



Bank risk and return: the impact of bank non-interest income

Barry Williams and Laurie Prather

School of Business, Bond University, Robina, Australia

Abstract

Purpose – The purpose of this paper is to consider the impact on bank risk of portfolio diversification between traditional margin income and fee-based income for banks operating in Australia.

Design/methodology/approach – Considering several performance variables, this analysis compares the benefits of diversification across different bank types relative to margin income and fee income. Further, regression analysis considers bank risk and revenue concentration.

Findings – This paper documents that fee-based income is riskier than margin income but offers diversification benefits to bank shareholders. While improving bank risk-return tradeoff, these benefits are of second order importance compared to the large negative impact of poor asset quality on shareholder returns.

Practical implications – These results have implications for all stakeholders in Australian banks. The results suggest that shareholders of banks will benefit from increased bank exposure to non-interest income via diversification. From a regulatory perspective, diversification reduces the possibility of systemic risk, but caution must be offered with respect to banks pursuing absolute returns rather than monitoring risk-return trade-offs, and so exploiting the benefits of the implied guarantee offered by “too big to fail” However, shareholders should also monitor bank exposure to non interest income to ensure that they do not become over-exposed to the point where the volatility effect outweighs the diversification benefits.

Originality/value – The results of this study suggest that Australian regulators should consider requiring increased disclosure of the composition of bank non-interest income. Such disclosure would aid in understanding the changing nature of banking in Australia. Given the recent sub-prime crisis in the USA and the role played by fee based income sourced from securitization, increased disclosure of the nature of bank non interest income is now of global importance. This disclosure is particularly germane within the context of the implementation of Basle II, with its increased emphasis upon market discipline, given that Stiroh found increased disclosure in this area is accompanied by improved market pricing for risk.

Keywords Banks, Income, Diversification, Risk management, Australia

Paper type Research paper

1. Introduction

The nature of financial intermediation has changed significantly over the past two decades. In the case of the United States, the traditional function of banks as financial intermediaries has been in decline (Allen and Santomero, 2001). Similarly, in Australia, income from non-traditional sources (fee income) has increased since the mid-1990s (Reserve Bank of Australia, 2005)[1]. Despite this increase, income from traditional sources (interest income) still contributes over 80 percent of bank total income in

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Australia. These transformations in the financial system raise the question “Have these changes impacted upon bank risk?” This paper addresses the question by considering the impact on bank risk of traditional income drawn from intermediation versus non-traditional income drawn from fee income[2]. This adds to the literature on bank financial stability by considering the impact on bank risk of changing revenue structure. In particular Stiroh and Rumble (2006, p. 2158) consider that bank management “... may have gotten the diversification idea wrong...”. Although, as they discuss, bank management may be more concerned with total return than risk-return tradeoffs[3]. Further, the agency impact of “too big to fail” may encourage a focus on returns rather than risk and return tradeoffs[4].

The conventional view of fee income in banking is that banks offset lost margin income via increased fee income. Traditionally banks are viewed as intermediaries, taking deposits, writing loans, and earning margin income on the spread between the deposit and loan interest rates. Due to the process of disintermediation and effects of increased competition, the profitability of this traditional source of income has been declining (Reserve Bank of Australia, 2004). This has important implications for financial system risk. As discussed by Smith *et al.* (2003), the conventional view of fee income is that it is more stable than margin income. However, DeYoung and Roland (2001) present several arguments contending that fee income may in fact be less stable than margin income. While several recent studies considering the United States (DeYoung and Roland, 2001; Stiroh, 2004b) find fee income more volatile than margin income, European evidence (Smith *et al.*, 2003) suggests non interest income reduces bank risk, with Baele *et al.* (2007) finding that bank diversification into non interest income reduces bank total risk, but increases bank systematic risk. Given the conflicting results of prior studies (see for example, Stiroh (2004a) and DeYoung and Roland (2001)), and the lack of Australian evidence on this issue, there is a need for further studies that consider different perspectives and institutional settings.

The conventional view of bank shareholders is that they can diversify away any increases in idiosyncratic risk associated with increased non interest income. However, arguments presented by Merton (1974), Froot *et al.* (1993), Froot and Stein (1998) and Stiroh and Rumble (2006) illustrate that shareholders may be concerned about bank total risk due to the impact upon foregone investment and the need for active risk management by bank managers addressing information asymmetry and agency problems. Likewise bank total risk is important to bank regulators due their concern about systemic risk and the potential for contagion to other banks within their regulatory ambit. Borrowers are also concerned about bank survival as they face information and agency costs in the event of bank failure requiring a change of borrowing relationship, the resulting switching costs reduce the intrinsic value of the bank-client relationship (Stiroh and Rumble, 2006). Finally, since bank management cannot diversify total wealth away from their exposure to the individual bank, total risk is critical for these stakeholders. (Stulz, 1984).

The issue of bank income, both fees and margins, has provoked considerable public debate since deregulation of the Australian banking system in the early 1980s. Of notable interest are bank fees associated with payment processing (see for example; Reserve Bank of Australia and Australian Competition and Consumer Commission (2000) and Katz (2001)) and fees from providing intermediation services. Despite the

level of public attention, academic studies of bank fees are virtually non-existent, particularly in the area of rigorous statistical analysis. To date, one study (Williams, 2007) has considered net interest margins from the perspective of the classic Ho and Saunders (1981) model, but the issue of bank risk and changing bank revenue has not been explored.

This paper finds that traditional (margin) income is less risky than fee income, but unlike Stiroh (2004a) or Stiroh and Rumble (2006), the combination of the two revenue sources generates positive portfolio diversification benefits in Australia, similar to Baele *et al.* (2007) in the European case[5]. This Australian result is largely due to the negative correlation between the two revenue sources. Unlike Stiroh and Rumble (2006) this diversification effect is not dominated by the volatility effect, however Australian banks have a lower, on average, exposure to non interest income volatility. Additionally, the smaller domestic banks seem to have failed to take full advantage of these portfolio diversification possibilities. Foreign banks' risk adjusted returns to shareholders are on average below that of the risk free benchmark and foreign banks experience higher income volatility, but also hold more capital. Further, results indicate that the portfolio diversification benefits are of second order importance when compared to the large negative impact to bank shareholder returns of poor loan quality.

The paper is structured as follows. The next section reviews the relevant literature; the third section details the sample selection and methodology. The fourth section discusses the results, while the final section concludes the paper.

2. Literature review

2.1 Australian studies

Studies of Australian bank margins and non interest income are dominated by government reports. These involve comparisons of either average revenues (or average costs) versus charges without statistical testing, and none considers the issues of risk and return. These reports can be broken into three main groups:

- (1) the single study comparing Australian bank margins with some selected global benchmarks;
- (2) the annual series of surveys produced by the Reserve Bank of Australia on domestic bank fees; and
- (3) by far the largest set of reports, those considering the payments system.

The single report on Australia's net interest margins, (Reserve Bank of Australia (1994), compares Australian bank net interest margins with a selected set of banks from English-speaking nations. The study reports that bank net interest margins fell over the study period both in Australia and globally, while Australian bank margins (at that time) are higher than globally comparable banking systems[6]. The Reserve Bank of Australia (1994) also found that non interest income has risen somewhat to offset declining interest margins[7].

The second sequence of relevant reports are the annual surveys produced by the Reserve Bank of Australia (see for example Reserve Bank of Australia (2004, 2005, 2006, 2007, 2008). These surveys focus on fee income from the domestic provision of intermediation services and payment processing. Thus, they exclude non interest income earned from trading activity, securitization, fund management and insurance.

In 2008 bank fee income was dominated by charges levied upon business rather than households (See Reserve Bank of Australia (2008) Table I). As discussed by the Reserve Bank of Australia (2004), fees increased quite rapidly early in this century, while interest margins fell. In later reports the rate of fee increases fell due to reforms in charges upon payments systems in late 2003. The Reserve Bank of Australia (2008) concludes that fee income is growing more slowly than the growth of domestic asset, and that the decline in margin income have not been fully offset by growth in fee income (Reserve Bank of Australia (2005).

The third series of reports on non interest income in Australia deals with the issue of charges upon payments systems[8]. These reports were prompted by public discussion followed by a series of regulatory reviews and reforms. Representative are reports by the Reserve Bank of Australia and Australian Competition and Consumer Commission (2000) and Katz (2001). These reports find marginal revenue in excess of marginal cost. They also note that in addition to earning monopoly profits on the processing fee component, banks also earn an interest margin on the credit card loan component.

While the discussions summarized above focus upon a particular aspect of bank non interest revenue they do not consider the effect of increased bank fee income on bank risk. In addition, these reports do not explore the issue of bank income drawn from trading activity, securitization, funds management and insurance nor is the data employed exposed to any statistical testing. One study, Williams (2007), explores the issue of bank net interest margins from the perspective of the Ho and Saunders (1981) model and finds that Australian bank net interest margins have fallen and the core elements of the Ho and Saunders (1981) model apply in Australia.

	All banks	Big Four	Other domestic	Foreign
All years	413	72	178	163
1987	27	4	9	14
1988	32	4	13	15
1989	33	4	14	15
1990	31	4	14	13
1991	29	4	12	13
1992	28	4	13	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	11	4	5	2

Notes: 49 banks in sample; 23 other domestic; 22 foreign; 4 Big four

Table I.
Sample composition

2.2 International studies

Many of the studies of fee versus margin income and bank risk have been stimulated by the debate regarding the impact of changing the Glass-Steagall Act, and as a result this literature focuses on the United States. Following Stiroh (2004a), this research can be broken into three broad streams:

- (1) those simulating the impact of mergers between banks and other financial institutions;
- (2) those considering actual return and volatility data; and
- (3) those using market data to consider the existence of any diversification benefits[9].

The simulated merger studies such as Lown *et al.* (2000) generally conclude that there are some risk reduction benefits possible from mergers between banks and other financial firms. Those studies employing actual return and volatility data have produced mixed results. Other studies use market data to determine the risk effects of actual or possible mergers. These studies generally conclude that combining banks with life insurance firms improves the risk-return characteristics of the combined firm (Santomero and Chung, 1992; Saunders and Walter, 1994).

More recent studies consider actual risk and return data drawn from the banks balance sheet. DeYoung and Rice (2004) provide a model of factors determining fee income for commercial banks in the United States, from 1989 to 2001. Of particular note to this study is the finding that increases in non-interest income are associated with higher profit variability and a worsening of banks' risk-return trade-off. They also conclude that non interest income is acting as a supplement to interest income, rather than replacing interest income, as also suggested by the Reserve Bank of Australia (2005).

Recent studies by Stiroh (2004a, 2006b), Stiroh and Rumble (2006) and Baele *et al.* (2007) use non interest income to measure bank diversification away from traditional net interest income toward a wider range of financial services. Stiroh (2004a) studied both aggregate and bank-level data for United States banks between 1984 and 2001 and finds few benefits from non interest income at either the aggregate or bank-level. He concludes that the overall volatility of bank income has declined over the study period and attributes this to declining interest income volatility. Stiroh (2004a) also finds that the correlation between interest income and non-interest income has increased over the study period, thus reducing the benefits from diversification into non traditional income sources. Further, risk adjusted returns are strongly negatively correlated with the share of income derived from non-interest sources, with trading income, in particular, associated with a decline in profit per risk unit.

Stiroh (2006b) adopts a portfolio perspective toward non interest income and finds no link between non interest income exposure and bank stock returns. However, he identifies a positive link between non interest income exposure and return volatility (beta, total volatility and idiosyncratic volatility). Stiroh (2006b) concludes that the shift toward non interest income has increased bank risk but not bank returns, and that the largest US banks may be over-exposed to this revenue source. Stiroh and Rumble (2006) also employ non interest income to measure bank income diversification and conclude that increased exposure to non interest income results in worsening bank risk-return tradeoffs. They find that the increased volatility of non interest income more than offsets any portfolio diversification benefits. However, it is possible that

these negative effects are due to start-up and learning costs. As argued by Deng *et al.* (2007), diversification into non-traditional activity results in increased agency problems, resulting in a higher cost of debt[10]. A later study by Stiroh (2006a) finds that greater reliance upon non interest income is systematically associated with higher stock market volatility. Further, Stiroh (2006a) finds that the role of income items in determining bank risk is increasing over time.

In comparison to the US literature, studies considering Europe in this context are relatively rare. Smith *et al.* (2003) study banks in 15 European Union nations between 1994 and 1999. They conclude that non interest income has become increasingly important to banks over the study period, but it is more volatile than traditional income. A negative correlation between interest and non interest income is found by Smith *et al.* (2003), suggesting that non interest income acts to generate portfolio diversification benefits so stabilizing the variability of total income[11]. DeYoung and Rice (2004) explain this by considering the institutional differences between the United States and European markets, acknowledging that universal banking has a longer history in Europe than in the United States. Baele *et al.* (2007) argue that the preferred measure of bank diversification is non interest income as a proportion of total operating income. They find that banks with higher levels of non interest income have higher expected returns as measured by Tobin's *Q*, but also higher systematic risk. They find a non-linear relationship, and like Stiroh and Rumble (2006), suggest that banks can over-diversify into non traditional activities. Thus, those stakeholders with large exposures to banks should be concerned about bank-specific risk. For regulators this result means that large diversified banks have higher systematic risk and need attentive monitoring to manage potential systemic risk. Lepetit *et al.* (2008) also document increased non interest income resulting in higher bank risk. By exploiting detailed income data, they conclude that increased risk is due to commission and fee activities for small banks rather than trading activity.

In a study of 43 nations, Laeven and Levine (2007) find that diversified financial conglomerates are less valuable than specialized financial institutions, indicating that diversification across lending and non-lending activities does not add value and is likely to increase agency costs.

The recent evidence concludes that non interest income does not improve bank income risk-return characteristics, except in Europe. This is an important conclusion as DeYoung and Rice (2004) find that non interest income has grown in banking in the United States to contribute close to half of bank income. Further, large banks are more reliant upon non interest income than small banks, with the associated implications for systemic stability. They further find that 1 percent of all banks generate about 18 percent of all non interest income in the United States.

DeYoung and Roland (2001) suggest three reasons why non interest income acts to increase income volatility. First, as bank loans are based on relationships, the switching cost associated with changing lenders is high, while fee based income has less of a relationship component. The switching cost acts to reduce the volatility associated with interest margin income. Second, the main input to the lending process is interest expenditure, a variable cost. In the case of non interest income the main input is staff cost, which is mainly fixed, particularly in the short run, thus generating higher operating leverage and so higher potential risk. Finally, non interest income does not require high levels of fixed assets and thus has a lower level of required

capital (particularly for activities like fund management and trust services), unlike lending activity, and hence has higher financial leverage resulting in higher risk. Given the relatively limited evidence on this important evolutionary aspect of modern banking there is a need for further research beyond the two institutional frameworks that have been the focus of research to date.

3. Data and method

The data from this study are drawn from the individual bank annual reports. There are a total of 49 banks in the sample and these are categorized into three groups. The first group is the Big Four, representing the four dominant banks in Australia, which account for over 65 percent of Australian resident banking assets. These banks operate Australia-wide, offering a comprehensive range of financial products. The second group of banks are characterized as Other domestic banks. These are mainly regional banks that emphasize retail finance, but offer a wide range of banking products[12]. There are 20 Other Domestic banks in the sample. The final group of banks are the Foreign banks. These are banks with more than 50 percent foreign ownership. The majority of these banks are fully owned by their foreign parents, tend to be less focused upon retail finance[13], and are mainly located in the commercial centers of Sydney and Melbourne. Details of the sample and descriptive statistics are provided in Tables I and II respectively[14].

While several measures of bank interest income and non interest income are possible, many have the drawback of substantially reducing the number of banks in the sample, especially foreign banks. Thus, net interest income is measured as interest income less interest expense. This will be scaled by two alternative denominators:

- (1) total assets; and
- (2) shareholder's funds.

The first measure provides a generally used measure of interest margins; the second measure reflects the returns to shareholders from providing intermediation services. Non interest income will also be scaled by either:

- total assets; or
- shareholder's funds.

A measure of net non interest income will not be employed as the reported figures for non interest expenses include costs associated with the provision of both intermediation and fee-based services such as branch expenses, staff expenses and head offices costs. As discussed by DeYoung and Roland (2001, p. 66), non interest revenue does not completely differentiate between fees drawn from restructured intermediation (e.g. securitization) versus new activities. However, increased non interest income does measure the degree to which a bank has moved away from the traditional model of commercial banking.

Ideally we would like to decompose each bank's net interest margin figure into the components due to retail banking and the components due to wholesale banking. Unfortunately such detail is not available as a consistent set across banks or across the study period. As will be discussed later in this paper, an important policy conclusion that results is a call for increased disclosure (and consistency of that disclosure) of the components of bank revenue. The recent sub-prime mortgage crisis in the United States

	Net interest margin %	Non interest income/ total assets %	Total assets \$A, 000	Market share (all bank assets) %	Capital adequacy ratio	Interest income/total revenue %	Housing loans/ total assets %
<i>All banks 1987 to 2004</i>							
Mean	2.236	1.835	323,104,00.1	6.366	12.159	83.046	16.651
SD	1.315	1.959	66,359,190.6	10.561	4.159	13.975	16.175
Minimum	-0.165	0.063	29278.0	0.004	8.400	27.645	0.000
Maximum	18.676	12.098	41,130,900.0	45.909	42.100	99.442	64.423
<i>n</i>	413	397	413	372	343	391	343
<i>Big 4 banks</i>							
Mean	2.664	1.630	151,584,591.0	26.886	10.331	80.765	17.647
SD	0.569	0.295	86,947,376.9	6.341	1.089	5.508	9.731
Minimum	1.709	1.154	41,614,807.0	17.806	8.600	61.379	5.536
Maximum	3.821	2.853	411,309,000.0	45.909	13.900	89.711	39.901
<i>n</i>	72	72	72	72	60	72	72
<i>Other domestic banks</i>							
Mean	2.545	1.686	10,293,489.0	2.096	11.554	85.085	26.587
SD	1.072	2.146	13,081,564.0	2.216	1.894	14.366	16.291
Minimum	0.029	0.063	289,731.0	0.098	8.700	30.005	0.000
Maximum	5.261	10.838	69,960,000.0	8.883	18.400	99.442	64.423
<i>n</i>	178	175	178	151	117	175	143
<i>Foreign banks</i>							
Mean	1.710	2.108	3,667,875.1	0.780	14.057	81.762	4.992
SD	1.593	2.158	4,242,677.6	0.703	6.202	15.953	10.304
Minimum	-0.165	0.083	29,278.0	0.004	8.400	27.645	0.000
Maximum	18.676	12.098	24,430,600.0	2.564	42.100	98.558	45.152
<i>n</i>	163	150	163	149	128	150	128

*(continued)*Table II.
Descriptive statistics

Table II.

	Net interest margin %	Non interest income/ total assets %	Total assets \$, 000	Market share (all bank assets) %	Capital adequacy ratio	Interest income/total revenue %	Housing loans/ total assets %
<i>All banks 1987</i>							
Mean	2.042	1.953	10,786,442.4	5.598	Not available	86.577	18.562
SD	1.278	1.858	20,117,905.8	10.413		9.639	18.125
Minimum	- 0.013	0.125	320,641.0	0.155		50.497	0.000
Maximum	5.083	9.083	70,333,500.0	36.365		99.216	63.332
<i>n</i>	27	24	27	27		24	13
<i>All banks 1993</i>							
Mean	2.464	2.184	19,019,108.6	5.035	12.985	79.273	14.024
SD	1.089	2.169	35,517,457.1	9.205	5.131	14.515	15.653
Minimum	0.492	0.203	558,622.0	0.142	8.800	34.827	0.000
Maximum	4.412	9.336	117,251,300.0	29.967	32.800	97.491	51.897
<i>n</i>	28	27	28	27	26	27	26
<i>All banks 1999</i>							
Mean	2.087	2.010	44,691,023.3	7.077	12.586	78.916	18.874
SD	1.047	2.400	73,766,738.9	11.338	3.491	16.903	14.893
Minimum	- 0.165	0.199	429,252.0	0.062	9.200	27.645	0.000
Maximum	4.659	8.797	254,081,000.0	38.227	22.000	96.193	43.439
<i>n</i>	18	18	18	17	14	18	17
<i>All banks 2004</i>							
Mean	1.869	1.268	126,500,314.0	24.263	10.233	80.852	14.897
SD	0.294	0.766	148,906,260.0	5.952	0.380	11.031	19.405
Minimum	1.319	0.083	2,126,068.0	19.372	9.700	61.379	0.000
Maximum	2.304	2.853	411,309,000.0	32.512	10.580	98.558	39.901
<i>n</i>	11	11	11	4	4	11	10

and its global implications illustrate the importance of this improved need for transparency.

Thus, unlike the study by Stiroh (2006a) this study is also unable to disaggregate the non interest revenue earned by individual banks into those components due to fees charged upon intermediation activities and non interest income earned from trading income, securitization, funds management and insurance. Australian banks are not required to disclose such detail in their annual reports, and similarly, regulatory data does not provide this information for individual banks. Thus, banks may have shifted some of the revenue previously earned from margin income into fee income charged upon loans and deposit accounts. It is possible that such a shift would not change the risk profile of the bank's revenue, but rather simply change the composition of that revenue[15]. It is also possible that such a change would alter the risk characteristics of the bank's income, as charging upfront fees on a loan as opposed to an ongoing stream of margin income could result in increased risk[16], as Williams (2007) finds that lower bank margins are associated with higher levels of problem loans. Nonetheless, this lower level of disclosure of bank income components does place some limitations upon this study. As found by Stiroh (2006a), increased disclosure improved the prediction of bank holding company risk in the United States. As an outcome this paper will view the portfolio choice made by a bank as being an allocation decision between revenue sourced from net interest income or revenue sourced from non interest income.

The analysis in this paper will emphasize the performance measures scaled by shareholder's funds for several reasons. First, this measure represents the return to bank owners from these activities[17]. Second, as discussed above, regulators, bank management and bank shareholders all have some exposure to bank total risk and so are concerned about returns on shareholder's funds. This scaling is also consistent with a number of recent studies, as discussed above, which use scaled non interest income as a measure of bank portfolio diversification away from the provision of traditional bank deposit taking and lending. Using a measure based upon shareholder's fund means that the observed volatility may reflect leverage effects as well as revenue volatility. While the degree of leverage model of DeYoung and Roland (2001), would facilitate the decomposition of these effects, the data is not currently available. However, given that the current regulatory framework as embodied in Capital Adequacy Marks 1 and 2, place a central role upon shareholder's funds, analyzing the role of changing bank revenue composition upon shareholders, even at the aggregate level, remains important. In the light of the recent sub-prime financial crisis, this importance has increased rather than decreased.

As is well known in finance, if two assets have return sequences with less than perfect positive correlation, then it is possible to reduce the overall variation of income. Thus we examine the correlations between the income measures to determine if it is possible to reduce risk through diversification.

To measure the diversification benefits of combining Net Interest Income and Non-interest Income two alternative performance measures are considered. Following Smith *et al.* (2003) the first measure, the coefficient of variation (ν_i), expresses the standard deviation of the returns of the income source as a percent of the mean:

$$\nu_i = \sigma_i / \mu_i \quad (1)$$

where:

σ_i is the annual standard deviation of returns for income source i for the study period (1987-2004); and

μ_i is the average annual return for the income source i for the study period.

The coefficient of variation is a relative measure (risk per unit of return) that allows one to compare investments with widely different rates of returns and standard deviations. The higher the relative degree of dispersion or volatility the income measure displays, the higher the observed value of ν_i . As a general indicator, if ν_i of one income type is higher than for another income type with the corresponding scaling, it would be expected to be, *ceteris paribus*, riskier. The advantage of this measure is that it makes few assumptions about the underlying return generating process.

The second measure, another risk-adjusted performance ratio (RAP ratio) is similar to the coefficient of variation in that it is a relative risk measure commonly used to compare investment alternatives. The RAP ratio expresses the average excess return for the income source as a percentage of the standard deviation of returns:

$$\text{RAP}_i = \frac{\bar{r}_i - \bar{r}_f}{\sigma_i} \quad (2)$$

where:

\bar{r}_i is the average annual return for the income source i over the study period (1987-2004);

\bar{r}_f is the average annual return for the risk-free asset over the study period; and

σ_i is the annual standard deviation of returns for the income source i for the study period.

By subtracting a risk-free return, the numerator represents a risk premium, and the ratio can be interpreted as the excess return per unit of risk. An advantage of this measure is that the RAP includes an inflation adjustment, since one of the components of the risk-free rate is expected inflation. This provides a more accurate assessment of performance when analyzing a long time series with the potential for interest rate fluctuations. In the case of the RAP ratio, the volatility measure is in the denominator, so, the higher the relative degree of dispersion or volatility the income measure displays, the lower the observed value of RAP_i . In contrast to the coefficient of variation, the lower the RAP_i the riskier the income type.

Table III shows the risk and return of both income sources as well as interest income as a percent of total income. Total income is measured as interest income plus non interest income. Net interest income plus non interest income scaled by shareholders funds and profits before tax scaled by shareholders funds are also shown. The final column of Table III shows the average total assets. Table III also shows the same statistics segmented into the three main bank type sub-samples.

As the objective function of the firm is to maximize returns to shareholders, the RAP ratios of net interest income, non interest income and net interest income plus non interest income, all scaled by shareholders funds will be examined. The five year Treasury note rate obtained from the Reserve Bank of Australia serves as the risk-free

	Net interest income/total assets	Non interest income/total assets	Net interest income/equity	Non interest income/equity	(Net interest income + non interest income)/equity	Return on equity before tax	Total assets (\$'000)
<i>All banks</i>							
Mean	2.236	1.839	32.339	27.556	60.217	9.139	32,310,400
SD	1.315	1.960	16.865	47.312	48.879	24.681	66,359,191
N	413	396	413	397	397	412	413
CV	58.813	106.608	52.152	171.695	81.172	270.065	
<i>Big four banks</i>							
Mean	2.635	1.629	40.959	25.203	66.162	18.516	151,584,591
SD	0.568	0.296	9.872	6.361	12.924	9.084	86,947,376
N	72	72	72	72	72	72	72
CV	21.556	18.171	24.102	25.239	19.534	58.546	
<i>Other domestic banks</i>							
Mean	2.545	1.693	38.897	22.205	60.630	13.767	10,293,489
SD	1.072	2.150	17.263	23.075	24.449	12.716	13,081,564
N	178	174	178	175	175	178	178
CV	42.146	127.015	44.382	103.919	40.325	92.361	
<i>Foreign banks</i>							
Mean	1.710	2.108	21.369	34.927	56.880	-0.114	3,667,875
SD	1.593	2.158	12.397	72.229	74.455	34.522	4,242,678
N	163	150	163	150	150	162	163
CV	93.117	102.375	58.016	206.797	130.898	-30310.308	

Notes: CV = coefficient of variation; $\sigma^2/\mu * 100$; These statistics are calculated using the overall (panel) means and standard deviations (excluding the total asset figures, all other figures are percentages)

Table III.
Risk and return of income
sources 1987-2004

benchmark rate for the RAP measure[18]. Both bank-specific and year-specific RAPs will be calculated[19]. Due to a lack of data in some cases, the numbers of bank-specific RAPs are slightly below the 49 banks shown in Table I. This occurs in a few cases when only a single year's data is available, thus the RAP, with its denominator of standard deviation of returns cannot be calculated.

Additional regression analysis considers bank risk and revenue concentration. The measures of bank risk discussed above, plus additional measures, outlined below, are employed as dependent variables. For each risk measure the dependent variable is the bank specific mean value, and the bank specific mean value of revenue concentration (non interest income share) is the independent variable, while dummy variables identify bank type. This approach reflects (in general) that taken by DeYoung and Roland (2001) and Esho *et al.* (2005), with some modification due to differences in data availability. Both DeYoung and Roland (2001) and Esho *et al.* (2005) employed quarterly regulatory returns.

In the case of this study the annual frequency of the data does not allow estimation of a degree of total leverage model. Further, as the primary data source is the individual bank annual reports, consistent details regarding the sub-components of income (both interest income and fee income) are not available. Additionally, as the study has relatively few banks the degree of freedom available for these regressions is limited to forty-one observations. However, in contrast to the study by Esho *et al.* (2005), which considers 198 Credit Unions in Australia, with only a small market share of 2.1 percent of authorized deposit taking institutions (*Reserve Bank of Australia Bulletin*, 2006), this study considers Australian banks with a total market share of 96.7 percent of authorized deposit taking institutions (*Reserve Bank of Australia Bulletin*, 2006).

In addition to the measures defined previously, dependent variables employed in these regressions also include bank specific means of equity to total assets, a *Z* score and a regulatory *Z* score. Following Esho *et al.* (2005) the *Z* score is defined as:

$$Z = \frac{\text{Mean_ROA} + \text{Mean_E / A}}{\sigma_{\text{ROA}}},$$

with ROA = Return on Assets and E/A = Equity/Assets. The regulatory *Z* score is defined similarly, with E/A replaced by the bank average Capital Adequacy Ratio, less the eight percent regulatory minimum. The first *Z* score measures the probability of bankruptcy, while the regulatory *Z* score measures the probability of breaching the minimum required capital holdings. In each case the lower the score, the higher the likelihood of either bankruptcy or breaching the required minimum capital holdings.

4. Results

As shown in Table II, interest income still provides the major proportion of bank total income, accounting for over 80 percent of bank income, this is higher than the United States data reported in Stiroh (2006b), and closer to the 2004 European data reported by Baele *et al.* (2007). This is despite the increased emphasis upon non-interest income as reported by the Reserve Bank of Australia (2007)[20]. It is worth noting that the most recent years have seen a slight decline in interest income as a proportion of total revenue. These results are largely consistent across all three bank types in the study.

Thus, in the Australian case the importance of interest income is higher than in the case of the United States (DeYoung and Rice, 2004).

Following Smith *et al.* (2003), we use the Coefficient of Variation (CV) as an initial measure of risk. Table III indicates that in all cases but one the CV of non interest income is higher than that of net interest income, confirming the arguments of DeYoung and Roland (2001), and the findings of Stiroh (2004a). In the case of the Big Four banks the result is less conclusive, with the CV of non-interest income scaled by assets lower than that for net interest income scaled by assets. The opposite is true for non-interest income and net interest income scaled by equity. For the Other Domestic banks and Foreign Banks non interest income is consistently riskier.

As the relationship between the individual constituent's performance is an important aspect of any portfolio, Table IV presents the correlations between the different measures of revenue used in this study. For the entire sample, the correlation between net interest income and non interest income is consistently negative. In the case of the Big Four Banks this result also largely holds. It is worth noting that return on equity before tax shows a negative correlation with non interest income scaled by equity, implying that returns to shareholders before tax are reduced by increased non interest income for the Big Four Banks. In the case of Other Domestic Banks, the correlation between net interest income and non interest income is consistently negative, while this result is less conclusive for the Foreign Banks. Overall, these results indicate that there are potential diversification benefits from combining net interest income and non interest income, especially for the domestic banks. The results for the Foreign Banks are slightly less conclusive. This is borne out by comparing the CV of total income with those of net interest income and non interest income. For the Big Four and Other Domestic Banks the CV of total income is below those of its two constituents, indicating that combining these two revenue sources reduces risk.

The RAPs of these two revenue sources provide a risk-adjusted measure; they are shown in Tables V-VII. As shown in Table V, net interest income displays a significantly superior RAP, with the exception of the Foreign Banks, which show no significant difference in risk return trade-off for the two income sources. The difference between the RAPs for the Other Domestic Banks is also notable; interest income has a higher RAP than fee income, with this difference being significant at the 0.1 percent level[21]. This illustrates the continued importance of traditional intermediation income for this bank type. Given the results, it is likely that the Other Domestic Banks are the main source of the differences in RAP found in Tables V-VII. Further, the small sample size for the Big 4 banks makes it difficult to discern any significant differences. The RAP for Foreign Bank net interest income is significantly lower than that of the Domestic Banks. However, the RAP for Foreign Banks' non interest income is not significantly different from that of the domestic banks.

Across all banks, the RAP of total income is higher than that for net-interest income. The correlation between margin and fee income is generally negative, suggesting potential benefits from combining these two income sources into a portfolio of revenue sources and this is documented in Table VI. While non-interest income offers an inferior risk-return trade-off alone, as compared to net interest margin income; combining non interest income with margin income improves the risk return trade-off of a bank's total income, with the exception of Other Domestic Banks. This result is predominately driven by the improvement in risk-return trade-off experienced by

Table IV.
Correlation matrices 1987
to 2004

	Net interest income/total assets %	Non interest income/total assets %	Net interest income/ equity %	Non interest income/ equity %	(Net interest income + non interest income)/equity %	Return on equity before tax %
<i>All banks</i>						
Net interest income/total assets	1.000	-0.036	0.584	-0.214	-0.009	0.059
Net interest income/total assets		1.000	-0.349	0.488	0.355	-0.060
Net interest income/equity			1.000	-0.078	0.263	0.305
Non interest income/equity				1.000	0.941	0.000
(Net interest income + non interest income)/equity					1.000	-0.056
Return on equity before tax						1.000
<i>Big four banks</i>						
Net interest income/total assets	1.000	-0.215	0.703	-0.272	0.403	-0.001
Net interest income/total assets		1.000	-0.199	0.730	0.207	-0.265
Net interest income/equity			1.000	0.232	0.878	0.058
Non interest income/equity				1.000	0.669	-0.171
(Net interest income + non interest income)/equity					1.000	-0.040
Return on equity before tax						1.000
<i>Other domestic banks</i>						
Net interest income/total assets	1.000	-0.270	0.824	-0.253	0.335	0.323
Net interest income/total assets		1.000	-0.410	0.929	0.591	0.206
Net interest income/equity			1.000	-0.285	0.427	0.292
Non interest income/equity				1.000	0.745	0.878
(Net interest income + non interest income)/equity					1.000	0.390
Return on equity before tax						1.000
<i>Foreign banks</i>						
Net interest income/total assets	1.000	0.204	0.260	-0.183	-0.134	-0.173
Net interest income/total assets		1.000	-0.281	0.403	0.343	-0.120
Net interest income/equity			1.000	0.094	0.259	0.134
Non interest income/equity				1.000	0.986	0.427
(Net interest income + non interest income)/equity					1.000	-0.152
Return on equity before tax						1.000

	Average net interest income RAP	<i>n</i>	Average non-interest income RAP	<i>n</i>	<i>F</i> -value	<i>p</i> value	Wilcoxon test	Two-sided <i>p</i> value	Kruskal-Wallis test Chi-square	<i>p</i> value
All banks	3.562	49	1.326	48	6.680	0.0113	3.063	0.0022	9.404	0.0022
Foreign banks	1.908	22	1.137	22	1.569	0.217	0.974	0.330	0.972	0.324
Other domestic	5.009	23	1.136	22	5.147	0.028	3.372	0.0007	11.446	0.0007
Non foreign (Big 4 and other domestic)	4.911	27	1.485	26	5.050	0.023	3.247	0.001	10.601	0.001
Big 4	4.348	4	3.407	4	0.885	0.3832	0.722	0.4705	0.750	0.387

Table V.
Risk-adjusted
performance – net
interest income versus
non interest income
(scaled by equity)

Table VI.
Risk-adjusted
performance – net
interest income versus
total income (net interest
income plus non interest
income): all scaled by
equity

	Average net interest income RAP	<i>n</i>	Average total income RAP	<i>n</i>	F-value	<i>p</i> value	Wilcoxon test	Two-sided <i>p</i> value	Kruskal-Wallis test Chi-square	<i>p</i> value
All Banks	3.562	49	4.157	48	0.413	0.522	2.421	0.016	5.878	0.015
Foreign banks	1.908	22	3.657	22	6.117	0.018	-2.969	0.003	8.887	0.003
Other domestic	5.009	23	4.462	22	0.099	0.754	1.169	0.242	1.394	0.2377
Non foreign (Big 4 and other domestic)	4.911	27	4.901	26	0.000	0.995	1.326	0.185	1.781	0.182
Big 4	4.348	4	7.317	4	1.414	0.279	-0.722	0.471	0.750	0.387

	Average net interest income RAP	<i>n</i>	Average return on equity (before tax) RAP	<i>n</i>	<i>F</i> -value	<i>p</i> value	Wilcoxon test	Two-sided <i>p</i> value	Kruskal-Wallis test Chi-square	<i>p</i> value
All banks	3.563	49	0.226	48	10.379	0.002	-4.466	0.0001	22.747	0.0001
Foreign banks	1.908	22	-1.498	22	6.923	0.012	4.636	0.0001	21.600	0.0001
Other domestic	5.009	23	1.447	27	5.099	0.029	2.725	0.0064	7.479	0.006
Non foreign (Big 4 and other domestic)	4.911	27	1.479	31	6.348	0.015	3.118	0.002	9.769	0.002
Big 4	4.348	4	1.694	4	5.657	0.055	1.876	0.061	4.083	0.043

Table VII.
Risk-adjusted
performance – net
interest income versus
return on equity
(before tax)

Foreign Banks as a result of combining these two income sources. Overall, these results indicate that the bank's shareholders, (especially of Foreign Banks, which are more active in off-balance sheet types of activity (Williams, 2003)), are benefiting in terms of risk-return trade off by the banks combining margin income with non-interest income. This is somewhat different to DeYoung and Rice (2004) and Stiroh (2004a), highlighting the impact of the differences in institutional settings.

Given that fee income displays an inferior RAP to margin income, then over-emphasizing non interest income will reduce the portfolio diversification benefits to bank shareholders. Other Domestic Banks show no significant benefits from diversification into fee income. The Other Domestic banks have the highest proportion of total income drawn from traditional (margin) income. This result may not indicate that Other Domestic banks have fewer opportunities for this type of portfolio diversification, but instead may reflect their limited involvement in non-traditional banking, thus reducing portfolio diversification benefits.

As an additional analysis the RAP of net interest income is compared with the RAP of return on equity before tax. This comparison is shown in Table VII. Unsurprisingly, the RAP of return on equity before tax is significantly lower than that for net interest income. This illustrates the negative impact on shareholders' risk and return of non-interest expenses and bad loans. It is apparent that the shareholders of some banks, particularly the Foreign Banks, earned a return before tax, on average, lower than the Five Year Treasury bond rate. Further, the RAP of return on equity (before tax) of Domestic Banks is significantly above that of the Foreign Banks.

The cyclical properties of these risk-return trade-offs are shown in Table VIII. As can be seen, non-interest income displays a consistently inferior risk return trade-off as compared to margin income, and the combination of net interest income with non interest income into a portfolio of revenue improves the overall risk-return trade-off of the average bank's revenue. Also in Table VIII, the RAP of return on equity before tax is negative in some years, again indicating that the shareholders of the average bank in those years would have been financially better off investing in Five Year Treasury Bonds. This indicates the importance of non-interest costs and loan quality to the risk adjusted before tax return for bank shareholders.

The importance of asset quality in determining the shareholder risk-return trade-off is shown in the last four columns of Table VIII. These columns show, respectively, the average balance of the provisions for bad and doubtful debts account divided by total loans and the doubtful debts expense divided by total loans. In the years that these two measures increase, the RAP of return on equity before tax declines; and in the years 1987, 1989 to 1992, and 2000 and 2001, they are negative. Thus the negative impact of poor asset quality can be sufficiently large to overcome any positive diversification effects resulting from combining traditional and non traditional income for banks, and in the extreme produce an outcome whereby shareholders would have been better off investing in the risk free Five Year Treasury Bond. Consistent with some of the activity associated with the recent sub-prime crises, and lacking superior disclosure of the composition of bank income, an alternative explanation of these results is that some of the banks have increased the upfront fees charged on riskier loans. However, it remains apparent that the negative impact of poor asset quality outweighs any impact (at the margin) of changing revenue composition.

Year	RAP net interest income		RAP non interest income		RAP net interest plus non interest income		RAP return on equity before tax		Balance of provisions account to total loans		Doubtful debts expense to total loans	
		<i>n</i>		<i>n</i>		<i>n</i>		<i>n</i>	%	<i>n</i>	%	<i>n</i>
1987	0.867	27	0.539	25	1.841	24	-0.109	28	1.121	21	0.481	22
1988	1.137	32	0.697	30	1.626	30	0.053	33	1.231	29	0.776	29
1989	1.012	33	0.477	31	1.820	31	-0.347	35	1.890	31	2.251	30
1990	1.096	31	0.340	29	1.092	29	-0.551	34	2.927	29	3.095	29
1991	1.128	29	0.733	29	2.353	28	-0.414	31	4.086	27	2.558	27
1992	1.211	28	0.872	29	2.092	27	-0.255	30	3.537	26	1.390	26
1993	1.484	28	1.130	28	2.597	27	0.649	31	2.832	27	0.713	27
1994	1.407	25	0.939	25	2.520	24	0.881	29	2.650	21	0.164	23
1995	1.631	24	0.851	24	2.958	23	1.074	28	1.343	22	0.161	23
1996	1.472	23	0.837	23	2.559	22	1.220	27	1.103	20	0.111	22
1997	1.610	19	0.666	19	1.495	18	1.031	22	1.118	17	0.173	18
1998	1.809	19	0.702	19	1.539	19	0.210	21	1.221	18	0.318	18
1999	1.393	18	0.518	18	1.101	18	0.320	20	1.442	17	0.384	17
2000	1.627	20	0.375	20	0.756	20	-0.065	20	1.538	19	0.493	19
2001	1.7771	18	0.330	18	0.519	18	-0.052	18	1.283	16	0.461	18
2002	1.964	15	0.456	15	0.829	15	1.639	15	1.340	14	0.635	14
2003	1.899	13	0.789	13	2.795	13	2.878	13	1.167	13	0.223	12
2004	2.424	11	1.166	11	2.823	11	2.006	11	0.611	11	0.161	11

Table VIII.
Annual risk adjusted
measures for revenue and
asset quality measures

The regressions based upon the degree of leverage approach of DeYoung and Roland (2001) and Esho *et al.* (2005) find no evidence that the proportion of fee income determines bank risk, but this result must be interpreted with caution, as the degrees of freedom for this portion of the study are relatively small. In each case the regressions are estimated using both OLS and Two Stage Least Squares to control for an endogeneity bias[22]. In order to fully apply the degree of leverage model more detailed data with a higher time series frequency is needed.

5. Conclusion

This paper finds that income derived from traditional sources is less risky than income derived from non interest based revenue, supporting the arguments and results of Smith *et al.* (2003) and DeYoung and Roland (2001). However, unlike Stiroh (2004a), non-interest income is a source of diversification for bank income, similar to the European results to date. The average level of non interest income as a percent of revenue is lower in Australia than in the study by Stiroh (2006b), thus it remains possible that as Australian bank non interest income activity increases the portfolio diversification benefits will decline, consistent with Stiroh and Rumble (2006). Overall, these results suggest that shareholders of banks will benefit from increased bank exposure to non interest income via diversification[23]. However, shareholders should monitor bank exposure to non interest income to ensure that they do not become over-exposed to the point where the volatility effect outweighs the diversification benefits. Shareholders with poorly diversified holdings and bank management with reduced ability to hedge away their bank-specific risk (Stulz, 1984) will benefit from diversification, with the same caveat.

From a regulatory perspective, diversification reduces the possibility of systemic risk, but caution again must be offered with respect to banks pursuing absolute returns rather than monitoring risk-return trade-offs, with an eye to exploiting the benefits of the implied guarantee offered by “too big to fail” (Stiroh and Rumble, 2006). Changes in the nature of financing have resulted in banks facing increased competition from market based solutions offering a direct substitute to traditional intermediation (Allen and Santomero, 2001). In light of this trend, banks increased exposure to non interest income may be an inevitable evolutionary process changing the nature of risk and return trade-offs in banking, a process that should be monitored by all stakeholders.

A further policy recommendation follows from Stiroh (2006a), in that increased disclosure of the composition of bank non interest income sources has resulted in improved understanding of the determinants of bank risk in the case of US bank holding companies. Thus the Australian regulators should consider requiring increased disclosure (and consistency of that disclosure) for both interest and non interest income as well as the components of interest costs. Such disclosure would aid in understanding the changing nature of banking in Australia. Two possibilities present themselves as reflective of the evidence found in this study; that Australian bank revenue reflects the global move to financial conglomeration and disintermediation (Allen and Santomero (2001)), or that Australian banks have transformed the nature of intermediation from an interest margin based activity to a mix of upfront fees and interest margins (a type of new intermediation). Given the recent sub-prime crisis in the United States and the role played by fee based income sourced from securitization, increased disclosure of the nature of bank revenue is now

of global importance. This disclosure is particularly germane within the context of the implementation of Basle II, with its increased emphasis upon market discipline, given that Stiroh (2006a) found increased disclosure in this area is accompanied by improved market pricing for risk. Such an improved pricing for risk provides one avenue for potentially reducing a recurrence of the sub-prime crisis.

Notes

1. It should be noted that the Reserve Bank of Australia surveys on this topic confine themselves to considering non interest income resulting from the intermediation process. This paper will take a wider perspective and also include non interest income resulting from funds management, securities trading, underwriting and other activities.
2. This view follows the lead of Baele *et al.* (2007), Stiroh (2006b) and Stiroh and Rumble (2006).
3. Interestingly a recent study by Clarke *et al.* (2007) documents a return to retail banking by the major US banks to the higher revenue stability of retail activity.
4. Deng *et al.* (2007) document “too big to fail” effects in bond yield spreads.
5. Stiroh and Rumble (2006) find positive portfolio benefits from combining non interest income with interest income but that the higher volatility of non interest income outweighs the benefits given the level of non interest income as a proportion of total revenue for the US banks in their sample.
6. It should be noted that the conclusions of the Reserve Bank of Australia (1994) were not accompanied by any statistical testing. A study by Williams and Rajaguru (2007) confirmed that bank margins have fallen Australia, using vector autoregression testing.
7. Again this was not verified with any statistical testing, but was confirmed by Williams and Rajaguru (2007), with it being found that increases in non interest income were proportionally smaller than falls in net interest margins.
8. This issue generated quite a voluminous controversy that is outside of the scope of this research. Interested readers are referred to the Reserve Bank of Australia web site (www.rba.gov.au) for further detail.
9. In addition to Stiroh (2004a), DeYoung and Roland (2001) and Smith *et al.* (2003) also provide informative reviews of the literature.
10. As a counterpoint Deng *et al.* (2007) document reduced cost of debt resulting from domestic geographic diversification and asset diversification.
11. Such portfolio diversification benefits are of course possible as long as the correlations between the two income sources are less than one.
12. Included in the Other Domestic category is Macquarie Bank which has a focus upon wholesale banking.
13. A major exception to this generalization is BankWest, owned by HBOS (UK) which is a foreign acquisition of a regional domestic bank and retains a retail focus.
14. While the PWC survey of foreign banks (PriceWaterhouseCoopers (2005)) shows a greater number of foreign banks than that shown in Table I, this is explained by several institutional factors. This study confines itself to those banks operating in Australia with a full banking licence. Further, to be included in the sample the bank annual report had to be available to these authors. The PWC survey includes both subsidiary banks (which are now a decreasing set of the foreign banks operating in Australia), plus branch banks which are not separately incorporated in Australia (and do not make available their Australian annual report) plus the foreign subsidiary merchant banks (which do not have to provide annual reports). The

Australian Prudential Regulation Authority (APRA) website (www.apra.gov.au) lists all licensed banks operating in Australia. Foreign branch banks are the dominant proportion in terms of numbers of the foreign banks operating in Australia.

15. We are grateful to an anonymous referee for comments in this area.
16. The recent sub-prime mortgage crisis strongly suggests that moving away from a traditional model of mortgage lending increases risk.
17. It should be noted that the shareholder's returns from both activities will be reduced by factors such as non interest costs; however, the available data does not allow apportionment of non interest costs into those relevant to each type of activity.
18. The five year Treasury bond is the only risk free interest rate series consistently available for the entire sample period.
19. DeYoung *et al.* (2004) applied similar ratios to the return on equity (ROE) of community banks in a similar manner.
20. The Reserve Bank of Australia surveys on this topic focused upon non interest income resulting from intermediation only such as fees levied upon deposits and loans, and so provides a less comprehensive perspective on bank non interest income than this study.
21. Test statistics and corresponding *p*-values are included for the standard parametric, ANOVA *F*-test and two non-parametric tests (Wilcoxon Ranks Sums test and the Kruskal-Wallis test). The advantage of the non-parametric tests is that they make no distributional assumptions and require only that the samples be independent. Additionally, the non-parametric tests are less likely to give spurious results if there are outliers.
22. The results of these regressions are available from the authors on request.
23. With the caveat that banks that choose to charge upfront fees on lower quality loans will reduce shareholder value.

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Corresponding author

Barry Williams can be contacted at: Barry_Williams@bond.edu.au

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