Investigating the Link between Bank Capital & Economic Activity: Evidence on Jamaican Panel Data

Sherene A. Bailey-Tapper[1]
Financial Stability Department
Bank of Jamaica

December 2009

This paper applies the GMM technique to panel data for the Jamaican banking sector to evaluate the impact of economic activity on bank capital over the period February 2002 to March 2009. This relationship is evaluated by estimating an equation for the determinants of bank capital, which incorporates an indicative measure of growth in economic activity. Findings for the merchant banking sector as well as for small commercial banks show that there is a significant inverse relationship between growth in economic activity and current and excess capital holdings, providing evidence of procyclicality or the likelihood for banking activity to reinforce economic credit cycles. Findings for the building societies show a statistically insignificant relationship between bank capital and growth in economic activity. Additionally, overall results show that merchant banks and commercial banks with a higher weight of GOJ sovereign bonds as a proportion of assets hold higher capital buffers as a means of covering additional exposure related to market risk. Smaller commercial banks respond to deterioration in loan quality by reducing excess capital and may be reflective of increased provisioning by these institutions in response to increased default risk. Of importance is that commercial and merchant banks, in particular the smaller institutions, respond to increases in cost of capital by increasing excess capital in order to satisfy future funding needs. Moreover, based on the results for the commercial banks and merchant banks, and given the potential for increased risk sensitivity of capital requirements under Basel II, supervisors should explore various tools prior to the implementation of the new accord, in order to limit excessive procyclicality of bank capital and help safeguard macro financial stability.

JEL Code: C23, D24, G21, O4
Keywords: Economic Activity; Basel Accord; Bank Capital

[1] The views expressed are those of the author and do not necessarily reflect those of The Bank of Jamaica.

Table of Contents

1.0 Introduction

Business cycle fluctuations and increased asset risk may lead to large swings in bank capital, as has been reflected in the current economic and financial crisis. If these swings in capital are procyclical or result in amplifying business cycle fluctuations, then this has the potential to fuel further economic uncertainty. The global financial crisis has highlighted that financial systems which are excessively procyclical can lead to adverse consequences by reinforcing the momentum of economic cycles. For instance, in a recession, when raising capital is costly, profits are decreasing and risks are likely to materialize, banks may be forced to reduce their loan portfolio in order to meet capital requirements or increase capital holdings. The resulting contraction in available credit is likely to deepen and prolong the recession. In addition, in a downturn, banks are likely to pass on increased costs of capital to borrowers in the form of higher interest rates, given the prevailing low sources of finance. This may result in manufacturing and other industries cutting back on investment spending and aggravating the downturn. This can lead to a breakdown in the normal linkages between savers and investors, thereby compromising the effectiveness of monetary policy and further undermining financial stability. Alternatively, during an expansion, procyclicality may be manifested in the form of banks' lowering capital holdings and increasing bank lending, given the greater willingness of institutions to take on risks and to compete more aggressively for new business during this phase of the cycle. This is likely to fuel the pace of economic acceleration, which may ultimately impair financial stability when the cycle bursts. Therefore, procyclicality of the financial system raises challenges for policymakers in maintaining macro stability.

The global financial crisis has also reignited debate on the potential consequences of strongly risk sensitive regulatory regimes, such as the Basel II, for macro financial stability. A key objective of the new Basel Accord is to increase the risk sensitivity of minimum capital requirements of banks, but this has stimulated strong debate on the

procyclical effects such risk-sensitive requirements might have on the economy. For instance, under Basel II, capital requirements will be dependent on the current risk assessment of borrowers, resulting in increased capital requirements if borrowers are downgraded during a downturn. However, this would result in the wide scale increase in the capital of banks during a downturn, which could further jeopardize macroeconomic stability. This could offset the intended goal of capital regulation, which is to enhance stability of individual banks and the entire financial system. In this respect, the Basel II Accord may make it harder for policymakers to maintain macroeconomic stability. In this context, proposals for reform of financial system regulation stress the need to make the financial system less procyclical.

Against this background, some studies have focused on the link between the business cycle and capital requirements. However, few banks hold just the minimum capital required by regulators. As such, a number of authors have investigated the relationship between excess capital and the business cycle.[2] In some literature, capital buffers are seen as a potential solution for mitigating procyclicality if it emerges under Basel II. This would mean that banks accumulate capital during upturns which might be used to satisfy a likely increase in capital requirements during a next downturn (*Ayuso & Perez, 2002*). For instance, banks build reserves during an expansion in order to dampen exuberance in good times e.g. when there is a sharp increase in house prices, banks should build buffers to ensure their lending practices are robust against rapid increases in housing prices which could quickly reverse.

Banks may hold capital buffers to avoid possible undesirable regulatory and market sanctions if capital sharply and unexpectedly declines below the minimum. In these instances, buffers help banks avoid costs related to market discipline and supervisory intervention. Furthermore, banks hold capital buffers as a signal to the market of their soundness (and satisfy the expectations of the rating agencies) and for competitive reasons and in order to facilitate borrowing funds at lower interest rates. Higher portfolio

[2] Throughout the paper, excess capital is used synonymously with buffer capital. Both terms refers to the amount of capital banks' hold in excess of that required of them by regulators.

volatility also leads institutions to increase their capital buffers, given that some institutions differ in the amount of capital they hold on the basis of their risk aversion. Banks may also hold buffer capital as a way of positioning to exploit potential investment opportunities by increasing their capital ratio above the Basel requirement.

Economic cycles cannot be avoided; therefore it is critical for supervisors to develop macro prudential approaches and appropriate regulatory measures to reduce the impact of future economic cycles and diminish procyclical behaviour. Against this background, it is important for local regulators to examine the role of bank capital in influencing economic credit cycles. If there is increased procyclicality under Basel II, can this impact be offset, at least partially, by banks' capital buffers? Against this background, the paper assesses the relationship between economic activity and bank capital. This is accomplished, by estimating an equation for the determinants of bank capital, which incorporates, as one of the determinants, an indicative measure of growth in economic activity.

The paper is organized as follows: Section 2 presents the literature review while section 3 outlines the framework employed to investigate the determinants of bank capital. Section 4 gives a brief description of the data and the estimation technique employed. Section 5 presents the findings of the model, while the policy implications of the results and the conclusion are outlined in section 6.

2.0 Literature Review

A number of studies on the procyclicality of bank capital have focused on the sensitivity of capital requirements to economic activity or business cycle fluctuations. In one study, using data across 120 countries, Bikker and Metzemakers (2004) investigated the determinants of commercial banks' own internal capital targets and the potential sensitivity of these levels to the business cycle based on the Basel I accord. As expected, results showed that minimum requirements do not fluctuate substantially over the business cycle. However, smaller banks combined a relatively risky portfolio with limited buffer capital, which could induce procyclicality of these institutions' capital holdings under Basel II.

Bikker and Metzemakers (2004) also found that banks tend to hold substantial capital buffers on top of minimum requirements, reflecting that they hold capital for other reasons than strictly meeting the capital requirements. More recent studies have examined how this excess capital behaves over the business cycle. Some authors also examine whether there is a positive relationship between capital buffers and growth in economic activity, in order to assess whether this could help in offsetting the greater procyclicality in capital requirements anticipated under Basel II. Some findings show that buffers will not be sufficient to prevent procyclicality of bank capital and lending, therefore strong regulatory reform is needed.[3]

Using annual data on Spanish banks over the period 1986 to 2000, Ayuso and Perez constructed an equation for capital buffers over time and across institutions that reflected the cost of capital, non-performing loan rations, size-specific dummy variables and the annual growth in GDP. They found that capital buffers are negatively related to the growth rate in GDP under the Basel I framework. That is, capital buffers tend to fall in periods of rising GDP and rise when GDP falls. The results also showed that capital buffers are negatively related to the cost of capital, the level of non-performing loans and to a dummy variable which accounts for banks in the largest *10.0 per cent* of the sample. The findings for Spanish bank raise concerns as to whether capital buffers would be useful in mitigating the anticipated procyclical impact expected under Basel II.[4]

Stolz and Wedow (2005) investigated the effect of the business cycle on the regulatory capital buffer of German savings and cooperative banks over the period 1993 to 2003. They found that capital buffers fluctuate anticyclically over the business cycle. The study also found that banks with low capital buffers reacted differently to the business cycle than banks with relatively higher capital buffers. For instance, in business cycle

[3] Banks' lending position is a function of historically determined capital positions and capital requirements imposed by regulation. Risk sensitivity of capital requirements may imply a substantial increase in the procyclicality of bank lending.

[4] Credit standards need to be raised and credit extensions restricted during an upturn in order to minimize bad debt losses that erode capital during a downturn.

downturns, low-capitalized banks dampen the increase in capital, while well capitalized banks boost the increase in capital. In addition, low capitalized banks do not decrease risk weighted assets in a business cycle downturn by more than well-capitalized banks. The authors found that while this issue may raise some supervisory concerns, it also implies that low capitalized banks do not cut back on lending, as these institutions did not reduce risk-weighted assets in a downturn. As such, the results do not support the widely held view that banks with low capital buffers cut back on lending in order to increase capital buffers in a downturn, thereby further aggravating the contraction in economic activity.

Jokipii and Milne (2006) investigated the cyclical behaviour of bank capital buffers on capital regulation of European banks, under the old Basel 1988 Accord, using panel data over the period 1997 to 2004. Their objective was to determine the extent of the co-movement between this buffer and the cycle, and to determine whether such co-movement is country, bank type or bank size specific. They found that, for EU-15 countries, and controlling for individual bank costs and risks, there was a negative co-movement between capital buffers and the business cycle.[5] A main conclusion from their study is that, the negative co-movement of capital buffers, after implementation of Basel II, will exacerbate its pro-cyclical impact.

Boucinha & Ribeiro (2007) investigated the determinants of Portuguese banks' capital buffers using data from 1994 to 2004. The key determinants included in the study were risk measures including the ratio of provisions to non-performing loans (NPLs), a default ratio and stock holdings as a share of total assets. A ROA variable and its variance were included to measure the capacity of the institutions to absorb losses and a output variable was included to capture the impact of the business cycle on the bank's holdings of excess capital. The results showed a negative impact of the output gap on excess capital, not only suggesting that banks tend to cover the higher risks that arise in cycle downturns with higher capital reserves, but also that the lending behavior may be procyclical, in that it will tend to amplify economic cycles. The findings confirm the theory that banks adjust

[5] EU-15 represents the number of member countries in the European Union prior to the accession of ten candidate countries on 1 May 2004. The EU-15 is comprised the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.

their capital reserves in response to changes in the risks they face. That is, both those directly resulting from changes in the macro economic environment throughout the cycle and those resulting from banks' own decisions.

3.0 The Theoretical Framework

3.1 How is Bank Capital Determined?

The framework employed to evaluate the determinants of bank capital buffers is based on the model by Ayuso et al. (2002). This model starts with an equation, which is based on the literature on real investment which describes the dynamics of the capital stock of a representative single bank. Based on equation 1, k_t stands for the capital level at the end of period t and I_t stands for stock issues or repurchases plus retained profits during period t.

$$k_t = k_{t-1} + I_t \qquad (1)$$

In addition, the model captures the decision a bank makes on capital as a result of a tradeoff among three different types of costs related to capital levels (see Froot and Stein, 1998).
These costs are outlined in equation in 2:

$$C_t = (\alpha_t - \gamma_t) k_t + (1/2) \delta_t I^2_t \qquad (2)$$

Where α_t represents the costs of remunerating capital, γ_t represents the cost of failure (and/or penalties for not complying with the regulatory minimum), and δ_t reflects adjustment costs.[6] The costs of remunerating capital involve direct costs to the bank of holding capital. The opportunity cost of bank capital or the cost of remunerating capital

6 Assumptions include linearity between the first two groups of costs and symmetry in relation to adjustment costs.

may even be more costly than alternative bank liabilities such as deposits or debt (see Campbell (1979) and Majluf (1984)).

Secondly, holding sufficient capital reduces the probability for the bank to face costs related to not complying with compulsory capital requirements. Additionally, holding capital minimizes the probability of bankruptcy as well as costs related to loss of charter value, reputational costs and legal costs of the bankruptcy process (see Acharya, 1996).

The final cost represented in equation (2), has to do with adjustment costs as a result of changing the capital level. These costs are related to transaction costs as well as costs due to the presence of asymmetric information between buyers and sellers of stocks in the capital markets, which can increase or reduce adjustment costs.

Against this background, a typical bank minimizes its inter-temporal costs by solving the following problem:

$$\underset{\{I_{t+i}\}_0^{\infty}}{Min} \; E_t \sum_{i=0}^{\infty} \beta^i C_{t+i} \tag{3}$$

s.t.
$$C_t = (\alpha_t - \gamma_t) k_t + (1/2) \delta_t I^2{}_t \tag{4}$$

$$k_t = k_{t-1} + I_t \tag{5}$$

Based on first order conditions, equation 4 can be re-written as follows:

$$I_t = E_t \left(\frac{1}{\delta} \sum_{i=0}^{\infty} \beta^i (\gamma_{t+i} - \alpha_{t+i}) \right) \tag{6}$$

And therefore:

$$E_t(K_t) = K_{t-1} + E_t\left(\frac{1}{\delta}\sum_{i=0}^{\infty}\beta^i(\gamma_{t+i} - \alpha_{t+i})\right) \quad (7)$$

Subtracting the regulatory minimum from both sides of equation (7), and replacing expected capital by observed capital and including an expectation error term yielded the expression outlined in equation (8):

$$(K-\bar{K})_t = (K-\bar{K})_{t-1} + E_t\left(\frac{1}{\delta}\sum_{i=0}^{\infty}\beta^i\gamma_{t+i}\right) - E_t\left(\frac{1}{\delta_t}E_t\sum_{i=0}^{\infty}\beta^i\alpha_{t+i}\right) + \varepsilon_t \quad (8)$$

A more specific empirical model is outlined in equation (9), for the capital buffer (BUF_{it}) held by institution i in period t :

$$BUF_{it} = \beta_0 BUF_{i,t-1+}\beta_1 ROE_{it} + \beta_2 NPL_{it} + \beta_3 BIG_{it} + \beta_4 SMA_{it} + \beta_5 GDPG_{t+\eta_t} + \varepsilon_{it},$$

i=1,2,…, N (number of banks), t=1,2,…,T (9)

Where $BUF_{i,t-1}$ captures adjustment costs as a result of the bank increasing its buffer capital, while ROE represents the cost of remunerating excess capital and is expected to have a negative coefficient. The NPL variable captures the risk profile of the institution. After including the determinants of capital buffer based on the model described above, a GDP growth variable was also included in order to determine whether the business cycle has an additional effect on the capital buffer held by banking institutions. And BIG and SMA represent dummy variables to capture institution size, where BIG (SMA) take the value of 1 for the largest (smallest) banks based on asset size.

4.0 Empirical Analysis

4.1 Data

Two equations for bank capital were estimated for each sector in the banking system, which includes commercial banks, merchant banks and building societies, over the period February 2002 to March 2009 based on the model outlined in equation 9.[7] The data used in this study is an unbalanced panel of monthly balance sheet data for each of the three sectors, an indicative measure of economic activity and a proxy for cost of capital. A summary of the data statistics are presented in Tables 4 to 6 in the Appendix.[8]

Cost of capital is proxied by the average monthly 30-day private market rate, risk by the ratio of non-performing loans to total loans and changes in economic activity by growth in the money supply. The dependent variable for the excess capital equation (excess capital ratio) is measured as excess capital as a ratio of risk-weighted assets, while for the dependent variable for the total capital equation (total capital ratio) is measured as total capital as ratio of risk-weighted assets. Additionally, GOJ sovereign bonds as a share of total assets and shares as a proportion of total assets are also included in the analysis.[9] Dummy variables were also used to capture the impact of small and large banks, respectively.

The generalized method of moments (GMM) estimator was employed in the empirical assessment and is very useful in obtaining unbiased and efficient estimates in dynamic models with lagged endogenous variables as regressors. Against this background, the paper utilizes the GMM estimator developed by Arellano and Bond (1991). The procedure was applied to both equations.

[7] An excess capital equation and total capital equation were estimated.

[8] The study utilizes panel data, because of the advantage of capturing both differences across banks and time-series variation, as well as of allowing for meaningful statistical inferences even using a sample with a relatively small number of banks observed over an equally short time period. The explicit treatment of the model's dynamic is relevant not only to infer on the persistence of the dependent variable, but also to ensure that estimates for other parameters of the model are consistent.

9 This variable was included given potential for increased volatility in GOJ bond yields and likely marked to market losses to negatively impact earnings and impair capital.

The main advantages of this methodology consist in the possibility of obtaining consistent estimates for the parameters of interest when the persistence of the dependent variable needs to be explicitly modeled and not requiring strong hypotheses about the exogeneity of the regressors (see Bochina, 2008).

4.2 Results

4.2.1 *GMM Model /MERCHANT BANKS*

4.2.2 *Dynamic Panel Results*

Table 1a: Dynamic Panel Results

	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Excess Capital Ratio(-1)	0.908059	80.63635	0.68443	10.17773	0.850883	20.4051
Growth M2	-0.146169	-7.819126	0.191802	1.721919	-0.102489	-1.799846
COC	0.033532	2.121068	-0.030149	-0.264763	0.008247	2.43927
LoanS toTA	-0.028615	-2.702348	-0.251972	-31.66202	-0.146012	-4.020318
NPLTOTL	0.104796	1.14207	-0.010441	-0.08548	-	-
GOJ Sovereign to TA	0.130222	9.057384	0.034307	0.567282	-	-
Shares to TA	-0.455722	-2.297734	-1.510423	-9.63021	-	-
@LEV (@ISPERIOD ("2002"))	-0.009415	-2.052762	-0.018258	-1.345218	0.006508	0.905746
@LEV (@ISPERIOD ("2003"))	0.020436	1.316535	0.037625	3.155015	0.00785	2.55108
@LEV (@ISPERIOD ("2004"))	-0.015913	-3.851947	-0.033814	-2.191135	-0.037286	-1.465231
@LEV (@ISPERIOD ("2005"))	0.123299	1.618345	0.108073	1.761509	-0.03816	-2.248006
@LEV (@ISPERIOD ("2006"))	0.024048	2.409209	0.00542	0.984749	0.008972	0.278034
@LEV (@ISPERIOD ("2007"))	0.009467	0.55572	-0.004603	-0.229135	0.013529	2.079039
@LEV (@ISPERIOD ("2008"))	-0.018139	-1.790206	-0.018458	-8.033932	0.004735	0.293282
Effects Specification						
R-squared		0.8208		0.8301		0.8122
J-statistic		78.0883		57.015		29.3612
Sum Squared resid.		0.6423		0.5851		1.425
Instrument rank		87		86		86

Table 1b: Dynamic Panel Results						
	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Total Capital Ratio(-1)	0.945077	66.15944	0.673392	11.29773	0.850883	20.4051
Growth M2	-0.063238	-1.684433	0.22618	2.666005	-0.102489	-1.799846
COC	0.014433	0.53154	-0.031977	-0.22427	0.008247	2.43927
LoanS toTA	-0.020609	-0.98904	-0.265742	-21.97891	-0.146012	-4.020318
NPLTOTL	0.018821	0.22323	-0.017123	-0.205157	-	-
GOJ Sovereign to TA	0.129616	9.218918	0.033136	0.638439	-	-
Shares to TA	-0.362374	-3.065043	-1.537832	-10.76731	-	-
@LEV (@ISPERIOD ("2002"))	-0.004978	-0.690523	-0.020645	-1.756495	0.005434	0.600278
@LEV (@ISPERIOD ("2003"))	0.017027	1.254004	0.03693	3.5959	0.005222	13.12304
@LEV (@ISPERIOD ("2004"))	-0.021132	-3.00378	-0.035584	-2.020909	-0.018702	-11.52061
@LEV (@ISPERIOD ("2005"))	0.123308	1.650166	0.106916	1.752447	-0.022416	-157.8733
@LEV (@ISPERIOD ("2006"))	0.021158	2.865869	0.003903	0.649991	0.013614	1.771663
@LEV (@ISPERIOD ("2007"))	0.007752	0.419642	-0.005694	-0.27152	0.014711	2.348312
@LEV (@ISPERIOD ("2008"))	-0.016216	-1.538077	-0.019217	-9.362625	0.012633	8.795275
Effects Specification						
R-squared		0.8144		0.8292		0.8122
J-statistic		72.4457		58.4378		29.3612
Sum Squared resid.		0.6649		0.5884		1.425
Instrument rank		87		87		86

RESULTS: MERCHANT BANKS[10]

One of the key findings from the excess capital equation is that overall results show a significant inverse relationship between growth in the money supply and the excess capital ratio (see Table 1a).[11] This result indicates that during an expansion there are likely to be declines in the excess capital ratio, while the reverse is expected to occur during a contraction in economic activity. An implication of this result is that, for instance, during a downturn, to the extent that an increase in the excess capital ratio may be reflective of growth in excess capital or a decline in risk weighted assets, this may be the result of a reduction in loan supply; which is likely to further aggravate the downturn.

[10] In general, the instruments chosen in the empirical assessment were one lag of the loans to asset ratio, the ratio of non-performing loans to total loans and the cost of capital variable.
[11] Overall results relate to findings for 'All banks".

In other words, the policy implication of this is that institutions build up capital buffers when it is too late, only to further aggravate prevailing economic conditions and further jeopardize financial stability. Findings by bank size also confirm a negative and significant relationship between bank capital and money supply growth for the smaller merchant banks. This result reflects the fact that smaller institutions are more likely to increase buffer capital to avoid market and regulatory sanctions and to facilitate borrowing funds at lower interest rates. However, for the larger merchant banks, there is positive and significant relationship between growth in the money supply and excess capital holdings. This outcome suggests that larger merchant banks have stronger risk management practices, enabling them to identify and account for risks when economic activity accelerates by building capital buffers. As such, the build up in capital buffers during the period of expansion can then be utilized in the event of a downturn. In addition, the coefficient associated with the lagged dependent variable is positive and significant for both large and small merchant banks, presenting evidence in favour of the adjustment cost hypothesis. For all merchant banks, in particular smaller commercial banks, there is a positive and significant relationship between the cost of capital variable and excess capital. This is consistent with apriori expectations, in that, when there are increases in this variable, these institutions are likely to retain capital for satisfying future funding needs rather than substituting alternative liabilities.

Also, for merchant banks, overall findings show that an increase in GOJ sovereign bonds as a share of total assets results in higher capital buffers, suggesting that banks with higher exposure to market risk hold higher capital reserves in order to cover for the additional risk. However, overall results show that a higher weight of loans and stocks and shares as a proportion of total assets is associated with declines in the excess capital ratio. This impact is largely reflective of the resulting expansion in risk weighted assets.

The results showed similar findings for the total capital equation (see Table 1b). Most notably, findings for all merchant banks and for smaller merchant banks show a significant and inverse relationship between growth in the money supply and the total capital ratio. This suggests that for the sector, and in particular for the smaller merchant

banks, excess capital holdings may have influenced the performance of bank capital. Additionally, these results imply that there may be increased procyclicality under Basel II, given the anticipated increased sensitivity of capital requirements to the business cycle under the new Accord. Additionally, for the larger merchant banks, there is a positive and significant relationship between growth in the money supply and capital holdings.

4.3 Results

4.3.1 GMM Model/ COMMERCIAL BANKS

4.3.2 Dynamic Panel Results

Table 2a: Dynamic Panel Results

	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Excess Capital Ratio(-1)	0.927955	42.95414	0.856253	42.26902	0.965676	70.38426
Growth M2	-0.151202	-1.445029	-0.157352	-1.482519	-0.245477	-2.906133
COC	0.045507	2.241119	-0.009074	-0.382257	0.033173	3.130909
LoanS toTA	-0.008648	-1.545952	-0.082088	-3.912763	-0.02188	-2.652898
NPLTOTL	-0.17377	-1.212287	-0.150771	-1.157714	-0.097404	-2.01774
GOJ Sovereign to TA	0.048734	2.130923	-0.058883	-0.737292	-	-
@LEV (@ISPERIOD ("2002"))	-0.001023	-0.170198	-9.31E-05	-0.032332	-0.003871	-0.29192
@LEV (@ISPERIOD ("2003"))	0.003764	0.382574	-0.000959	-0.484359	0.006367	0.258843
@LEV (@ISPERIOD ("2004"))	-0.003484	-1.14822	-0.004271	-1.539021	-0.005622	-1.909526
@LEV (@ISPERIOD ("2005"))	0.015743	1.050041	0.004169	2.396324	0.02631	0.855415
@LEV (@ISPERIOD ("2006"))	-0.001099	-0.54113	-0.00083	-0.629506	-0.006773	-1.008837
@LEV (@ISPERIOD ("2007"))	0.010146	1.645642	0.004982	0.787192	0.013389	1.364473
@LEV (@ISPERIOD ("2008"))	-4.80E-05	-0.006881	0.012862	2.407693	-0.008941	-2.154441
Effects Specification						
R-squared		0.9292		0.9683		0.9021
J-statistic		69.005		60.713		71.7034
Sum Squared resid.		0.3323		0.0648		0.2693
Instrument rank		87		87		88

Table 2b: Dynamic Panel Results						
	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Total Capital Ratio(-1)	0.951962	43.66013	0.855914	43.44087	0.953948	63.16448
Growth M2	-0.16726	-1.353204	-0.156744	-1.491351	-0.361517	-2.643453
COC	0.043017	2.153063	-0.097281	-0.371641	0.045187	1.555919
LoanS toTA	-0.005128	-0.971154	-0.082029	-3.902724	-0.028283	-2.801881
NPLTOTL	-0.08537	-1.414777	-0.151329	-1.180911	-0.284759	-2.044721
GOJ Sovereign to TA	0.04926	1.81117	-0.058524	-0.729559	-	-
@LEV (@ISPERIOD ("2002"))	-0.001517	-0.251104	-7.41E-05	-0.025417	-0.000904	-0.070737
@LEV (@ISPERIOD ("2003"))	0.003088	0.3039	-0.000974	-0.485045	0.007943	0.304388
@LEV (@ISPERIOD ("2004"))	-0.003048	-1.059126	-0.004264	-1.556829	-0.006113	-3.53046
@LEV (@ISPERIOD ("2005"))	0.015682	0.97298	0.004162	2.367349	0.028183	0.953082
@LEV (@ISPERIOD ("2006"))	-0.001672	-0.574562	-0.000844	-0.64662	-0.004439	-0.834994
@LEV (@ISPERIOD ("2007"))	0.010154	1.625518	0.004967	0.785175	0.013745	1.407175
@LEV (@ISPERIOD ("2008"))	-0.000169	-0.020574	0.012828	2.397794	-0.007432	-3.674329
Effects Specification						
R-squared		0.9271		0.9683		0.9010
J-statistic		68.4824		60.6837		73.269
Sum Squared resid.		0.3447		0.0648		0.2693
Instrument rank		87		87		87

RESULTS: COMMERCIAL BANKS

In contrast to the merchant banks, overall results for the commercial banking sector show that there is no significant relationship between growth in the money supply and excess capital (see Table 2a). However, findings by bank size show a significant inverse relationship between growth in the money supply and excess capital holdings for the smaller commercial banks. For the larger commercial banks, there is an insignificant relationship between growth in the money supply and excess capital holdings. The results in relation to cost of capital are similar to those obtained for the merchant banks. Findings for the overall sector and for the smaller commercial banks show a positive and significant relationship between cost of capital and excess capital holdings.

Results for the overall sector show an insignificant relationship between deterioration in loan quality and excess capital holdings. There were similar findings for the larger commercial banks. However, for smaller commercial banks, deterioration in loan quality is associated with declines in the excess capital ratio, and may reflect the impact of a greater level of provisioning by these institutions in response to the increased default risk.[12]

Similar to the merchant banks, results for all commercial banks show a positive and significant relationship between the ratio of GOJ sovereign bond holdings to total assets and the excess capital ratio. This suggests that a higher weight of GOJ sovereign bonds as a proportion of assets results in these institutions holding higher capital buffers as a means of covering additional exposure related to market risk. In addition, the overall findings show that increases in the loan to asset ratio is associated with declines in the excess capital ratio, largely reflecting the impact on risk weighted assets as a result of the growth in loan holdings.

For the total capital equation, the results also show an insignificant relationship between growth in the money supply and bank capital for all commercial banks and for larger commercial banks (see Table 2b). For the smaller commercial banks, similar to the finding from the excess capital equation, there is a significant inverse relationship between growth in the money supply and bank capital. Nonetheless, the findings for other determinants of bank capital are largely consistent with the findings from the excess capital equation across all banks.

[12] Increased provisioning is a substitute for holding higher capital.

4.4 Results

4.4.1 GMM Model /Building Societies
4.4.2 *Dynamic Panel Results*

Table 3a: Dynamic Panel Results

	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Excess Capital Ratio(-1)	1.012613	71.23733	1.014542	61.38285	1.008353	63.86466
Growth M2	-0.028348	-0.849255	-0.032485	-0.963728	-0.028939	-0.810322
COC	0.013953	1.375687	0.012957	0.012957	0.012436	1.099655
Loans to TA	-0.006801	-2.592217	-0.00704	-2.532119	-0.010161	-2.590507
NPLtoTL	0.018315	0.045806	0.025087	0.468351	0.01771	0.36179
GOJ Sovereign to TA	-0.022275	-0.627209	0.009825	0.187037	0.006958	0.158431
@LEV (@ISPERIOD ("2002"))	0.011684	5.23706	0.011683	4.632709	0.011153	4.894417
@LEV (@ISPERIOD ("2003"))	0.002759	0.718446	0.002443	0.543159	0.002712	0.706885
@LEV (@ISPERIOD ("2004"))	0.006127	1.828824	0.006364	1.654198	0.005946	1.914018
@LEV (@ISPERIOD ("2005"))	0.001346	0.437019	0.001357	0.439971	0.001165	0.301579
@LEV (@ISPERIOD ("2006"))	0.001149	0.278404	0.002371	0.562861	0.001223	0.255671
@LEV (@ISPERIOD ("2007"))	0.004706	1.530192	0.005321	1.819147	0.005336	1.468505
@LEV (@ISPERIOD ("2008"))	0.003564	0.4883	0.00365	0.51276	0.004034	0.527046
Effects Specification						
R-squared		0.9917		0.9916		0.9917
J-statistic		60.201		57.7368		53.8703
Sum Squared resid.		0.0354		0.0356		0.0351
Instrument rank		87		87		87

Table 3b: Dynamic Panel Results

	All Banks		Large Banks		Small Banks	
	GMM	t-Statistic	GMM	t-Statistic	GMM	t-Statistic
Total Capital Ratio(-1)	1.011983	90.95128	1.013094	78.35096	1.007938	81.59394
Growth M2	-0.028878	-0.892728	-0.033407	-1.012699	-0.030292	-0.890709
COC	0.012395	1.275937	0.011897	1.125513	0.011976	1.099804
Loans to TA	-0.00789	-2.42487	-0.008202	-2.320956	-0.010422	-2.432261
NPLtoTL	0.018193	0.438048	0.023003	0.480169	0.015932	0.359958
GOJ Sovereign to TA	-0.032227	-0.855477	-0.003535	-0.068594	-0.002458	-0.052376
@LEV (@ISPERIOD ("2002"))	0.011596	5.202734	0.011605	4.785088	0.011233	4.899401
@LEV (@ISPERIOD ("2003"))	0.002838	0.736971	0.002876	0.73487	0.002806	0.72991
@LEV (@ISPERIOD ("2004"))	0.006105	1.788598	0.006198	1.920043	0.005998	1.924855
@LEV (@ISPERIOD ("2005"))	0.001408	0.486621	0.001382	0.40211	0.001279	0.345705
@LEV (@ISPERIOD ("2006"))	0.001123	0.273463	0.001372	0.288884	0.001267	0.265314
@LEV (@ISPERIOD ("2007"))	0.004612	1.650409	0.005123	1.75511	0.005266	1.574791
@LEV (@ISPERIOD ("2008"))	0.003729	0.509448	0.003931	0.51002	0.00412	0.536788
Effects Specification						
R-squared	0.9917		0.9916		0.9917	
J-statistic	62.6693		59.769		56.2294	
Sum Squared resid.	0.0353		0.0355		0.035	
Instrument rank	87		87		87	

RESULTS: BUILDING SOCIETIES

Results for the building societies' sector show that there is no significant relationship between growth in the money supply and excess capital (see Table 3a). Regarding the other determinants of excess capital, as in the case of the merchant banks and commercial banks, there is a negative and significant relationship between the loan to asset ratio and excess capital, and this result holds regardless of bank size.

Of importance, unlike for the other sectors, the overall results show an insignificant relationship between the ratio of GOJ sovereigns to total assets and the excess capital ratio. This finding is not surprising for the building societies given the relatively lower of share of GOJ sovereigns as a ratio of total assets for this sector.

For the total capital equation, the results also show an insignificant relationship between growth in the money and bank capital, regardless of bank size (see Table 3b). In addition, the findings for other determinants of bank capital are largely consistent with results from the excess capital equation.

8.0 Conclusion & Policy Implications

The main purpose of the study was to investigate the impact of economic activity on bank capital in Jamaica during the period 2002 to 2009. This is accomplished through the estimation of a dynamic panel framework, which includes as one of the determinants, an indicative measure of growth in economic activity. The motivation for the study stems from ongoing debate that risk based capital requirements, in particular the Basel II accord, is anticipated to result in bank capital reinforcing economic cycles. This is anticipated to occur in a context where there is expected to be increased sensitivity of capital charges to changes in the economic cycle. This is expected to materialize because capital requirements or charges will be revised to take into account a more dynamic assessment of the credit rating of borrowers which is based on the stage of the economic cycle. While this will give a better assessment of the true capital charges facing the institution, it could jeopardize macroeconomic and financial stability by reinforcing the state of an economic cycle. As such, in anticipation of the introduction of the Basel II accord in some economies, many authors have explored the relationship between economic activity and bank capital buffers, particularly in a context where most institutions hold capital well in excess of the minimum regulatory requirement.

Against this background, this study is intended to provide local regulators and policymakers with evidence on the relationship between bank capital and economic activity under the existing Basel accord. Evidence from the study is useful in understanding whether capital buffers can be a useful tool in mitigating procyclicality, particularly in a context where this may increase with the introduction of the new Accord. The study also examines the importance of other determinants of bank capital, which is also important in understanding the risk motives of these institutions.

Based on the results of the model, there is evidence for the commercial banks and merchant banks that bank capital is likely to reinforce economic cycles, driven by the smaller institutions. One implication of this result is that banks are unlikely to build up buffers during expansions and, as such, are more likely to have difficulties meeting capital requirements and offsetting losses when there is a downturn in the business cycle. This is of concern for regulators, given that based on the findings, capital buffers would not help in offsetting any increased procyclicality of risk sensitive capital requirements under Basel II.

Based on an April 2009 report by the Financial Stability Forum, there are various approaches regulators can employ to address increased procyclicality in the financial system. Some of the recommendations from the report are that regulators should employ techniques to strengthen the regulatory framework so that the quality and level of capital in the banking system increase during strong economic conditions, which can be drawn down during periods of economic and financial stress. In addition to this, regulators should maintain close monitoring and surveillance of the financial system during periods of economic downturn. Secondly, regulators should employ enhanced stress testing practices to inform the build up of capital buffers above the regulatory minimum during periods of economic expansion. This is in an effort to fully capture potential areas of vulnerabilities, as well as risks which may materialize in the event of a downturn. This would involve regulators continually revising stress testing in relation to financial developments and the banks' evolving risk profile. Additionally, similar to what has been done by the Bank of Spain; a dynamic provisioning can be employed, which is also useful in dampening procyclicality. Under this technique, banks make provisions based on the losses expected when loans are originated. This would result in a rising stock of provisions when actual losses are low, which would help to protect banks in periods when actual losses are high.

An important finding is that merchant banks cover additional market risk associated with holding an increasing share of GOJ sovereigns by holding higher capital buffers. This is

also the case for the commercial banking sector. For the larger merchant banks, there is positive and significant relationship between growth in the money supply and excess capital holdings. The implication of this is that these institutions are more likely to identify and account for risks when economic activity accelerates, by building capital buffers, which can be utilized in the event of a downturn. While findings show that for smaller commercial banks, there is a significant inverse relationship between growth in economic activity and excess capital holdings, providing evidence of procyclicality or the likelihood for banking activity to reinforce economic credit cycles.

References

Borio, C., Furfine, C., Lowe, P., "Procyclicality of the Financial System and Financial Stability: Issues and Policy Options" *BIS Papers No. 1*.

Ismail, A., and Sulaiman,A., (1986). "Cyclical Patterns in Profits, Provisioning and Lending of Islamic Banks and Procyclicality of the New Basel Capital Requirements.

Ayuso, J., and Perez, D. and Saurina, J, (2002), "Are Capital Buffers Pro-Cyclical? Evidence from Spanish Panel Data," Banco de Espana, Research Working Paper 0224.

Ismail, A., Sulaiman, A., "Cyclical Patterns in Profits, Provisioning and lending of Islamic Banks and Procyclicality of the New Basel Capital Requirements.

Andritzy, J., Kiff, J., Kodres, L., Madrid, P, Maechler, A., Sacasa, N., Scarlata, J. (2009) "Policies to Mitigate Procyclicality", IMF Staff Position Note.

Jokipii, T., Milne, A. (2007) "The Cyclical Behaviour of European Capital Buffers", Report, Swedish Institute for Financial Research.

Taylor, A., and Goodhart, C., (2004) "Procyclicality and Volatility in the Financial System: The Implementation of Basel II and IAS 39".

Amato, J., Furfine, C., (2004). "Are Credit Rating Procyclical?," *Journal of banking and Finance*, Vol. 28 (November), pp. 2641-77.

Heid, F., (2005) “Cyclical Implications of Minimum Capital Requirements”, Deutsche Bundesbank Discussion Paper.

Rochet, J., (2008) “Procyclicality of Financial Systems: Is there a need to Modify Current Accounting & Regulatory Rules?” *Article*, Toulouse School of Economics.

d’Avack, F., and Levasseur, S., (2007) “The Determinant of Capital Buffers in CEEs,”*Working Paper*.

Gropp, R., (2007) “What can Corporate Finance say about Banks’ Capital Structures?”.

Boucinha, M., and Ribeiro, N., (2007) The Determinants of Portuguese Banks’ Capital Buffers, Article, Financial Stability Report, Banco de Portugal.

Dodd, R., (2004) “The Virtues of Prudential Regulation in Financial Markets,” *Financial Policy Forum*, Derivatives Study Center.

Stolz, S., and Wedow, M., (2005). “Banks’ Regulatory Capital Buffer and the Business Cycle: Evidence for German Savings and Commercial Banks”, Discussion Paper Series 2: Banking and Financial Studies, No. 7. (2005), Deutsche Bundesbank Research Centre.

Furfine, C., (2000), “Evidence on the Response of US Banks to Changes in Capital Requirements,” BIS Working Papers, No. 88.

APPENDIX

Figure 1

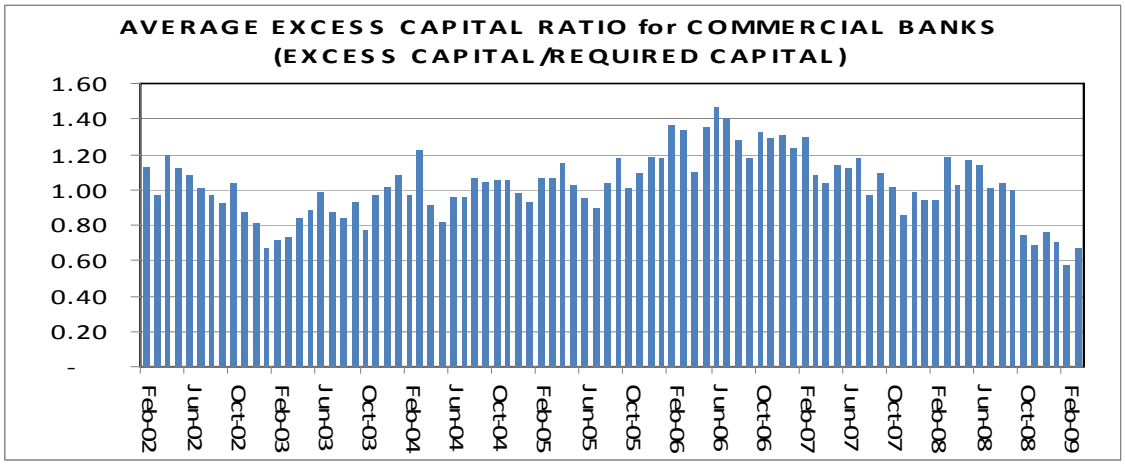

Figure 2

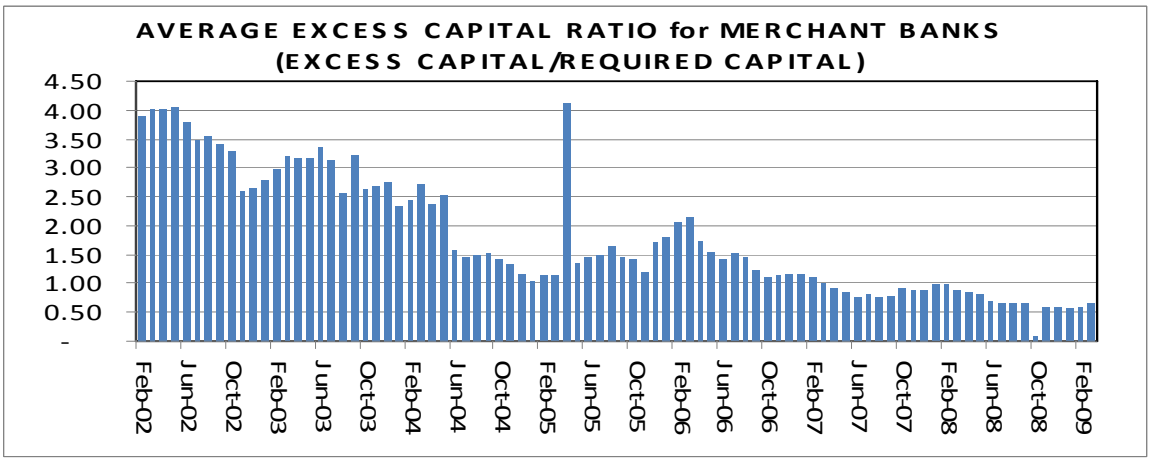

Figure 3

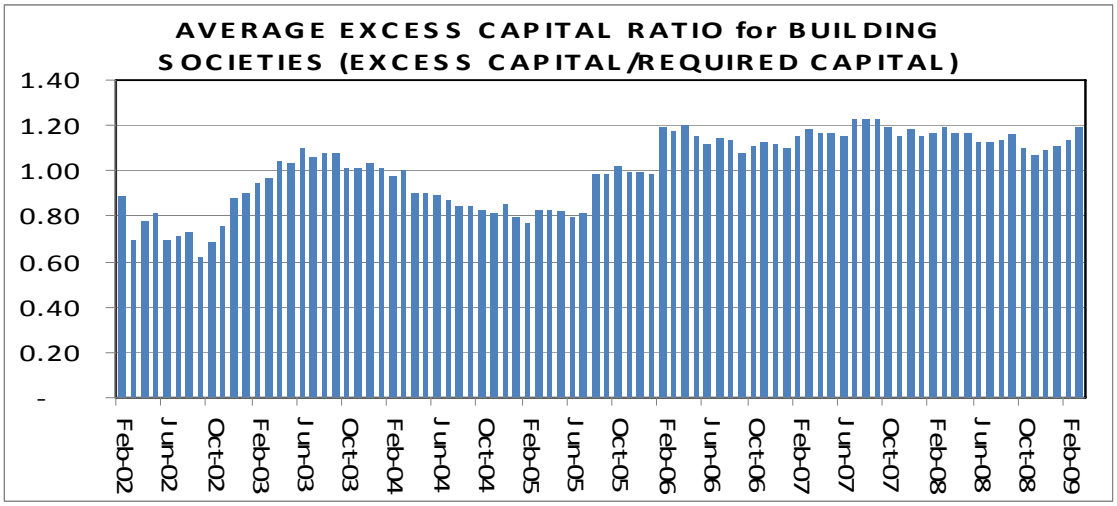

Figure 4

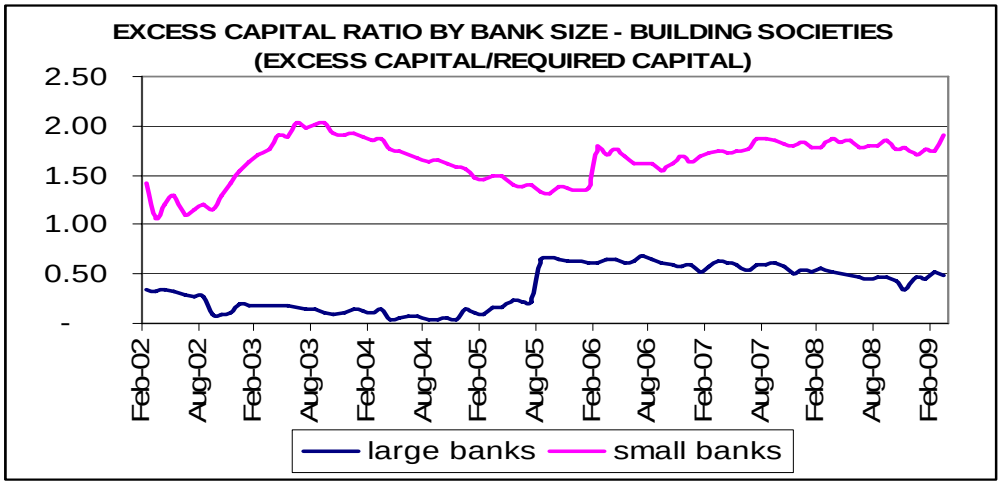

Figure 5

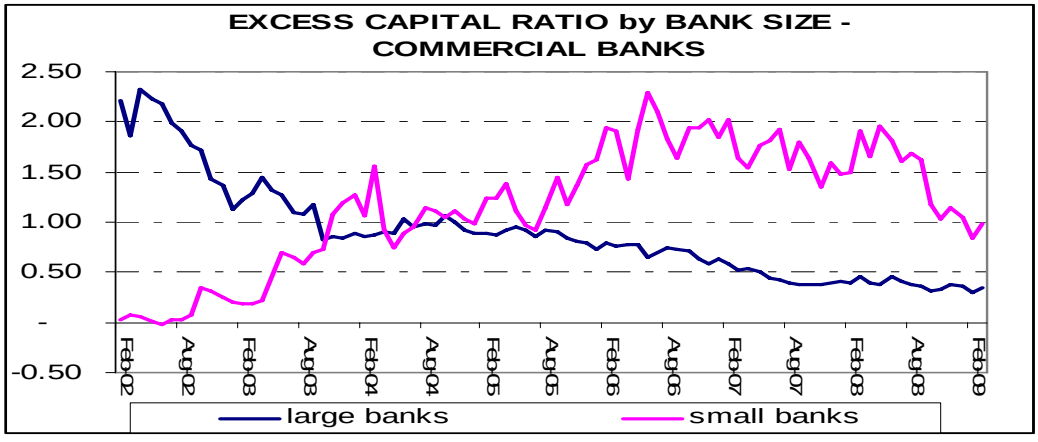

Figure 6

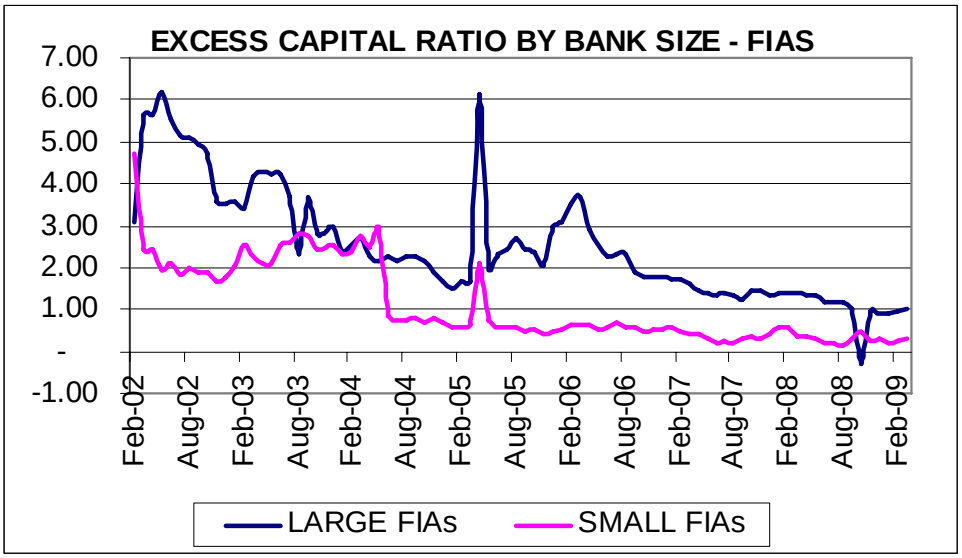

Table 4: Summary Statistics - COMMERCIAL BANKS

	EC	GM2	COC	LOANSTA	NPLTOTL	GOJSTA
Mean	0.097943	0.000709	0.158393	0.315000	0.026964	0.097612
Median	0.059198	0.000200	0.140000	0.320000	0.020000	0.080000
Std. Dev.	0.105931	0.001167	0.050249	0.140081	0.025562	0.086647
Skewness	1.366869	2.623706	2.242343	0.146656	4.468303	1.028531
Sum	43.87847	0.317520	70.96000	141.1200	12.08000	43.73000
Sum Sq. Dev.	5.016001	0.000609	1.128643	8.771400	0.292071	3.355944
Observations	448	448	448	448	448	448

Table 5: Summary Statistics - Merchant banks

	EC	GM2	COC	LOANSTA	NPLTOTL	SHARESTA	GOJSTA
Mean	0.253434	0.000742	0.158976	0.259578	0.051747	0.018434	0.201325
Median	0.250000	0.000205	0.140000	0.235000	0.030000	0.020000	0.175000
Std. Dev.	0.147536	0.001180	0.048550	0.177161	0.046891	0.015491	0.139430
Sum	42.07000	0.123130	26.39000	43.09000	8.590000	3.060000	33.42000
Sum Sq. Dev.	3.591543	0.000230	0.388926	5.178670	0.362793	0.039593	3.207708
Observations	166	166	166	166	166	166	166

Table 6: Summary Statistics - Merchant banks

	EC	GM2	NPLTOTL	LOANSTA	GOJSTA	COC
Mean	0.100809	0.000707	0.036424	0.539622	0.027122	0.156279
Median	0.044762	0.000200	0.030000	0.450000	0.010000	0.140000
Std. Dev.	0.111588	0.001163	0.022800	0.206517	0.030480	0.047835
Sum	34.67828	0.243360	12.53000	185.6300	9.330000	53.76000
Sum Sq. Dev.	4.270995	0.000464	0.178302	14.62865	0.318651	0.784837
Observations	344	344	344	344	344	344