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Integration in Futures Markets

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Abstract

The study of integration in futures markets extends the understanding of issues in financial markets integration, which mostly focuses on equity markets. The integration index is created following Pukthuanthong and Roll (2009), which captures the degree of integration through time. The outcomes of this study display the similarity in the movement but the variance in the level between futures and stock markets. There is a sharp declining in futures markets integration in 2012 and 2013 due to the decreasing in futures markets volatility.

Key words: *Market integration, Futures markets, Principal components analysis*

1. Introduction

Although there are many studies of market integration in equity markets, the study of market integration in futures markets is limited. Both of underlying and derivatives markets share some common characteristics, such as high correlation, and co-integration of price movement between futures markets and their underlying spot markets (Modest and Sundaresan, 1983 and Chang and Lee, 2015). However, the rules that regulate the markets and trading method are different, such as, margin requirement, trading hours, securities maturity, and etc. One of the evidence of difference in characteristics of these markets is that Andersen (1996) investigates noise trading in equity and futures markets. The findings show that noise trading dominates in the equity market, but informed trading dominates in futures markets (Holmes and Tomsett, 2004). Therefore, the information in futures market should be reflected better than that in the underlying equity markets leading to the hypothesis that the degree of integration in these two markets may be different as the integration in futures markets is expected to be higher than that in stock markets.

In order to complete this gap, this study will provide the information in financial market integration with the different data set. Most previous studies concentrate to examine the behavior in emerging stock markets. This study explores the integration with broad sample and focuses on futures markets. The level of integration is measured with the method of Pukthuanthong and Roll (2009) (thereafter PR). The results also present the higher degree of integration in futures markets than that in spot markets, which is consistent with the hypothesis that informed traders play more role than noise traders in futures markets. The level of market integration also associates with changes in volatility of futures return.

The contribution of this study provides not only the profound understanding of integration development in futures markets, but also the ideas of future research in futures markets. For example, factors cause a change in futures market integration, or structural change exists in the integration. The higher degree of financial market integration is associated with the lower cost of capital, which can lead to the efficiency in capital accessing. The comprehensive study of integration in futures market would enlighten policy makers how to regulate the markets.

The organization of this study is that section 2 reviews previous literatures. Section 3 describes the data used. Section 4 explains the methodology applied. Section 5 shows the empirical results, and section 6 is conclusion and discussion.

2. Literature Reviews

Kearney and Lucey (2004) review the literatures of financial market integration, and categorize the definition of market integration into two types - direct and indirect measures. Direct measure indicates that financial market integration is where the law of one price applied such that in different markets assets with similar risk profile should have the same

price. Indirect measure describes financial market integration with liberalization and deregulation policy. The review of literature in this study is divided into two categories as regard of the definition of Kearney and Lucey (2004). Errunza and Losq (1985) test hypothesis of mild segmentation by dividing assets into two groups - eligible and ineligible assets, and grouping investors to two types - restricted and unrestricted investors. They study the integration between nine emerging markets and the U.S. The result is not statistically significant to the mild segmentation hypothesis. Errunza, Losq, and Padmanabhan (1992) test the market integration of emerging markets with international asset pricing model (IAPM). They do not find the fully integration nor fully segmentation.

Another approach of in the study of financial market integration is financial liberalization. If the markets have higher degree of liberalization, investors are able to invest in various markets, or the barriers of investment are less; then it is lessen the cost of capital. Khanthavit and Sungkaew (1993) measure Thailand's barriers to investment between Hong Kong, Japan, Singapore, the U.K., and the U.S. They apply the single-latent-variable and GMM estimation to estimate the level of barriers between Thai and these markets. The findings are diverse in each market. Some literatures examine the relation between investment barriers and market integration. Bekaert (1995) measures the market integration with the correlation of excess return in 19 emerging markets with excess return in the U.S. market. Then, he measures the correlation between market integration and investment barriers. There are two types of investment barriers - direct and indirect barriers. The outcomes identify that changes in indirect barriers affect the market integration more than changes in direct barriers. This finding still remains in other data set. Nishiotis (2004) explores the impact of indirect barriers, which the definition is consistent with Bekaert (1995), on market segmentation. He measures the market segmentation with the difference between U.S. closed-end funds and domestic closed-end funds in nine emerging countries. The results show that indirect barriers can lead to market segmentation even in the inexistence of the restriction of capital flow.

Bekaert and Harvey (2003) examine the market integration and market liberalization with regime switching model. They state that the liberalization increases small level of correlation in world markets, and reduces cost of capital. They use official liberalization dates, which relate with changes in law and regulation in those observed markets. They also consider the dates of introduction of ADR and country funds in those emerging markets. The event studies of liberalization show that dates of events of financial liberalization development are essential. Bekaert, Harvey, and Lumsdaine (2002) investigate the date of world equity markets integration. They employ a reduced-form model to study the structural break in emerging markets. They conclude that actual break dates do not correspond to official dates of capital market reforms (see Laopodis, 2004). From the previous literature, we can infer

that the fully market segmentation or integration does not exist. Liberalization plays vital roles on the development of market integration especially indirect barriers.

Time-varying market integration is another issue in market integration. Research questions whether it is constant through time, and whether the level can be reverse are investigated. Bekaert and Harvey (1995) apply a conditional regime-switching model to measure the degree of the market integration. They conclude that the degree of market integration is time varying, but does not present the increasing trend through time. De Jong and De Roon (2005) use the fraction of noninvestable assets to world assets as a proxy of market segmentation. This allows time-varying market integration. The decreasing in market segmentation leads to the reducing of returns. Yu, Fung, and Tam (2010) study the financial market integration in Asian stock markets with several methods. The results show the low degree of integration during 2002 - 2006, and the increasing level in 2007 and 2008, which can imply that the degree of integration is higher just before and during crisis period. The existence of time-varying market integration guides to the development of integration index. Carrieri, Errunza, and Hogan (2007) apply GARCH-in-mean to asset pricing model. They create integration index with R-square from the asset pricing model. They also find that financial liberalization is a significant factor of market integration. PR (2009) use the principal components analysis to find global factors. These factors are independent variables in an asset pricing model of returns of stock market index. R-square from the regression presents the degree of integration similar to Carrieri et al (2007). They find the rising in market integration especially during the bear market. Carrieri, Chaieb, and Errunza (2013) create integration index with the R-square from IAPM in Errunza and Losq (1985). The integration index does not show the increasing trend all the time. They also display that the improvement in implicit barriers related to institutional environment, corporate governance, and quality of information.

The previous studies in financial market integration focus on stock markets and most of them focus on emerging markets. Therefore, this study will fill the loop in this area by concentrating on integration among futures markets. Moreover, the issue of time-varying in the degree of integration is concerned, so the idea of integration index is applied with the method of PR (2009).

3. Data

The daily data employed in this study covers the period of January 1, 2007 to December 31, 2013. The futures prices are retrieved from DataStream continuous series. If there are several indexes in one market, I choose the one that has the longest available period. There are 33 futures markets in the database. The inactive markets are excluded; therefore, only 28 markets are left for this research. Table 1 shows the list of the countries used in this study.

Table 1: List of futures markets and their sample periods

28 active futures markets are retrieved from DataStream. The continuous series used in this study is a perpetual series of futures prices. It starts at the nearest contract month, which forms the first price for the continuous series until either the contract reaches its expiration or until the first business day of the notional contract month, whichever is sooner. At this point prices from the next trading contract month are taken. No adjustment for price differentials is made. The prices of futures contracts are U.S. dollar denominated.

Country	Name	Exchange	Underlying Name	DataStream Start Date	Trading Cycle
U.S.	CME-S&P 500 INDEX CONTINUOUS	Chicago Mercantile Exchange	S&P 500 COMPOSITE	23-Apr-82	Mar, Jun, Sep, Dec
U.K.	LIFFE-FTSE 100 INDEX CONTINUOUS	NYSE Euronext Liffe	FTSE 100	3-May-84	Mar, Jun, Sep, Dec
Brazil	BMF-BOVESPA INDEX CONTINUOUS	BM&F Bovespa	BRAZIL BOVESPA	14-Feb-86	Feb, Apr, Jun, Aug, Oct, Dec
Hong Kong	HKFE-HANG SENG INDEX CONTINUOUS	Hong Kong Futures Exchange	HANG SENG	18-Jan-88	All
Japan	TSE-TOPIX INDEX CONTINUOUS	Osaka Securities Exchange	TOPIX	5-Sep-88	Mar, Jun, Sep, Dec
Netherlands	AEX-AEX INDEX CONTINUOUS	Euronext.liffe Amsterdam	AEX INDEX (AEX)	26-Oct-88	All
South Africa	SAFEX-ALL SHARE 40 INDEX CONT.	South African Futures Exchange	FTSE/JSE TOP 40	2-May-90	Mar, Jun, Sep, Dec
Germany	EUREX-DAX INDEX CONTINUOUS	EUREX	DAX 30 PERFORMANCE (XETRA)	23-Nov-90	Mar, Jun, Sep, Dec
Spain	MEFF-IBEX 35 PLUS INDEX CONT.	MEFF Renta Variable	IBEX 35	20-Apr-92	All
Norway	OSLO-OBX INDEX CONTINUOUS	Oslo Stock Exchange	OSLO SE OBX	4-Sep-92	All
Belgium	BELFOX-BEL20 INDEX CONTINUOUS	NYSE Euronext - Euronext Brussels - Derivatives	BEL 20	29-Oct-93	All
Hungary	BSE-BUX INDEX CONTINUOUS	Budapest Stock Exchange	BUDAPEST (BUX)	3-Apr-95	All
Malaysia	KLSE-KLCI CONTINUOUS	Kuala Lumpur	FTSE BURSA MALAYSIA KLCI	15-Dec-95	All
Portugal	BDP-PSI 20 INDEX CONTINUOUS	New York Stock Exchange (NYSE) Euronext	PORTUGAL PSI-20	20-Jun-96	Mar, Jun, Sep, Dec
Poland	WSE-WIG 20 CONTINUOUS	Warsaw	WARSAW GENERAL INDEX 20	16-Jan-98	Mar, Jun, Sep, Dec
Taiwan	TAIFEX-TAIEX WEIGHTD INDEX CONTINUOUS	Taiwan Futures Exchange	TAIWAN SE WEIGHED TAIEX	21-Jul-98	All
Singapore	SGX DT-MSCI SING. INDEX	Singapore Exchange - Derivatives Trading	MSCI SINGAPORE F	7-Sep-98	All

Country	Name	Exchange	Underlying Name	DataStream Start Date	Trading Cycle
	CONT.	Division			
France	MONEP-CAC 40 INDEX CONTINUOUS	Euronext Paris MATIF	FRANCE CAC 40	8-Jan-99	All
Mexico	MEXDER-IPC INDEX CONTINUOUS	Mexican Derivatives Exchange	Mexican IPC	1-Jun-99	Mar, Jun, Sep, Dec
Greece	ADEX-FTSE/ASE-20 CONTINUOUS	Athens Derivatives Exchange	FTSE/ATHEX LARGE CAP	30-Aug-99	Mar, Jun, Sep, Dec
Canada	ME-S&P CANADA 60 INDEX CONT.	Montreal Exchange	S&P/TSX 60 INDEX	7-Sep-99	Mar, Jun, Sep, Dec
Australia	SFE-SPI 200 INDEX CONT. TRAD	ASX Trade24	S&P/ASX 200	2-May-00	All
India	NSE-S&P CNX NIFTY CONTINUOUS	National India		12-Jun-00	All
Italy	IDEM-FTSE MIB CONTINUOUS	Italian Derivatives Market	FTSE MIB INDEX	22-Mar-04	Mar, Jun, Sep, Dec
Turkey	TURKDEX-ISE 30 CONTINUOUS	Turkish Derivatives Exchange	BIST NATIONAL 30	4-Feb-05	Feb, Apr, Jun, Aug, Oct, Dec
Sweden	OMX-OMXS30 INDEX CONTINUOUS	OM Nordic Exchange	OMX STOCKHOLM 30 (OMXS30)	15-Feb-05	All
Russian	RTS-RTS INDEX CONTINUOUS	Russian Trading System	RUSSIA RTS INDEX	3-Aug-05	Mar, Jun, Sep, Dec
Thailand	TFEX-SET50 INDEX CONTINUOUS	Thailand Futures Exchange	BANGKOK S.E.T. 50	28-Apr-06	Mar, Jun, Sep, Dec

Futures prices are converted from their local currency to USD in order to incorporate the effect of exchange rate in the analysis. The data of January 1 is removed since it is a holiday in almost of every country. However, other holidays are not common in all countries, so the return is computed from the previous daily price for the holiday country. The return is calculated from the difference in logarithm of futures price. Table 2 exhibits the descriptive statistics. Panel A presents futures returns and panel B reports standard deviation of returns of futures contracts. The return of every observed market in 2008, which is subprime crisis, is negative, but the markets are substantially growth in 2009. The negative return in 2011 may be the result from European debt crisis. The standard deviation of futures return is high in 2008 and 2009 due to the huge price variation in these years.

Table 2: Descriptive statistics of 28 active futures markets

Panel A presents annual returns of futures contract in each year separating by markets. Panel B shows annual standard deviations of return of futures contract in each market. The observed data is from January 1, 2007 to December 31, 2013. The classification of developed and emerging markets follows the classification of MSCI.

Panel A: Annual return

	2007	2008	2009	2010	2011	2012	2013
Developed markets:							
Canada	24.2553%	-61.1775%	41.7450%	16.4711%	-12.6081%	7.7222%	3.5355%
U.S.	3.3460%	-48.9525%	22.4096%	13.0301%	1.4389%	13.3541%	26.3475%
Belgium	4.0618%	-79.0400%	31.5400%	-2.4267%	-21.2826%	19.3606%	20.9877%
France	11.0606%	-57.9350%	24.2941%	-7.8739%	-18.6890%	16.4352%	21.1364%
Germany	29.7225%	-55.2125%	25.3200%	9.4731%	-16.4780%	27.5300%	27.6700%
Italy	3.1561%	-71.1450%	22.6259%	-18.0610%	-28.5425%	10.7273%	20.3034%
Netherland	13.7230%	-75.5375%	34.5950%	0.4999%	-13.2355%	11.4513%	20.3128%
Norway	25.4100%	-95.9200%	72.1050%	17.2376%	-11.1448%	21.2323%	12.3699%
Portugal	24.6173%	-74.0900%	32.0875%	-14.4868%	-32.7625%	5.4663%	19.9400%
Spain	16.7354%	-53.6800%	30.9475%	-23.1990%	-14.8514%	-1.1978%	24.9565%
Sweden	-0.5130%	-67.4950%	48.3075%	26.3325%	-14.6192%	17.5417%	20.4402%
U.K.	5.2371%	-67.8325%	32.0775%	7.3743%	-5.1431%	10.5786%	15.5162%
Australia	21.5657%	-72.3375%	51.4200%	11.1319%	-13.8045%	15.4295%	0.3351%
Hong Kong	32.0650%	-63.2275%	42.6675%	5.5547%	-19.7073%	21.1346%	3.6772%
Japan	-6.8227%	-31.1150%	3.7047%	13.5720%	-13.7184%	5.8695%	22.4661%
Singapore	20.1811%	-63.5100%	49.0825%	17.5021%	-21.8420%	23.9539%	-1.0325%
Emerging markets:							
Brazil	52.1075%	-76.3850%	87.8625%	7.6562%	-28.8300%	-0.5296%	-28.3875%
Mexico	10.1542%	-48.6850%	41.6850%	23.8373%	-13.5663%	23.7150%	-1.9400%
Greece	23.7560%	-108.3925%	23.0064%	-56.8800%	-86.6575%	21.9370%	27.9225%
Hungary	14.8055%	-82.8100%	57.1225%	-6.3702%	-34.4350%	17.3887%	5.5930%
Poland	20.3705%	-82.6950%	36.3650%	11.6882%	-35.9500%	30.0325%	-3.5958%
Russia	17.5541%	-136.9900%	94.0075%	20.8439%	-23.8279%	12.9593%	-4.4656%
South Africa	17.9965%	-57.3075%	46.7150%	24.8113%	-17.7470%	16.2682%	-2.4159%
Turkey	52.7775%	-95.1450%	68.4300%	18.0689%	-44.0250%	50.4125%	-32.2825%
India	54.7500%	-94.7200%	65.2300%	21.8967%	-44.3675%	23.4635%	-3.9543%
Malaysia	33.7250%	-53.3150%	38.7850%	29.8450%	-1.9463%	14.4396%	4.3127%
Taiwan	7.6816%	-62.7600%	63.1750%	19.4873%	-26.5900%	13.9139%	10.1152%
Thailand	34.4125%	-71.7800%	55.1150%	42.4650%	-3.5599%	31.7825%	-13.4047%

Panel B: Annual standard deviation

	2007	2008	2009	2010	2011	2012	2013
Developed markets:							
Canada	18.6880%	48.4317%	35.6743%	20.4234%	25.3132%	17.1018%	13.2737%
U.S.	15.9972%	41.6904%	26.1555%	17.8868%	23.5286%	13.5455%	11.0616%
Belgium	17.6240%	42.5156%	30.3409%	28.2383%	33.8090%	23.0389%	16.5577%
France	18.1787%	45.2244%	33.4103%	29.5706%	36.2944%	26.0837%	18.3581%

	2007	2008	2009	2010	2011	2012	2013
Germany	16.5865 %	44.7839%	34.0013%	24.0869%	35.8111%	23.9756 %	16.9852%
Italy	16.4906 %	42.5363%	38.2677%	31.1023%	39.9685%	33.2778 %	22.5746%
Netherland	17.0159 %	48.2990%	34.9285%	26.0554%	30.4376%	21.2794 %	14.8782%
Norway	26.3693 %	63.3532%	48.8232%	33.4291%	36.5604%	24.5029 %	17.9129%
Portugal	15.7747 %	38.6913%	26.6727%	33.2150%	31.4405%	23.1379 %	22.1608%
Spain	17.8950 %	45.4834%	31.8865%	36.3330%	36.7569%	33.1698 %	20.9194%
Sweden	24.2457 %	51.2771%	47.3135%	30.2320%	39.4292%	26.3630 %	19.5389%
U.K.	18.7134 %	44.9534%	31.7682%	21.6605%	25.6233%	17.5751 %	13.0368%
Australia	24.9687 %	51.1683%	31.6414%	26.6291%	29.4519%	16.7830 %	17.0421%
Hong Kong	28.1697 %	48.9513%	32.8597%	18.6745%	25.2111%	17.5116 %	15.4958%
Japan	18.6165 %	43.0432%	26.1489%	18.6824%	22.6656%	15.0800 %	22.8595%
Singapore	25.0065 %	38.5588%	31.8305%	19.5033%	24.1242%	15.4123 %	13.0216%
Emerging markets:							
Brazil	36.5689 %	64.4127%	40.6754%	28.9099%	33.4356%	26.8185 %	25.3238%
Mexico	25.8115 %	47.0740%	36.2890%	22.0640%	27.3839%	17.9056 %	21.3694%
Greece	20.5491 %	48.2097%	45.1156%	47.8944%	55.5095%	52.9334 %	36.7638%
Hungary	21.8382 %	56.9495%	49.4239%	39.5614%	40.9855%	30.4561 %	20.9528%
Poland	25.9640 %	52.2152%	53.7046%	33.2045%	38.6041%	27.9384 %	23.6328%
Russia	25.5495 %	77.8300%	54.8326%	29.6285%	35.7660%	27.8141 %	20.0869%
South Africa	29.9381 %	54.8753%	39.5104%	28.7410%	33.9078%	24.0259 %	20.3186%
Turkey	41.2359 %	62.5222%	41.2601%	31.1889%	35.8620%	23.2521 %	37.4942%
India	30.0265 %	51.5402%	41.5175%	21.9630%	26.5997%	21.8401 %	25.9245%
Malaysia	26.0983 %	30.7932%	21.0203%	17.4366%	18.7748%	11.4348 %	15.5767%
Taiwan	25.2364 %	43.4129%	30.0227%	20.7143%	25.5838%	17.5590 %	13.5889%
Thailand	30.8868 %	45.1433%	34.8311%	22.8440%	30.1269%	17.4827 %	25.7522%

4. Methodology

4.1 Estimation of global factors

PR (2009) includes 82 countries from 1973 to 2004 in their study. Due to broad and depth of the data, they divide the data into three cohorts and use 17 markets in the first cohort to estimate global factors. However, futures markets do not have long history like stock markets.

Thus, I do not separate the data to multi-cohort, and I use 11 countries, which have the longest series in DataStream among 28 sample countries, to estimate global factors. Principal components analysis is employed to estimate the common factors. Connor and Korajczyk (1988) and PR (2009) are also used this method. It also eliminates the problem of an appropriated asset pricing model. Principal components are estimated from 11 countries. The largest six eigenvalues can explain more than 90 percent of variance. Figure 1 illustrates the average cumulative percentage of variance of 11 countries across seven sample years. Only the first component explains 61% and other five factors totally explain about 31%. This evidence is consistent with PR (2009) proving the validity of multiple global factors.

Figure 1: Average cumulative percentage of variance explained by sorted eigenvalues.

This figure shows an average cumulative percentage of variance explained by sorted 12 eigenvalues. 11 futures markets and one-day lagged of the return of USA from 2007 to 2013 are included in the estimation. These 11 markets have the longest history in DataStream. The prices of futures contracts are U.S. dollar denominated.

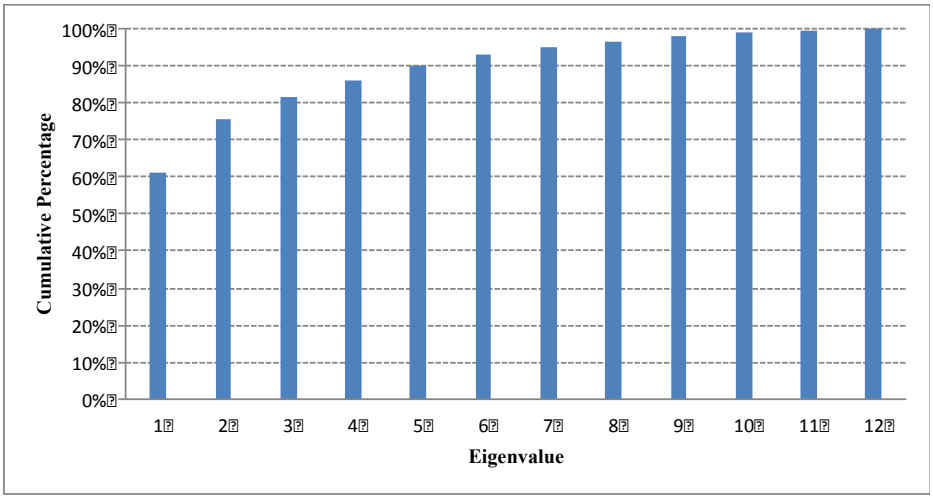
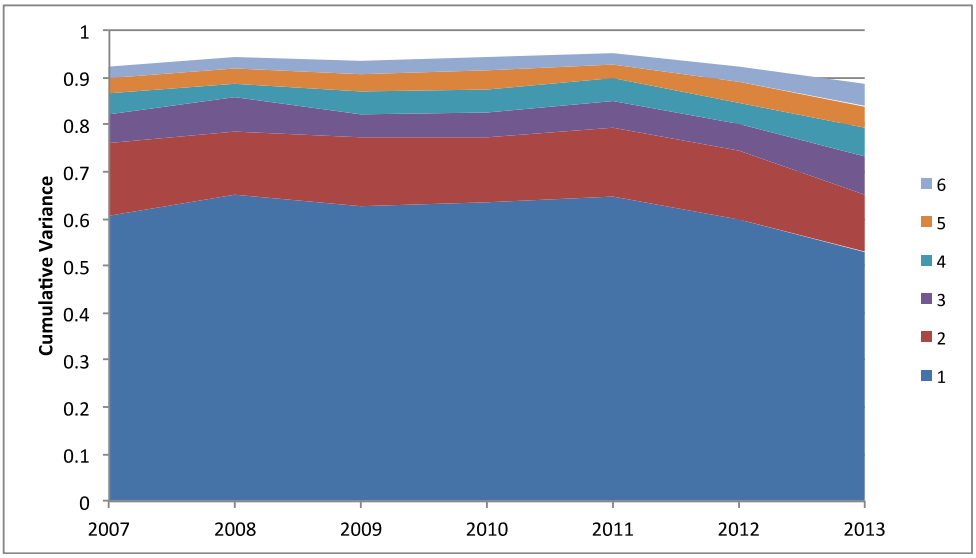


Figure 2 demonstrates the cumulative variance in each year of the first six principal components. The explanation power is slightly different each year, and declining in 2012 and 2013.

Figure 2: Cumulative variance of the first six eigenvalues.

This figure shows the cumulative variance of sorted eigenvalues from 2007 to 2013. The first six eigenvalues contribute to the average cumulative variance more than 90 percent. 11 futures markets, which have the longest history in DataStream, are employed in the estimation. The prices of futures contracts are U.S. dollar denominated.



Estimated eigenvalues are employed to calculate the weights of returns of each market. The weight from the previous year will be used with returns in the year later. Therefore, the weights estimated in year 2007 - 2012 are used with the return in year 2008 - 2013, respectively. The eigenvalues of each country are separately estimated, and that country itself is excluded when estimated in order to prevent the high principal components weightings in the particular country. Different time zone is another concern. This study follows the practice of PR (2009) by including one-day lagged return of North American countries because it is the last trading region.

4.2 Measurement of Market Integration

The return of futures markets are explained by common global factors as shown in equation (1), which is similar to PR(2009). The advantage of this estimation is that it does not restrict to any specific asset pricing model.

$$R(i,t) = a(i) + \sum_{n=1}^{N} b(i,n) f(n,t) + e(i,t) \quad (1)$$

Where R (i,t) is the return of futures market in country i at time t.

f (n,t) is the global factor n at time t

ε (i,t) is the error term

If the return is mostly explained by common global factors, the R-square should be high, and this shows the market integration. This can create measurement of the integration index (Carrieri et al, 2007, and PR, 2009) as:

$$\text{integration index} = 1 - \frac{Var(e)}{Var(R)} \quad (2)$$

The advantage of R-square measurement over correlation is that the cross-market correlation of futures market return is not a good proxy of market integration. The

correlations can be small, while markets are perfectly integrated because each market may have different sensitivity to the same factors (Carrieri et al, 2007). However, R-square has a drawback that it is biased by heteroskedasticity (Forbes and Rigobon, 2002). After finding the R-square of each country, then I find average values to measure the integration level in each period. If the integration index equals one, it means that the markets are perfectly correlated.

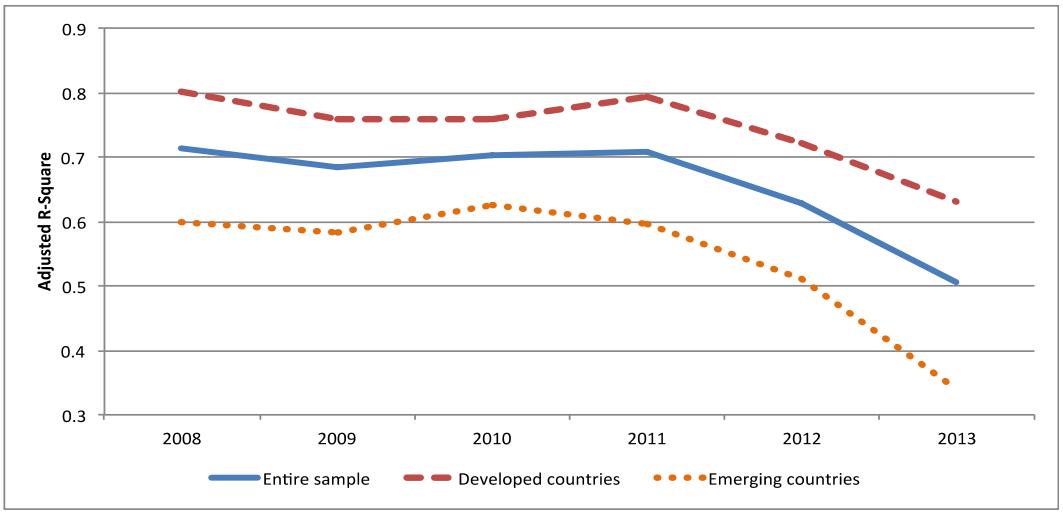
5. Empirical Results

Figure 3 illustrates the average of adjusted R-square from equation (1). The level of market integration changes slightly over the studying periods. However, it declines in 2012 and 2013. The result is different from PR (2009), which measures the level of integration among stock markets from 1974 to 2007. Their findings show the increasing trend in the degree of the market integration, but I cannot discover a trend in this study.

The degree of market integration of developed markets is much higher than that of emerging markets. The changes of integration level of emerging markets are steeper than those of developed markets. Lehkonen (2014) also applies the method of PR(2009) to study market integration of stock markets from 1987 to 2011. The results indicate that the degree of integration boosts at the early stage of the crisis, but during the crisis the integration level slightly changes. Comparing the intersection period of 2008-2011, the pattern of adjustment in the integration level between Lehkonen (2014) and this study during this four-year period is similar. I also find the high degree of integration in 2008, which is a period of subprime crisis, and it marginally declines in 2009.

Figure 3: Global integration of futures markets.

Adjusted R-square from the regression of futures markets returns is a measurement of the level of integration. The regression is analyzed for each country, then, adjusted R-squares are averaged for each period. This figure presents the degree of integration of entire sample of futures markets, developed countries, and emerging countries. The classification of developed and emerging markets follows the classification of MSCI.



The integration index shows the time-varying integration degree, and it does not always increase through time. The interesting finding is the sharp declining of integration level in 2012 and 2013. The volatility of these two years is less than those of the previous years, and this may be the reason for the declining of integration. Although the findings of Solnik, Boucrelle and Le Fur (1996) explain that the correlation across markets increases in periods of high volatility, this study finds that the degree of market integration associates with not only the level of volatility, but also changes in volatility (please see table 2 for an evidence).

6. Conclusion and Discussion

This study provides the integration measurement in equity futures markets, which has not been examined before. The integration index of futures markets is created with the method of PR (2009) that applied to equity markets. The movement of the index of futures markets is similar to that of the index of spot markets, and the degree is slightly different. The higher integration level in futures markets can imply that information in futures markets is more efficiently reflected than that in spot markets, which can refer to previous studies that informed traders dominate in futures markets. The index also shows that the integration level changes and not always increases through time. It cannot be implied that a trend exists in this study. The remarkable outcome is the declining in the level of integration in 2012 and 2013. One reason that may explain this diminishing is the decreasing of the volatility of market returns.

Comparing to equity markets, futures markets have shorter history. Therefore, the study of this area in futures markets have a potential to be improved. Moreover, the market integration can possible be developed by investigating the solid evidence that explain this movement, such as, the QE policy, and etc. Moreover, the structural change in futures markets is another possible extension of this research.

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