship funds (e.g. the KG model).

The KSF is a relatively new ship fund model in which initiators can design special purpose companies to be listed in the Korean Stock Exchange. In addition, this scheme can be used as a useful tool which shipping companies can use, particularly in recession periods, to relieve capital intensity by removing ships from their balance sheet and chartering from special purpose companies invested by the KSF (Bang *et al.*, 2012). Therefore, the KSF scheme provides opportunities to examine the potential of ship funds as an investment alternative through obtaining market values of the KSF. The objective of this study is to examine the diversification effects of the KSF. To this end, Granger causality and cointegration tests are employed to examine short-term and long-term diversification effects among stocks, bonds and the KSF.

Literature review

There is a significant body of previous studies conducted on the diversification effect of major alternative investment assets such as hedge funds, real estate funds and private equity funds. Relatively less research has been conducted on investments in ships and its diversification effect (Lee and Woo, 2015). As explained earlier, the basic background behind investing in alternative investment assets is the diversification effect; therefore, many empirical studies have examined the diversification potential of major alternative investment assets.

Diversification effect of alternative assets

Real estate has relatively more literature available on the diversification effect than other asset classes. As Schindler (2011) demonstrated, many authors argued that diversification benefits are driven by country factors, thus broadening the investment horizon from a domestic to a more global perspective. Therefore, investors need to extend their investment horizon beyond their local real estate markets. However, real estate assets might adversely affect the mean-variance performance as indicated by Rubens *et al.* (1998) who argued that allocating funds to real and international assets does not result in statistically significant gains. In other words, adding such assets may result in reduced risk or additional returns, but the addition may not improve mean-variance portfolio performance. Even without considering these risks or the taxes and transaction costs associated with these alternative assets, investing in such seemingly attractive instruments may simply not be worth the effort. For hedge funds, as also found by Amin and Kat (2002, 2003), most studies demonstrated that their inclusion in the traditional stock and bond portfolio could bring diversification benefits, as defined by mean-variance portfolio performance under Markowitz theory. Karavas (2000) argued that adding hedge funds to traditional stock, bond and traditional alternative portfolios improves further risk and return opportunities. As several studies have shown private equity's diversification effect, Milner and Vos (2003) also found that private equity funds have low correlations with listed equities. Even though the degree of diversification depends upon the investment types, the combined relationship between private equity and listed equity results in an improved risk return profile compared to investing individually in either asset. Ennis and Sebastian (2005) found that private equity's diversification potential exists primarily within equity portfolios rather than balanced ones, which derive substantially all their diversification benefits from common stocks, real estate and bonds.

Diversification effect of shipping investment

Previous studies relating to shipping or investing in ships have generally focused on the diversification effect of vessel type portfolios consisting of different types and sizes of vessels from shipping companies' perspectives. However, the results of these studies have not been consistent. Magirou *et al.* (1997) investigated the diversification benefit of hypothetical portfolios with bulk carriers and tankers under Markowitz and Capital Asset Pricing Model, demonstrating the benefit of investing in a portfolio rather than a single ship type. They also analyzed the correlation with Dow Jones Industrial Average (DJIA) as a proxy for stocks and found low or negative covariance and β values between their proposed portfolio and DJIA, implying diversification potential. However, there were limitations in that only bulk carriers and tankers were considered and no significance tests were conducted. Veenstra and Franses (1997) examined the long-term relationships of dry bulk freight rates of three Capsize and three Panamax freight routes by applying cointegration analysis. The results indicate that the general pattern of freight rates cannot be forecasted as they are stochastic in nature and that the freight rates are cointegrated; thus, there are long-term relationships.

Jia and Adland (2002) investigated the correlations of five different types of ships based upon one-year investment returns calculated by monthly time series of period time charter rates. Their results show relatively high correlations, implying that the shipping industry in general appears to be positively correlated most of the time, which means that operating different types of ships is not justified in the diversification context. Tsolakis (2005) and Köseoğlu and Karagülle (2013) applied cointegration analysis to verify diversification benefits of investing in ships. Tsolakis (2005) econometrically analyzed four markets (i.e. freight, newbuilding, second-hand and demolition) of the dry and wet bulk industry with several time-series analyses such as correlation, regression and cointegration tests.

Employing the Johansen tests on 247 different combinations of investments in two dry bulk carriers and five wet bulk carriers, Tsolakis (2005) found that investing in more than one type of bulk carrier invalidates any risk reduction benefits. Furthermore, risk reduction benefits decrease as diversification increases with no risk reduction benefits obtained when investing in more than five different ship types. In investigating the diversification benefits of investing in dry and wet bulk carriers, Köseoğlu and Karagülle (2013) applied the cointegration approach with ten different ship types of dry and wet bulkers. In agreement with Tsolakis's (2005) study, only 74 of 1,013 combinations of investments showed the possibility of risk reduction benefits through investment in different ship types. If the vessels are dry bulkers, diversification does not generate risk reduction. However, the results also indicated that there is a possibility of risk reduction benefits by investing in more than one type of wet bulk carriers but no more than four different types and sizes. Lian and Toften (2015) proposed a multi-factor model to explain differences in returns from operating different types of ships by applying the modern portfolio theory. They find a clear difference in the risk-return characteristics of each vessel type of dry bulkers, wet bulkers and container ships. The results also show that holding a diversified portfolio statistically outperforms a segment-specific dry bulk or container portfolio, whereas the same cannot be inferred for a pure wet bulk portfolio due to its strong historical performance.

On the other hand, some studies have used stock returns of shipping firms to analyze the diversification effect. Grammenos and Marcoulis (1996) and Kavussanos and Marcoulis (1997) study the systemic risk of the shipping industry using stock returns of shipping companies listed on stock exchanges such as the USA, Norway, Stockholm and London exchanges. These studies are not directly relevant to the diversification effect, but provide the fundamentals for examining the stock return risks of shipping companies. Gong *et al.* (2006) also investigated β stability in the US-listed international transportation industry using different estimation designs. They found that β values depend upon the estimation procedure employed, the sampling interval for returns, the market index employed, the time period covered by the data and the nature of the sample analyzed. The use of the value-weighted market index, in particular in combination with the Scholes–Williams β estimation method, generally leads to higher β values than the use of the equally weighted market index.

There are very few studies investigating the diversification effect of investment in shipping stocks. Syriopoulos and Roumpis (2009) investigated the market risk as measured by value-at-risk with 17 shipping companies listed on the US stock exchange as well as portfolio benchmark indices. Their empirical findings support that smaller shipping companies are not riskier compared to larger shipping stocks, and the addition of smaller shipping stocks in portfolio construction does not increase the risk in terms of value-at-risk estimates. Grelck *et al.* (2009) investigated the distribution properties of investing in ships by applying three methods: correlation analysis, comparison of efficient portfolio frontiers and a significance test of differences in the Sharpe ratios. Two indices (i.e. the ClarkSea Index and MSCI World Marine Index) were used as proxy for investments in shipping as each index has advantages and shortcomings. The results confirmed that adding an investment in shipping as a new asset class to the base portfolio improved diversification, in most cases resulting in significant performance increases as measured by Sharpe ratios.

Methodology and data

Unit root test for stationarity

In general, the first step in an empirical analysis involving time series is to verify whether or not the time series under consideration is stationary. The problem of spurious regressions often appears when the variables of the model are non-stationary and the standard statistical tests, such as correlation and causality tests, are not applicable. Non-stationary time series become stationary when differenced, which are called $I(1)$ series. Among the most used are the Dickey–Fuller (DF), Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests to examine the properties of time series.

The ADF test is based upon the following regressions:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta y_i + e_i,$$

where y_t is a time series at time t, Δ is the first difference operator, α_0 is a constant, n is the optimum number of time lags on the dependent variable, and e is a random error term.

The null hypothesis for testing non-stationarity is H_0: $\alpha_0 = 0$. That is, y_t is a random walk and has a unit root. If the t-statistic associated with the estimated coefficient is less than the critical values for the test, the null hypothesis of non-stationarity cannot be rejected at the associated significance level. This study also employs the PP test because the possibility of the presence of structural breaks makes the ADF test unreliable for testing stationarity.

Correlation analysis and cointegration test

After testing the stationarity of the time series for the underlying variables, the correlation is analyzed to evaluate relationships between variables. If the unit root test indicates that the time series data are non-stationary, differenced data must be used for correlation analysis. According to Markowitz's portfolio theory, investors can reduce investment risks by holding assets with zero or negative correlations, where correlation coefficients are used to quantify correlations of assets in the range of −1 and +1. One simple way to test the existence of the diversification effect is a correlation test. If the correlation coefficient of two assets is −1, which indicates a perfect negative correlation between the assets, then the two assets move in perfectly opposite directions. Therefore, investing in the two assets can reduce risks to zero.

In addition to the basic static correlation mentioned above, this study also employs 12-month rolling correlation analyses to analyze dynamic movement of the correlations. Correlation analysis, however, has a shortcoming in that it only indicates a short-term relationship between variables. Because investments in ships normally have a long-term investment horizon, it is necessary to analyze the long-term relationships among shipping funds and other investment assets. Cointegration analysis can enables us to investigate the existence of long-term equilibrium relationships.

When a time series is non-stationary or integrated, values that take a moment of time are the accumulation of all the disturbances, unlike the stationary series for which the effect of perturbation is transitory. Therefore, the fact that a linear combination of a set of variables is stationary intuitively implies that the way they move in time is similar. In other words, if a set of underlying variables in the same order of integration is cointegrated, the existence of a non-spurious relationship between them is stationary. When there is a relationship between economic variables, deviation from the underlying relationship cannot be strong and grow without limit. Thus, cointegration of the variables of a model gives validity to its long-term relationships.

For this purpose, the time series data are examined for cointegration by applying the Johansen and Engle-Granger cointegration tests. The Engle-Granger method applies the ADF unit root test on the residuals from the regression of the variables under consideration. If a set of underlying variables in the same order of integration is cointegrated, then the residuals from the linear regression of the variables must be stationary, implying a long-term relationship between them. Johansen's methodology

(Johansen and Juselius, 1990, 1992, 1994) takes its starting point in the vector autoregression (VAR) of order p given by:

$$y_t = \mu + A_1 y_{t-1} + \cdots A_p y_{t-p} + \varepsilon_t,$$

where y_t is an nx1 vector of variables that are integrated of order 1, commonly denoted as I (1), and ε_t is an nx1 vector of innovations. This VAR can be re-written as:

$$\Delta y_t = \mu + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \ ,$$

where:

$$\prod = \sum_{i=1}^{p} A_i - \mathrm{I} \text{ and } \Gamma_i = -\sum_{j=i+1}^{p} A_j.$$

If the coefficient matrix Π has reduced rank $r < n$, then there exist nxr matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. The number of cointegrating relationships is r, the elements of α are known as the adjustment parameters in the vector error correction model and each column of β is a cointegrating vector. It can be shown that for a given r, the maximum likelihood estimator of β defines the combination of y_{t-1} that yields the r largest canonical correlations of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests for the significance of these canonical correlations and thereby the reduced rank of the Π matrix: the trace test and maximum eigenvalue test shown as follows:

$$J_{\text{trace}} = -T \sum_{i=1}^{n} \ln\left(1 - \hat{\lambda}_i\right),$$

$$J_{\max} = -T \ln\left(1 - \hat{\lambda}_{i+1}\right).$$

where T is the sample size and $\hat{\lambda}_i$ is the estimated values of the characteristic roots obtained from the estimated Π matrix. The number of cointegrating vectors is r. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigenvalue test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r +1 cointegrating vectors.

Data collection

The data set employed for the empirical analysis consists of monthly data from the Korea Stock Price Index (KOSPI) 200, Korea Bond Index (KOBI) 120 and KSE-listed KSFs from September 2004 to December 2015. It was September 2004 that the first KSF was listed on KSE and the stock price was first available. Therefore, the data were collected from September 2004 to December 2015 of which data were the most recent at the time of data collection. KOSPI 200 and KOBI 120 are used as proxy measures for stocks and bonds, respectively. The monthly frequency data for KOSPI 200 and KOBI 120 was obtained from KSE and KIS Pricing. In total, 55 KSE-listed funds are chosen for this study because much information is publicly available. Average month-end closing share prices of the 55 KSE-listed KSFs[1] were obtained from KSE. Figure 1 shows the time series of KOSPI 200, KOBI 120 and the KSFs for 2004–2015.

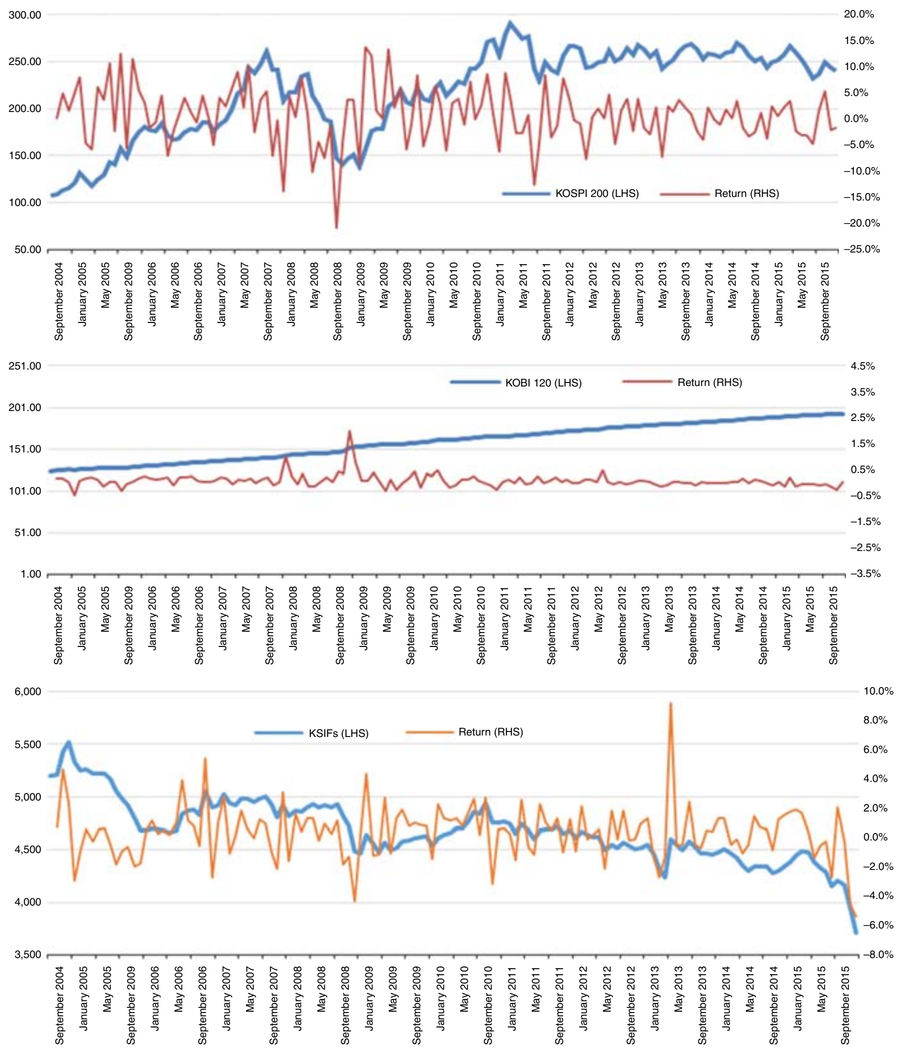

Figure 1.
Movements of KOSPI 200, KOBI 120 and the KSFs

Analysis results

ADF and PP tests

Table I shows descriptive statistics of the three variables. The values of the Jarque–Bera test show that the null hypothesis of normal distribution can be rejected at 1 percent level of significance for both KOSPI 200 and KOBI 120, which means that only the KSFs are normally distributed.

As discussed earlier, an initial step for time-series analysis is to examine the property of the individual series. A preliminary procedure for the time-series property of the concerned variables is followed using the ADF and PP unit root tests. The results show that the test statistics are significantly greater than the critical values at 1 and 5 percent levels in both the ADF and PP tests (Table II). Thus, it is not possible to reject the null hypothesis of the presence of the unit root for the series, implying that all three series are non-stationary at those levels. However, the results of the first differenced series indicate that the null hypothesis for non-stationarity can be rejected in all series at 1 and 5 percent levels. The results demonstrate that the series are integrated at order 1, and thus the series at the first difference are stationary. The PP test also shows that all three series at the first difference are stationary, also implying that they are integrated at order 1.

Correlation analysis

Table III presents the results of the correlation analysis based on the series at the first difference. In general, stocks and bonds are not correlated, with their correlation coefficient not significantly different from zero. There is a similar result in the correlation between KOSPI 200 and KBI 120 (correlation coefficient of −0.08, $p = 0.34$). Due to the low and negative correlations of the KSFs with stocks (0.12, $p = 0.18$) and bonds (−0.13, $p = 0.12$), the inclusion of the KSFs in the traditional stock and bond portfolio can improve the risk and return characteristics.

As the correlations in Table III show static relationships, it is also necessary to find the dynamic relationships by applying rolling correlations. The 12-month rolling method is applied with results shown in Figure 2. The correlations appear to vary over time. Specifically, from 2007 to 2008 and from 2012 to 2013, the KSFs are negatively correlated

	Variables		
	KOSPI 200	KOBI 120	KSFs
n	136	136	136
Mean	218.0	159.6	4,688
Median	237.1	162.1	4,668
Maximum	290.4	192.9	5,523
Minimum	107.7	124.8	3,710
SD	46.7	21.5	287
Skewness	−0.7377	−0.0889	0.1190
Kurtosis	2.4180	1.6570	3.7763
Jarque–Bera	14.1902	10.3999	3.7361
p-value	0.000829	0.0055	0.154428

Table I. Descriptive statistics

	ADF test statistic		PP test statistic	
Variables	Level	First difference	Level	First difference
Ln(KOSPI 200)	−2.396250 (0.1447)	−11.54941*** ($p < 0.001$)	−2.407714 (0.1415)	−11.55464*** ($p < 0.001$)
Ln(KOBI 120)	−0.524473 (0.8817)	−8.674152*** ($p < 0.001$)	−0.542674 (0.8780)	−8.690542*** ($p < 0.001$)
Ln(KSFs)	−0.464469 (0.8933)	−11.56900*** ($p < 0.001$)	−0.286377 (0.9227)	−11.56619*** ($p < 0.001$)

Notes: Values in parenthesis are p-values. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table II. ADF and PP test results

	Stock: KOSPI 200	Bond: KOBI 120	Ship investment: KSFs
Stock: KOSPI 200			
Bond: KOBI 120	−0.08 ($p = 0.34$)		
Ship investment: KSFs	0.12 ($p = 0.18$)	−0.13 ($p = 0.12$)	

Table III. Correlation coefficients

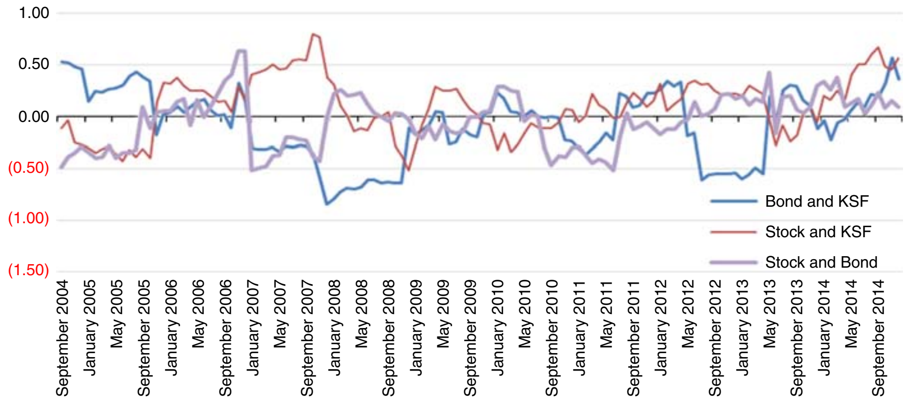

Figure 2.
12-month rolling correlations between KOSPI 200, KOBI 200 and KSFs

with bonds, which is consistent with the result of the above correlation analysis. These results suggest that investors should rebalance their portfolio on a regular or dynamic basis rather than constantly holding it unchanged over time.

Cointegration tests

To determine the long-term equilibrium relationships among variables in the series, the Johansen and Engle-Granger cointegration tests are applied. The results are summarized in Tables IV and V, respectively. From Table IV, the statistics of both the trace and maximum eigenvalue tests are less than the critical values at the 5 percent level; therefore, the null hypothesis cannot be rejected at the 5 percent level. These results indicate non-existence of any cointegration relationships, implying that the variables, including the KSFs under consideration, are not moving together in the long-term equilibrium. Also according to the Engle-Granger cointegration test in Table V, there exists no cointegration relationships among the variables under consideration. In summary, based upon two cointegration tests,

Table IV.
Johansen cointegration test results

Null hypothesis (H_0): series are not cointegrated			
Hypothesized No. of CE(s)	Trace statistic	5% critical value	p-value
None	24.50966	29.79707	0.1797
At most 1	6.510694	15.49471	0.6351
At most 2	1.459782	3.841466	0.2270
Hypothesized No. of CE(s)	Max-eigenvalue	5% critical value	p-value
None	17.99896	21.13162	0.1299
At most 1	5.050912	14.26460	0.7354
At most 2	1.459782	3.841466	0.2270

Table V.
Engle-granger cointegration test results

Null hypothesis (H_0): series are not cointegrated				
Dependent	τ-statistic	p-value	z-statistic	p-value
KOSPI 200	−2.817061	0.3308	−13.06379	0.4063
KOBI 120	−2.650039	0.4116	−13.80035	0.3664
KSFs	−2.284580	0.6001	−14.82513	0.3152

all three variables under consideration are not cointegrated in the long run. This implies that the KSFs, as a new investment asset class, can bring a diversification effect under Markowitz portfolio theory, in agreement with the correlation analysis results.

Findings and conclusion

The main objective of this study was to empirically investigate the diversification potential of KSFs using monthly data from 2004 to 2015. This study differs from previous studies in terms of applying both correlation and cointegration tests to investigate not only the short-term relationships but also the long-term equilibrium relationships. In addition, the KSFs were selected as a proxy to represent ship investment assets, rather than the freight rates of ships, which were commonly used in the previous literature. The KSFs are a good proxy of shipping investments since their investments include almost all types of commercial vessels (i.e. dry and wet bulk carriers, and container ships of both newbuilding and second-hand) as shown in the Appendix.

Prior to applying both correlation and cointegration tests, stationarity was verified by the ADF and PP unit root tests and was non-stationary at the level. Thus, the first differenced series data were used for correlation analysis. The correlation coefficients indicate that the KSFs have relatively low correlation coefficients, even slightly negative correlation coefficients with bonds. It was clearly shown that adding KSFs to traditional stock and bond portfolios provides investors with diversification benefits. Moreover, cointegration was analyzed by the Johansen and Engle-Granger cointegration tests indicating that long-term equilibrium relationships are not evident in the three variables. This may lead to the possibility of diversification with KSFs in the long term.

This paper makes contribution to the literature as follows: first, whereas the previous literature investigated diversification effect of ship investment using freight indices or freight rates which are not able to represent returns from ship investment, this study is the first study to use actual stock prices of the KSFs to our best knowledge; and second, diversification effect of ship investment represented by KSFs is empirically verified in the both short term and long term.

This paper also provides policy and practical implications. First, while KSFs aim at supporting shipping companies and shipbuilders as vehicles for investors to invest in ships, policy-makers and managers of shipping companies can have sound ground that the KSFs are alternative and attractive assets to investors. One expectation of investors toward the KSF is to enhance existing portfolios in the context of improved risk and return characteristics. A major reason for investors to become increasingly interested in investing in alternative assets, including ship investment funds, is that alternative assets can offer diversification benefits.

Second, while investors to the KSFs are provided with incentives in terms of tax for example, it is shown that the KSFs have potential to improve risk and return structure of investors on their own regardless of existence of incentives. Therefore, decisions of policy-makers can be made free from expectations for stronger incentives provided by the Government. However, it should also be noted that, considering role of the KSFs that not only provides liquidity to shipping industry when necessary but also relieve capital intensity in shipping companies, the KSF scheme need to be well managed and maintained.

In addition, those countries that do not have such a ship investment platform may consider introducing a similar ship investment fund in order to revitalize the capital markets of the country. Finally, as ships are globally operating and traded, the KSFs are likely to bring global diversification effect when included in global portfolio.

Constructing an optimal portfolio consisting stocks, bonds and the KSFs and evaluating its improved performance maybe using the Sharpe ratios when the KSFs are added is another important subject which is left for future research. In addition, more assets can be included in the analysis as alternative assets such as real estate investment firms in future research.

Note

1. Please refer to the Appendix for an overview of the 55 KSF used in this study.

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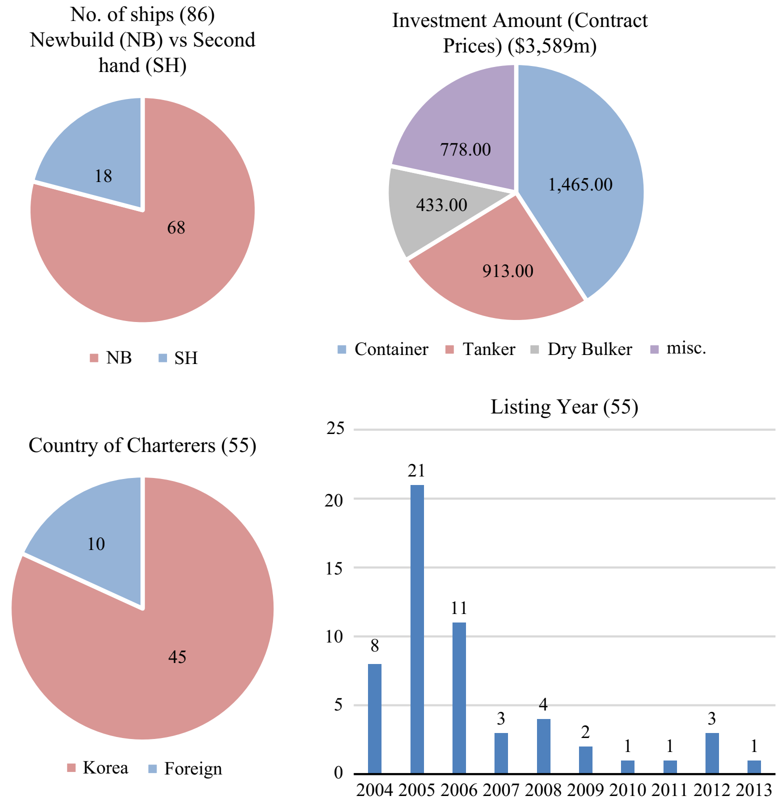
(The Appendix follows overleaf.)

Appendix. Details of the 55 Korea Ship Funds

The 55 KSFs acquired a total of 86 newly built or second-hand ships, amounting to approximately $3.6bn in terms of the contract price, and chartered them to shipping companies. Key characteristics of the KSFs are summarized as follows:



Source: Korea Stock Exchange, DART (Financial Supervisory Service)

Corresponding author
Su-Han Woo can be contacted at: shwoo@cau.ac.kr