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LIQUIDITY AND THE BUSINESS CYCLE: EMPIRICAL EVIDENCE FROM THE GREEK BANKING SECTOR

ABSTRACT: *In the aftermath of the global financial turmoil the negative market sentiment and the challenging macroeconomic environment in Greece have severely affected the banking sector, which faces funding and liquidity challenges, deteriorating asset quality, and weakening profitability. This paper aims to investigate how banks' liquidity interacted with solvency and the business cycle during the period 2004-2010. To this end a panel of 17 Greek banks is utilized which, in conjunction with cointegrating techniques and one-way static and dynamic panel models, explores the presence and the strength of the relationship between banks' liquidity and the business cycle, while allowing for the role of banks' solvency. Addressing the liquidity risk of the Greek banking sector and the liquidity-solvency nexus remains largely an uncharted area. The results generated provide clear-cut evidence on the linkages between banks' market liquidity and the business cycle, as reflected in the real GDP and the effective exchange rate. Yet the results display a transmission channel that runs from banks' solvency to liquidity and from country risk to bank risk.*

KEY WORDS: *Greek Banking Sector, Liquidity, Capital, Business Cycle, Panel Data*

JEL CLASSIFICATION: G21, C23, L2

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1. INTRODUCTION

Broadly speaking, the Greek banking sector entered the global financial crisis in a relatively sound financial state. In light of the rapid and sharp worsening of the fiscal situation in Greece, financial markets and rating agencies turned their attention to the sustainability of Greece's fiscal and external imbalances. What followed was an utter disaster, as the entire banking edifice was on the brink of collapse, rendering banks almost insolvent. Rapidly, the eruption of the Greek debt crisis spilled over into banks' fundamentals, and banks sought emergency capital and liquidity assistance, initially from the State and later from Eurozone rescue funds.

Undoubtedly, comprehending fully the mechanism through which economic crises affect the process of financial intermediation through the banking sector remains a key challenge, since empirical studies are rather scarce (Gorton, 2012). In the Greek context the research area remains uncharted, with the scarcity of studies owing to the inherent elusiveness of bank data, the problems of providing operational definitions of crises events, and the fact that the sovereign debt crisis has not yet been fully addressed (Candelon and Palm, 2010). Most empirical studies in the Greek context use models of banks' profitability or asset quality that include mostly financial ratios as explanatory variables and do not explicitly account for systematic problems arising from an adverse evolution of the macroeconomic environment.

This study, by utilizing a panel of 17 Greek banks that cover about 90% of the sector's assets, attempts to shed some light on the relationship of liquidity and the business cycle in the period 2004-2010. Furthermore, the study investigates how liquidity and solvency, the twins of banking, interact with each other in the period 2004-2010. In particular, Section 2 very succinctly reviews the existing literature in the specific area whilst Section 3 touches on the empirical methodology used, as well as presenting the evidence generated from the estimation process. Finally, Section 4 provides some concluding remarks.

2. LIQUIDITY-CAPITAL AND THE BUSINESS CYCLE: A REVIEW OF EMPIRICAL STUDIES

This section provides a critical account of the literature on the relation between banks' liquidity and the business cycle, emphasizing the role of capital in the equation. The aim is to facilitate the choice of methodology and provide grounding for the research framework. Hence, meaningful variables and latent relationships worth exploring subsequently emerge from this section.

Broadly, the empirical literature provides conflicting assumptions about the relationship between capital and liquidity creation, both in terms of its magnitude and of the nature of its causality. Diamond and Rajan (2001) assert that tightening capital requirements hampers liquidity creation[1]. Using Granger causality tests in a dynamic panel framework, Horvath et al. (2012) find that capital negatively Granger-causes liquidity creation in the Czech banking sector, where the majority of banks are small. On the other hand Berger and Bouwman (2009), in a pioneering article, frame the causal link that moves from banks' capital to liquidity creation. The authors' "risk absorption hypothesis" suggests that increased capital enhances the ability of banks to create liquidity. This hypothesis stems from the theoretical literature concerning the role of banks as risk transformers (Bhattacharya and Thakor 1993; Allen and Gale, 2004). Using an unbalanced panel of SEE banks from 2001 to 2009, Athanasoglou (2011) explores the role of liquidity on capital and posits a positive, significant, and robust effect.

Granting loans is an indispensable feature of a healthy financial sector, and a solid deposit base is a key to sustainable and stable credit growth (Westerlund, 2003; Guo and Stepanyan, 2011). Following this train of thought, Westerlund's (2003) results suggest that loan growth falls significantly following a monetary contraction, while the fall is pronounced among illiquid and under-capitalised banks. Consistent with theory, well-capitalised and liquid banks are expected to supply more credit (Kashyap and Stein, 1995; Kishan and Opiela, 2000).

Many banking system crises, especially in developing countries, display a recurrent pattern of distress, with insolvency and illiquidity usually traceable to pervasive government involvement, while other countries have experienced macroeconomic collapses before the crisis (Honohan, 1997). In general, empirical studies concur that good economic conditions positively affect the quality of banks' fundamentals, whereas disturbances anywhere in the business cycle and the macro-economy are likely to have repercussions on the banking system (Arpa et al., 2001; Quagliariello, 2004). Models of banks' pro-cyclical behaviour aim to answer whether the business cycle affects banks' financials and if banks' behaviour reinforces fluctuations in the business cycle. Furthermore, models that

1 The authors' results also suggest that if a liquidity shock hits, the banks with higher leverage could be more likely to survive because they can encounter the shock through asset sales.

include macroeconomic variables as regressors perform better than those that employ solely bank-specific variables (Demirgüç-Kunt and Detragiache, 1997; Kaminsky and Reinhart, 1999; Hardy and Pazarbasioglu, 1999; Quagliariello, 2008).

Although the empirical evidence on the liquidity-capital nexus appears mixed, the theory of liquidity points to a correlation between banks' liquidity, capital, and the business cycle that is worth testing empirically. While most economists may consider that a 'trivially true' relationship exists between macroeconomic conditions and banks' balance sheets (Jacobson et al., 2005), in practice it is challenging to quantify these linkages, given the idiosyncratic features of the Greek banks and the timeline of the research. The latter manifests itself as an innovative feature of our paper, yet is an endeavour in uncharted territory, given the scarcity of empirical studies on the liquidity-capital nexus, especially in the Greek context.

3. EMPIRICAL INVESTIGATION

Using two metrics of liquidity, we investigate the liquidity-capital nexus and the impact of business cycle and crisis-related factors on Greek banks' liquidity. Hence, the modelling exercise employs the liquid asset ratio (LAR) that serves as a proxy for market liquidity and the loan-to-deposit ratio (LD) as a measure of funding liquidity[2]. Both ratios are simple yet transparent measures of banks' liquidity positions. A similar notion applies to the banks' solvency that is approximated by the equity to assets ratio, known as capital ratio. Estrella et al. (2000) point out that simple capital ratios which are virtually costless to implement are as effective in predicting banking failures as more complex ratios.

Table 1 in Appendix III reports the correlation coefficients between the liquidity measures and a set of explanatory variables over the period 2004-2010. Between them the liquidity measures exhibit a strong negative association, revealed by the coefficient of -0.4, suggesting that market and funding liquidity move in opposite directions. The market liquidity proxy is positively related to capital and credit growth, providing some preliminary evidence in line with expectations.

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2 Brunnermeier and Pedersen (2007) distinguish between two types of liquidity: market liquidity and funding liquidity. The former refers to the asset side and the latter to the liability side of the banks' balance sheets.

The Methodology

For the empirical investigation both static and dynamic panel data analysis are utilized and effectively applied to a dataset consisting of 17 Greek banks spanning the period 2004 to 2010.

The term 'panel data' refers to the pooling of observations of different entities, banks in this case, on the same individual variables over several time periods (Baltagi, 2003). Thus, panel data combine features of both time series and cross-sectional data. A main advantage of panel data compared to other types of data is that it allows testing and relaxing of the assumptions that are implicit in cross-sectional analysis (Maddala, 2001). A number of econometricians assert that panel data analysis can be beneficial in a number of ways (Baltagi, 2003; Gujarati, 2004; Hsiao, 2005).

The static model

The use of pooled time series and cross sections allows us to take into account the unobserved and time invariant heterogeneity across banks. The main models used in static one-way panel data analysis are:

(a) The pooled model
(b) The fixed effects model
(c) The random effects model

For the estimation of the models we use a dataset which consists of N cross-sectional units, denoted $i = 1,\ldots,N$ observed at T time periods, denoted $t = 1,\ldots,T$. Therefore the total number of observations is $T \times N$. Then, y is a $(TN \times 1)$ vector of endogenous variables, X is a $(TN \times k)$ matrix of exogenous variables, which does not include a column of units for the constant term. In the context of the research, $N = 17$ and $T = 7$. In econometric terms, the setup is described in the following equation:

$$y_{it} = a_i + b_i x_{it} + e_{it}, \qquad (1)$$

where y_{it} is the dependent variable, a_i is the intercept term, b_i is a $k\times1$ vector of parameters to be estimated on the explanatory variables, and x_{it} is a $1\times k$ vector of observations on the explanatory variables, $t = 1, \ldots, T$, $i = 1, \ldots, N$. The specification in equation (1) suggests a linear panel data model. The associated assumptions to the model are:

- Error terms are normally distributed and have zero mean and standard deviation σ_i^2, $\varepsilon_{it} \sim$ i.i.d. $(0, \sigma_i^2)$
- Similar variances among banks, $\sigma_i^2 = \sigma_\varepsilon^2 \ \forall i$
- Zero covariances among banks, $Cov(\varepsilon_{it}, \varepsilon_{js}) = 0$ for $i \neq j$

We then proceed with the choice of the best alternative static specification that links to the pros and cons of each specification. The argument in favour of the random effects model are that the fixed effects model or LSDV often results in a loss of a large number of degrees of freedom and also eliminates a large portion of the total variation in the panel. Another argument is that a_i combine a total of several factors specific to the cross-sectional units and as such they represent 'specific ignorance' (Maddala, 2001). Hence, a_i can be treated as random variables by much the same argument that e_{it} representing 'general ignorance' can be treated as random variables. On the other hand, there are two arguments in favour of the use of the fixed effects model. The first, common in the analysis of variance literature, is that if the analysis wants to make inferences about only this set of cross-sectional units then we should treat a_i as fixed. On the other hand, if we want to make inferences about the population from which these cross-sectional data come, then a_i should be treated as random. Mundlak (1978) argues that the dichotomy between the fixed effects and random effects model disappears if we make the assumption that a_i depend on the mean values of x_{it}, an assumption regarded as reasonable in many problems.

The dynamic model

The dynamic panel data specifications are used in this study's models in an attempt to capture the time path of the dependent variable in relation to its past values. Many related studies provide evidence that bank-specific or economic variables are dynamic in nature (Athanasoglou et al., 2006; Rinaldi and Sanchis-Arellano, 2006; Louzis et al., 2012). For instance, Athanasoglou et al. (2006) criticize other studies that falsely assume a static relationship between bank-specific variables when in fact it is a dynamic one. A body of literature indicates that in typical micro-panels with large N and small T, the fixed effect (FE) estimator is biased and inconsistent when the model is dynamic. Similarly, the random effects GLS estimator is also biased in a dynamic panel data model (Baltagi, 2003). Yet many economic relationships are dynamic in nature and should be modelled as such (Asteriou and Hall, 2007).

In view of these arguments, our approach involves the estimation of dynamic panel data models using the Generalised Method of Moments (GMM) framework originated by Holtz-Eakin et al. (1988) and developed by Arellano and Bond (1991) and Arellano and Bover (1995). Pesaran et al. (1999) argue that even if the dynamic specification is unlikely to be the same in all cross sections, it is still possible to pool the estimates treating the model as a system since, as Baltagi and Griffin (1997) argue, the efficiency gain from pooling the data outweighs the losses from the bias introduced by heterogeneity. Empirical literature suggests that Arellano and Bond's (1991) framework suits cases with small T and bigger N (but N>T), especially when samples are small, as with the undertaken research, and the model is of dynamic form as emphasized by a number of authors (Pain, 2003; Quagliariello, 2004; Louzis et al., 2012). Also, the need to validate the static models' results - triangulation of methods – justifies the use of Arellano and Bond's (1991) framework.

The Results

We kick off the empirical process by investigating the existence of a cointegrating relationship between banks' liquidity and solvency. Subsequently, we estimate static and dynamic models to capture the factors that affect Greek banks' liquidity in the short-run. The results of unit root tests, shown in Table 2 of Appendix III, point out that the variables used to proxy banks' liquidity (LAR) and solvency (EA) are integrated of order 1, i.e., I(1). Subsequently, the Pedroni panel cointegration[3] results, reported in Table 3 of Appendix III, suggest that the null hypothesis of no cointegration can be rejected in three out of seven cases at all significance levels[4]. Hence, the outcome seems to advocate a positive link between liquidity and capital in concert with expectations arising from theoretical standpoints. Then, we model the banks' liquidity as a function of a number of exogenous variables and banks' solvency, using the general to specific approach. The estimated static and dynamic models are couched in the following manner:

$$LAR_{it} = a_0 + \overset{+}{a_1} EA_{it} + \overset{-}{a_2} DGDP_t + \overset{-}{a_3} REED_t + \varepsilon_{it} \quad (2)$$

$$\Delta LAR_{it} = \overset{+}{b_0} \Delta LAR_{it-1} + \overset{+}{b_1} \Delta EA_{it} + \overset{-}{b_2} \Delta DGDP_t + \overset{-}{b_3} \Delta REED_t + \Delta\varepsilon_{it} \quad (3)$$

i= 1,…,17; t= 2004,..., 2010

3 The Pedroni (1999) panel cointegration test is based on seven statistics, four of which are called panel statistics and pool the autoregressive coefficient in the residual-based test, while the remaining four, the group statistics, take the average, thus allowing for more heterogeneity.

4 In another two cases, the no cointegration hypothesis is rejected at a 5% significance level.

where LAR_{it} denotes the ratio of liquid assets to total assets for bank i at time t, and EA_{it} is the capital to assets ratio for bank i at time t. The business cycle is reflected in $DGDP_t$, the growth rate of GDP, $REED_t$, is the growth rate of the real effective exchange rate in terms of unit labour costs that serves as a proxy for the economy's competitiveness. The operator Δ in the dynamic equation denotes the data transformation – first differences or orthogonal deviations – used to reduce the banks' individual effects. The panel regression results are summarized in Table 1.

Among the alternative static specifications the fixed effects model has an advantage, whilst on the basis of the Sargan test the dynamic model that uses orthogonal deviations is preferred. The static and dynamic frameworks fit the data reasonably well, presenting fairly stable coefficients bounding the relationship under investigation. In the static modelling framework the tests for redundant fixed effects and the likelihood ratio reject the null hypothesis that the cross-sectional effects are unnecessary. The fixed effects model maintains that about 75% of the variation in LAR over the period 2004-2010 is explained by the model's variables. Banks' solvency and GDP have a positive significant and contemporaneous effect on liquidity. On the other hand REED has a clear negative association with liquidity.

The dynamic specifications present an acceptable convergence with the outcome of the fixed effects model. Both dynamic models seem to fit the panel data adequately, presenting stable coefficients. The Wald test suggests an adequate goodness of fit[5] and the Sargan test provides no evidence of over-identifying restrictions in both dynamic specifications. All significant variables in the static model remain significant in the dynamic specification. Furthermore, the variables' coefficients turn out to be close in magnitude and bear the same signs in both static and dynamic models[6]. A significant lagged liquidity lends evidence in favour of the dynamic specification, suggesting a moderate persistence of market liquidity.

5 The related X^2 or F-statistic of the Wald test is significant, suggesting that the null hypothesis that all coefficients are jointly not significant is rejected at all conventional significance levels.

6 The variables' coefficients remain almost the same in both dynamic specifications. Still, the standard errors in the dynamic specifications are smaller than those in static model, an issue which gives credit to the dynamic framework.

Table 1. Static and Dynamic Specification for the Greek Banks' Liquidity Model Dependent Variable: LAR (Liquid asset ratio)

	Fixed		Random		Pooled		First Differences		Orthogonal Deviations	
Explanatory Variable	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
C	12.438	0.855	11.640	1.428	10.016	1.364				
LAR (-1)							0.144	0.008	0.132	0.020
EA	0.618	0.064	0.714	0.087	0.911	0.159	0.554	0.014	0.574	0.029
DGDP	1.397	0.194	1.370	0.179	1.314	0.167	1.099	0.104	1.041	0.107
REED	-0.644	0.206	-0.598	0.197	-0.505	0.191	-0.566	0.063	-0.530	0.069
AIC	6.38				6.787					
SIC	6.85				6.88					
Wald test (1)	271.36		66.98		48.96		269.42		41.08	
F-statistic	19.374		49.042		53.585					
F-test (FE=0) (2)	5.988									
Sargan test (p-value)							0.228		0.265	
R^2	0.79		0.56		0.58					
Adjusted R^2	0.75		0.55		0.57					

(1)Wald test that all coefficients (except intercept and fixed effects) are jointly not significant.
(2)Tests the joint significance of the fixed effects estimates.
All coefficients are significant at a 1% significance level.
Source: Authors calculations.

A major hypothesis under investigation remains the interaction between banks' liquidity and solvency. In the light of the Greek crisis, the results evidence a clear-cut nexus between liquidity and capital, in agreement with theory and other empirical studies (Berger and Bouwman, 2009). A high leverage ratio[7], or alternatively a weak capital position, is critical in the propagation of banks' liquidity shocks. The results' importance relates to the theory that maintains that well capitalised and liquid banks are able to provide credit in the economy (Kashyap and Stein, 1995; Kishan and Opiela, 2000; Westerlund, 2003). Contrary to Horvath et al.'s (2012) study on Czech banks, but broadly in line with the framework of new capital rules known as Basel III[8] and Berger and Bouwman's (2009), the modelling outcome suggests that solvency increases liquidity creation. On the other hand the results support a negative association of REED, a leading crisis indicator, with market liquidity. In the research's timeline, Greece's currency appears to be persistently overvalued, pointing to a loss in competiveness and higher domestic inflation compared to eurozone countries (Meghir et al., 2010; Polychroniou, 2011). And this divergence in competitiveness or real exchange rate misalignment can be traced to excessive debt accumulation in a bi-directional relationship (Babecky et al., 2010). Thus, the modelling results support the "sovereign crisis hypothesis", maintaining also the premise of the real exchange rate as a crisis indicator (Kaminsky et al., 1998; Hardy and Pazarbasioglu, 1999; Frankel and Saravelos, 2010). Overall, the role of capital and cyclical movements in macroeconomic variables are valuable indicators in explaining the Greek banks' market liquidity in the crisis period.

Improving banks' liquidity, and therefore their capacity to fund themselves without relying on rescue funds, will flow from putting straight other challenges, namely solvency and asset quality. Realistically, returning to a normal liquidity position is only likely to occur after the Greek crisis has been resolved.

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7 The leverage ratio is defined as the ratio of assets to equity, which is the inverse of the capital ratio used in the research defined as equity to assets. The leverage ratio has been attracting increasing attention worldwide because it has been a source of weakness for banks even in strong economies. Thus, it is another indicator of the resilience of Greek banks.

8 Based on the premise that the low solvency levels of banks lies at the centre of financial crises, Basel III emphasizes the importance of stronger capital requirements and of liquidity creation as well.

4. CONCLUDING REMARKS

Using correlation analysis, cointegrating techniques, and one-way static and dynamic panel models we explored the presence as well as the strength of the relationship between banks' liquidity with the business cycle, while allowing for the role of solvency.

The modelling framework used identified several significant relationships between the variables of interest. In all modelling cases, the static and dynamic framework presented an adequate fit of the data confining the relationship under investigation, as the results produced by the two methods were very close. Broadly, business cycle variables were found to be semantic in explaining the Greek banks' liquidity over the period 2004-2010. In line with theory, the business cycle reflected in the growth in real GDP and the real effective exchange rate in labour costs - also a leading crisis indicator - exerts a significant effect on Greek banks' market liquidity. Also, the results pinpoint a clear-cut nexus between market liquidity and solvency. Economic growth is liquidity-friendly, but macroeconomic imbalances reflected in the real exchange rate weaken banks' liquid positions. The modelling outcome contributes to the research agenda of Greek banks and provides the basis for policy recommendations. Solid capital positions are important during prosperous but also during troubled economic periods. Alternatively, solvency shocks can induce liquidity problems and constrain significantly the bank's intermediation role. Addressing banks' liquidity is a pressing issue that can be solved through stronger capital bases and restoring competitiveness in the economy.

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APPENDIX I: THE DATASET

Table 1. The sample of Greek banks

	Bank	Total Assets	Gross Loans	Deposits
1	National Bank of Greece (NBG)	120.745	75.105	68.039
2	Eurobank Ergasias (EFG)	87.188	58.597	44.435
3	Alpha Bank (ALP)	66.798	51.525	38.293
4	Piraeus Bank (PIR)	57.680	40.027	29.254
5	ATE Bank (ATE)	31.221	22.912	19.683
6	Marfin Egnatia Bank (MEG)	22.131	13.794	9.861
7	Emporiki Bank (EMP)	26.777	24.105	12.246
8	TT Hellenic Postbank (TT)	16.566	8.216	12.125
9	Millennium Bank (MIL)	6.858	5.123	3.122
10	Proton Bank (PRN)	4.255	2.058	1.934
11	Attica Bank (ATT)	4.770	3.892	3.317
12	Probank (PRO)	3.938	2.876	3.031
13	Geniki Bank (GEN)	4.276	4.332	2.361
14	T Bank (TB)	2.733	1.939	1.701
15	FBB First Business Bank (FBB)	1.850	1.562	1.349
16	Panellinia Bank (PAN)	964	671	501
17	Aegean Baltic Bank (ABB)	385	217	221
	Total of sample	459.135	316.949	251.472
	Total Assets of Greek Banking System	514.130	377.175	281.197
	Percentage of system covered by sample	89.3%	84.0%	89.4%

Sources: BankScope, Banks' IFRS audited annual reports.
Amounts in millions of euro.

Table 2. The dataset of the bank-specific variables

Variable	Definition	Measures or Proxies
EA	Equity to assets	Capital – Solvency
GLG	Gross loans (% change pa)	Growth in loans
LAR	Liquid assets to total assets	Liquidity
LD	Loans to deposits	Liquidity

Sources: Bankscope, Banks' IFRS audited annual reports.
All ratios expressed in percentage points

Table 3. The set of macroeconomic variables

Variable	Definition
DGDP	Gross domestic product, real (% change pa)
PUDP	Public debt (% of GDP)
REED	Real Effective Exchange Rate (unit labour costs, % change pa)

Sources: IMF Statistics, OECD, EIU.

APPENDIX II: DESCRIPTIVE STATISTICS AND DATA PLOTS

Table 1. Descriptive Statistics of the bank-specific variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EA	8.66	7.14	73.30	-1.86	7.58	119
GLG	20.88	16.63	159.10	-12.77	22.45	114
LAR	19.53	16.98	65.86	2.51	10.84	119
LD	1.10	1.10	1.97	0.22	0.30	119

Source: Authors calculations.

Table 2. Descriptive Statistics of the macroeconomic variables

Variable	Mean	Median	Maximum	Minimum	Std.Dev.	Observations
DGDP	1.18	2.28	5.54	-3.52	3.59	7
PUDP	114.60	107.42	144.97	98.86	16.70	7
REED	-0.14	-0.12	3.07	-4.08	2.44	7

Source: Authors calculations.

APPENDIX III: LIQUIDITY OF GREEK BANKS

Table 1. Banks' liquidity metrics: Correlation Coefficients

	LAR	LD
DGDP	0.372	-0.317
PUDP	-0.405	0.332
REED	-0.028	-0.069
EA	0.655	-0.078
GLG	0.391	-0.265
LAR	1.000	-0.486

Table 2. Panel unit root tests for liquidity (LAR) and solvency (EA)

	Levin, Lin and Chu test	ADF test	PP test
LAR	-7.122 (0.00)	85.304 (0.00)	107.904(0.00)
EA	-13.398 (0.00)	61.387 (0.00)	92.048 (0.00)

Note: The p-values are shown in brackets next to the corresponding statistic of each test

Table 3. Pedroni panel cointegration test for liquidity (LAR) and solvency (EA)

	Statistic	p-value
Panel v-Statistic	0.461	0.322
Panel rho-Statistic	-2.240	0.012
Panel PP-Statistic	-6.055	0.000
Panel ADF-Statistic	-1.973	0.024
Group rho-Statistic	1.798	0.963
Group PP-Statistic	-5.994	0.000
Group ADF-Statistic	-12.345	0.000

Note: The Pedroni test is an Engle-Granger type test where the null hypothesis suggests no cointegration and the decision is based on seven statistics – panel and group.

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