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Are there long-run diversification gains from the Dow Jones Islamic Finance Index?

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Abstract

We compare nonlinear (time-varying) cointegration test with the standard cointegration test in studying the relationship of the Dow Jones Islamic finance index with three other conventional equity market indices. Our results show that there is a long-run nonlinear cointegrating relationship between the Dow Jones Islamic stock market index and other conventional stock market indices, which was not picked up by the linear test of cointegration. Thus, Islamic markets seem to offer little, if any, long-run diversification to international investors.

JEL: C5, C12, G1

Keywords: Islamic and conventional finance, time-varying cointegration

1 Introduction

It has been argued that Islamic finance is often decoupled from the conventional finance due to heavy restrictions on the former. Islamic markets have become important as risk diversifiers after the recent crises. The decoupling argument is empirically motivated by the rejection of cointegration. At the core of the decoupling lies the rules that dictate how investments ought to take place. The biggest difference is that Islamic-type investments prohibit the payments and receipts of interest, while conventional finance allows for interest and debt payments (Ajmi et al., 2013). With the various Sharia-based screening requirements, it would almost seem as though investors might be able to diversify and hedge themselves against unwanted movements in the conventional stock markets.[1] Or, it would just mean that Islamic finance is an alternative to other stock markets despite the possibility of being prone to similar stochastic shocks.

Other studies find that there is no long-run cointegrating relationship between Islamic stock market and conventional stock market indices, implying the possibility of significant diversification strategies (see Khalichi et al., 2014; Bakri et al., 2010).

Standard cointegration tests that rely on linearity and normality assumptions might yield misleading results with the existence of multiple regimes or structural breaks. The core contribution of this paper is to identify whether the constant coefficients cointegration tests are reliable in studying the relationship between various stock markets which have become more interlinked by globalization. We

[1] These rules prohibit speculation using derivative markets and government debt that issues fixed coupons, and allow investing in certain industries (Hammoudeh et al., 2013).

employ the Park and Hahn (1999) test for single equation cointegration and also extend the analysis using the Bierens and Martins (2010) multivariate time-varying cointegration test.[2]

There seems to be some evidence of risk sharing and an element of contagion among the Islamic and conventional markets (Nazlioglu et al., 2013). However, the market shocks seem to be systemic rather than idiosyncratic. An important implication of our research is that the contagion effects link the two types of stock market indices, i.e., no significant diversification strategy.

Ajmi et al. (2013) uses linear and nonlinear causality tests to study the link between the Islamic stock market indices and major conventional equity markets. They show that there is a strong causal relationship between them. They also show that the Islamic stock market indices are prone to the same shocks that strike the conventional equity markets and are sensitive to changes in global financial factors.

2 Methodology

We use Standard and Poor's US, European and Asian stock market indices (SP500, LSPEU, LSPAS50, respectively) and test for possible cointegration with the Dow Jones Islamic Finance Index (LDJIM) using daily data from April 1, 1999 until July 22, 2013, which gives us 3796 observations. All data are sourced from Bloomberg. Figure 1 shows the natural logarithm of the series.[3]

We use a combination of standard (linear (with and without breaks) and nonlinear) tests to check for both stationarity and cointegration.[4] Our main test is that of Bierens and Martins (2010) which tests for time-varying coefficient (TVC) cointegration in a multivariate setup, unlike that of Park and Hahn (1999) that test for cointegration in a single equation. The time-varying coefficients (TVC's) are approximated with Chebyshev polynomials. The implementation uses the AIC, BIC and HQ information criteria to select the number of Chebyshev polynomials.

Bierens and Martins (2010) show that a time-varying VECM(p) can be represented as follows:

$$\Delta Y_t = \mu + \Pi_t^{'} Y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_{t-j} + \varepsilon_t \quad (1)$$

[2] Failure to detect parameter shifts in econometric specifications when they exist imply that the model is misspecified and could lead to poor forecasting performance (Gabriel and Martins, 2004).

[3] The summary statistics show that for data in both log levels and log difference, the null hypotheses of normality, no autocorrelation, and no ARCH effects are strongly rejected..

[4] These tests fail to reject the null of unit root, and also the null of no cointegration (results available upon request) for the log-levels of the series.

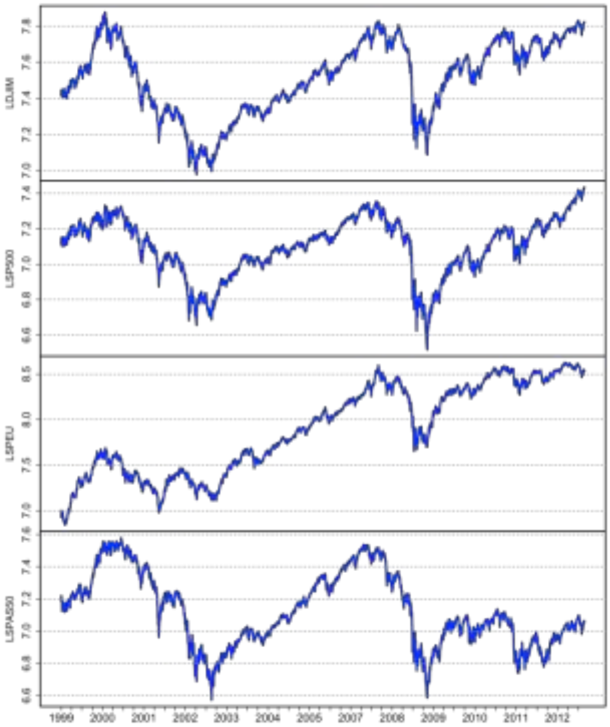

Figure 1: Stock market indices in logs

where μ is a $k \times 1$ vector of intercepts, Y_t is a $k \times 1$ time series vector and $\varepsilon_t \sim N_k(0, \Omega)$. There are fixed $r < k$ linearly independent columns for the time-varying cointegrated matrix. As in Bierens and Martins (2010), the objective is to test the null hypothesis of time-invariant cointigration $\Pi_t' = \Pi' = \alpha\beta'$ against the time-varying cointegration $\Pi_t' = \Pi' = \alpha\beta_t'$.

The time-varying polynomials are defined as: $P_{0,T}(t) = 1$ and $P_{i,T}(t) = \sqrt{2}\cos(i\pi(t-0.5)/T)$. Any function $g(t)$ of discrete time can be (due to orthonormal property) represented as:

$$g(t) = \sum_{i=0}^{T-1} \xi_{i,T}\, P_{i,T}(t)$$

where $\xi_{i,T} = \frac{1}{T}\sum_{t=1}^{T} g(t) P_{i,T}(t)$.

Bierens and Martins (2010) then substitute $\Pi_t' = \alpha\beta_t' = \alpha(\sum_{i=0}^{m} \xi_{i,T}\, P_{i,T}(t))'$ into (1). Here the Chebyshev polynomial is a smooth function which allows β_t to change gradually over time. This yields the VECM(p):

$$\Delta Y_t = \alpha(\sum_{i=0}^{m} \xi_{i,T}\, P_{i,T}(t))' Y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta Y_{t-j} + \varepsilon_t \qquad (2)$$

$Y_t^m = (Y_{t-1}' P_{1,T}(t), Y_{t-1}' P_{2,T}(t), .., Y_{t-1}' P_{m,T}(t))'$ and $\xi_i' = (\xi_0', \xi_1', .., \xi_m')$ is a $r \times (m+1)k$ matrix of rank r. The null hypothesis on the time-invariant cointegration is $\xi_i' = (\beta', O_{r,k,m})$. This test is then conducted using a likelihood ratio (LR) test (Bierens and Martins, 2010).

3 Results

The constant parameter cointegration tests show that there is no cointegration among the Islamic and conventional stock variables. However, cointegration exists when we allow for the possibility that each point in time represents a different regime. [5]

We initially use the standard Johansen cointegration test for multiple cointegrating relationships. We employ a VAR(3) as given by the BIC criterion. Table 1 shows the results using the maximal eigenvalue λ_{max} and trace λ_{trace} cointegration order tests of Johansen. A non-rejection of r=0 for the Johansen (1991) tests implies no cointegration. These standard tests show that there is at least one cointegrating relationship.

Table 2 reports the Bierens and Martins (2010) multivariate time-varying coefficient cointegration tests based on the Chebyshev time polynomials. These tests are constructed as LR tests under the null of time-invariant cointegration that is tested against the time-varying coefficient (TVC) cointegration. The AIC selected an extremely large number of polynomials, and therefore is not used. m denotes the number of the Chebyshev time polynomials and r denotes the number of cointegration relationships. The distribution of the LR test is a Chi-square with $m \times k \times r$ degrees of freedom, where k is the number of variables. The p-values of the LR tests are given in brackets and "<" means "less than".

The BIC selects 1, the HQ selects 4 and the AIC selects 376 polynomials for all the cases of 1 to 3 cointegration vectors. The results are robust to VAR orders between 1 and 9. In all cases, the null of the time-invariant cointegration against the TVC cointegration is rejected for 1 to 3 cointegration vectors.

[5] This is supported by the Park and Hahn (1999) tests. The null hypothesis of fixed coefficient cointegration is rejected at the 1% level and favours the alternative that the fixed coefficients model is not cointegrated. We were unable to reject the null hypothesis of cointegration in the time-varying coefficient model.

Table 1
Multivariate linear cointegration tests

Panel A: VAR order selection criteria

Lag (p)	1	2	3	4	6	8	10
AIC	-37.54	-38.04	-38.07	-38.09	-38.10	-38.10	-38.10
HQ	-37.53	-38.02	-38.04	-38.05	-38.04	-38.01	-38.00
BIC	-37.51	-37.98	-37.99	-37.98	-37.93	-37.86	-37.83

Panel B: Johansen cointegration tests

Eigenvalues	0.0021	0.0019	0.0011	0.0003
		Critical values		
H_0	λ_{max}	10%	5%	1%
$r = 3$	1.17	6.50	8.18	11.65
$r = 2$	4.15	12.91	14.90	19.19
$r = 1$	7.39	18.90	21.07	25.75
$r = 0$	8.01	24.78	27.14	32.14
H_0	λ_{trace}	10%	5%	1%
$r \leq 3$	1.17	6.5	8.18	11.65
$r \leq 2$	5.32	15.66	17.95	23.52
$r \leq 1$	12.72	28.71	31.52	37.22
$r = 0$	20.73	45.23	48.28	55.43

Table 2
Multivariate time-varying cointegration test

Likelihood Ratio (LR) test for time-varying cointegration

m	*r*=1	*r*=2	*r*=3
1	42.86 (<0.01)	53.71 (<0.01)	62.12 (<0.01)
2	63.65 (<0.01)	105.57 (<0.01)	121.47 (<0.01)
3	89.42 (<0.01)	139.22 (<0.01)	175.66 (<0.01)
4	118.49 (<0.01)	184.07 (<0.01)	245.91 (<0.01)

Log likelihood of TVC cointegration model

m	*r*=1	*r*=2	*r*=3
1	50767.18	52090.39	52865.62
2	50777.58	52116.32	52895.30
3	50790.47	52133.14	52922.39
4	50805.00	52155.57	52957.52

HQ for TVC cointegration model

m	*r*=1	*r*=2	*r*=3
1	-26.70	-27.39	-27.78
2	-26.71	-27.39	-27.79
3	-26.71	-27.39	-27.79
4	-26.71	-27.40	-27.79

BIC for TVC cointegration model

m	*r*=1	*r*=2	*r*=3
1	-26.64	-27.31	-27.69
2	-26.63	-27.30	-27.68
3	-26.63	-27.30	-27.67
4	-26.63	-27.29	-27.66

Figure 2 plots the normalized parameter estimates from the TVC cointegration model with 1 cointegration relationship imposed on the estimation. The normalized time-varying cointegration relationship is specified as:

$$LDJIM_t = \beta_0 + \beta_{1t}LSP500 + \beta_{2t}LSPEU + \beta_{3t}LSPAS50$$

where these variables are defined as above.

The parameters are quite unstable for the whole period, however they are relatively stable after 2002 compared to 1990s. The parameters during the late 90's were markedly different, which could be due to a number of reasons such as the dot-com bubble. We also observe that big stock market swings induce more parameter volatility - the 2008 financial crisis seems to affect the cointegrating relationships.

Contrary to other findings in the literature, our results suggest that the benefits of diversification in terms of using the DJIM, are slightly overstated. The DJIM, the SP500 and SPEU enjoy a positive long-run relationship despite controlling for a parameter shift. It does, however, seem as though the stock market crises slightly invert these relationships.

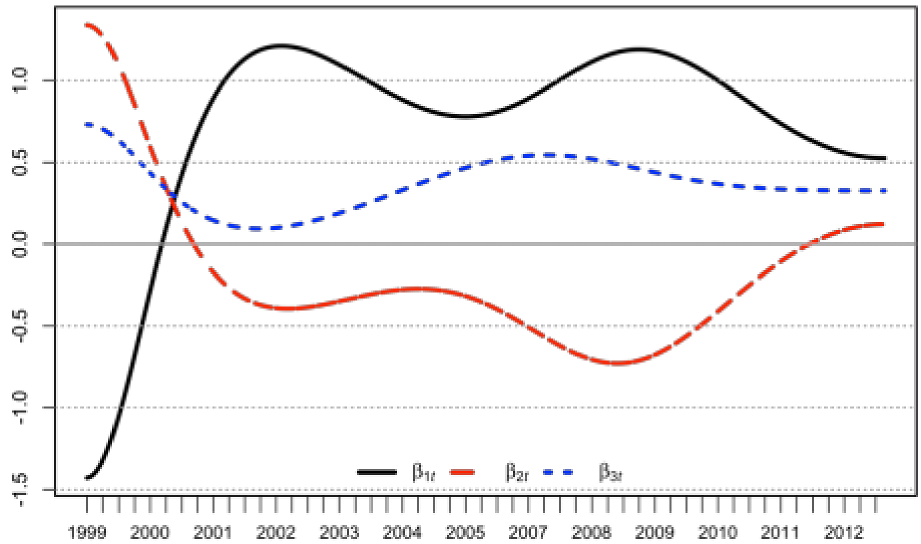

Figure 2: Time-varying cointegrating parameters

4. Conclusion

We use various cointegrating tests to analyze the cointegrating relationship between the Dow Jones Islamic Market (DJIM) index with other conventional stock markets because of its implications for portfolio diversification. Our results show that the constant parameter cointegration tests tend to reject cointegration in the presence of regime shifts. However, we are able to identify cointegrating relationships in a multiple equation setup with parameter shifts.

It also seems that there is little benefit in using the DJIM to diversify and hedge against movements in conventional stock market indices. There is a strong and positive cointegrating relationship between the SP500 and DJIM. However, the stock market crises seem to have some effect on inverting this relationship.

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