The Impact of Diversification on the Banking Industry: A Non-Stationary Panel Approach in the Presence of Cross Section Dependence

by

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Abstract

One of the central aims of Basel II is to ensure that capital allocation is more risk sensitive. Behind this goal, is the notion that a more diversified commercial bank is less likely to fail, than one which is not as diversified. This study uses non-stationary panel techniques along with quarterly data for the Barbadian banking industry between 1979 and 2005 to empirically investigate the link between diversification and commercial bank risk and return. The results of the study suggest that diversification increases loan returns. However, diversification's impact on risk is sector specific.

JEL Classification: Bank Diversification; Panel Unit Roots and Cointegration; Cross-Sectional Dependence

Keywords: G21; C23

1. Introduction

One of the most important challenges facing banks and regulators in developing countries is the introduction of the Basel II new capital requirement directive which describes the minimum standards of capital adequacy for all banks, credit institutions and investment firms (Bank for International Settlements, 2005). The central goal of Basel II is to more closely align existing rules on capital requirements with the risks that banks face. In this approach, capital requirements are set to provide a buffer to protect a bank's debt holders against peak losses that exceed expected levels. The expected loss of a portfolio is assumed to equal the product of the proportion of obligors that might default, the outstanding exposure at default, and the percentage of exposure that will not be recovered by the sale of collateral.

In the Basle II framework, a more diversified commercial bank will therefore be required to hold a smaller amount of capital. The implicit assumption here is that a diversified commercial bank should be more profitable and have lower expected losses. The theoretical literature, however, is not clear on this topic. For instance, Allen and Santomero (1998) argue that a more diversified loan portfolio leads to greater profitability through risk spreading. In contrast, Bolton and Scharfstein (1998) suggest that diversification can lead to an overextension of the bank's resources and therefore result in deterioration in its financial performance.

Empirically, the effects of diversification in the banking industry can be grouped into three broad areas: (1) studies that investigate the effects of bank mergers with non-banks; (2) studies that examine the market reactions to bank diversification, and; (3) studies that relate the performance of the bank to its involvement in many activities. Papers that utilise the first approach include those by Boyd and Graham (1988) and Boyd, Graham and Hewitt (1993). These authors, by simulating the impact of mergers between bank holding companies and non-banks, generally find that diversification reduces the risk of bankruptcy. The second approach employed by Delong (2001), decomposes bank mergers into those that either diversify or focus the bank's portfolio along either geographic or activity dimensions. The author finds that the largest market gains are for those mergers that increase both the specialisation of the bank in terms of geography and activity. The final approach, which relates commercial bank returns and risk to various measures of diversification, is the one closest to what is used in this paper. Early research like Rugman (1979, 1986) reported that a diversified banking portfolio has a lower risk and increase profitability. Also, Xu (1996), using a mean-variance framework, found that Canadian banks benefit from international diversification, through the stabilisation of their asset returns. More recent studies, however, utilising bank level data present different results. DeYoung and Roland (2001) examine the link between bank profitability, volatility and different revenue shares for 472 larger commercial banks from 1998 to 1995, and find that a rise in non-interest income activities increases the volatility of bank revenue and bank earnings. Similarly, Acharya, Hasan, and Saunders (2002) using observations on 105 Italian banks between 1993 and 1999 and Hayden, Porath and Westernhagen (2005) employing a database of 963 German banks between 1996 and 2002, both report that the diversification of bank assets is not guaranteed to produce superior performances (in terms of returns) and/or greater safety for banks (lower risk).

From the preceding brief empirical literature review, one will notice that most of the studies mentioned focus on developed economies; work on developing countries appear non-existent. This paper fills this gap in the literature by investigating the relationship between diversification and commercial bank risk and returns for the case of Barbados, which is a relatively high-income small open economy in the Caribbean. The study also expands the empirical literature by incorporating the notions of non-stationarity and cross-sectional dependence. Data on commercial banks should be expected to be non-stationary; therefore applying traditional panel data techniques could lead to erroneous inferences. In addition, given that the activities of commercial banks are likely to be inter-related, one should utilise an approach, which takes this into account.

This paper is structured as follows. After the introduction, the authors outline the empirical model and data employed in the study. Section 3 provides the econometric approach employed, while Section 3 presents the results. Section 5 concludes as well as provides policy recommendations.

2. Empirical Model

Based on the work of Markowitz (1952) and Sharpe (1964), traditional capital market theory suggests that a bank can, through diversification, reduce the risk of its portfolio and increase expected returns. Applying this model to the banking industry, Diamond (1984) assumes that monitoring costs and monitoring quality are considered to be constant across all banks. The author therefore finds that diversification reduces the bank's monitoring costs and should improve its performance. In contrast, Winton (1999) argues that diversification only yields an advantage to the bank when there is moderate downside risk. If the bank's loan portfolio is low risk, loan returns are almost guaranteed and diversification would only serve to expose the bank to unnecessary risk. In addition, diversification in the face of high levels of uncertainty could also increase the probability of bank failure since the bank is now exposed to the downturn of many sectors instead of one or a few sectors.

The theoretical results of Diamond (1984) and Winton (1999) therefore suggest that the relationship between bank returns/risk and diversification should be non-linear. That is, when there is little downside risk for a portfolio of loans, specialisation has little impact on a bank's returns or performance. Specialisation only impacts on bank returns when loans have moderate downside risk. When the bank's portfolio of loans has sufficiently high downside risk, specialisation may actually enhance a bank's returns.

As an initial step in the investigation of the relationship between bank return and diversification, the authors include two measures of diversification (goods industries, $THHI$ and services industries, $SHHI$) in a regression of bank performance:

$$Return_{it} = \alpha_i + \beta_1 * THHI_{it} + \beta_2 * SHHI_{it} + \varepsilon_{it} \qquad (1)$$

where α_i are the bank-specific fixed-effects for banks $i = 1,...,7$, β_1 and β_2 are coefficient estimates on the diversification variables and ε_t is an error term assumed to have the classical properties. If diversification increases bank returns, then $\beta_1, \beta_2 < 0$ implying that an increase in specialisation will lead to a decrease in returns.

To account for the proposed non-linear relationship between bank return and diversification, the authors employ a quadratic equation of the following form:

$$\begin{aligned} Return_{it} &= \alpha_i + \beta_1 * THHI_{it} + \beta_2 * SHHI_{it} + \eta * Z_{it} + \beta_3 * Risk_{it} + \beta_3 * THHI_{it} * Risk_{it} \\ &+ \beta_4 * THHI_{it} * Risk_{it}^2 + \beta_5 * SHHI_{it} * Risk_t + \beta_6 * SHHI_{it} * Risk_{it}^2 + \varepsilon_{it} \end{aligned} \quad (2)$$

where Z_{it} is a vector of non-risk control variables and $Risk_{it}$ is a measure of portfolio risk to be discussed in the data section below. Differentiating Equation (2) with respect to the two measures of diversification gives:

$$\partial Return / \partial THHI = \beta_1 + \beta_3 * Risk_{it} + \beta_4 * Risk_{it}^2 \quad (3)$$

$$\partial Return / \partial SHHI = \beta_2 + \beta_5 * Risk_{it} + \beta_6 * Risk_{it}^2 \quad (4)$$

Equations (3) and (4) imply that for there to be a non-linear relationship between diversification and bank performance, then $\beta_3 < 0$, $\beta_4 > 0$, and $\beta_5 < 0$, $\beta_6 > 0$. The signs of the coefficients suggest that at low levels of risk, diversification has a negative impact on commercial bank returns, while as downside risk rises, diversification improves bank.

It is also likely that a bank's monitoring effectiveness may be lower in newly entered and more competitive sectors primarily because of the substantial learning costs incurred to develop meaningful lending relationships coupled with the problems of the "Winner's Curse" (selecting the firms that other banks, more familiar with the sector, has rejected) and adverse selection in its pool of borrowers. Thus specialisation can result in a superior quality of a loan portfolio that reduces the bank's loan portfolio risk. It is assumed that loan quality (or the inverse, loan risk) is endogenous and that there is a positive (negative) relationship with specialisation. Two cases are considered: (i) where there are no new loans, and; (ii) where there are new loans. Considering the former, the following regression is estimated:

$$Risk_{it} = \theta_i + \gamma_1 * THHI_{it} + \gamma_2 * SHHI_{it} + \eta * Z_{it} + \theta_1 * \mathrm{Re}\,turn_{it-1} + \theta_2 * Risk_{it-1} + \varepsilon_{it} \quad (5)$$

The coefficients on the diversification variables, γ_1 and γ_2 should be negative, indicating that diversification reduces a loan portfolio's level of risk. In the case where there are new loans, Equation (5) is modified by the inclusion of the first difference of the sum of the loans to the two sectors to give:

$$Risk_{it} = \vartheta_i + \gamma_1 * THHI_{it} + \gamma_2 * SHHI_{it} + \eta * Z_{it} + \gamma_3 * \mathrm{Re}\,turn_{it-1} + \gamma_4 * Risk_{it-1} + \gamma_5 * DTHHI_{it} + \gamma_6 * DSHHI_{it} + \varepsilon_{it} \quad (6)$$

where $DTHHI$ and $DSHHI$ are the first difference of the loans to the goods and services sectors, respectively. As in Equation (5), it is expected that $\gamma_1 < 0$ and $\gamma_2 < 0$. In this situation, because it is the new loan industries that are being considered, then it is only the inter-temporal effects that are emphasised.

The final hypothesis evaluated in the paper is that diversified banks require less capital than specialised ones, as ceteris paribus, the former has greater success probabilities and stronger monitoring incentives. The authors therefore estimated the following model of bank capital:

$$Equity_{it} = \omega_i + \delta_1 * THHI_{it} + \delta_2 * SHHI_{it} + \varepsilon_{it} \quad (7)$$

The signs of the coefficients (δ_1, δ_2) on the specialisation measures are expected to be positive, indicating that as specialisation increases, then the need for capital also expands.

3. Econometric Approach and Data

3.1 Econometric Approach

The econometric approach employed in this study proceeds in three stages. First the statistical properties of the banking variables are investigated using panel unit root tests. The traditional panel unit root tests (Im, et. al., 2003; Levin, et. al., 2002; Choi, 2001; Maddala and Wu, 1999; Levin and Lin, 1992, 1993) assume that units in the panel are independent. However, in the banking industry this assumption is unrealistic as co-movements of banks are often observed; banks in a given environment may share common processes like technological developments. Applying these traditional panel unit root tests to series characterised by cross-section dependencies leads to size distortion and low power (Banerjee, Marcellino and Osbat, 2004). To explicitly account for cross-sectional dependence the authors employ the covariate recursive mean adjustment (RMA) unit root tests of Sul (2005) to detect whether the common factor is stationary. This test is appropriate for when N is relatively large (greater than 20). However, given the small number of banks in Barbados, a pooled recursive mean adjusted feasible generalised least squares (PRMA-GLS) estimator is also employed, which has reasonable properties when N is small.

Consider a modified autoregressive panel model of the following form:

$$y_t - c_{t-1} = \rho(y_{t-1} - c_{t-1}) + \sum_{j=1}^{p} \phi_j \Delta y_{t-j} + u_t \tag{8}$$

where c is a common factor which is assumed to satisfy the conditions $Ec_{t-1}u_t = 0$, $Ec_{t-1} = a$ and $E\sum_{t=2}^{T}(y_{t-1} - c_{t-1})(c_{t-1} - Ec_{t-1}) < \mathrm{O}(T)$. The unit root test statistic is therefore given as:

$$t = \frac{\hat{\rho}}{\sqrt{V(\hat{\rho})}} \tag{9}$$

The critical values for the test statistic are provided in Sul (2005), with limiting values of -1.88 for the case of a constant and -1.86 for a linear trend model. These values are invariant in regards to T.

If $N < 20$, the number of common factors is difficult to estimate and most panel unit root tests perform poorly (Bai and Ng, 2002). Sul (2005) shows that for a small N but large T, cross-section dependence can be asymptotically handled by utilising panel feasible generalised least squares estimation. Employing the model of the following form:

$$y_{it} - c_{it-1} = \rho(y_{it-1} - c_{it-1}) + u_{it} \tag{10}$$

where $u_{it} \sim N(0, \Sigma_u)$ and the off-diagonal terms of Σ_u (which is assumed to be known) are not equal to zero. Now letting $\Sigma_u^{-1} = \Lambda'\Lambda$, the following transformed vectors can be derived: $y_t^+ = y_t\Lambda'$ and $c_{t-1}^+ = c_{t-1}\Lambda'$. Taking the *i*th elements of y_t^+, c_{t-1}^+ and u_t^+, one obtains:

$$y_{it}^+ - c_{it-1}^+ = \rho(y_{it-1}^+ - c_{it-1}^+) + u_{it}^+ . \tag{11}$$

The test statistic is therefore given as $(\rho_{PGLS} - 1)/\sqrt{Var(\hat{\rho}_{PGLS})}$ which is normally distributed with mean zero and a variance of one.

In stage two, the authors utilise three panel co-integration tests to investigate if there exists a long-run relationship between the variables. The first two co-integration tests (Pedroni, 1999; Larsson, Lyhagen and Lothgren, 2001) assume long run cross section independence, while the third test, Westerlund (2004), allows for cross section dependence. The Pedroni test estimates the equations by ordinary least squares and then tests the residuals for the presence of a unit root.

The test statistics are standardised with respect to the time and cross section dimensions and compared to the appropriate tails of the normal distribution. The null hypothesis of the Pedroni test is that there is no co-integration. The Larsson, Lyhagen and Lothgren's test is the average of the rank trace statistics for each cross section equation. The null of the test is that all the cross sections in the panel have at most r co-integrating relationships among p variables. The Westerlund statistic is a non-parametric modified variance ratio test. If one considers the following model:

$$y_{it} = z_t^{'} \upsilon_i + x_{it}^{'} \hat{\beta}_i + \hat{e}_{it} \tag{12}$$

where z_t is the deterministic component. The variance ratio test is applied to the residual of Equation (12), since if the residual $\hat{e}_{it}$ is stationary then y_{it} and x_{it} are co-integrated. For the test statistic, the null hypothesis is formulated as $H_o : \lambda_i = 1$ for all i (where λ_i is the coefficient on the lagged residual term in the test regression), against the alternative $H_o : \lambda_i = \lambda < 1$ for all i. Define $\hat{E}_{it} = \sum_{j=1}^{t} \hat{e}_{ij}$, $\hat{R}_i = \sum_{t=1}^{t} \hat{e}_{it}^2$, $\hat{E}_i = (\hat{E}_{i1},...,\hat{E}_{iT})'$, $\hat{E} = (\hat{E}_1,...,\hat{E}_N)'$, $\hat{U}_i = (\hat{e}_{i1},...,\hat{e}_{iT})'$ and $\hat{U} = (\hat{U}_1,...,\hat{U}_N)'$, the modified variance ratio statistic is defined as:

$$VR = tr(\hat{E}'\hat{E}(\hat{U}'\hat{U})^{-1}) \tag{13}$$

In the third stage, if a co-integrating relationship exists the equations are estimated using panel dynamic ordinary least squares (Kao and Chiang, 2000; Mark and Sul, 2003). In this method lags and leads are included in each equation for the first difference of the I(1) variables to correct for possible autocorrelation and endogeneity. The co-integrating equation is augmented to give:

$$y_{it} = \alpha_i + \beta X_{it} + \sum_{k=-K}^{K_i} \gamma_{ik} \Delta X_{it-k} + u_{it}^{*} . \tag{14}$$

Mark and Sul assume that the co-integrating vector is homogenous across individuals, but individual heterogeneity is allowed through the short-run dynamics, individual-specific fixed effects and individual-specific time trends. The approach also allows for some degree of cross-sectional dependence through the presence of time-specific effects.

3.2 Data

The paper utilizes quarterly observations on the seven commercial banks in Barbados from 1979 to 2005. Summary statistics are given in Table 1 and the data source is the Central Bank of Barbados. A Hirschman-Herfindahl Index (HHI) constructed for each of the two industries: goods and services. The industries incorporated in the goods sector are agriculture, fisheries, mining and quarrying, manufacturing, public utilities, construction and personal (housing), while the services includes the distribution, tourism, entertainment, transportation, government, financial, professional and miscellaneous. The HHI is calculated as the sum of the squares of exposures as a fraction of total exposure under a specific industry category. The formula for the index is given by:

$$HHI = \sum_{i=1}^{n} \left(\frac{X_i}{X} \right)^2 \tag{15}$$

where n is the number of sub-sectors, X_i gives the measure of exposure for sub- sector i and X is the total exposure. Exposure in an industry category can be thought of intuitively as the percentage of the current value of the bank's total loan portfolio that is devoted to that sub-sector. Since diversification is the opposite of specialization, then an expansion in these measures signifies a similar increase in focus and a fall in diversification. The range for the HHI lies between $1/n$ and 1, where 1 means perfect specialization and $1/n$ would refer to full diversification (Hayden, Porath and Westernhagen, 2005).

Prior studies used the change in the Herfindahl Indices (DTHHI and DSHHI) to represent the new loan divisions. However, due to the problem of multicollinearity, a proxy (the change in the total value of loans to the sectors) was employed. The correlations between the original variables used for new loans (DTHHI and DSHHI) and the proxies (DATHHI and DASHHI) are 0.4 and 0.6 respectively.

Risk is measured by the reserve for bad debts, which captures the level of expected losses. Arguably a more accurate proxy would be unexpected losses, for example, the Value at Risk indicator (Hayden, Porath and Westernhagen, 2005). However, the first measure is more readily available for all the banks under study. The sum of retained earnings or undistributed profits and capital paid up serves as a proxy for Equity. Bank returns can be measured by either return on assets, return on equity or stock return. However, the return on assets is used, as it is the only series that is available for the entire sample period. The control variables are: (i) the asset size of the respective bank; (ii) the capital ratio, total equity divided by the assets of the bank, and; (iii) the employee ratio, the number of employees over the assets of the bank.

4. Empirical Results

Several types of panel unit root tests (see the recent surveys of Harris and Solis, 2003; Pedroni and Urbain, 2005) are undertaken in the paper. The Levin, Lin and Chu (2002) and the Breitung (2002) statistics assume a common unit root process as the null hypothesis. The Im, Pesaran and Shin (2002), as well as the Augmented Dickey Fuller (ADF) Fisher Chi- square (Dickey- Fuller, 1979) and the Phillips- Perron (PP) Fisher Chi- square (Phillips and Perron, 1988) tests have as the null hypothesis that there is an individual unit root process. The Hadri Z-statistic (Hadri, 2000) is unique in that the null is that there is no unit root, but also assumes a common unit root process. Finally, two unit root tests that account for cross section dependence are also employed: RMA and PRMA-FGLS. The software programme E-Views is used to compute the traditional panel tests that assume cross-unit independence while the more recently developed panel cross-unit dependence tests are done in Ox. The overall analysis of these panel unit root and stationarity tests is that the employee ratio, the reserve for bad debts and return on assets are stationary in levels, while the remaining variables are integrated of order one (Table 2).

Given the non-stationarity of the variables, the authors then attempted to investigate whether there exists a co-integrating relationship for Equations (1), (2), (5), (6) and (7) using the Pedroni (1999) and Larsson, Lyhagen and Lothgren (2001) statistics, which assume cross section independence and the Westerlund (2004) pool and group mean variance ratio statistics that allow for cross section dependence. Again, the assumption of cross section dependence does not seem to impact significantly on the conclusions of the study. This could reflect the fact most of the banks in the sample are owned and managed by their regional and international parent companies, and therefore their decision-making may be independent of each other. The co-integration test statistics in Table 3 suggest that there is at least one co-integrating relationship for each of the five equations in the paper.

Given the results from various Monte Carlo studies, and since the variables show varying orders of integration and are co-integrated, the long-run co-integrating equations with fixed effects are estimated using the Panel Dynamic Ordinary Least Squares (DOLS) method proposed by Kao and Chiang (2000) and Mark and Sul (2003). Since the data is quarterly four lags and leads are included in each equation for the first difference of the I(1) variables to correct for possible autocorrelation and endogeneity and then a general to specific reduction process is undertaken. The results for the five equations (with the lags and leads terms omitted to preserve space) are presented in Table 4 (the full results are available upon request).

In the case of Equation (1), the signs on the specialisation variables are negative which implies that diversification increases loan returns. In Equation (2), the goods industry justifies the claim that the interaction between return and specialization decreases risk, as it is the case that $\beta_{11} < 0,\ \beta_{12} > 0$. However, the results from the services industry diversification variable in Equation (2) indicate that $\beta_{21} > 0$, $\beta_{22} < 0$, supporting the contention from Equation (1) that diversification has a positive effect on returns.

Equation (5) examines the relationship between risk and specialisation. In this instance, there is an inverse relationship between concentration in the goods industries and risk. However, the coefficient on the variable that depicts specialisation in the services industries is insignificant but its sign indicates that specialisation in the services industries amplifies loan risk. A possible reason for the divergence in the signs for the two industries is the relative sensitivity of each sector to risk. Equation (6) considers whether or not loan quality expands when banks go into new loan sectors. In line with *a priori* expectations, the coefficient on the variable reflecting new loans in the goods sector is negative, which suggests that diversifying into new loan goods sector increases risk. However, for the services sector, as in Equation (5), the coefficient is insignificant but the sign would suggest that diversifying into new services sector reduces risk. It would appear then that diversification impact on risk is sector specific.

For Equation (7) – which examines the relationship between specialisation and capital requirements – the signs of the coefficients on the diversification variables are positive, suggesting that specialisation and equity needs are positively correlated. This result indicates that diversification yields greater success and provides a stronger incentive for monitoring.

5. Conclusions and Policy Recommendations

This paper investigates the effects of loans portfolio specialisation or diversification on bank performance in the small open economy of Barbados. It utilises quarterly observations on each of the seven commercial banks between 1979 and 2005. To account for the non-stationarity of most bank variables and the co-movements between units in the panel, the authors employ panel unit root and co-integration tests that explicitly take into account cross section dependence.

The main conclusion from the study is that specialisation in the tangible goods industries improves bank performance, while for the services industries diversification is a superior loan portfolio strategy. Traditionally, the service industries have been the most dynamic area of the Barbadian economy. Many of these industries, for example tourism, are subject to large negative shocks from time-to-time. Given the dependence of most of the other service industries on tourism, a more diversified loan portfolio in services would be a prudent strategy for commercial banks. In the tangible goods industries, in contrast, most loans are covered by assets, which can be sold to recoup any losses due to non-payment, for example land in the case of agriculture and machinery for manufacturing. The downside risk of these loans is relatively low compared to the service industries. As a result, diversification of the banks loan portfolio to the goods industry might overextend the bank's capabilities.

In the final analysis, it is difficult to conclusively assert that diversification is best for commercial banks. The factor underlying the divergence in the two measures of specialisation has to be examined. Is it the case that one sector's financing needs is more suited to a specialized loan facility? This is a possible avenue for further investigation. The growing trend to diversify may be justified in terms of efficiency (less capital requirements) and loan returns. However on the issue of risk, the effect is still ambiguous. Thus for the Barbadian banking industry, the present diversification of loan portfolios should be subjected to intensive monitoring policies to ensure acceptable levels of loan quality.

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Table 1: Descriptive Statistics

	Return	THHI	SHHI	Risk	Equity	Total Assets	Employee Ratio	Equity Ratio
Mean	0.003	0.246	0.293	5.161	22.400	479.521	0.001	0.041
Maximum	0.020	0.681	0.810	182.534	653.683	2425.557	0.003	0.307
Minimum	-0.015	0.010	0.030	-2.015	0.000	44.305	0.000	0.000
Standard Deviation	0.004	0.131	0.152	9.477	83.655	424.101	0.001	0.063
Observations	667	667	667	667	667	667	667	667
Cross sections	7	7	7	7	7	7	7	7

Table 2: Unit Root and Stationarity Test Results

Variable	Cross Section Independence Tests						Cross Section Dependence Tests	
	Levin, Lin & Chu	Breitung	Im, Pesaran & Shin	ADF – Fisher Chi-square	PP – Fisher Chi-square	Hadri Z-statistic	PRMA-FGLS	RMA
Employee	-7.866	1.278	-5.195	68.965	86.128	16.776	-9.728	-3.126
Ratio	(0.000)	(0.899)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
	1.824	-0.901	3.611	4.926	4.282	6.575	0.000	0.271
Equity	(0.966)	(0.184)	(0.999)	(0.987)	(0.993)	(0.000)	(0.398)	(0.384)
	-0.212	0.369	-1.139	23.383	16.118	6.012	-0.025	-1.355
Equity Ratio	(0.416)	(0.644)	(0.127)	(0.054)	(0.306)	(0.000)	(0.398)	(0.159)
Risk	-6.688	-3.157	-6.721	93.604	97.024	10.467	-0.000	-2.978
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.398)	(0.005)
Return	-9.470	-7.005	-10.498	162.663	226.452	4.659	-5.242	-3.938
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SHHI	0.268	-0.924	-0.046	11.585	14.005	9.829	-0.021	-4.904
	(0.606)	(0.178)	(0.482)	(0.640)	(0.449)	(0.000)	(0.398)	(0.000)
Total Assets	9.883	-5.572	10.802	0.204	0.112	14.936	0.000	2.398
	(1.000)	(0.000)	(1.000)	(1.000)	(1.000)	(0.000)	(0.398)	(0.024)
THHI	-0.201	0.007	-0.254	15.029	20.161	7.031	-0.038	-5.204
	(0.420)	(0.503)	(0.399)	(0.376)	(0.125)	(0.000)	(0.400)	(0.000)

Note: (1) The test statistics are reported along with the probability values in parentheses.
(2) All tests include an intercept. The entire panel unit roots tests results for the categories intercept and trend and without; is available upon request.

Table 3: Cointegration Test Results

Equation	Cross Section Independence Tests		Cross Section Dependence Tests	
	Pedroni	Larsson, Lyhagen and Lothgren	Wunderland Pool Variance Ratio	Wunderland Group Mean Variance Ratio
1	0.316	22.246	5.957	16.505
2	3.361	88.387	4.788	41.125
5	5.612	80.173	0.893	54.711
6	4.916	73.013	0.898	92.239
7	4.204	31.290	22.894	38.997

Note: The asymptotic critical value for the Pedroni tests is 1.66, for the.

Table 4: Panel DOLS Estimation Results

Regressors	Dependent Variables				
	Return (1)	Return (2)	Risk (3)	Risk (4)	Equity (5)
Intercept	0.012	0.011	5266.997	5825.705	-14315.970
	(8.257)	(8.848)	(4.447)	(3.902)	(-4.277)
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
THHI	-0.019	-0.014	-4478.454	-5361.933	51441.920
	(-5.670)	(-4.583)	(-1.802)	(-1.723)	(10.770)
	[0.000]	[0.000]	[0.072]	[0.085]	[0.000]
SHHI	-0.013	-0.015	1734.615	880.266	63803.410
	(-5.743)	(-5.823)	(0.844)	(0.328)	(8.278)
	[0.000]	[0.000]	[0.400]	[0.743]	[0.000]
Total Assets	-	0.000	0.004	0.005	-
		(-3.534)	(5.120)	(5.445)	
		[0.000]	[0.000]	[0.000]	
Employee Ratio	-	-	-1436.786	-1781.550	-
			(-2.137)	(-2.493)	
			[0.033]	[0.013]	
Equity Ratio	-	0.006	-	-2975.881	-
		(2.056)		(-0.905)	
		[0.040]		[0.366]	
Return $_{t-1}$	-	-	-	-	-
THHI*Risk (10^6)	-	-1.580	-	-	-
		(-4.347)			
		[0.0000]			
THHI*Risk ^{2} (10^11)	-	7.840	-	-	-
		(4.043)			
		[0.000]			
SHHI*Risk (10^7)	-	7.040	-	-	-
		(5.094)			
		[0.000]			
SHHI*Risk ^{2} (10^11)	-	-2.090	-	-	-
		(-4.256)			
		[0.000]			
DATHHI	-	-	-	-0.014	-
				(-1.168)	
				[0.243]	
DASHHI	-	-	-	-0.021	-
				(-1.718)	
				[0.086]	
Adjusted R^2	0.340	0.443	0.326	0.333	0.277
F statistics	25.732	13.637	15.145	10.882	17.040
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Number of Observations	673	636	615	614	671

Note: The t-test statistics are presented in parentheses and the probability values in square brackets.