The trade-off between bank fees and net interest margins.

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Abstract: This study considers the time series relationship between bank non interest income and bank net interest margins in Australia using panel vector autoregressions. It is found that increases in bank non interest income are being used to supplement decreases in net interest margins, but that the magnitude of the increase in non interest income is smaller than the decrease in net interest margins. Thus, consumers of bank products are overall better off as a result of this process, but not necessarily every consumer group. The agency risks of increased bank non interest income are explored from the perspectives of regulators, bank shareholders, borrowers and bank management.

Keywords: Bank Interest Margins, Non interest income, Panel Data, vector autoregression

JEL Classification: G21, G11, C33.

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1. Introduction.

Changes in the nature of financial intermediation (Allen and Santomero, 2001) have been accompanied by a change in the nature of bank income. In particular the revenue of banks has seen a shift in emphasis from traditional income sourced from the provision of intermediary services (margin income) to the less traditional fee income. Such a shift has a number of important implications from the perspectives of bank management and regulatory policy. A conventional view of this process is that banks have offset reduced traditional income sourced from margin income via increases in fee income. Reductions in margin income can be attributed to the process of disintermediation and increased competition. A recent study by DeYoung and Rice (2004) found that increases in non interest (fee) income are accompanied by increased variability in profits and worsening in bank risk-return trade-off. Together, DeYoung and Rice (2004), the Reserve Bank of Australia (2004) and the Reserve Bank of Australia (2005) conclude that observed increases in fee income is acting to supplement declines in margin income rather than replacing margin income. Stiroh and Rumble (2006) conclude that the level of exposure of U.S. banks to non interest income has resulted in worsening of bank's risk-return trade-off. This paper addresses this important issue from a perspective that has not been applied previously in this literature.

The research question of "Is there a stable time series relationship between fee income and margin income in Australia?" will be considered. If a stable long term relationship is found this will tend to support the argument that increases in fee income have been used to offset declines in margin income. If there is no stable long term relationship found it will support the argument that the factors causing the observed decline in margins income and the

accompanying increase in fee income are in fact derived from different fundamental sources, suggesting a fundamental change in the nature of financial intermediation (Allen and Santomero, 2001). A further question that this paper will also address is to consider if the nature of this relationship differs between the three different types of banks considered in this study.

These results are of interest as this is the first time that these authors are aware of that the issue of margins and fees have been considered from this perspective. The results will contribute not only to the body of knowledge considering the changing nature of intermediation, but also will consider the impact of this change upon the nature of bank portfolio diversification and risk. The Reserve Bank of Australia (2006) find that bank fees from domestic banking activity has grown over the past few years, but that as a percent of total assets, domestic fee income has declined. The Reserve Bank survey confines its focus to fee income earned in the process of taking deposits and writing loans, as so excludes income from funds management, insurance and trading activities. As this has been a growing area of banking operations in Australia and globally (Allen and Santomero, 2001), a wider perspective of bank non-interest income is also relevant, as will be adopted in this paper. In general this paper finds that there exists a stable relationship between bank fee income and interest income, indicating that increases in fee income is being used to supplement declines in margin income. Given the results of Stiroh and Rumble (2006) and Baele*, et al.* (2006) this result raises some policy concerns, as over exposure to non interest income results in a worsening of bank risk return trade-offs. This potential outcome is of concern to bank shareholders, bank management, prudential regulators and borrowers from bank as they all face agency concerns resulting from bank diversification (Froot and Stein, 1998, Stiroh and Rumble, 2006)

This paper is structured as follows; the next section will provide an overview of the relevant literature. The third section will discuss the sample to be used and presents the relevant descriptive statistics. The fourth section will discuss the method used to address the research question posed. The fifth section will discuss the results, while the final section will provide some concluding comments and suggest directions for further research endeavour.

2. Literature Review.

As pointed out by Allen and Santomero (2001), the nature of the financial system has changed dramatically over the last decade, with banks becoming increasingly active in the provision of non-traditional services such as insurance products, funds management and securitisation. This change is sourced from the increased competition posed to traditional intermediaries from non-traditional sources including the evolution of more sophisticated market-based products that directly compete with banks. DeYoung and Roland (2001) find that this changing income mix is accompanied by increased earnings volatility that represents both the volatility of non-interest income as well as volatility due to its leverage effects. DeYoung and Rice (2004) find that banks that are less reliant upon non-interest income generally exhibit higher management quality, and that customer focus and technology use are associated with higher levels of non-interest income. Further, it was found that increases in non-interest income are associated with a worsening of the bank's risk-return trade-off and increased profit variability. Stiroh and Rumble (2006) find that increased reliance upon non interest income as a revenue source generated a positive portfolio diversification effect and a negative impact via the higher volatility of non interest income. As this level of exposure increased so the volatility effect outweighed the diversification effect resulting in a worsening

of bank risk return trade-off. Stiroh (2006) find that increased non interest revenue was not accompanied by higher share market returns, but was accompanied by increased market risk (beta, total volatility and idiosyncratic volatility). It was concluded by Stiroh (2006) that large U.S bank may have become over-exposed to non interest income.

Increases in bank non-interest income have not been found to be associated with improvements in bank portfolio diversification at either the bank level or in aggregate, and that the correlation between interest income and non-interest income has increased over time, so reducing any portfolio diversification benefits from combining the two income sources (Stiroh, 2004). Smith, *et al.* (2003) provide one of the few non-U.S. studies on this topic and find that non-interest income is of increased importance to banks within the European Union, but that non-interest income displays a higher volatility than interest income. Baele, *et al.* (2006) find that European banks with higher levels of non interest income have higher expected returns as measured by Tobin's Q, but also have higher beta risk. They also conclude that over exposure to non interest income increases bank risk. Laeven and Levine (2006) studied this issue from a different perspective across 43 nations and conclude that financial conglomerates had a lower market value than focussed financial institutions and so concluded that there exists a diversification discount in multiple activity financial firms.

DeYoung and Roland (2001) argue that there are three reasons why non-interest income is more volatile than interest income. Firstly, as bank lending has a substantial relationship component, the costs of switching loan providers are higher than of changing fee-based transactions, which have a lower relationship component. Second, non-interest income is substantially reliant upon staff costs to provide the required services, which generates a high fixed cost component, as opposed to interest income which is more reliant upon interest

expenditure as an input, a variable cost. Thus, non-interest income has a higher level of operating leverage. Third, non-interest income has a higher level of financial leverage due to lower levels of required fixed assets, and so has higher financial risk. Overall, this literature has emphasised the risk-return characteristics of bank non-interest income, thus there is scope for considering the time series relationship between interest and non-interest income to determine if this relationship is stable through time.

The exposure of banks to non interest income is of concern to a number of stakeholders in the banking system. The conventional view of bank shareholders is that they can diversify away bank-specific risk by their holding of a well diversified portfolio. However, as discussed by Stiroh and Rumble (2006) and Laeven and Levine (2006), bank diversification increases agency costs and income volatility. As discussed by Froot, *et al.* (1993) and Froot and Stein (1998) increased income volatility has a non linear impact on bank cost of funds and makes risk management by the bank on behalf of the shareholders worthwhile. From the perspective of bank management, their holding of a poorly diversified wealth portfolio means that that they are concerned about bank total risk (Stulz, 1984). From a borrowers perspective the implicit value of the bank-client relationship means that borrowers face switching costs in the event of bank failure. Bank regulators, with focus on maintaining the viability of the financial system are concerned about bank total risk due to the risk of contagion and systemic failure resulting from the failure of single (large) bank.

As discussed by Stiroh and Rumble (2006) it is possible that management of large U.S. have "*… gotten the diversification idea wrong …*" (p. 2158). It is possible that bank management are more concerned with increasing the level of returns rather than managing risk-return trade-offs. If this is true, this would represent an agency conflict between regulators who are

concerned with financial system stability and bank management and bank shareholder who are concerned with profits. It was suggested by Stiroh and Rumble (2006) that the negative aspects of 'too big to fail' may have encouraged this agency problem in that bank management and shareholders profit from higher returns while regulators will bear the costs of bank failure due to higher risk, thus creating an asymmetry in the risk-return trade-off that explains the U.S. evidence of over-exposure to non-interest income.

Several reasons have been advanced to explain the increased move of banks into less traditional activities. One is that banks have over estimated the benefits of cross-selling financial products within the financial conglomerate group (Stiroh and Rumble, 2006). As discussed above, it could be that bank management are focussed on the level of returns rather than risk and return. It is also possible that managerial non-profit maximising activities are to blame. As discussed by Aggarwal and Samwick (2003), managers choose to diversify their firms to increase personal utility rather shareholder wealth. Mergers in the banking industry, resulting in increased exposure to non traditional activity may also be motivated by managerial utility maximisation rather than shareholder wealth maximisation (Berger*, et al.*, 1999, Bliss and Rosen, 2001, Milbourn*, et al.*, 1999). It is also possible that increased exposure to non interest income reflects the changing nature of the financial process in which markets are increasingly taking the place of traditional intermediation (Allen and Santomero, 2001). In such changing environment banks are seeking new revenue lines to take the place of declining traditional income, with a resulting change in bank risk. It is also possible that some of the negative effects of increased exposure to non interest income are due to start up and initial learning costs.

In the Australian context the main discussion of this issue has been provided by the annual series of discussions by the Reserve Bank of Australia, of which the most recent is Reserve Bank of Australia (2006). These discussions do not provide any statistical testing of the relationship between bank net interest margins and fees and do not include in their ambit any non interest income drawn from activities such as underwriting, funds management and insurance. Instead these discussions focus only upon fee income resulting from the processes of taking deposits and writing loans. With these restrictions in mind, the Reserve Bank of Australia (2005) concludes that increases in bank fees has not offset declines in bank margin income from traditional banking activity. Further, the Reserve Bank of Australia (2006) found that the growth in fee income in 2005 is the lowest in the nine-year life of the survey, mainly due to lower income from credit card merchant fees. Given that Allen and Santomero (2001) find that there has been a switch in bank activity from traditional intermediation (taking deposits and writing loans) toward non interest income in the United States, a wider perspective is relevant. Thus, in this study a wider view of bank non interest income will be taken, along with a longer time series than the nine years that the most recent survey by the Reserve Bank of Australia encompasses.

A recent study by Williams (2006) applied the Ho and Saunders (1981) model of bank net interest margins Australian data and found that bank net interest margins have fallen over the study period 1989 to 2001, with larger banks showing higher net interest margins, but some evidence of decreasing returns to scale. Evidence was also found of banks buying market share and some mispricing of risk. It was also found that Foreign Banks in Australia experienced significantly lower net interest margins. The issue of a trade-off between net interest margins and non interest income was not explored by Williams (2006). It was

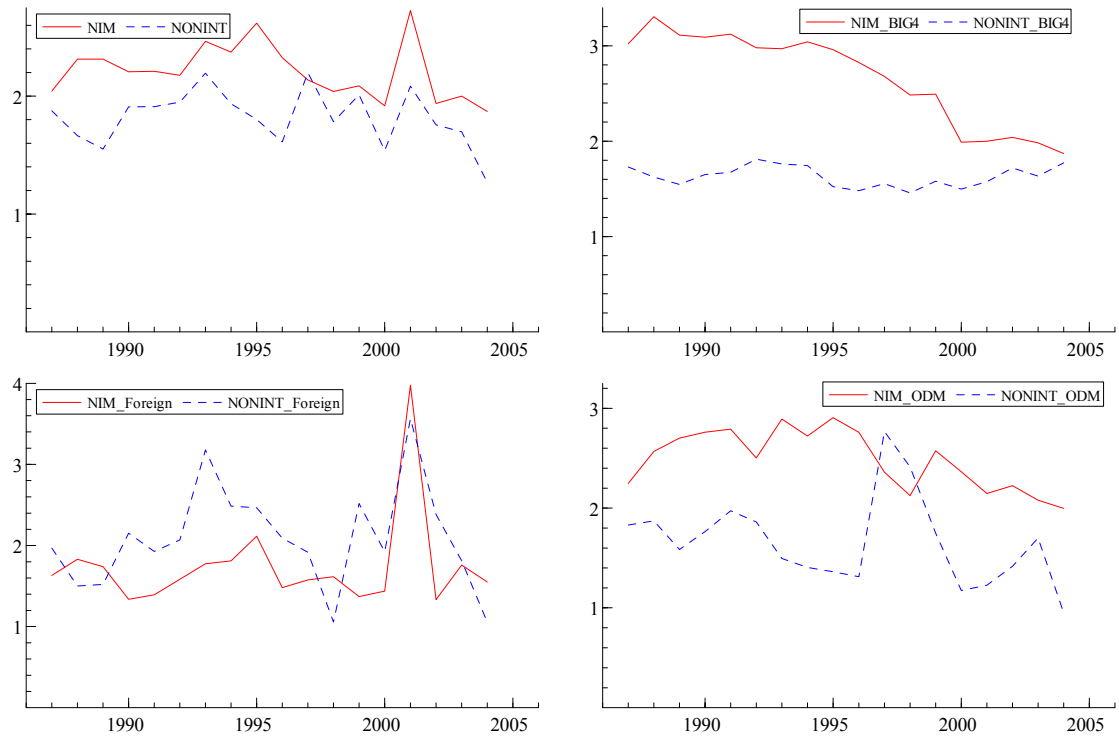
concluded that the area of net interest margins is still under-researched relative to their importance to bank revenue.

3. Data.

The main data for this study will be the individual bank annual reports. The sample includes 1988 to 2004, with a total of fifty banks in the sample. The banks are categorised into three groups. The first group is the Big Four, which represent the four major banks in Australia, who together account for over sixty-five percent of Australian banking assets. The second group are the Other Domestic banks, who are mainly regional and state-owned banks with a focus on retail finance, with the state-owned banks largely leaving the sample in the mid-1990s as these institutions were privatised. The final group are the Foreign Banks. These are generally smaller, more wholesale-oriented banks. A bank is categorised as foreign if it has more than fifty percent foreign ownership. With only a few exceptions the foreign banks are largely fully foreign owned operating as subsidiary banks. While foreign banks can operate in Australia using a branch structure as an alternative to subsidiary operations, data regarding foreign bank branches was not available for this study. There is a total of twenty-four Other Domestic and twenty-two Foreign Banks in the sample. Details of the sample are in Table 1 with the descriptive statistics of the sample in Table 2. Net Interest Margin will be measured by (interest received – interest expense)/total assets as a percent. Non Interest Income will be measured by non interest income/total assets as a percent. Figure 1 shows the time series properties of both net interest margins and non interest income over the study period for all banks, the Big Fours Banks, the Other Domestic banks and the Foreign Banks.

Figure 1.

Graph of the time series properties:



4. Method.

Panel VAR: In this section, we econometrically investigate the linkages between Net Interest Margin (*NIM*) and Non Interest Income (*NONINT*) using panel data for 50 banks and 18 years, 1988 to 2004.

Unit root tests, described in Appendix 1, suggest that our data are stationary. Hence, we estimate a panel vector autoregressive (VAR) model to analyse the relationships between *NIM* and *NONINT*. The multivariate VAR(q) model with fixed effects takes the form

$$\begin{pmatrix} NIM_{i,t} \\ NONINT_{i,t} \end{pmatrix} = \sum_{j=1}^{q} \begin{pmatrix} \beta_{11}^{(j)} & \beta_{12}^{(j)} \\ \beta_{21}^{(j)} & \beta_{22}^{(j)} \end{pmatrix} \begin{pmatrix} NIM_{i,t-j} \\ NONINT_{i,t-j} \end{pmatrix} + \begin{pmatrix} \eta_{1,i} \\ \eta_{2,i} \end{pmatrix} + \begin{pmatrix} \eta_{1,BIG4} \\ \eta_{2,BIG4} \end{pmatrix} + \begin{pmatrix} \eta_{1,Foreign} \\ \eta_{2,Foreign} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1,i,t} \\ \varepsilon_{2,i,t} \end{pmatrix}, \quad (1)$$

where *NIM* and *NONINT* are, respectively, Net Interest Margin / Total Assets (%) and Non Interest Income to Total Assets (%) for banks *i* (=1, …, *N*) at time *t* (=1, …, *T*). η_i is a bank-specific fixed effect and $\varepsilon_{i,t}$ is a multivariate normally distributed random disturbance. Fixed effects for BIG4 and Foreign banks are captured through η_{BIG4} and $\eta_{Foreign}$ respectively. We estimate a fixed effects model with bank specific dummies, rather than a random effects model, as the η_i's are likely to represent omitted bank-specific characteristics which are correlated with other explanatory variables.[1]

The system of equations described by equation (1) assumes that the random error terms are orthogonal to the bank specific fixed effects, as well as the lagged values of the endogenous variables. Further, the errors are assumed to have positive variance and to be uncorrelated across cross-sectional units and time. However, due to the likely correlation between the lagged endogenous variables and the fixed effects in equation (1), the least squares dummy variable estimator produces biased parameter estimates. Accordingly, we remove the fixed effects by differencing, i.e., equation (1) is rewritten as

$$\begin{pmatrix} \Delta NIM_{i,t} \\ \Delta NONINT_{i,t} \end{pmatrix} = \sum_{j=1}^{q} \begin{pmatrix} \beta_{11}^{(j)} & \beta_{12}^{(j)} \\ \beta_{21}^{(j)} & \beta_{22}^{(j)} \end{pmatrix} \begin{pmatrix} \Delta NIM_{i,t-j} \\ \Delta NONINT_{i,t-j} \end{pmatrix} + \begin{pmatrix} \Delta\varepsilon_{1,i,t} \\ \Delta\varepsilon_{2,i,t} \end{pmatrix}, \tag{2}$$

where Δ is the first difference operator, e.g., $\Delta X_{i,t} = X_{i,t} - X_{i,t-1}$.

Since the transformed lagged endogenous variables and the transformed error terms in equation (2) may be correlated in panels with a limited time dimension (see Nickell, 1981; Kiviet, 1995), we estimate the coefficients in equation (2) by the generalised methods of moments (GMM) technique proposed by Arellano and Bond (1991). This technique uses the pre-determined lags of the system variables as instruments to exploit a potentially large set of over-identifying restrictions and provides consistent coefficient estimates (see Bond, 2002).

[1] Under an assumption of independence between the fixed effects and the explanatory variables, the generalised least squares estimator for the random effects model is biassed (Hsaio, 1986)).

The errors in equation (2) satisfy the following orthogonality conditions

$$E(NIM_{i,s}\Delta\varepsilon_{i,t}) = E(NONINT_{i,s}\Delta\varepsilon_{i,t}) = 0, \quad \forall s < t-1. \tag{3}$$

Assuming serially uncorrelated errors, the orthogonality conditions imply that the vector of instruments available to identify the parameters of equation (2) has the form

$$Z_{i,t} = [NIM_{i,t-2},...,NIM_{i,1}; NONINT_{i,t-2},...,NONINT_{i,1}]. \tag{4}$$

Letting Z_i^* be a block diagonal matrix whose t^{th} block is given by equation (4), for $t = 1,...,T-2$, the matrix of instruments for each equation of the VAR is $Z = (Z_1^*,...,Z_N^*)'$.

The one-step GMM estimator for the $k \times 1$ coefficient vector for each equation of the VAR in equation (2) is given by[2]

$$\hat{\beta} = \left(\widetilde{X}^{*\prime} Z A_N Z' \widetilde{X}^* \right)^{-1} \widetilde{X}^{*\prime} Z A_N Z' Y ,$$

(5)

where Y is a $N(T-q-1)\times 1$ vector of stacked dependent variables, $A_N = \left(\frac{1}{N} \sum_{i=1}^{N} Z_i^{*\prime} H Z_i^* \right)^{-1}$, with H a $T-2$ square matrix with 2's on the main diagonal, -1's on the first sub-diagonal and 0's elsewhere, and $\widetilde{X}^*$ is an $N(T-q-1)\times k$ design matrix stacked by cross-sectional units with typical row

$$\widetilde{X}_{i,t}^* = [\Delta NIM_{i,t-1},....\Delta NIM_{i,t-q}, \Delta NONINT_{i,t-1},...,\Delta NONINT_{i,t-q}] \tag{6}$$

Finally, the asymptotic variance-covariance matrix of the GMM coefficient vector is given by

$$a\,\mathrm{var}(\hat{\beta}) = N\left(\widetilde{X}^{*\prime} Z A_N Z' \widetilde{X}^* \right)^{-1} \widetilde{X}^{*\prime} Z A_N V_N A_N Z' \widetilde{X}^* \left(\widetilde{X}^{*\prime} Z A_N Z' \widetilde{X}^* \right)^{-1},$$

(7)

[2] Bond (2002) notes that most applied work using GMM employs the one-step estimator rather than the two-step estimator. Arrellano and Bond (1991) use simulations to show that only modest efficiency gains are achieved by using the two-step procedure, even in the presence of heteroscedasticity.

where $V_N = N^{-1}\sum_i^N Z_i{}' \Delta\varepsilon_i \Delta\varepsilon_i{}' Z_i$ and the $\Delta\varepsilon_i$'s are the GMM residuals.

Despite the popularity of GMM estimators in dynamic panel regression studies, the error process of the panel VAR does not necessarily follow multivariate normal distribution especially in small samples. The standard errors and the corresponding hypothesis testing could be misleading under the normality assumptions. To overcome this problem, the empirical distribution is constructed by drawing a bootstrap sample of 5000. An important advantage of the bootstrapping technique is that the error process of the estimated panel VAR does not necessarily follow a multivariate normal distribution and the critical values are obtained from appropriate percentile values of the empirical distribution.

5. Estimation and Results

In this exercise, the model described by (2) is estimated for four different groups: (i) Pool of all 50 banks, (ii) Big 4 (iii) Foreign banks and (iv) all other domestic banks. Within each group the model is estimated for three different sample periods namely (a) Full sample periods from 1988 to 2004 (b) Sub samples from 1988 to 1992 and (c) sub sample from 1993 to 2004. These two sub-periods were chosen because as discussed in Avkiran (1999), the early 1990s saw a recession in the Australian economy, resulting in increased bad loans and a change in bank strategy following this experience.

The optimal lag length q is determined by nested likelihood ratio tests.[3] In all cases, we find that $q = 1$ is optimal.[4] The GMM estimates for the panel VAR(1) are reported in

[3] The correct lag length is critical for panel VAR's since excessively short lags may fail to capture the system's dynamics, lead to omitted variables, bias the remaining coefficients and be likely to produce serially correlated errors. On the other hand, too many lags lead to a rapid loss of degrees of freedom and to over-parameterisation. See Holtz-Eakin, *et al.* (1988) for more detail about the nested likelihood test for lag length selection.

tables 3a, 3b, 3c and 3d . For $T > 3$ the model is over-identified and the validity of the assumptions used to estimate equation (2) can be tested using the standard GMM test of over-identifying restrictions or a Sargan test. From the Sargan test statistics and the *p*-values reported in tables 3a through 3d, the null hypothesis that the moment conditions are valid (i.e., equation (3)) is unable to be rejected. In this context, the key identifying assumption of no serial correlation in the ε_{it} disturbances can be examined by testing for no *second*-order serial correlation in the first-differenced residuals (Arellano and Bond, 1991).[5] The results generally show the absence of serial correlation and that the estimated models satisfy the standard assumptions.[6]

Sensitivity analysis: In this sub-section, we discuss the results of tests that were performed to check the robustness of our results. To see how sensitive our results are to pooling the banks by group (i.e., Big Four, Foreign and Other domestic Banks), we first delete each bank one at a time and compare the resulting model with the results reported in tables 3b through 3d. Overall, this procedure did not affect any of the signs of the coefficients reported in the tables. The experiment is conducted for each group for the full sample period. However, the sensitivity analysis is not conducted for the sub-sample periods within each group as the deletion banks will result in lack of degrees of freedom.

Unsurprisingly, however, due to the smaller sample sizes, the regression results are somewhat sensitive to exclusion of few banks in foreign and other domestic banks groups. Depending on the bank, the coefficients of some variables became statistically significant,

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[4] To evaluate the sensitivity of the results in higher order lags, the model also estimated for the lag length of 2. The general results are the same as that of lag 1. For the sake of brevity, the results are not reported for lag 2 and can be made available from authors upon request.

[5] Negative first-order serial correlation is expected in the first-differenced residuals if ε_{it} is serially uncorrelated.

[6] In addition, note that the asymptotic standard errors reported in tables 3a through 3d are robust to heteroscedasticity (see Arellano and Bond, 1991). However, as a check we regress the squared residuals on the independent variables for each of the estimated models. Wald tests indicate homoscedastic errors. For the sake of brevity, these test results are not presented here. (The results are available from the authors upon request.)

while others became statistically insignificant. It is important to note that there were *no* sign reversals. These results are summarised in Appendix table 2.

To illustrate how to interpret Appendix table 2, consider deleting the Colonial State bank (COL) from the sample. Doing so makes the coefficient for the *NONINT* become statistically insignificant in the *NIM* equation. In addition, the coefficient for *NONINT* becomes statistically significant in the *NONINT equation*. Overall, what is immediately obvious from Appendix table 2 is that our most robust results are for those reported in table 3. That is, the conclusions that were drawn about the relationships between *NIM*'s and *NONINT*'s are the most defensible.

Overall it is found that changes in net interest margins are offset by changes by in non interest income with each showing offsetting time series properties. Consistent with increased emphasis on non interest income based revenue sources (Allen and Santomero, 2001), this relationship is strongest in the second sub period, post 1992. Thus banks in Australia reacted to reductions in net interest income by increasing non interest income in the following period, and this relationship is fairly robust over time. However, the increase in non interest income was generally smaller than the reduction in net interest income. As a result consumers of bank products were generally better off as they were paying smaller net interest margins to consume bank products, but increases in non interest payments to banks did not fully offset the reduction in net interest margin payments.

The results for the Big Four banks were largely the same as for the All Banks sample, with the exception that the trade-off between net interest income and non interest income seemed to begin a little earlier in the first sub-sample period, 1988 to 1992. In the case of the Foreign Banks, this relationship is weaker, no doubt due to the Foreign Bank's higher level of emphasis on fee-based income rather than margin income. In the case of the Foreign Banks, no evidence was found of a systematic relationship over time between net interest margins

and non interest income. Instead the time series process of the two income streams seem to be entirely separate.

The results for the Other Domestic Banks are similarly mixed. When considering the full sample period, the Other Domestic Banks substitute reductions in net interest income with increases in non interest income, with the increases in non interest income of a smaller magnitude than decreases in net interest income, again indicating that bank consumers are in general better off as a result of this process. However, it should be noted that the changes in non interest income show a weaker relationship across the sub sample periods. In the first sub-sample period (1988 to 1992), there is no evidence of a systematic relationship between changes in net interest margin in one period and the following period. However, there is evidence of a systematic substitution relationship between net interest income in one period and non interest income in the following period, and that changes in non interest income have a systematic time relationship, with changes increases in non interest income in the first period being systematically followed by increases in the subsequent period. In the second sub-period sample the relationship between net interest margins and non interest income became weaker, with evidence of the trade-off between net interest income and non-interest income persisting for the Other Domestic Banks.

The differences in the results for the two Other Domestic Bank sub-samples is most likely due to changes in the composition of the sample across the two periods. In the first sub-sample (1988 to 1992) the Other Domestic Bank sub-sample includes the State-owned regional banks such as the State Bank of Victoria, the State Bank of South Australia, the R&I of Western Australia and the State Bank of New South Wales. Many of these banks experienced substantial financial difficulties in the early 1990s results in their sale to other banks or privatisation. In one case this bank was a Foreign Banks (R&I Bank's sale to the Bank of Scotland) or one of the Big Four (the sale of the Sate Bank of Victoria to the

Commonwealth Bank). In another case the sale was to a converted building society (the sale of the residual of the Bank of South Australia to Advance Bank; Advance Banks was subsequently purchased by another converted building society, St. George Bank). In the last example of this type the State Bank of New South Wales was sold to Colonial Mutual (an insurance and funds management group), which was subsequently taken over by the Commonwealth Bank, a Big Four bank. In the case of the second sub-sample period the Other Domestic Banks sub sample increasingly comprises building societies that converted to full banks status in the early 1990s.

As a further sensitivity analysis the impact of removing each bank in turn from the sub-samples was analysed. These results are shown in Appendix Table 2. In the case of the Big Four banks only the constant was found to be sensitive to outlier banks. In three of four cases the removal of one of the Big Four banks resulted in the constant becoming statistically insignificant. In the case of the Foreign banks three banks were found to impact upon the coefficients for the Net Interest Margin equation, in each case the removal of these banks results in the coefficient becoming statistically insignificant. In each case these banks had experienced a significant restructure during the sample period. In the case of the Non Interest Income equation, the removal of three banks resulted in the estimated coefficient becoming statistically significant. Again each of these banks experienced a significant restructure during the sample period. It is noteworthy that Standard Chartered Bank acted as a outlier bank for both the Net Interest Income and Non Interest Income equations. In the case of the Other Domestic Banks, again three banks acted as outlier banks. For the Net Interest Income equation removal of these outliers resulted in the estimated coefficient becoming insignificant.

6. Conclusions and Directions for Further Research.

Overall, this study finds that there is a systematic relationship between decreases in Australian bank net interest income and increases in non interest income. It is also found that the increases in non interest income are of a smaller magnitude than the decreases in net interest income, indicating that bank consumers as a whole have been made better off by this relationship. However, the currently available data does not allow analysis of non interest income from intermediation services versus non interest income from other financial services such as funds management, trading financial instruments and underwriting (particularly for the foreign banks). Thus, it cannot be concluded that the same consumer groups are being affected by this relationship. It may be the case that the increases in non interest income observed in this study reflect a strategic effort by the Australian bank to counteract the impact of falling interest margins by diversifying their income sources away from traditional intermediation toward other revenue sources such as funds management. This would reflect the changing nature of the United States banking systems as discussed by Allen and Santomero (2001). This is exemplified by the growing trend toward larger banks proving one stop financial services (allfinanz or bankassurance), and can be considered in this case illustrated by the acquisition by the Commonwealth Bank of Australia of the Colonial Group of companies. Alternatively, it is possible that the increases in non interest income observed in this study are directly due to increases in fees and charges being levied as part of intermediation services. This is the trend observed by the Reserve Bank of Australia (2006), although with the caveat that the Reserve Bank of Australia (2006) used a narrower definition of non interest income than applied in this study and so the two studies my not be reflective of the same effects. If, however, this is the case, then the Australian banks are reacting to decreases in margin income by increasing the fees charged to users of bank products and approximately (but not exactly) the same consumer groups are paying for decreases in net

interest income via higher fees and changes. However, given that that this study has found that the increases in non interest income is of a smaller magnitude than the decreases in net interest income, then this consumer group is, on average, still better off as a result of this trade-off. However, depending on their patterns of bank service usage there may remain some consumer groups that are worse off at the margins from this process, particularly those bank consumers making frequent use of deposit service but do not have loan accounts which benefit from the effects of lower bank net interest margins. In order to determine where the wealth transfers have occurred as a result of the process observed in this study, further research will be necessary, employing more detailed data than available for the sample employed in this study.

This trend of increasing bank non interest income raises different agency concerns to the different stakeholders in the banking system. It is conventionally assumed that bank shareholders are able to diversify away the impact of idiosyncratic risk. However, as discussed by Froot and Stein (1998) increased income volatility resulting from increased exposure to non interest income can have a non linear impact on bank cost of funds and result in increased reliance upon internal bank hedging on behalf of shareholders. Borrowers of banks bear increased agency costs in times of bank failure resulting in the loss of the implicit value of their bank-client relationship (Stiroh and Rumble, 2006). As discussed by Stulz (1984), bank management hold poorly diversified wealth portfolios and so are concerned about bank total risk. Further, increased bank non interest income results in increased returns but worsening risk return trade-offs. Prudential regulators are concerned about financial system viability and increased non interest income results in increased bank systematic risk (Baele*, et al.*, 2006, Stiroh, 2006). With bank management potentially more concerned about the level of risk rather than risk and return, the negative aspects of 'too big to fail' increase

the risk to regulators of bank failure due to increased income volatility resulting from higher levels of non interest income. The outcome for regulators is an increased exposure to systemic risk. The evidence presented in this study finds that banks in Australia are increasing their level of non interest income while at the same time margin income is declining. Thus the agency costs resulting from this trend are more likely to increase rather than decrease and all bank stakeholders should be aware of the resulting changes in bank risk characteristics. These changes in bank portfolio composition and bank risk also offer a number of potentially fruitful avenues for future bank research.

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Table 1
Sample Composition

	All Banks	Big Four	Other Domestic	Foreign
All Years	385	68	168	149
1988	32	4	13	15
1989	33	4	14	15
1990	31	4	14	13
1991	29	4	12	13
1992	28	4	12	12
1993	28	4	13	11
1994	25	4	10	11
1995	24	4	11	9
1996	23	4	11	8
1997	19	4	8	7
1998	19	4	9	6
1999	18	4	7	7
2000	20	4	8	8
2001	18	4	8	6
2002	15	4	7	4
2003	13	4	7	2
2004	10	4	4	2

50 Banks in sample: 24 Other Domestic; 22 Foreign; 4 Big Four

Table 2
Descriptive Statistics.

All Banks

	Mean	Standard Deviation	Minimum	Maximum	Number of Observations
Net Interest Margin / Total Assets (%)	2.25027	1.32923	-0.165427	18.6761	385
Non Interest Income to Total Assets (%)	1.8353	1.95155	0.0626704	12.0982	380

Big Four.

	Mean	Standard Deviation	Minimum	Maximum	Number of Observations
Net Interest Margin / Total Assets (%)	2.6435	0.5713	1.7085	3.8211	68
Non Interest Income to Total Assets (%)	1.6239	0.2805	1.1540	2.8531	68

Other Domestic.

	Mean	Standard Deviation	Minimum	Maximum	Number of Observations
Net Interest Margin / Total Assets (%)	2.5632	1.06234	0.1079	5.2613	168
Non Interest Income to Total Assets (%)	1.6745	2.1222	0.0627	10.8379	165

Foreign.

	Mean	Standard Deviation	Minimum	Maximum	Number of Observations
Net Interest Margin / Total Assets (%)	1.7179	1.6418	-0.1654	18.6761	149
Non Interest Income to Total Assets (%)	2.1136	2.1595	0.0827	12.0982069	147

Table 3a: All Banks

	Full Sample		Sub sample 1 1988 to 1992		Sub sample 2 1993 to 2004	
	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$
ΔNIM_{t-1}	0.448** (0.21)	-0.214* (0.13)	0.084 (0.22)	0.157 (0.56)	0.351* (0.21)	-0.491** (0.23)
$\Delta NONINT_{t-1}$	-0.19*** (0.06)	0.216** (0.09)	-0.108*** (0.02)	0.055 (0.14)	-0.111 (0.13)	0.505*** (0.16)
Constant	-0.02 (0.05)	-0.04* (0.02)	-0.09** (0.04)	0.022 (0.08)	-0.018 (0.07)	-0.038 (0.05)
Diagonistics:						
Sargan statistic	410.1	200.7	26.0	28.6	441.9	258.1
Sargan *p*-value	1.00	1.00	0.11	0.16	1.00	1.00
AR(1)	-2.71***	-2.48**	-1.64*	-1.67*	-2.08**	-1.74*
AR(2)	-1.26	-0.27	-0.78	-0.10	-1.00	0.67

Notes: a) Standard errors are in the parentheses. ***, ** and * denote rejection of null of zero restriction at 1%, 5% and 10% levels of significance (based on bootstrapping), respectively;
b) The Sargan statistic tests over-identifying restrictions (based on bootstrap samples). AR(1) and AR(2) are tests for first-order and second order serial correlation (based on bootstrap samples).

Table 3b: Big4 Banks

	Full Sample		Sub sample 1 1988 to 1992		Sub sample 2 1993 to 2004	
	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$
ΔNIM_{t-1}	0.545*** (0.03)	-0.308** (0.10)	-0.047 (0.09)	-0.303*** (0.08)	0.471*** (0.08)	-0.374** (0.17)
$\Delta NONINT_{t-1}$	-0.351*** (0.07)	0.523*** (0.21)	-0.121** (0.06)	0.028 (0.165)	-0.128* (0.07)	0.519* (0.29)
Constant	-0.048*** (0.01)	-0.025* (0.015)	-0.065* (0.03)	0.051*** (0.01)	-0.063*** (0.01)	-0.034 (0.03)
Diagonistics:						
Sargan statistic	76.97	74.94	12.7	10.31	41.78	46.23
Sargan *p*-value	1.00	1.00	0.81	0.92	1.00	1.00
AR(1)	-1.76*	-1.92*	-1.67*	-1.77*	-1.73*	-1.84*
AR(2)	-1.32	1.49	-0.39	-0.73	0.22	0.53

Notes: a) Standard errors are in the parentheses. ***, ** and * denote rejection of null of zero restriction at 1%, 5% and 10% levels of significance (based on bootstrapping), respectively;
c) The Sargan statistic tests over-identifying restrictions (based on bootstrap samples). AR(1) and AR(2) are tests for first-order and second order serial correlation (based on bootstrap samples).

Table 3c: Foreign Banks

	Full Sample		Sub sample 1 1988 to 1992		Sub sample 2 1993 to 2004	
	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$
ΔNIM_{t-1}	0.249**	-0.211	-0.091	0.486**	0.340*	-0.238
	(0.13)	(0.14)	(0.06)	(0.21)	(0.20)	(0.24)
$\Delta NONINT_{t-1}$	-0.22***	0.218	-0.035	-0.131	-0.135	0.644***
	(0.04)	(0.19)	(0.03)	(0.10)	(0.11)	(0.15)
Constant	0.130	0.004	-0.172**	0.166	0.289	0.149
	(0.13)	(0.05)	(0.07)	(0.15)	(0.29)	(0.15)
Diagonistics:						
Sargan statistic	159.8	94.38	24.97	39.77	66.98	59.09
Sargan *p*-value	1.00	1.00	0.13	0.21	0.99	1.00
AR(1)	-2.03**	-1.69*	-1.71*	-1.66*	-1.86*	-1.65*
AR(2)	-1.07	-0.002	-1.42	-0.67	-0.87	0.39

Notes: a) Standard errors are in the parentheses. ***, ** and * denote rejection of null of zero restriction at 1%, 5% and 10% levels of significance (based on bootstrapping), respectively;
d) The Sargan statistic tests over-identifying restrictions (based on bootstrap samples). AR(1) and AR(2) are tests for first-order and second order serial correlation (based on bootstrap samples).

Table 3d: Other Domestic Banks

	Full Sample		Sub sample 1 1988 to 1992		Sub sample 2 1993 to 2004	
	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$
ΔNIM_{t-1}	0.271*	-0.211***	0.098	0.653	0.047	-0.567***
	(0.15)	(0.07)	(0.21)	(0.52)	(0.13)	(0.14)
$\Delta NONINT_{t-1}$	-0.096**	0.188	-0.214***	0.402**	-0.009	0.145
	(0.05)	(0.16)	(0.07)	(0.17)	(0.08)	(0.17)
Constant	-0.09***	-0.079***	-0.061	-0.106	-0.109***	-0.078**
	(0.02)	(0.03)	(0.07)	(0.07)	(0.02)	(0.04)
Diagonistics:						
Sargan statistic	116.0	221.6	20.79	42.27	73.72	115.2
Sargan *p*-value	1.00	1.00	0.29	0.30	1.00	0.81
AR(1)	-1.98**	-1.73*	-1.93*	-1.64*	-1.98**	-1.99**
AR(2)	-0.69	-1.16	-0.01	-1.25	-1.23	0.88

Notes: a) Standard errors are in the parentheses. ***, ** and * denote rejection of null of zero restriction at 1%, 5% and 10% levels of significance (based on bootstrapping), respectively;
e) The Sargan statistic tests over-identifying restrictions (based on bootstrap samples). AR(1) and AR(2) are tests for first-order and second order serial correlation (based on bootstrap samples).

Appendix 1. Panel unit root tests

As with pure time series regression analysis, the asymptotic distributions of the estimators in panel regressions are likely to be affected by the presence of unit roots. This is especially likely in datasets with relatively long time series and short cross-sectional dimensions. Hence, as precursor to our econometric analysis, we examine the stationarity of our data. The variables we use for our econometric analysis are described in detail in Table 2.

We test for unit-roots using the test proposed byIm, *et al.* (2003) (henceforth, IPS).[7] Using obvious notation, the heterogeneous panel data model is given by

$$\Delta y_{it} = \mu_i + \beta_i y_{it-1} + \sum_{j=1}^{q_i} \varphi_j \Delta y_{it-j} + \gamma_i t + \varepsilon_{it}, \quad i = 1,2,...,N; \; t = 1,2,...,T. \qquad \text{(A.1)}$$

The null hypothesis to test for unit roots is given by $H_0 : \beta_i = 0$, for all *i*, $H_1 : \beta_i < 0$, for some *i*. Based on equation (A.1), each individual component of the panel is estimated separately by OLS and then the test statistics are obtained as studentised averages of the test statistics for each equation. The number of lags, q_i, in the model is determined by the Akaike Information Criteria.[8]

The $\bar{t}$-statistic proposed by IPS is defined as the average of the individual ADF τ-statistics, i.e.,

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} \tau_i, \text{ where } \tau_i = \frac{\hat{\beta}_i}{\hat{\sigma}_{\beta_i}}. \qquad \text{(A.2)}$$

The critical values for the $\bar{t}$-statistic are obtained by stochastic simulation using 100,000 replications.

The IPS panel unit root test results are reported in Appendix table 1. The statistics suggest that the data are stationary. Hence, we estimate a panel vector autoregressive (VAR) model

[7] Unlike the augmented Dickey-Fuller (ADF) test, the power of the IPS panel unit root test increases with the number of panels.

[8] The general results do not change when we use other criteria, e.g., the Schwartz criterion.

to analyse the relationships between *NIM*'s and *NONINT*'s in preference to a panel vector error correction model, which requires that variables are non-stationary and cointegrated.[9]

[9] Binder, *et al.* (2003) show that GMM estimation of panel VAR's based on orthogonality conditions breakdown if the underlying time series contain unit roots. However, as a check we re-estimated the model in ECM-form under the assumption of non-stationarity (i.e., even though all the variables are stationary). The ECM terms for both equations were insignificant. Eliminating the insignificant ECM terms lead to the restricted model in differenced form; which is what we pursue and report here.

Appendix table 1: IPS Panel Unit Root Test Results

Variable	$\bar{t}$ ***-statistic***
Net Interest Margin / Total Assets (%)	-2.93***
Non Interest Income to Total Assets (%)	-2.78***

Note:

a) ****, ** and * represent rejection of the unit root hypothesis at the 1%, 5% and 10% significance level, respectively;
b) All variables are de-trended prior to the unit root test for consistency, i.e., the IPS panel unit root test is based on the model with an intercept;
c) Critical values are obtained from stochastic simulations with 100,000 replications.

Appendix table 2. Sensitivity Analysis

	BIG4		Foreign		Other Domestic	
	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$	ΔNIM_t	$\Delta NONINT_t$
ΔNIM_{t-1}			LLO*, NAW*, STC*	BOA#, CIT#	BOQ*, MEL*	
$\Delta NONINT_{t-1}$			STC*	STC#	BOQ*, COL*, MEL*	COL#
Constant		ANZ*, COM*, WES*				

Note: # denotes that coefficient became statistically significant (based on bootstrap samples) when one of the banks listed was deleted from the sample;
* denotes that coefficient became statistically insignificant when one of the banks listed was deleted from the sample.

ANZ = Australian and New Zealand Bank.
COM = Commonwealth Bank.
WES = Westpac.
LLO = Lloyds Bank.
NAW = NatWest.
STC = Standard Chartered.
BOA = Bank of America
CIT = Citibank
BOQ = Bank of Queensland
MEL = Bank of Melbourne
COL = Colonial Bank