Stock Market Liquidity and O/N LIBOR Rates: A Study for PIGS Countries and Turkey

Samet Günay, Ph.D.

Assistant Professor of Finance, Department of Banking and Finance, School of Applied Sciences, Istanbul Arel University, Istanbul, Turkey
Email: dr.sgunay@gmail.com

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Abstract

During the mortgage crisis in 2008 there was a significant demand increase in the LIBOR market due to the shrinkage in commercial paper market and liquidity crunch. This study examines the relationship of stock market price movements and liquidity with the overnight LIBOR rates for PIGS countries and Turkey. In the first section of empirical analysis we determined the stationary levels of data and tested long term relationship through Maki (2012) cointegration test with structural breaks. Following the verification of the relationship between stock market liquidity and overnight LIBOR rates, we conducted Fully Modified OLS, Canonical Cointegrating Regression and Dynamics Least Squares tests to estimate the parameter of LIBOR variable and identify the direction of relationship. This parameter was only significant for the Turkish and Spanish stock markets and the sign of this parameter was negative. Results showed that when the overnight LIBOR rates increased, the bid-ask spreads of the Turkish and Spanish markets expand indicating a decrease in liquidity of the market. A possible reason for this finding was the decoupling process of Turkey and Spain, especially during the mortgage crisis. EU defined debt stock/GDP ratios also supported that explanation.

Keywords: *Liquidity crisis, overnight LIBOR rates, stock market liquidity,*

1. Introduction

Many macroeconomic variables can affect prices or returns of stocks. A broad range of literature exists which comprehensively examines the effect of currency rates, inflation and interest rates on stock returns. It is widely accepted that stock returns are negatively related to the changes in interest rates. Xu et al. (2012) explains why interest rates affect the stock returns negatively: First, as increasing in interest rates make it difficult for the companies to find funds, managers are obliged to decrease the scale of production and the stock returns decline in accordance with the fall in future income. Second, the increase in interest rates raises the discount rate in the stock valuation and the price determined in the valuation of investor drops. The result will be reflected as a decrease in the stock prices in conjunction with a change in demand. Finally, due to the fact that some funds shift to national debt instruments and bank savings following the increase of interest rates, stock prices fall in conjunction with the decreasing demand in stock market. On the other hand, the rises in interest rates put a precarious position in terms of liquidity. The funding sources for companies can be classified as direct and indirect sources. The first is credit facility via banking system and the second is funding via commercial papers and business bonds to reach funders directly. Although the lower cost of the commercial papers and bonds comparing banking credits leads firms to the indirect financing option, this market is not open for all firms because of credibility issues.

As stated by Kacperczyk and Schnabl (2010), before the mortgage crisis in 2008, commercial papers were considered safe and risk-free securities thanks to their high credit ratings and short maturities. However, two important events completely altered this paradigm. The first event was the collapse of two Bear Sterns' hedge funds on July 31, 2007 which invested in subprime mortgage credit related instruments. In addition, on August 07, 2007, BNP Paribas suspended withdrawals from three investment funds on which they could not assess the value of their mortgage portfolios. The second important event was the loss announcement of Reserve Primary Fund concerning the holdings in commercial papers of Lehman Brothers on September 16, 2008.

As banks generally fund their long term investment projects, mortgages and mortgage linked instruments with the short term liabilities such as deposits, the same maturity mismatch risk is transferred to the "shadow" banking system consisting of off-balance-sheet. Commercial banks funded these structured instruments using the Asset-Backed Commercial Papers (ABCP) with an average maturity of 90 days. Asset-Backed term is the toxic part of this name and it means that this security is backed by the pool of mortgages or other credits as collateral. In case of default, a holder of ABCP has the right to seize or sell the underlying assets of ABCP.

This off-balance-sheet instruments strategy exposes banks to funding liquidity risk as investors may suddenly stop

buying ABCP and banks cannot roll short term sources (Brunnermeier, 2009). Thus, similar events occurred in the early stages of the mortgage crisis. In conjunction with the outstanding volume of ABCP, Financial CP and Non-financial CP, the three aforementioned important events are presented in Figure 1 below. As seen, the heaviest shrinking volume occurred in the ABCP market, whereas the reflection of crisis to the Financial CP market transpired with a delay following the collapse of Lehman Brothers. Non-financial CP market, on the other hand, remained stable during this period.

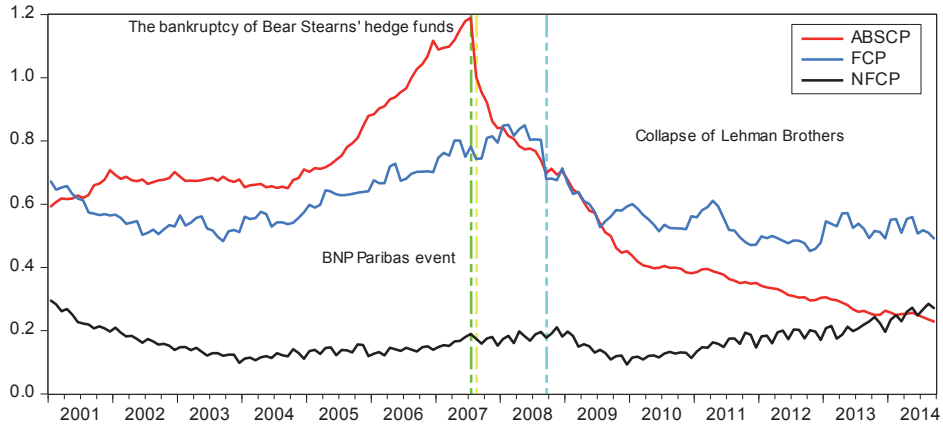

Figure 1. Path of ABCP, FCP and NFCP

According to the information released by FED, outstanding value of ABCP in July 2007 was $1.189.463.486.600. This number fell to $697.969.615.800 on the day Lehman Brothers collapsed. This decrease continued in the subsequent period. One of the most important reasons for these declines was the successively defaults which posits the question; who is the next? Due to the fact that the actual magnitudes of toxic assets in balance sheets were unknown, hence the inability to estimate the risks of these assets, during the mortgage crisis ABCP market was closed even for the credible firms. These firms turned to LIBOR market in order to roll their debts and cover cash requirements. Many hedge funds also started to finance their CDS tranches through the LIBOR market. However, considering the fact that LIBOR market already had its own clients, the excess demand over the same source caused serious increments especially in over-night LIBOR rates. Figure 2 below demonstrates the over-night, one month, six months and one year LIBOR rates during the period of August 01-24, 2007. The sharp rises in over-night LIBOR rates, exhibit the demand intensity of overnight funding requirements. Such developments affect price movements significantly.

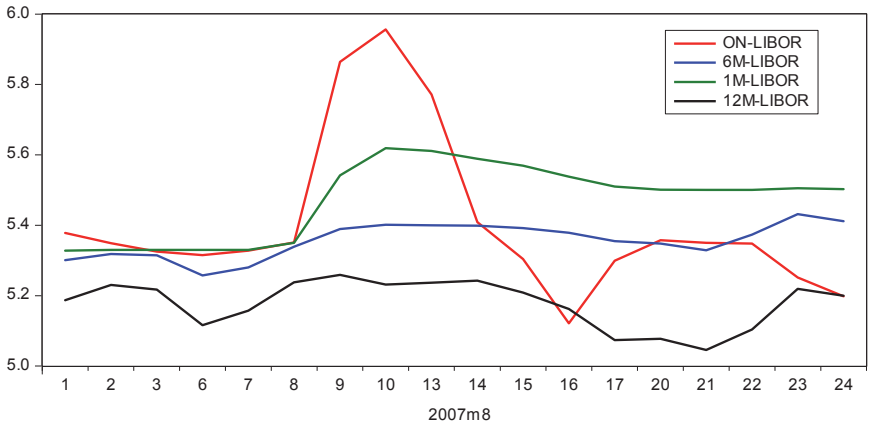

Figure 2. Path of Different LIBOR Rates in August 2008

As seen in Figure 2, the rising trend of ABCP market volume began falling in 2007 and this downtrend has yet to abate. Under these circumstances, we examine the long term relationship of stock market price and bid-ask spreads (as a liquidity indicator) with the over-night LIBOR rates for the PIGS countries: Portugal, Italy, Greece and Spain. By considering potential structural breaks during the time period we examined, the long term relationship was analyzed using the Maki (2012) cointegration test. Following the Maki (2012) cointegration analysis, the value and sign of the parameters in the long term relationship were determined using Fully Modified OLS, Canonical Cointegrating Regression and

Dynamics Least Squares methods. Although there is a great deal of interest in the relationship between stock market and interest rates, we have seen that some studies fail to take structural breaks into account. Distinct from the previous literature, we also examined the connection of stock market liquidity and over-night LIBOR rates using bid-ask spreads of stock indexes.

2. Literature Reviews

In one of the earlier studies in literature, Fama and Schwert (1977) revealed a negative relationship between short term stock returns and short term interest rates for the period of 1953-1971 in the USA market. Schwert (1981) examined the reaction of stock index prices to new data concerning inflation for the Standard and Poor index and demonstrated that stock prices react negatively to the announcements of unexpected inflation but with relatively small reactions. Geske and Roll (1983) stated that American stock returns respond nominal interest rates and changes in the expected inflation. Solnik (1983) analyzed the relationship between inflationary expectations and stock returns within the context of nine countries for the period of 1971-1980 and used the interest rates as proxy for expected inflation. According to his results, price movements of stocks signal (negative) revisions in inflationary expectations. Campbell and Ammer (1993) explained the movements in stock and bond returns in terms of future dividend expectations, inflation, short term real interest rate and the excess returns. The results showed that the postwar excess returns of stocks and bonds are almost uncorrelated. Choi and Jen (1991) used two-factor model to demonstrate how interest rate risk premium significantly explains the changing rate of expected return in the NYSE and AMEX. Fama and French (1993) concluded that five common risk factors explain stocks and bonds mean returns; overall market factor, firm size, book-to market equity factor, maturity and default risk factors. Concerning France, Germany and UK stock markets, Peiró (1996) showed that stock returns are affected by current changes in interest rates and future changes in production, with interest rate having a stronger effect than the production level in the relationship. Likewise, Zhou (1996) exhibited that interest rates have significant effects on stock returns especially in the long run and also revealed that high volatility in the stock market has a strong link with the return volatility of long term bond. Thorbecke (1997) investigated the response of stock returns to monetary policy shocks. He found that expansionary policies increase the ex-post stock returns. Dinenis and Staikouras (1998) analyzed five sectors (banks, insurance companies, investment trusts, property investment companies and finance firms) in the UK concerning stock returns and interest rates. They proved that there was a negative relationship between the changes in interest rates and stock returns, and the coefficient of the relationship of stock returns and interest rate volatilities is significantly positive.

More recently, Nissim and Penman (2003) stated that changes in interest rates are positively related to successive stock returns, though not significantly enough to cover the required rate of return, hence the net effect of interest on stock value is negative. In a different study, Wong et al. (2005) examined the relationship of SP500 and STI index returns with selected macroeconomic indicators such as money supply and interest rates through Johansen multivariate cointegration system, fractional cointegration and Granger causality methods. According to the cointegration results, while there is a long term equilibrium relationship among STI returns, and interest rates and money supply, they found no evidence for this relationship in SP500 index. Garg and Chapman (2008) conducted research on the change of federal fund rates and sectoral stock index returns and showed that some sectors are more sensitive to changes in interest rates. Furthermore, they exhibited that the relationship among these sectors has a positive coefficient. Pilinkus and Boguslauskas (2009) analyzed the effect of different macroeconomic variables on the Lithuanian stock market and proved that GDP and money supply have a positive effect whereas unemployment rate, currency rate and short term interest rates have a negative effect. Lettau and Wachter (2011) presented a dynamic risk-based model which simultaneously explains the term structure of interest rates, market return, and risk-return characteristic of stock returns.

3. Econometric Methodology

3.1 Maki Cointegration Analysis with Multiple Structural Breaks

Distinct from the studies of Gregory and Hansen (1996), and Hatemi-J (2008), Maki (2012) introduced a cointegration model which allows for up to five structural breaks. While the null hypothesis of the model claims the absence of cointegration among variables, the alternative hypothesis concerns the existence of cointegration breaks in the presence of i ($i \leq 1$) breaks. Maki (2012) submitted four regression models for the cointegration analysis which allow multiple breaks:

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + u_t \quad (1)$$

$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad (2)$$
$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \beta' x_t + \sum_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad (3)$$
$$y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t\, D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta_i' x_t D_{i,t} + u_t \quad (4)$$

where $t = 1,2,\dots,T$. y_t and $x_t = (x_{1t},\dots,x_{mt})'$ denote the observable variables with $I(1)$, u_t is the equilibrium error. Given that an $(n \times 1)$ vector z_t can be produced by $z_t = (y_t, x_t')' = z_{t-1} + \epsilon_t$ and ϵ_t is i.i.d with zero mean, positive definite variance covariance matrix Σ and $E|\epsilon_t|^s < \infty$ for some $s > 4$. $\mu, \mu_i, \gamma, \gamma_i, \beta' = (\beta_1,\dots,\beta_m)$, and $\beta' = (\beta_{i1},\dots,\beta_{im})$ are the true parameters. If $t > T_{Bi}$ $(i = 1,\dots,k)$, $D_{i,t}$ will have the value 1, otherwise it will be zero. Here k is the maximum number of breaks and T_{Bi} is the date of breaks. Equation 1 is the model with level shifts. Equation 2 indicates the regime shifts model and allows the structural breaks for β in addition to μ. Equation 3 is a different version of the Equation 2 in conjunction with trend. As for equation 4, it is formed by structural breaks of level, trends and regressors.

4. Empirical Analysis

In the empirical section of the study we examine the relationship between Portugal, Italian, Greek, Spanish and Turkish stock markets and overnight LIBOR rates using two different data: first, logarithmic stock index values and second, bid-ask spreads of index values as the indicator of liquidity of stock markets. Expanding and tightening spreads were considered as a signal of high and low liquidity, respectively. All the data used in the study was obtained from stooq.com. The time interval of the data sample is from 02.01.2005 to 07.08.2014. In the beginning of the econometric analysis, we tested the stationarity of time series and then conducted the Maki (2012) test for series $I(1)$. Finally, depending on the results obtained, we performed the Fully Modified OLS, Canonical Cointegrating Regression and Dynamics Least Squares tests in order to determine the sign of the long term relationship of variables.

4.1 Unit Root Test Results

As the level of stationary is important in the cointegration test, we first conducted unit root tests for all of the index series and LIBOR data using Augmented Dickey Fuller and Phillips Perron tests. Depending on the unit root test results, we decided which data to use in the cointegration analysis. For dependent and independent variables we presented all unit root test results in Table 1.

Table 1. Unit Root Test Results

Variables	ADF Level	ADF First difference	ADF Stationary	PP Level	PP First difference	PP Stationary
P_Portugal	-0.606034	-46.53334	I(1)	-0.614964	-46.48348	I(1)
P_Italy	-0.647348	-50.79729	I(1)	-0.675475	-50.85617	I(1)
P_Greece	-1.136434	-46.62110	I(1)	-1.138154	-46.61108	I(1)
P_Spain	0.093116	-49.28259	I(1)	0.111253	-49.51129	I(1)
P_Turkey	1.215369	-49.48923	I(1)	1.177328	-49.51931	I(1)
S_Portugal	-0.482165	-24.89867	I(1)	-1.176031	-302.4289	I(1)
S_Italy	-0.217495	-26.08726	I(1)	-0.947023	-537.1421	I(1)
S_Greece	-0.906137	-29.43907	I(1)	-1.681013	-310.7036	I(0)
S_Spain	0.034671	-21.78083	I(1)	-1.223485	-461.4807	I(1)
S_Turkey	-0.116340	-22.85515	I(1)	-0.834006	-716.1724	I(1)
On	-0.989329	-11.25335	I(1)	-1.262450	-63.11396	I(1)

Unit root tests demonstrated that all stock index series are stationary for I(1) with the exception of Greek spread series, the preliminary requirement to proceed with the Maki (2012) cointegration test. As stated by Gujarati (2004), although some time series are not stationary individually, a linear combination of them may be stationary. This circumstance exhibits the long term relationship between the variables and demonstrates the long term co-movement of the series which can be analyzed through cointegration analysis.

4.2 Maki (2012) Cointegration Analysis

As remarked by Gonzalo and Lee (1998), when breaks are present in mean or/and trend spurious cointegration may occur. Likewise, Noh and Kim (2003) indicated that if breaks occur in the variance of innovation errors of two independent

time series, especially in early periods, spurious cointegration can appear. In addition, Noriega and Ventosa-Santaularia (2012) found that overlooked structural breaks can cause the rejection of null hypothesis regarding non-existence of structural among the time series. Given the importance of structural breaks in the cointegration analysis we conducted the Maki (2012) cointegration test to analyze the long term relationship between the index log prices and the overnight LIBOR rates, in addition to bid-ask spreads and overnight LIBOR rates allowing multiple breaks. The test results obtained under the four alternative models are presented in Table 2 below.

Table 2. Maki (2012) Test Results for Index Log Prices

		Model 0: Level Shift	**Model 1:** Level Shift with Trend	**Model 2:** Regime Shifts	**Model 3:** Regime Shifts and Trend
Portugal	Test statistic	-4.0196709 (−5.426)	-3.7918174 (−5.699)	-3.5372718 (−6.357)	-5.8478044 (−7.414)
	Break Dates	2 September 2005 1 June 2006 27 June 2008 8 July 2011 4 January 2012	20 December 2005 29 September 2008 26 April 2010 8 November 2010 25 September 2012	15 September 2008 12 October 2009 7 May 2010 15 November 2012 8 April 2014	14 July 2008 30 March 2009 1 October 2009 28 June 2010 16 April 2012
Italy	Test statistic	-5.2315989 (−5.426)	-4.997719 (−5.699)	-6.4473538** (−6.357)	-7.04696 (−7.414)
	Break Dates	29 September 2008 9 August 2011 16 April 2012 3 July 2013 15 April 2014	29 September 2008 28 June 2010 7 January 2011 31 October 2011 22 May 2012	29 September 2008 29 October 2009 28 June 2010 31 October 2011 7 May 2014	15 September 2008 20 March 2009 25 November 2009 4 January 2012 1 August 2012
Greece	Test statistic	-4.4601694 (−5.426)	-4.8588648 (−5.699)	-4.9203059 (−6.357)	-5.6718828 (−7.414)
	Break Dates	29 September 2008 20 April 2009 19 August 2010 18 February 2011 20 July 2012	29 September 2008 20 April 2009 15 October 2009 19 July 2010 22 June 2012	6 May 2010 30 December 2010 29 July 2011 21 February 2012 16 November 2012	29 September 2008 30 March 2009 10 May 2010 9 May 2012 27 December 2012
Spain	Test statistic	-3.8901673 (−5.426)	-5.081296 (−5.699)	-4.0540386 (−6.357)	-7.5345409** (−7.414)
	Break Dates	7 May 2010 10 February 2011 9 August 2011 12 March 2012 7 May 2014	15 September 2008 13 May 2010 22 November 2010 1 August 2012 1 February 2013	30 September 2005 15 September 2008 13 May 2010 24 December 2010 25 September 2012	12 September 2008 30 March 2009 29 October 2009 4 January 2012 19 July 2012
Turkey	Test statistic	-4.4271964 (−5.426)	-5.1573768 (−5.699)	-4.5586005 (−6.357)	-5.5490698 (−7.414)
	Break Dates	11 February 2008 30 May 2011 29 November 2011 3 June 2013 2 January 2014	14 March 2008 15 September 2008 6 November 2009 7 May 2010 28 February 2011	17 October 2006 2 October 2007 11 April 2008 1 July 2010 31 January 2011	14 March 2008 29 October 2008 27 November 2012 31 May 2013 14 May 2014

** indicates significant results at 95% confidence level

As the table shows, there is no evidence of long term relationship for the Level Shift, Level Shift with Trend, Regime Shifts or Regime Shifts and Trend models concerning the log prices of indexes and overnight LIBOR rates. However, we obtained significant cointegration test results for Italian and Spanish stock index prices in the Regime Shifts and, Regime Shifts and Trend models, at 95% confidence level. These findings are not seen credible since they are not supported by the other three models, but still first break dates of these two significant results coincide with the collapse of the Lehman Brothers. As stated in the first section of study, the financial crisis, which was caused by mortgage credits, turned into a liquidity crisis and spread to Europe. Therefore, liquidity crunch in commercial paper market and increasing demand in LIBOR market caused the sharply raising of overnight rates. In this section of the study, we analyze the relationship of the overnight LIBOR rate movements and the liquidity of stock markets of Turkey, Portugal, Italy and Spain. In accordance with this purpose, bid-ask spreads variable were used instead of stock market log prices, to examine the liquidity issue.

Bid-ask spread, which refers to difference between bid and ask prices, provides significant data concerning the liquidity of financial instruments and markets. It is expected to see narrowing spreads for a high level of liquidity and widening spreads for a low level of liquidity. When the level and changes in spreads are investigated, it is seen that the highest bid-ask spreads belong to Turkey, Italy, Spain, Portugal and Greece, respectively. Another notable finding is the increase in the spreads of Turkey after 2013 contrasting with a decrease of spreads in the other markets. Both general ratings and movements in 2013 show that the Turkish stock market has the lowest liquidity of these markets.

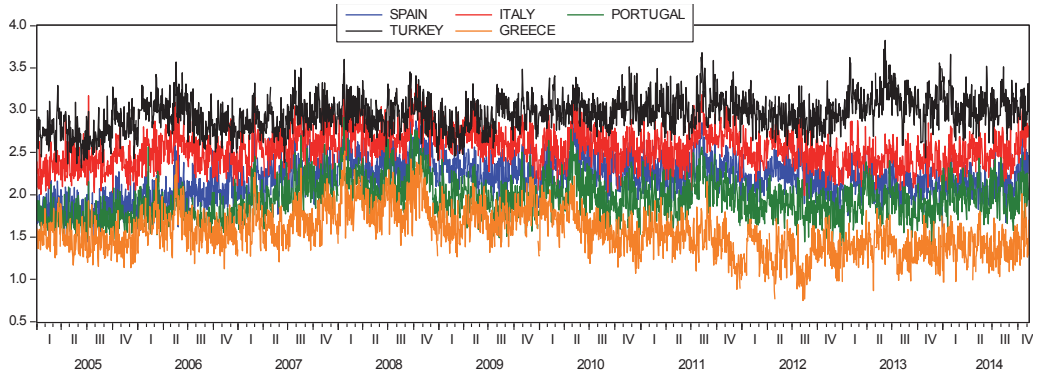

Figure 3. Bid-Ask Spreads of PIGS Countries and Turkey

Table 3 presents Maki (2012) cointegration test results for the relationship of bid-ask spreads of the stock markets and overnight LIBOR rates.

Table 3. Maki (2012) Test Results for Index Bid-Ask Spreads

		Model 0: Level Shift	**Model 1:** Level Shift with Trend	**Model 2:** Regime Shifts	**Model 3:**Regime Shifts with Trend
Portugal	Test statistic	-10.846133** (−5.426)	-12.440493** (−5.699)	-11.910224** (−6.357)	-14.90969** (−7.414)
	Break Dates	13 February 2007 15 August 2007 17 June 2008 19 May 2009 17 May 2010	23 July 2007 5 December 2008 22 July 2010 14 December 2011 7 August 2012	13 February 2007 31 December 2007 5 December 2008 20 April 2010 29 October 2012	23 July 2007 9 October 2008 31 December 2009 26 October 2010 21 January 2014
Italy	Test statistic	-8.8231699** (−5.426)	-9.6395999** (−5.699)	-10.027173** (−6.357)	-10.580264** (−7.414)
	Break Dates	19 February 2007 14 January 2008 3 September 2008 26 May 2009 7 August 2012	19 February 2007 14 January 2008 5 July 2011 7 August 2012 1 April 2014	19 February 2007 14 January 2008 3 September 2008 26 May 2009 7 August 2012	14 January 2008 9 December 2009 22 June 2011 21 December 2011 7 August 2012
Spain	Test statistic	-9.6447686** (−5.426)	-9.7135731** (−5.699)	-10.135107** (−6.357)	-10.764135** (−7.414)
	Break Dates	26 February 2007 1 February 2008 1 October 2008 22 April 2009 9 August 2012	26 February 2007 1 February 2008 7 July 2010 21 December 2011 9 August 2012	26 February 2007 30 October 2012 22 April 2009 20 April 2010 9 August 2012	14 January 2008 22 April 2009 7 July 2010 21 December 2011 9 August 2012
Turkey	Test statistic	-9.5142356** (−5.426)	-9.8588468** (−5.699)	-11.565463** (−6.357)	-11.797519** (−7.414)
	Break Dates	18 July 2007 29 July 2009 2 February 2012 24 January 2013 2 August 2013	30 September 2005 20 July 2006 18 July 2007 29 July 2009 24 January 2013	30 September 2005 30 June 2006 18 July 2007 29 July 2009 24 January 2013	2 January 2006 18 July 2007 29 July 2009 20 July 2011 24 January 2013

** indicates significant results at 95% confidence level

Unlike the outcomes of log price series, the results obtained for bid-ask spreads in Level Shift, Level Shift with Trend, Regime Shifts, and Regime Shifts and Trend models showed that Maki (2012) test statistics for all stock markets are

statistically significant at 95% confidence level. Accordingly, bid-ask spreads of the aforementioned stock markets and overnight LIBOR rates are cointegrated and have a significant long term relationship. However, no relationship has been identified among the log price and overnight LIBOR rates. The highest test statistics were obtained through the Model 3: Regime Shifts with Trend. Considering the findings of Model 3 we can say that the first break appeared in the Turkish stock market in January 2, 2006. This break prior to the mortgage crisis gives us clues about the fragility of the Turkish stock market and its relationship with overnight LIBOR rates. The latest break (January 21, 2014) happened in the stock market of Portugal. If this date marks the end of the mortgage crisis effects for both the USA and EU countries, we conclude the stock market of Portugal is still fragile regarding to the developments in overnight LIBOR rates.

4.3 Determining the Direction of Relationship

Upon confirming long term relationship between the stock index bid-ask spreads and overnight LIBOR rates for Portugal, Italy, Spain and Turkey, we conducted Fully Modified OLS, Canonical Cointegrating Regression and Dynamics Least Squares analyses to determine the direction and strength of the relationship and to estimate the parameters of cointegration. In all of the models, we used bid-ask spread as the dependent variable, and overnight LIBOR rates as the independent variable. As stated by Montalvo (1995) Dynamics Least Squares model outperforms other two models. The results of the parameter estimations are presented in Table 4.

Table 4. Results of Different Cointegrating Regression Models

		Fully Modified OLS	Canonical Cointegrating Regression	Dynamic Least Squares
	Variable	*Coefficient*	*Coefficient*	*Coefficient*
Portugal	SON	-0.009498	-0.009498	-0.009243
		(0.004989)	(0.004993)	(0.005070)
	C	1.963655**	1.963655**	1.964048**
		(0.013269)	(0.013275)	(0.013474)
Italy	SON	-0.001009	-0.001009	-0.000776
		(0.004419)	(0.004422)	(0.004476)
	C	2.548364**	2.548364**	2.548684**
		(0.011752)	(0.011757)	(0.011896)
Spain	SON	-0.026814**	-0.026814**	-0.026542**
		(0.005083)	(0.005086)	(0.005161)
	C	2.227328**	2.227328**	2.227819**
		(0.013516)	(0.013522)	(0.013713)
Turkey	SON	-0.020830**	-0.020831**	-0.020562**
		(0.003973)	(0.003976)	(0.003990)
	C	2.993040**	2.993041**	2.992868**
		(0.010567)	(0.010572)	(0.010603)

* and ** indicate significant results at 95% and 99% confidence level, respectively

The findings in Table 4 demonstrate that the overnight LIBOR rate parameters for Spanish and Turkish stock markets are statistically significant at 99% percent confidence level, whereas the results for Portugal and Italy are not significant. The parameter values for both Spain and Turkey indicate that rises in overnight LIBOR rates decrease the bid-ask spread in stock index prices and therefore raise liquidity in stock markets. Consequently, decreases in overnight LIBOR rates result in low stock market liquidity in these markets. Even though this finding is inconsistent with our theoretical expectations, it is still an interesting result. A possible reason for this enigma may be explained by the decoupling process of Turkish and Spanish stock markets especially in the mortgage crisis period. The statistics related to EU-defined debt stock/GDP in Table 5 support this idea.

Table 5. EU Defined Debt Stock/GDP Ratios

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Portugal	63,6	64,7	68,4	71,7	83,7	94	108,2	124,1	129	132,9
Italy	105,8	106,5	103,3	106,1	116,4	119,3	120,7	127	132,6	135,6
Greece	100	97,8	107,4	112,9	129,7	148,3	170,3	156,9	175,1	174,1
Spain	43	39,6	36,3	40,2	54	61,7	70,5	86	93,9	96,8
Turkey	52,3	46,1	39,9	40	46	42,3	39,1	36,2	36,2	35,8

As seen in Table 5, EU defined debt stock/ GDP ratio for Spain and Turkey is notably lower than other the countries' ratios in the sample interval of our study. While Turkey has the lowest ratio, Spain showed an increasing ratio as of the year 2010. Positive decoupling of Turkey after 2009 is explicitly observed in Figure 4 below.

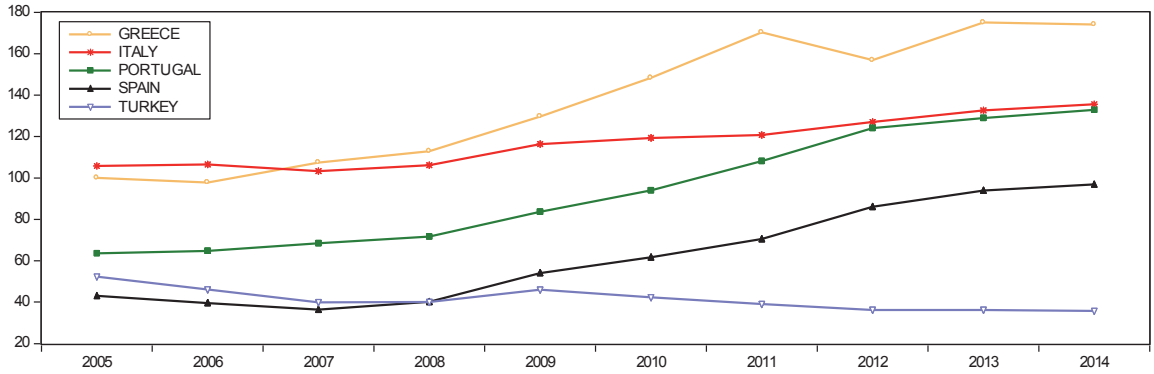

Figure 4. EU Defined Debt Stock/GDP Ratios

Despite the fact that EU-defined debt stock/GDP ratio exhibits supportive data about the decoupling of Turkish and Spanish stock markets, the nature of the relationship between bid-ask spreads and overnight LIBOR rates can be examined in a future study with additional variables. As this study analyzes the direction of the relationship, the examination of possible reasons can be the subject of further research.

5. Conclusion

This study analyzes the relationship of stock market price movements and stock market bid-ask spreads with overnight LIBOR rates. For the analyses, conducted in the period of 2005-2014, we used stock index log prices of Portugal, Italy, Greece, Spain and Turkey. Prior to the cointegration analysis, integration levels of all of the time series were determined through unit root tests and it was observed that the order of integration for all stock markets, except for Greece, are I(1) and warranted the cointegration test. According to the results of Maki (2012) cointegration analysis, there was no significant long term relationship between stock market log prices and overnight LIBOR rates except for two countries stock markets and two models. Only one model for Italy and Spain, regime shifts and regime shifts with trend, had significant statistics in the Maki (2012) test. For the analysis of long term relationship of stock index bid-ask spreads and overnight LIBOR rates, we obtained significant results for all of the countries. Subsequently, to determine the direction of the relationship, we performed three cointegrating regression models (Fully Modified OLS, Canonical Cointegrating Regression and Dynamics Least Squares) and estimated the parameters of overnight LIBOR rates for all the markets examined. The results of these tests were significant for the Turkish and Spanish stock markets with the estimated parameters of -0.021 and -0.027, respectively. The negative sign of the coefficients indicated an inverse relationship of bid-ask spreads and overnight LIBOR rates, that is, when overnight LIBOR rates increased, bid-ask spreads decreased as an indication of increasing liquidity for the Turkish and Spanish stock markets. Though this result is not consistent with our theoretical expectations, the findings were interpreted as a positive decoupling situation for the Turkish and Spanish stock markets considering the EU-defined debt stock/GDP ratio. According to the ratio Turkey and Spain have the lowest debt ratios of the countries examined.

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