The Global Financial Crisis and its Impact on Australian Bank Risk

Bernard Bollen\textsuperscript{a}
Michael Skully\textsuperscript{b}
David Tripe\textsuperscript{c}
Xiaoting Wei\textsuperscript{b}
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FOR COPIES PLEASE CONTACT:
UNE Business School
University of New England
Armidale NSW 2351
Tel: 02 6773 2432
Fax: 02 6773 3596
Email: unebsop@une.edu.au

AUTHOR AFFILIATIONS:
*Bernard Bollen, University of New England, Armidale*
*Michael Skully, Monash University, Melbourne*
*David Tripe, Massey University, Palmerston North, NZ*
*Xiaoting Wei, Monash University, Melbourne*
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Bernard Bollen
bbollen@une.edu.au
Phone: (02) 6773 2838
UNE Business School
University of New England
Armidale NSW 2351

Michael Skully
Monash University
Melbourne Victoria

David Tripe
Massey University
Palmerston North, New Zealand

Xiaoting Wei
Monash University
Melbourne Victoria

Tel: 02 6773 2432 • Fax: 02 6773 3596
Email: unebsop@une.edu.au
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ABSTRACT

This paper examines the global financial crisis (GFC) and its impact on Australian banking risk. An augmented market model is developed to identify changes in listed Australian bank systematic risk in relation to three key events: the GFC’s start in August 2007, the market downturn in Australian and global share markets in January 2008, and the announcement of Australia’s Deposit and Wholesale Funding Guarantee (DWFG) scheme on 12 October 2008. The study also examines changes in bank systemic risk during these event periods. The Australian market offers a unique opportunity to observe the impact of the introduction of the DWFG in that it lacked any explicit deposit insurance prior to the crisis. Initially the crisis period had little impact on bank systematic risk whilst bank systemic risk increase considerably. The share market downturn caused a marked increase in both systematic and systemic risk for Australia’s major internationally connected banks followed by a reduction in both systematic and systemic risk with the introduction of the guarantee scheme for all Australian banks.

Keywords: G28, Global financial crisis, bank guarantees, Australian banks, deposit insurance

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1. INTRODUCTION

During the global financial crisis (GFC) of 2007 – 2009 the Australian economy performed relatively well compared to other countries. Nevertheless the government introduced several policies to minimise its impact and to promote economic recovery. One of these was its Deposit and Wholesale Funding Guarantees (DWFG) scheme.\(^1\) According to the then prime minister, Kevin Rudd (2008), these measures were designed to "reassure Australian depositors that their deposits are safe and that they can have full confidence in the Australian financial system." They would also "assist Australia's financial institutions weather the global financial turbulence." Thus bank runs would be avoided and Australian institutions could raise funds competitively with their international (also home government guaranteed) counterparts. Arguably, the DWFG should have reduced bank liquidity risk (Diamond and Dybvig, 1983; Santos, 2006) although some researchers (Demirgüç-Kunt & Detragiache, 2002) believe that a deposit guarantee would cause a moral hazard problem, increasing bank risk.

Our aim in this paper is to examine the events related to the GFC and their impact on bank systematic and systemic risk in Australia, with particular focus on whether they increased or decreased with the DWFG’s introduction. Systematic risk is a measure of a bank’s sensitivity to changes in the wider economy. Systemic risk on the other hand is related directly to the possibility of a bank default. Acharya (2009, p. 224) defines systemic risk in relation to a financial crisis as one where “many banks fail together, or if one bank’s failure propagates as a contagion causing the failure of many banks.”

In order to analyse systematic risk, an event period from 1 January 2007 to 31 May 2012 is employed using an augmented market model. An examination of changes in portfolio and market standard deviations as well as changes in the correlation between portfolio and market returns during the event periods allow us to offer some conclusions relating to changes in systemic risk. We find no significant change in systematic risk at the start of the global crisis in 2007 but a considerable increase in systemic risk. A major increase in the systematic risk of the major Australian banks (but not the smaller banks) was observed after the January 2008 fall in Australian and global stock markets. Both major and smaller banks, however, saw an increase in systemic risk during this period. Conversely, the DWFG in October 2008 resulted in a significant decrease in both systemic and systematic risk for the major banks and smaller banks. These results suggest that the DWFG, as expected, has helped to control bank risks effectively.

Following the 2007 subprime mortgage crisis, many US subprime lenders or institutions with investments in subprime assets were severely affected and some even went bankrupt. Given these events, savers became concerned about the safety of their bank deposits –

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\(^1\) The Deposit and Wholesale Funding Guarantee announcement comprised two schemes: one for retail deposits up to a threshold of AS$1 million; and one for wholesale funding to include individual deposits in excess of AS$1 million and other wholesale funding liabilities. The latter guarantee required a specific individual guarantee and premium payment (paid by the institution or the client), whereas the former had no direct cost or administrative requirements for either the banks or their clients (Australian Government, 2008).
despite the USA's explicit deposit insurance scheme. In contrast, the Australian economy and hence the local banks felt much less impact from the crisis and showed a relatively steady performance compared to their international counterparts. However, in order to overcome the potential effect of the crisis and to mitigate depositor concerns regarding their banks, the Australian government introduced the DWFG scheme on 12 October 2008. While this was some 14 months after the start of the GFC, it followed the severe market distortions caused by the collapse of Lehman Brothers in September, the guarantees by many overseas governments of their banks, and increases in their national deposit insurance coverage (see Appendix 1). As Australian Treasurer, Wayne Swan (2010) later explained, this was done “in the face of severe dislocation of global credit markets which forced most G20 member countries to introduce some form of funding guarantee.” The DWFG scheme guaranteed Australian banks’ retail deposits and wholesale funding in case of insolvency and so limited the possibility of a bank run. It was hoped that this would help banks continue their business as usual, avoiding any temporary financial difficulties caused by the crisis.

While the Australian DWFG scheme was just one of many global responses to the crisis, its unique aspects justifies its investigation and so motivates this research. The first aspect is that unlike most advanced countries, Australia lacked an explicit deposit insurance scheme prior to the crisis. The DWFG’s impact on bank risk can thus be observed directly without the confounding impact of an existing deposit insurance program. Also unlike other 2008 guarantee plans, the Australian version had no formal ending date; it would simply be reviewed three years later. It also applied to all authorised deposit taking institutions and so included credit unions and building societies as well as banks. Whilst the DWFG’s retail deposit guarantee was provided at no direct cost, each individual wholesale guarantee was subject to a credit rating based risk adjusted premium which operated with a wider spread of premium charges and covered a longer period with up to a five year maturity (Black & Schwartz, 2010).

This study is one of relatively few internationally which has been able to observe the effects of the introduction of a deposit insurance or guarantee scheme where one did not previously exist. Wagster (2007) looked at the impact of the introduction of deposit insurance in Canada in the 1960s, and found that banking sector risk increased. Karas et al. (2013), looking at the introduction of insurance for household deposits in Russia in 2004, found that households became less sensitive to banking risk (as reflected in capitalisation) following the scheme’s introduction. Our study is more similar to Wagster’s, in that we look at the impact of the DWFG’s introduction on the banks.

The remainder of this paper is structured as follows. Part two introduces the scheme and the background to its introduction. Part three contains the literature review. Part four discusses the data and methodology employed. Part five outlines our results for the systematic risk analysis and part six outlines our results for the analysis of systemic risk. These results are discussed in Part seven. Part eight concludes the paper.

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2 This implicit versus explicit position is discussed in some detail in Dennis, Sharpe and Sim (1998).
2. Background

The 2007 subprime mortgage crisis was triggered by the end of the US housing bubble which resulted in a drop of housing prices. From August 2007, many countries experienced a credit crunch. This led to several central banks, including the European Central Bank, the Bank of England and the US Federal Reserve, injecting cash into the market enhancing liquidity and cutting interest rates. Some banks, including UBS and Citigroup, reported severe losses on the sub-prime related investments. All of these events signalled the start of a global financial crisis which later brought most countries into varying degrees of recession.

During late 2007, Australia and its banks seemed immune to the credit crunch. The Reserve Bank of Australia actually increased local interest rates when most other countries were cutting theirs. However, in January 2008 when the global share markets experienced a huge fall, the Australian share market became unstable and Australian banks suffered accordingly. Then, following the Lehman Brothers’ failure, many countries introduced deposit guarantees (Schwartz, 2010). To ensure Australian banks were not disadvantaged, the Australian government announced its own scheme on 12 October 2008. As the then Prime Minister told the country, the "Australian government guaranteed all deposits of Australian banks, building societies and credit unions and Australian subsidiaries of foreign-owned banks" for a period of three years with no limit on the deposits covered (Rudd, 2008). The DWFG was to operate as part of a new retail deposit focused, Financial Claims Scheme but would “also guarantee wholesale term funding of Australian incorporated banks and other authorised deposit-taking institutions" in return for a fee (Rudd, 2008).

This approach reflects the structure of the Australian banking system which then comprised five (now four) major local banks, 9 smaller regional banks, 11 local banking subsidiaries of foreign banks, and 29 foreign banks operating as branches. The larger banks dominated the market with some 65% of the local bank assets. In contrast other local banks had 15% and the foreign bank subsidiaries and foreign bank branches held 7% and 13% respectively. These banks are all covered under the same legislation but the branches of foreign banks, due to their overseas incorporation, are not allowed to accept retail deposits within Australia. This difference is important in understanding the DWFG’s much more restrictive coverage of these foreign bank branches.

Unlike the approach to deposits, the wholesale guarantee’s coverage of eligible non-deposit debt obligations was intended to be withdrawn once international markets returned to normal. In response, an A$ 1 million coverage limit on any individual's deposits with one institution was announced on 24 October 2008 with effect on 28 November 2008 (Swan, 2008). Smaller deposits would continue to be guaranteed at no direct cost to the depositor or institution. Larger deposits (over $1 million) would then be charged the same fee as other wholesale funding. The fees were charged monthly depending on the issuer’s credit rating with 70 basis points for issuers with AA rating, 100 basis points for an A rating, and 150 basis points for a BBB or no rating. Unlike the Financial Claims Scheme’s free retail deposit coverage, institutions needed to apply and
pay for each large deposit or other wholesale liability covered under the scheme; this was voluntary where the former was compulsory. If the DWFG scheme achieved its objective, a decrease in bank systematic risk should be observed after its introduction. As discussed in the next section, however, many academics have argued that such guarantees may actually increase bank risk.

3. Literature Review

As deposit insurance and guarantees both protect depositors and prevent bank runs so as to reduce liquidity risk, the terms are used interchangeably within this paper. Deposit insurance is designed to limit depositors’ fears, prevent bank runs, and therefore reduce bank liquidity risk. Some studies, such as Yin et al. (2002) find that risk-based deposit insurance and risk-based capital adequacy related regulation are adequate substitutes in controlling bank risk. Gropp and Vesala (2004) also show reduced systematic and asset risk for banks with the introduction of deposit guarantees in the European Union. Similarly, Anginer et al. (2012), examining banks across 96 countries, also document the effectiveness of deposit guarantees at lowering bank risk and promoting systemic stability during the global financial crisis.

Although the preceding comments suggest a reduction in risk, other arguments suggest that deposit insurance may increase risk, because of moral hazard. This refers to the banks’ incentives to take excessive risks at the expense of others (Demirguc-Kunt & Detragiache, 2002). The problem is that if risky investments result in higher returns, the bank enjoys the benefits whereas if the bank fails, the insurer must compensate depositors. Banks hope that the greater risk associated with the expected higher returns will benefit them but tend to ignore the potential losses, which are borne by others. Additionally, once the depositors feel their deposits are safe because of deposit insurance, their incentives to monitor banks are diminished and their demand for risk based compensation is lowered. Less depositor monitoring then may give banks incentives to take more risk (Demirguc-Kunt and Kane, 2002; Barth et al., 2004).

The flat-rate deposit insurance premium used by many countries has only a limited mitigation of the moral hazard problem (Horvitz, 1975; Gueyie & Lai, 2003 and Santos, 2006). Risk-adjusted deposit insurance rates have been tried but have not solved the problem. Firstly, banks with higher assessed risks would simply seek more risky investments and hope that their expected higher returns will cover the extra premium (Goldberg & Harikumar, 1991). Secondly, due to data availability and accuracy as well as the complexity of risk assessment process, an accurate quantification of the risks becomes problematic (Ronn and Verma, 1989). A few pricing methods have been developed. For example, Merton (1977) derived a formula from an option pricing model to determine the deposit insurance premium. Others have used the arbitrage pricing model (Acharya and Dreyfus, 1989; Allen and Saunders, 1998; Fries, Mella-Barral and Perraudin, 1997). Because of their underlying assumption of complete and perfect markets, they do not work so well in practice. Later models incorporated asymmetric information (Chan et al. 1992), but none of the research to date has been definitive. Theoretical models based upon restrictive assumptions can result in estimated premiums not fully reflecting bank risk, and
consequently banks may still seek excessively risky investments. Thirdly, in financial markets where deposit insurance is voluntary, the banks seeking deposit insurance may well be the banks at most risk. These more risky banks see their premiums as costing less than the value of deposit insurance and so can benefit. Wheelock and Wilson (1994) and Chiang et al. (2007) both showed that under a voluntary deposit insurance system, banks with deposit insurance had lower capital levels and higher failure rates than those without deposit insurance. Lastly, as Schich (2008) noted, the level of coverage is very important to the effectiveness of the deposit insurance or guarantee policy. Therefore, the Australian deposit guarantees, whose increase from zero to A $1 million dollar coverage is much larger than the USA US $ 100,000 to $250,000 increase, should have proven more effective in reducing bank risk.

While Australia's introduction of the DWFG is the key focus of this paper, it is important for it not to be judged out of context. Three research questions are therefore proposed. The first is whether Australian bank systematic and systemic risk changed with the start of the financial crisis on 1 August 2007? The second is whether the sharp decline in the Australian and global share markets in late November 2007 had an impact? The third is whether the announcement of the guarantee on 12 October 2008 changed the level of systematic and systemic risk among Australian banks? Given the marked difference in size between Australia's major and other banks, these questions will be examined through the use of two portfolios (big banks and small banks) so as to capture any "too big to fail" effect.

4. Data and Methodology

Seven currently listed\(^1\) Australian commercial banks - Australia and New Zealand Banking Group Limited (ANZ), Commonwealth Bank of Australia (CBA), National Australia Bank Limited (NAB), Westpac Banking Corporation (WBC), Bank of Queensland Limited (BOQ), Bendigo and Adelaide Bank Limited (BEN) and Suncorp-Metway Limited (SUN) - form our sample. Unlike some developed countries, Australia has a relatively concentrated banking industry. Together, the 'big four' banks (ANZ, CBA, NAB and WBC) comprise some 80% of domestic bank assets at February 2012. Therefore, the results derived from this study should well represent Australian banks.

Our methodology to examine changes in systematic risk utilises an augmented market model. In order to implement this model, excess market returns and the excess return of each bank are computed. Daily stock returns and market returns are collected from the DataStream database over the sample period, 2 January 2007 to 31 May 2012. In total there were 1,412 daily return observations for each bank. Daily stock returns are

\(^3\) The other local banks are not listed but for Macquarie which is effectively an investment bank. Given the difference in its operations from the other commercial banks, Macquarie is excluded from the sample.
calculated as  \( r_t^* = \ln\left( \frac{p_t + d_t}{p_{t-1}} \right) - \tau_{f, t} \) where \( r_t^* \) is the dividend adjusted excess stock return, \( p_t \) is the closing price, \( d_t \) is the dividend payment and \( \tau_{f, t} \) is the risk free rate of return on day \( t \).

Two candidates present themselves as potential proxies for the market index. The first is the All Ordinaries index which is the weighted average of the value of the 500 largest firms trading on the Australian Stock Exchange (ASX). However Australia is a very open economy and thus a global market equity index such as the MSCI world index would also seem a plausible second candidate to be employed as a proxy for the market index. Pre testing of the data revealed considerable differences in the use of these two market indexes. Whilst regressions on returns on a portfolio of big and small banks on the return on the All Ordinaries index had an \( R^2 \) of 67.9% and 56.1% respectively, a similar regression using the MSCI world index had an \( R^2 \) of 14.6% and 13.0% respectively. Clearly a massive increase in explanatory power is obtained when using the All Ordinaries index. When both indexes are included in the regression there was no appreciable increase in the \( R^2 \) over that obtained by solely using the All Ordinaries index. In the regression using both indices all parameter estimates on the MSCI world index were insignificant. It is thus concluded that relevant information from the MSCI world index is contemporaneously incorporated into the All Ordinaries index thus making the use of the MSCI world index redundant. Consequently for all regressions estimated in this study daily returns from the All Ordinaries index are employed. The risk-free rate, proxied by 90-day bank bill rate, is collected from the Reserve Bank of Australia website.

The augmented market model employed has to be conditioned on two key events, the start of the GFC and the date of the implementation of the DWFG. However there is a third event that is less apparent, the massive bear market that began in late November 2007 and continued until well into February 2009. During this period the All Ordinaries Index lost over 50% of its value: Figure 1 displays its level over the sample period.

**Figure 1: The All Ordinaries Index, 2 January 2007 to 31 May 2012.**
In the aftermath of this massive bear market it would seem reasonable to speculate that the bank return volatility rose considerably. In order to verify this view, an equally weighted portfolio of the four big banks (ANZ, CBA, NAB and WBC), and an equally weighted portfolio of the three small banks (BOQ, BEN and SUN) were formed and daily returns were calculated on both of these portfolios. Figure 2 displays the returns on both portfolios over the sample period.

Figure 2: Returns on portfolios of big and small Australian banks - 2 January 2007 to 31 May 2012.

A simple visual inspection of both graphs in Figure 2 reveals a considerable increase in the volatility of bank returns after 16 January, 2008. This period also corresponds to the massive bear market displayed in Figure 1. The preceding observation offers some evidence on the need to condition bank risk on the periods before and after 16 January 2008 given that the changes in total risk will also probably be reflected in systematic risk.

Following Binder (1985), Bundt et al. (1992) and Haq and Heaney (2009), for portfolio of banks i, the following model is estimated:

\[
\eta_t = \alpha + \left( \sum_{j=1}^{3} \beta_{ij} D_{jt} \right) + \beta_{i0} \eta_{Mt} + \left( \sum_{j=1}^{3} \beta_{ij} D_{jt} r_{Mt} \right) + \varepsilon_{it}
\] (1)

where \( \alpha_{ij} \) and \( \beta_{ij} \) are fixed parameters. Variable \( \eta_{it} \) is portfolio i’s dividend adjusted excess return on day t and \( r_{Mt} \) is the excess market return on day t. Variable \( \varepsilon_{it} \) is a normally distributed error term with expected value equal to zero.
Variable $j$ denotes the $j^{th}$ event relevant to the introduction of the DWFG. ($j=1, 2, 3$), where $j=1$ refers to start of the GFC or 1 August 2007, $j=2$ refers to 16 January, 2008 when the economy was in a severe bear market and bank return volatility rose significantly, and where $j=3$ refers to the introduction of the DWFG. The three dummy variables $D_{jt} (j = 1, 2, 3)$ are constructed so as to capture the cumulative effect on the abnormal returns and systematic risk after the three events. Specifically, $D_{1t} = 0$ before 1 August 2007, and $D_{1t} = 1$ on or after 1 August 2007, $D_{2t} = 0$ before 16 January 2008, and $D_{2t} = 1$ on or after 16 January 2008, and $D_{3t} = 0$ before 12 October 2008, and $D_{3t} = 1$ on or after 12 October 2008.

These dummy variables defined in this way offer a useful interpretation of the estimated parameters. The parameter $a_{i0}$ is referred to as Jensen alpha and represents portfolio $i$’s abnormal return before the GFC. If $a_{i0}$ is non-zero, then the portfolio’s expected return differs from that modelled by the standard CAPM. The parameter $a_{ij} (j = 1, 2, 3)$ captures any changes in abnormal returns after the $j^{th}$ event from that in the preceding period. Consequently, in the period between GFC and 16 January 2008, portfolio $i$’s abnormal return is given by $a_{i0} + a_{i1}$, in the period between 16 January 2008 and the introduction of the DWFG, portfolio $i$’s abnormal return is given by $a_{i0} + a_{i1} + a_{i2}$ and in the period after the introduction of the DWFG, portfolio $i$’s abnormal return is given by $a_{i0} + a_{i1} + a_{i2} + a_{i3}$. If the estimate of $a_{ij} (j = 1, 2, 3)$ is insignificant then we have no evidence of any changes in abnormal returns due to the $j^{th}$ event. The sign of $a_{ij} (j = 1, 2, 3)$ is also of interest as it indicates whether an asset’s abnormal return increased or decreased after that event.

Parameter $\beta_{i0}$ models the sensitivity of portfolio $i$’s return to market returns, that is, its systematic risk or beta before the GFC. Parameter $\beta_{ij} (j = 1, 2, 3)$ captures the changes in the systematic risk of asset $i$ after the $j^{th}$ event from that in the preceding period. In the period between GFC and 16 January 2008, portfolio $i$’s beta is given by $\beta_{i0} + \beta_{i1}$, in the period between 16 January 2008 and the introduction of the DWFG, portfolio $i$’s beta is given by $\beta_{i0} + \beta_{i1} + \beta_{i2}$, and in the period after the introduction of the DWFG, portfolio $i$’s beta is given by $\beta_{i0} + \beta_{i1} + \beta_{i2} + \beta_{i3}$. The significance and sign of $\beta_{ij} (j = 1, 2, 3)$ is taken as evidence of any changes in the level of systematic risk after the $j^{th}$ event.

To add further robustness to our testing procedures, we not only consider the behaviour of standard betas as described above but also the behaviour of the downside betas. In highly volatile times, such as the period surrounding the GFC, investors are deeply concerned about downside losses. If investor preferences toward portfolio returns are symmetrical then portfolio betas may well be an adequate measure of risk. If investors
have asymmetrical preferences in regard to upside and downside risk, then the beta measure of risk will require some modification to reflect these asymmetrical preferences. Estrada (2002, p. 366) notes, “… investors obviously do not dislike upside volatility; they only dislike downside volatility.” This observation motivates a definition of beta that reflects increased investor risk aversion to downside losses. Estrada (2007, p. 170) states that a semi-variance measure of market risk (as exemplified by downside beta), may be a far more practical measure of market risk than a variance measure of market risk (as exemplified by beta) because “… the semivariance is at least as useful a measure of risk as the variance.” Estrada (2007) continues “… the semivariance combines into one measure the information provided by two statistics, variance and skewness, thus making it possible to use a one-factor model to estimate required returns.” Estrada (2002, 2007) develops the DCAPM model where the downside risk beta parameter \( \beta^D \) is defined as:

\[
\beta^D = \frac{E[\text{min}(r_{Mt},0) \times \text{min}(r_{Mt},0)]}{E[\text{min}(r_{Mt},0)^2]}
\]

where, \( r_M \) is the excess return from the market index and \( r_i \) is the dividend adjusted excess return. Downside betas can readily be estimated using standard regression techniques. To obtain unbiased estimates of downside beta, however, the regressions must be run without any constants (see Estrada (2002) for a technical discussion of this requirement). Consequently the following model is estimated for both the big and small bank portfolios.

\[
\text{min}(r_{it},0) = \sum_{j=1}^{3} \beta^D_{ij} \text{min}(r_{Mt},0) + \epsilon_{it}
\]

where \( \beta_{ij} \) are the fixed downside risk parameters to be estimated. Variable \( r_{it} \) is portfolio i’s excess return on day t and \( r_{Mt} \) is the excess market return on day t. Variable \( \epsilon_{it} \) it is a normally distributed error term.

5. Systematic Risk Analysis

Table 1 displays the results of the two regressions (equation 1) on the portfolio of big and small Australian banks using standard betas. In both regressions, before the GFC and after each event, regression alphas are not significantly different from zero. Thus we have no statistical evidence of any change in abnormal returns as a consequence of any of the three events. In response to the first research question, no evidence was found of any change in bank systematic risk to either the portfolio of big or small banks following the start of the financial crisis in August 2007, as reflected in the insignificance of the \( \beta_{i1} \) parameter. In response to research question two, there does appear to be a significant increase in systematic risk as reflected in the significance of the \( \beta_{i2} \) parameter for both the portfolio of big and small banks. The third research question, whether the DWFG had an impact on bank systematic risk, also found significant results for both portfolios. The \( \beta_{i3} \) parameter is both negative and significant and implies that the DWFG announcement did decrease the level of systematic risk of all banks. However the level of significance for the portfolio of small banks is considerably less than that for the portfolio of big banks.
### Table 1: Results of Three Research Parameters based upon Standard Betas

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<tr>
<th></th>
<th>Portfolio of Big Banks</th>
<th>Portfolio of Small Banks</th>
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<td><strong>Alphas</strong></td>
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<td>Post GFC</td>
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<td></td>
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<td>Post Jan 08</td>
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</table>

This table displays the results of estimating standard betas using the regression equation:

\[ r_{it} = \alpha_{i0} + \left( \sum_{j=1}^{3} \alpha_{ij} D_{jt} \right) + \beta_{i0} \tau_{mt} + \left( \sum_{j=1}^{3} \beta_{ij} D_{jt} \tau_{mt} \right) + \varepsilon_{it}, \]

(equation (4)) on an equally weighted portfolio of the four big Australian banks and an equally weighted portfolio of the three small Australian banks over the period of 2 January 2007 to 31 May 2012. The table includes parameter estimates, t-stats and p values, the regression \( R^2 \) and number of observations. Parameters \( \alpha_{i0} \) and \( \beta_{i0} \) are the pre-GFC abnormal return and the beta of each bank. Parameter \( \alpha_{ij} \) is the change in the abnormal return of each portfolio after each event. Parameter \( \beta_{ij} \) represents the change in beta (bank equity risk) after the each event.

The model defined in equation (1) where regression results are reported in Table 1 is further tested by modifying the dummy variable that captures the impact of the DWFG. Three possible dates could be used to define this dummy variable: 12 October 2008 when the DWFG was first announced; 24 October 2008 when a limit of $1,000,000 per person was announced; and 28 November 2008 when the $1,000,000 limit was implemented. The 24 October 2008 dummy left the regression results virtually unchanged whilst the 28 November 2008 date resulted in a decrease in the regression \( R^2 \). It is concluded from this
testing that the impact of the DWFG did indeed occur when the October 2008 announcements were made. The final robustness test involves adding in a dummy variable for the start of the Australian bear market on 30 November 2007. The parameter estimate for this dummy variable was statistically insignificant offering evidence that it was on 16 January 2008 that the systematic risk for the portfolio of big banks increased.

The evidence obtained from estimating downside betas (equation 3) on the two portfolios forces us to modify some of the conclusions reached from the preceding analysis that uses standard betas. The results from estimating equation (3) are displayed in Table 2.

**Table 2: Results of Three Research Parameters based upon Downside Betas**

<table>
<thead>
<tr>
<th>Downside Betas</th>
<th>Pre GFC</th>
<th>Portfolio of Big Banks</th>
<th>Portfolio of Small Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\beta_{10}^D$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>t-statistic</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Pre GFC</td>
<td></td>
<td>0.8025</td>
<td>0.9731</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.4711)</td>
<td>(7.6398)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Post GFC</td>
<td></td>
<td>0.0055</td>
<td>-0.0224</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0413)</td>
<td>(-0.1427)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9671</td>
<td>0.8866</td>
</tr>
<tr>
<td>Post Jan 08</td>
<td></td>
<td>0.3608</td>
<td>0.1438</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.1578)</td>
<td>(1.3974)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000</td>
<td>0.1625</td>
</tr>
<tr>
<td>Post DWFG</td>
<td></td>
<td>-0.2715</td>
<td>-0.1843</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-5.7001)</td>
<td>(-3.2625)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0000</td>
<td>0.0011</td>
</tr>
</tbody>
</table>

This table displays the results of estimating downside betas using the regression equation $\min(r_{it}, 0) = \sum_{j=1}^{3} \beta_{ij}^D P_{jt} \min(r_{Mt}, 0) + \varepsilon_{it}$ (equation (4)) on an equally weighted portfolio of the four big Australian banks and an equally weighted portfolio of the three small Australian banks over the period of 2 January 2007 to 31 May 2012. The table includes parameter estimates, t-stats and p values, the regression $R^2$ and number of observations. Parameter $\beta_{10}^D$ is the pre-GFC downside beta of each bank. Parameter $\beta_{ij}^D$ represents the change in downside beta (downside bank equity risk) after the each event.

Both the analysis using standard betas and downside betas reveal that no significant change in systematic risk could be observed from the start of the GFC. Thus our conclusions relating to the first research question remain unchanged. Our conclusions on the second research question relating to the massive increase in bank volatility after 16 January 2008, however, must be modified. The analysis with standard betas and downside betas for big banks both show a large and statistically significant increase in systematic risk. Thus our conclusion for the portfolio of big banks remains unchanged. The analysis of the small bank portfolio using downside betas shows no statistically significant increase in systematic risk whilst that using standard betas does show a smaller and statistically weaker increase. At best, we have only tenuous evidence for an increase in systematic risk.
for the portfolio of small banks. Our conclusions in regard to the third research question relating to the impact of the DWFG remain unchanged. However the estimate of the $\beta_{t,9}^D$ parameter for the small banks (-0.1843) is far less than that for the portfolio of big banks (-0.2715).

6. Systemic Risk Analysis

Whilst an analysis of changes in systematic risk around the introduction of the DWFG in October 2008 is certainly of value to policy makers, an analysis of changes in systemic risk is even more important. This is because whilst changes in systematic risk mainly affect bank shareholders, a change in systemic risk affects not only bank shareholders but potentially many if not all participants in the wider economy. Bank systemic risk is deeply related to the risk of bank default which in turn is deeply related to the volatility of bank returns rather than the beta of a bank. Changes in bank systemic risk are also related to changes in the level of a bank’s leverage. However the level of leverage of all of the banks in this study did not change significantly throughout the sample period and as data is annual and reported with a lag, it can thus be discounted as a source of changes in systemic risk.\(^4\)

The beta of a portfolio is typically defined in terms of the ratio of the covariance of portfolio returns with market returns and the variance of market returns. Portfolio betas can equivalently be expressed in terms of the standard deviation of portfolio returns, the standard deviation of market returns and the correlation between portfolio returns and market returns as:

\[
\beta_i = \rho_{IM} \frac{\sigma_i}{\sigma_M}
\]

where $\sigma_i$ represents the standard deviation of portfolio returns, $\sigma_M$ the standard deviation of market returns and $\rho_{IM}$ the correlation between portfolio returns and market returns. Thus the change in the beta of the portfolios of big and small banks after the start of the GFC, the massive increase in market volatility in January 2008 and the introduction of the DWFG in October 2008 has three potential sources. These include a change in market volatility, in portfolio volatility and in the correlation of portfolio returns with market returns. The importance of decomposing changes of beta from these sources lies in the observation that changes in beta due to changes in correlation with the market do not have default risk implications. Changes in default risk (systemic risk) are primarily related to changes in portfolio volatility. The level and change in the level of portfolio volatility, market volatility and correlation between portfolio and market returns in the four event periods examined are displayed in table 3.

\(^4\) If anything, leverage decreased. Data to show this are available from the authors on request.
Table 3: Changes in standard deviations and correlations during the four event periods

<table>
<thead>
<tr>
<th></th>
<th>Big Portfolio</th>
<th></th>
<th>Small Portfolio</th>
<th></th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\sigma_t$</td>
<td>$\rho_{IM}$</td>
<td>$\sigma_t$</td>
<td>$\rho_{IM}$</td>
<td>$\sigma_M$</td>
</tr>
<tr>
<td>Pre GFC</td>
<td>0.1253</td>
<td>0.8773</td>
<td>0.2067</td>
<td>0.6209</td>
<td>0.1296</td>
</tr>
<tr>
<td>GFC to Jan 2008</td>
<td>0.1892</td>
<td>0.8742</td>
<td>0.2302</td>
<td>0.7660</td>
<td>0.1969</td>
</tr>
<tr>
<td>Change</td>
<td>+51.05%</td>
<td>-0.35%</td>
<td>+11.36%</td>
<td>+23.37%</td>
<td>+51.92%</td>
</tr>
<tr>
<td>Jan 2008 to DWFG</td>
<td>0.4656</td>
<td>0.7840</td>
<td>0.4552</td>
<td>0.7519</td>
<td>0.2923</td>
</tr>
<tr>
<td>Change</td>
<td>+146.05%</td>
<td>-10.32%</td>
<td>+97.74%</td>
<td>-1.84%</td>
<td>+48.49%</td>
</tr>
<tr>
<td>Post DWFG</td>
<td>0.2638</td>
<td>0.7571</td>
<td>0.2782</td>
<td>0.7571</td>
<td>0.2005</td>
</tr>
<tr>
<td>Change</td>
<td>-43.33%</td>
<td>-3.43%</td>
<td>-38.88%</td>
<td>+0.69%</td>
<td>-31.43%</td>
</tr>
</tbody>
</table>

This table displays the annualized standard deviation of portfolio returns ($\sigma_t$), the annualized standard deviation of market returns ($\sigma_M$) and the correlation between portfolio and market returns ($\rho_{IM}$) for both the portfolio of big and small banks during each of the four event periods. The table also displays the percentage change in standard deviations and correlations from the preceding event period.

Table 3 draws attention to the fact that changes in systematic risk may be unrelated to changes in systemic risk. Consider the first major event in our analysis, the start of the GFC. Bank volatility rose considerably from the pre GFC event period to the period after the start of the GFC. For the big bank portfolio the volatility increased by 51.05%. At the same time, though, the market volatility increased by 51.92%. For the big bank portfolio the correlation with the market remained virtually unchanged (-0.35%) and consequently the portfolio beta remained unchanged. It is thus concluded that the start of the GFC massively increased the systemic risk of the big bank portfolio whilst leaving the level of systematic risk unchanged.

For the small bank portfolio the level of volatility rose by 11.36% from the start of the GFC whilst the correlation with market returns increased by 23.37%. Thus while portfolio volatility increased for the small bank portfolio, the interaction of changes in portfolio volatility, market volatility and correlation with the market left beta virtually unchanged. It is thus concluded that the start of the GFC increased the systemic risk of the small bank portfolio as it did with the big bank portfolio whilst leaving the level of systematic risk unchanged.

The period after January 2008 saw a considerable increase in market volatility (48.49%) since the start of the GFC. However the period after January 2008 experienced an even greater increase in portfolio volatility (146.05% for the big bank portfolio and 97.74% for the small bank portfolio). These massive increases in portfolio volatility with little changes in the correlation with the market lead to large increases in portfolio betas. It is thus
concluded that the period after January 2008 saw a considerable increase in both systematic and systemic risk of the both portfolios.

The period after the introduction of the DWFG saw a considerable decrease in the volatility of the big and small bank portfolios (-43.33% and -38.88% respectively). Market volatility dropped by a lesser amount (-31.43%). Correlations with the market changed very little for both portfolios and consequently the beta decreased for both portfolios. It is thus concluded that the introduction of the DWFG saw a decrease in both the systematic and systemic risk of the big and small bank portfolios.

7. Discussion of the Results

The question arises as to why there should be a large observable effect for the level of systematic risk for four major banks after January 2008, but a smaller effect for the so-called regional banks. This may be due to many interrelated factors but two particular ones suggest themselves. The first, and perhaps the most important, is a function of differences in the risk profiles of the two groups. The second relates to the size of the large banks compared to the smaller ones and hence their treatment in the stock market.

The operations of the two groups of banks are in marked contrast to each other. The smaller banks are almost exclusively retail commercial banks with their operations confined to Australia and often concentrated in one state. They also rely substantially on locally sourced retail deposits. In contrast, the larger banks operate in both retail and wholesale markets, have extensive operations outside Australia with a dominant presence in New Zealand (via subsidiaries), branches in the major financial centres (London, New York, Tokyo, Hong Kong and Singapore) and often branches and/or equity interests in banks elsewhere in the Asia Pacific (particularly ANZ). The NAB also has important retail banking subsidiaries in the UK and to a lesser extent, the USA. They also source an important part of their funding from the US and international capital markets. Furthermore these larger institutions in some cases had their own direct exposure to the US and international markets. In mid 2008, for example, the NAB announced provisions of A$ 830 million on a major exposure on US related CDOs while the ANZ credit intermediation trades resulted in provisions of A$ 386 million. These differences suggest that the larger banks would be much more impacted by overseas events than their smaller competitors. The fact that the wholesale guarantees were used heavily by the large banks in the few months after their introduction (Schwartz, 2010) also supports this international linkage story.

1In their 2007 annual reports, Australia accounted for roughly 75% of the four majors’ earnings whereas it provided effectively 100% for the regional banks.

6Australian Government (2008) Guarantee Scheme for Large Deposits and Wholesale Funding statistics show that the four major banks and Macquarie Bank (effectively an investment bank) accounted for 327 of the 478 wholesale guarantees: CBA used it 119 times, WBC 93 times, ANZ 41 times, MBL 39 times and NAB 35 times.
In respect to the market treatment, the four large banks with their large market capitalization are included as significant components in almost all Australian related market indices (ASX 50, ASX 100, ASX 200, ASX 300 and MSCI EAFE) whereas the smaller banks appear only in the ASX 200 and ASX 300. As a result, the larger banks are more likely to be held by institutional investors, particularly foreign ones. When international markets declined and fund managers sought to fund client withdrawals, they would be forced to liquidate their portfolio with a preference - all things being equal - for selling their more liquid stock holdings. The four major Australian banks, which are all quite actively traded and listed across a range of markets, would be more likely to be sold than their less liquid holdings. In contrast, Australia's three smaller banks experience much less trading and so would present more difficulties in selling any substantial holdings, particularly during such a crisis period.

Unlike the January 2008 event, both groups of banks benefited from the DWFG’s introduction. This can be explained in terms of banks’ reduced exposure to systematic risk and a reduction in the level of systemic risk. Once the guarantee was in place, the likelihood of any particular bank being subject to a run was reduced. Because a run on one bank would likely have an impact on all banks, each bank benefits from the reduction in risk of all the other banks in the market. Two points potentially follow. The first is that this effect may be observed in more concentrated markets, where the cost of one bank failure exceeds the potential benefit that the surviving banks might gain from acquiring that failed business. The second is that banks only hold capital against their own risk exposures not the risks that arise from the failure of other banks (Acharya, 2009). This lack of capital for other banks’ risk is one of the underpinnings of the Basel III proposal for larger banks to hold additional capital for systematic risk. These findings suggest that the major Australian banks should similarly be subject to these additional capital requirements, which are likely to be implemented.

While all banks benefited from the DWFG, the slightly greater reduction in systematic and systemic risk experienced by the large banks may reflect the greater effect of DWFG at reducing bank risk when the banks experienced more economic turbulence (Anginer et al., 2012). According to Anginer et al. (2012), deposit insurance only helps to mitigate bank risk during turbulent times and under good economic conditions, moral hazard prevails. The major Australian banks underwent a significant increase in risk after January 2008: with the introduction of DWFG, depositors’ confidence was promoted and the likelihood of bank runs reduced, reducing bank risk. The relatively stable smaller banks which were not so affected by the market downturn have subsequently benefited less from the DWFG.

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7 Basel Committee on Banking Supervision (2010) provides further details on these changes.
8 The regulator has foreshadowed an increased capital requirement for domestic systemically-important financial institutions, but the specifics had not been formalised as of late 2013.
7. Conclusion

This paper examined the GFC's impact on the level of systematic and systemic risk of Australian banks. It did so by using an augmented market model to identify any changes associated with three specific events: the GFC's start in August 2007; the global stock market fall in January 2008; and Australia's introduction of the deposit and wholesale guarantee scheme on 12 October 2008. Changes in systemic risk were also analyzed by quantifying the combined changes in bank volatility, market volatility and the correlation between bank and market returns. The introduction of the deposit and wholesale guarantee scheme was our key area of interest. The analysis showed that the start of the crisis had little impact upon bank systematic risk but a considerable increase in bank systemic risk. The announcement of the guarantee found a decrease in overall bank risk. The global stock market fall in January 2008 saw the large banks experience a significant increase in systematic risk whereas the smaller banks had little, if any increase. However both large and small banks experienced a considerable increase in the level of systemic risk. The change in the level of bank systematic risk of the large and small banks is believed to reflect the difference in their respective difference in operations (more international versus domestic) and their share liquidity (highly liquid attracting international investors versus less liquid with largely domestic retail holders). Thus in respect to our key area of interest, the DWFG scheme, the empirical findings of an overall decrease in systematic and systemic risk for all Australian banks suggest that the scheme largely achieved its objectives.

Events subsequent to this research provide further evidence for the DWFG scheme's success. In late 2009, for example, the credit risk premium on the major banks had declined to the point that the AA rated banks could raise funds directly in the market themselves more cheaply without a guarantee. The Australian government therefore removed further wholesale guarantees for new funding as of the end of March 2010. From its first guarantee on 8 December, 2008 to 31 March 2010, the Australian government had guaranteed the equivalent of US$ 130 billion in wholesale fund raisings (large deposits and other liabilities). While the last of the debt guaranteed continues until 10 March 2015, it is unlikely that the Australian government will have to make any payments under the scheme, although it collected some A$ 5.5 billion in premiums. Indeed given the improved credit market conditions, some banks have since found it worthwhile to repurchase their existing guaranteed debt so as to save on these premium costs. Further market improvements caused the Financial Claims Scheme’s free retail deposits coverage to be dropped from A$ 1 million to A$ 250,000 on new deposits as of 1 February 2012. As of late 2013, the Financial Claims Scheme coverage remains free of charges, but the government has announced that it may introduce a flat 0.05% fee on all retail deposit of up to $250,000 as of 1 January 2016. The actual implementation and its specifics are to be considered in a forthcoming national financial inquiry.

While not addressed in this research, a further comment regarding the "law of unintended consequences" should be made regarding the DWFG experience. As the Australian scheme covered all authorised deposit taking institutions, one might have expected that the smaller institutions would have gained proportionally more from the guarantee than the
larger ones. This view is a function of their respective credit ratings with AA and AA- for the big four, BBB for the regional banks and often no ratings for other ADIs. In practice, the deposit (and hence loan) market became more concentrated in favour of the four large banks. Their market share between January 2007 and January 2011 moved from 65.6% to 77.3%. The impact was even more significant for non-ADI financial firms where cash management trusts, mortgage trusts, and mortgage originators all experienced major declines in their business and hence market share. So while the DWFG scheme achieved its objective and provided some direct benefit to taxpayers, it did so at the cost of reduced competition from those institutions not covered.

This paper contributes to the literature as one of first papers to examine bank risk changes after the introduction of deposit and wholesale funding guarantee. This is because relatively few countries - particularly developed ones - had introduced such guarantees (as opposed to ordinary deposit insurance schemes) before the GFC. It also allows a more specific examination of the impact in that Australia had no explicit deposit insurance scheme in operation before the guarantee. The Australian findings add to the evidence that such guarantees, at least in short to medium term, can result in reduced systematic and systemic risk. It also confirms Australia’s isolation from the initial stages of the GFC and dual market impact of the global market declines on large capitalized banks compared to smaller institutions.

This study offers some practical implications for regulators. It suggests that at least in the Australian case, a deposit/funding guarantee, as the government hoped, can reduce overall bank systematic risk. It also shows, however, that as local banks become more involved in international activities, they may also become more exposed to the impact of adverse international events. This provides some support to the Basel III views concerning systemic risk capital requirements. It can also offer bankers some insights as to the consequences of their own operational decisions and to what extent these may change their overall risk exposure.

REFERENCES


Appendix 1: Selected government deposit guarantee schemes by amount covered (figures in USD)

Source: OECD, 2009