Non-interest Income and Systemic risk: The Role of Concentration

Fariborz Moshirian, Sidharth Sahgal, Bohui Zhang

University of New South Wales

Nov 17,2011

Motivation

- After the financial crisis, the diversification by banks into non-traditional banking activity has become a critical concern for regulators.
  - A British panel has recommended "ring-fencing" of investment banking from retail banking.
  - The "Volcker" rule in the Dodd-Frank bill seeks to curtail proprietary trading.

Motivation

- After the financial crisis, the diversification by banks into non-traditional banking activity has become a critical concern for regulators.
  - A British panel has recommended "ring-fencing" of investment banking from retail banking.
  - The "Volcker" rule in the Dodd-Frank bill seeks to curtail proprietary trading.
- Questions in this paper:
  - What is the relationship between non-core banking activity (non-interest income) and systemic risk?

Motivation

- After the financial crisis, the diversification by banks into non-traditional banking activity has become a critical concern for regulators.
  - A British panel has recommended "ring-fencing" of investment banking from retail banking.
  - The "Volcker" rule in the Dodd-Frank bill seeks to curtail proprietary trading.
- Questions in this paper:
  - What is the relationship between non-core banking activity (non-interest income) and systemic risk?
  - Is the relationship homogenous in countries with different levels of banking concentration?

Previous Literature

- Non-interest income
  - Theoretical: Portfolio theory (Markowitz (1952)) advocates that diversification can decrease risk when individual assets are not fully correlated. But Wagner (2010) points out that even though diversification can decrease individual bank risk, it can increase systemic risk due to increase possibility of joint failure.
  - Empirical: De Jonghe(2009), Brunnermeir, Dong and Palia (2011) and Demigurc-Kunt and Huizinga (2010) show that bank failure increases bank fragility.

Previous Literature

- Non-interest income
    - Theoretical: Portfolio theory (Markowitz (1952)) advocates that diversification can decrease risk when individual assets are not fully correlated. But Wagner (2010) points out that even though diversification can decrease individual bank risk, it can increase systemic risk due to increase possibility of joint failure.
    - Empirical: De Jonghe(2009), Brunnermeir, Dong and Palia (2011) and Demigurc-Kunt and Huizinga (2010) show that bank failure increases bank fragility.

- Concentration
    - Theoretical: Keeley (1990) shows that a decrease in concentration can increase bank default risk. Boyd and De Nicolo (2005) shows that it is possible for bank portfolios to become less risky as competition increases in the loan market .
    - Empirical: Beck, Demigurc-Kunt and Levine (2006) show that countries with higher concentration suffer fewer banking crises. Boyd, De Nicolo and Jalal (2006) show that banks in higher concentration environments are less stable.

Our contribution

- Relationship between concentration and non-interest income:
  - Banks in lower concentration countries have higher levels of non-interest income.

Our contribution

- Relationship between concentration and non-interest income:
  - Banks in lower concentration countries have higher levels of non-interest income.
- Distinct effects of non-interest income:
  - Non-interest income is linked to higher levels of systemic risk in low concentration countries.

Our contribution

- Relationship between concentration and non-interest income:
  - Banks in lower concentration countries have higher levels of non-interest income.
- Distinct effects of non-interest income:
  - Non-interest income is linked to higher levels of systemic risk in low concentration countries.
- Covariates of systemic risk (MES) in a global sample of banks:
  - Larger and less profitable banks, banks with lower loan quality and higher non-deposit funding are linked to higher systemic risk. Surprisingly leverage is not linked to higher MES.

Data

- Large banks- More than \$5 billion USD in market value. Two digit SIC code of 60 and four digit SIC code of 6712.

- Total sample of 174 banks. The analysis focuses on 109 banks in 20 developed countries (MSCI definition), but results are robust to inclusion of developing countries.

- Bankscope is used for annual accounting data and Datastream for daily equity returns. The matching is done manually.

- The World Bank collection of development indicators is used for national accounts data. The World Bank Banking and Supervision Database (Barth, Caprio and Levine (2008)) for country level regulations.

- Data is winsorized at 5th and 95th percentile. Numbers which are not in ratios are in inflation-adjusted US dollars (year 2000).

Key variables

- Systemic Risk: We use Marginal Expected Shortfall (MES) (Acharya, Pedersen, Philippon and Richardson (2009)).

  - $MES^i_{5\%} = -\frac{\sum R^i_t I_{\{t \in D\}}}{\sum I_{\{t \in D\}}}$ where I takes the value 1 if $D = \{R^m_t$ in bottom 5th percentile$\}$ and 0 otherwise.
  - MES is calculated from July of each fiscal year to June of the next year.

Key variables

- Systemic Risk: We use Marginal Expected Shortfall (MES) (Acharya, Pedersen, Philippon and Richardson (2009)).

  - $MES^i_{5\%} = -\frac{\sum R^i_t I_{\{t \in D\}}}{\sum I_{\{t \in D\}}}$ where I takes the value 1 if $D = \{R^m_t$ in bottom 5th percentile$\}$ and 0 otherwise.
  - MES is calculated from July of each fiscal year to June of the next year.

- Non-interest income
  - Ratio of non-interest income/gross interest income.

Key variables

- Systemic Risk: We use Marginal Expected Shortfall (MES) (Acharya, Pedersen, Philippon and Richardson (2009)).

  - $MES^i_{5\%} = -\frac{\sum R^i_t I_{\{t \in D\}}}{\sum I_{\{t \in D\}}}$ where I takes the value 1 if $D = \{R^m_t$ in bottom 5th percentile\} and 0 otherwise.
  - MES is calculated from July of each fiscal year to June of the next year.

- Non-interest income
  - Ratio of non-interest income/gross interest income.

- Concentration
  - Asset Herfindahl index by calculating squared sum of share of individual bank assets in total banking assets in Bankscope.
  - Imprecise measure because of large number of foreign banks or banks with assets in multiple countries.

Summary -Year 2006

- Split sample into two by calculating the median asset HHI each year and putting countries below the median asset HHI in the Low Concentration (LC) sample.
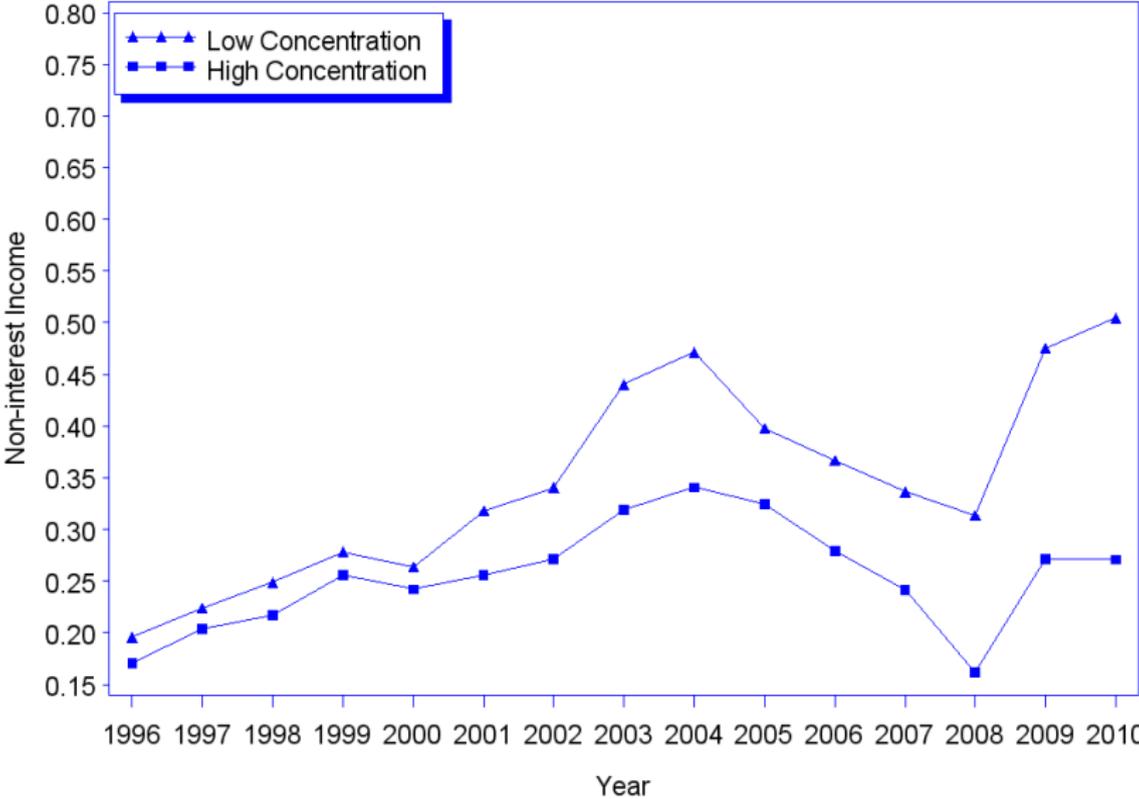
	MARKET	#	assets	assetsHHI	niIncome	MES	tradIncome	netFees	otherFees	NPL	mktLvg
LC	Austria	2	133,630	0.07740	0.41520	0.02352	0.04676	0.24696	0.11133	0.02857	7.02
LC	France	4	1,247,240	0.06739	0.39908	0.01823	0.15555	0.15047	0.01913	0.02803	18.28
LC	Germany	5	252,367	0.08104	0.24579	0.01653	0.03559	0.15185	0.01767	0.01901	21.84
LC	Japan	9	150,634	0.05174	0.48571	0.02590	0.02050	0.29677	0.09190	0.01249	12.42
LC	United Kingdom	5	992,345	0.06894	0.40069	0.01785	0.10787	0.17565	0.03182	0.01166	11.11
LC	United States	23	85,990	0.01999	0.36572	0.01396	0.01155	0.21375	0.18141	0.01058	5.37
HC	Australia	6	202,611	0.17134	0.21678	0.01810	0.01278	0.09688	0.04536	0.00477	5.98
HC	Belgium	2	501,817	0.15818	0.23638	0.01920	0.02745	0.10894	0.05019	0.01081	14.72
HC	Canada	6	265,906	0.13837	0.52619	0.01022	0.00000	0.27938	0.20463	0.00858	8.32
HC	Denmark	1	413,314	0.24662	0.10862	0.01662	0.06332	0.06639	0.04880	0.00446	16.33
HC	Greece	1	86,139	0.15102	0.28154	0.02845	0.00535	0.15606	0.05497	0.03383	4.31
HC	Hong Kong	3	73,511	0.19648	0.18154	0.02198	0.04075	0.11430	0.02021	0.00446	4.73
HC	Ireland	1	167,713	0.17986	0.18794	0.02714	0.00504	0.12462	0.01948	0.00446	10.02
HC	Israel	2	57,783	0.18727	0.61992	0.02965	0.08582	0.38158	0.10478	0.04772	10.89
HC	Italy	7	131,518	0.13204	0.30523	0.01492	0.04258	0.23698	0.00000	0.01806	8.63
HC	Portugal	1	66,529	0.13947	0.28583	0.01074	-0.01033	0.21282	0.06446	0.02431	7.34
HC	Singapore	3	89,848	0.21779	0.21207	0.02204	0.03109	0.14310	0.02829	0.02983	5.60
HC	Spain	5	118,513	0.12251	0.28167	0.02010	0.01917	0.22022	0.02806	0.01934	7.42
HC	Sweden	3	231,731	0.24662	0.30922	0.02535	0.04970	0.20060	0.01603	0.00478	12.25
HC	Switzerland	2	1,260,782	0.24662	0.51717	0.01972	0.15555	0.32115	0.01835	0.00514	13.15

Summary (1996-2010)

VARIABLE	LOW CONCENTRATION			HIGH CONCENTRATION		
	MEDIAN	MEAN	STD	MEDIAN	MEAN	STD
Assets	85,035	113,627	65,128	122,741	145,240	61,637
Assets HHI	0.0153	0.0257	0.0173	0.1497	0.1582	0.0190
Assets Top 3 Concentration	0.1311	0.1819	0.0831	0.5897	0.5937	0.0455
Relative Size	0.0157	0.0275	0.0239	0.3435	0.3702	0.0826
Loans/Assets	0.5958	0.5950	0.0347	0.5877	0.5864	0.0477
Deposits/Assets	0.6117	0.6071	0.0296	0.4601	0.4759	0.0629
MES	0.0231	0.0264	0.0142	0.0272	0.0290	0.0136
VOL	0.2957	0.3214	0.1200	0.3100	0.3060	0.1152
ZSCORE	43.5351	39.0975	15.5099	33.8002	33.2472	9.0740
$niIncome$	0.3363	0.3449	0.0963	0.2561	0.2550	0.0520
$tradIncome$	0.0081	0.0140	0.0115	0.0000	0.0082	0.0112
$netFees$	0.1959	0.1747	0.0624	0.1667	0.1648	0.0465
$otherOperatingFees$	0.0914	0.0913	0.0289	0.0244	0.0277	0.0102
$intSpread$	2.7400	2.5767	0.7560	1.9900	1.9833	0.2838
$mktLvg$	6.8406	8.8832	5.0347	10.9009	11.7765	3.1244
$bookLvg$	13.7132	13.9288	1.0254	19.0483	19.4616	2.1522
NPL	0.0161	0.0162	0.0028	0.0176	0.0163	0.0047
NUMBANKS	59	59	59	50	50	50

Difference In Non-Interest Income

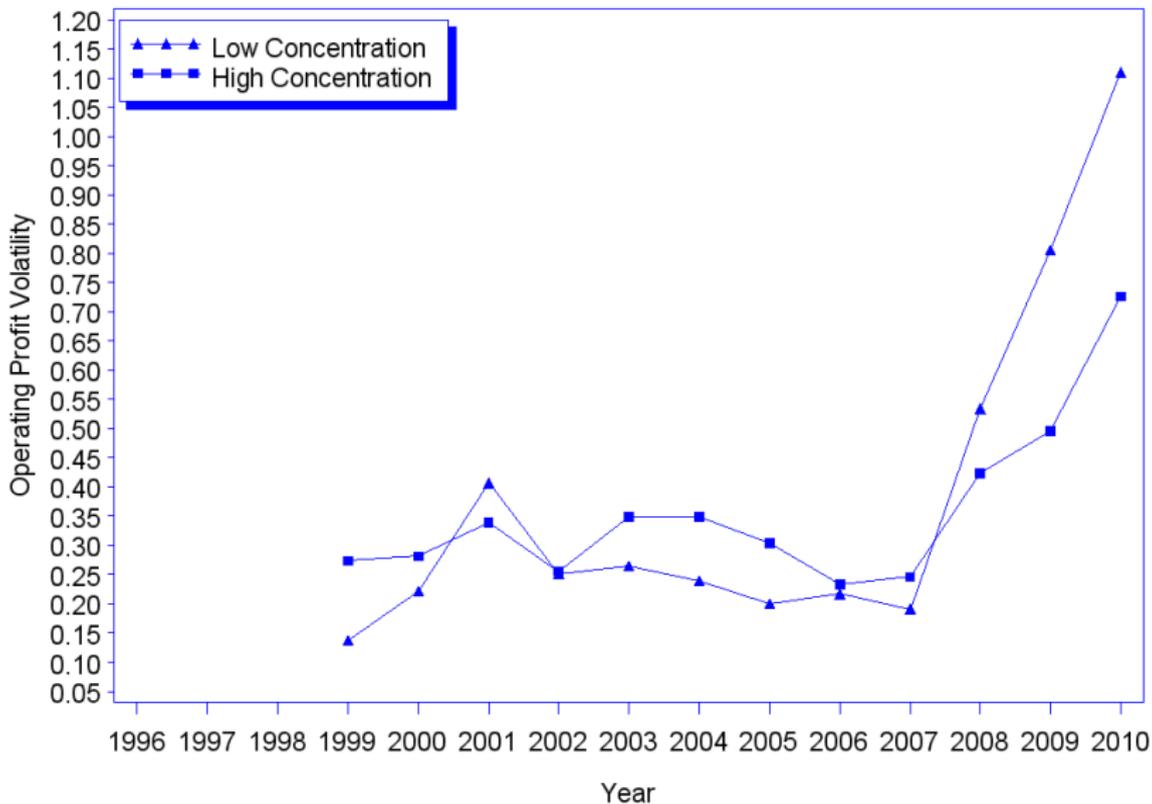
Median non-interest income 1996-2010

Summary Stats-Volatility

- Volatility and correlation are calculated over three years using annual data.

VARIABLE	LOW CONCENTRATION			HIGH CONCENTRATION		
	MEDIAN	MEAN	STD	MEDIAN	MEAN	STD
$Vol(tradIncGr)$	0.7823	0.8593	0.3166	0.9294	0.9897	0.3643
$Vol(netFeesGr)$	0.1260	0.1457	0.0551	0.1621	0.1648	0.0406
$Vol(otherIncGr)$	0.3829	0.4750	0.2382	0.5248	0.6248	0.3934
$Vol(grsIntIncGr)$	0.1227	0.1292	0.0347	0.1598	0.1718	0.0618
$Vol(nonIntIncGr)$	0.1736	0.1857	0.0687	0.1952	0.2212	0.0723
$Vol(preTaxProfitGr)$	0.2450	0.3814	0.2964	0.3209	0.3563	0.1395
$Corr(nonIntIncGr, grsIntIncGr)$	0.4682	0.4237	0.2817	0.5415	0.4679	0.3328
$Corr(tradIncGr, grsIntIncGr)$	0.1934	0.2499	0.2478	0.2602	0.2510	0.3226
$Corr(netFeesGr, grsIntIncGr)$	0.5851	0.5993	0.1614	0.6396	0.5732	0.2800
$Corr(otherIncGr, grsIntIncGr)$	0.1046	0.1201	0.3487	0.3682	0.3169	0.2528
NUMBANKS	59	59	59	50	50	50

Differences in Volatility of Operating Profit

Median operating profit volatility 1996-2010

MES Regression

	LOW CONCENTRATION				HIGH CONCENTRATION		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mes	mes	mes	mes	mes	mes	mes
$niIncome$	0.0133***	0.0118***	0.0115***	0.0114***	-0.00258	-0.00363	-0.00323
	(8.63)	(10.13)	(7.98)	(7.88)	(-1.07)	(-1.31)	(-1.18)
$niIncome*assetsHHI$	-0.0792***						
	(-5.19)						
$assetsHHI$	0.0336*						
	(1.81)						
$relSize$	0.0120***	0.0117***	0.0104***	0.0108***	0.0130***	0.0124***	0.0127***
	(6.20)	(3.83)	(3.15)	(3.23)	(5.74)	(5.16)	(5.35)
$mktLvg$	0.0000351		0.00000507	0.00000925		0.0000671*	0.0000796*
	(1.09)		(0.11)	(0.19)		(1.65)	(1.92)
$nonDepFunding$	0.00522*		0.00285	0.00301		0.00509	0.00444
	(1.82)		(0.79)	(0.83)		(1.08)	(0.94)
$loans$	0.00358		0.00137	0.00130		0.00201	-0.00157
	(1.45)		(0.50)	(0.47)		(0.42)	(-0.32)
NPL	0.183***		0.230***	0.221***		0.150***	0.109**
	(5.79)		(5.72)	(5.49)		(3.06)	(2.22)
ROA	-0.182***		-0.264***	-0.240***		-0.0858	-0.115
	(-3.24)		(-3.84)	(-3.47)		(-0.85)	(-1.12)
N	1325	746	721	721	651	604	604
adj. R-sq	0.702	0.690	0.729	0.730	0.662	0.692	0.696

MES Regression-Components

	LOW CONCENTRATION				HIGH CONCENTRATION			
	(1) mes	(2) mes	(3) mes	(4) mes	(5) mes	(6) mes	(7) mes	(8) mes
tradIncome	0.0180* (1.85)			0.00784 (0.76)	-0.0152 (-1.06)			-0.0124 (-0.87)
netFees		0.0113*** (4.58)		0.0109*** (4.17)		-0.00910** (-2.39)		-0.00881** (-2.22)
otherOper			0.0156*** (5.36)	0.0156*** (5.37)			0.00497 (0.95)	-0.000222 (-0.04)
mktLvg	-0.00000998 (-0.20)	-0.00000692 (-0.15)	-0.0000182 (-0.37)	-0.00000293 (-0.06)	0.0000805* (1.91)	0.0000748* (1.82)	0.0000798* (1.91)	0.0000748* (1.80)
nondepFunding	0.00185 (0.51)	0.00153 (0.43)	0.00313 (0.86)	0.00236 (0.67)	0.00415 (0.89)	0.00304 (0.64)	0.00461 (0.98)	0.00271 (0.57)
relSize	0.00899*** (2.65)	0.0106*** (3.15)	0.00954*** (2.85)	0.00991*** (2.89)	0.0135*** (5.74)	0.0125*** (5.38)	0.0132*** (5.67)	0.0128*** (5.44)
loans	-0.00667** (-2.14)	-0.00506* (-1.92)	-0.00850*** (-3.61)	-0.00226 (-0.73)	-0.000534 (-0.11)	-0.00209 (-0.43)	0.000572 (0.01)	-0.00248 (-0.51)
NPL	0.287*** (6.91)	0.263*** (6.20)	0.248*** (6.09)	0.228*** (5.40)	0.0997** (2.02)	0.110** (2.24)	0.104** (2.09)	0.103** (2.08)
ROA	-0.121* (-1.75)	-0.150** (-2.15)	-0.166** (-2.36)	-0.194*** (-2.77)	-0.128 (-1.27)	-0.118 (-1.17)	-0.141 (-1.40)	-0.109 (-1.08)
N	721	721	721	721	604	604	604	604
adj. R-sq	0.710	0.716	0.715	0.723	0.696	0.699	0.696	0.698

Non-interest Income Regression

	(1) niIncome	(2) niIncome	(3) niIncomeDiff	(4) niIncomeDiff
assetsHHI	-0.746*** (-3.79)	-0.814*** (-3.86)		
intSpread	-0.0770*** (-6.99)	-0.0786*** (-6.96)		
intSpreadDiff			-0.0392*** (-4.41)	-0.0447*** (-5.13)
assetsHHIDiff			-0.373*** (-2.95)	-0.414*** (-3.24)
aggRegulation	0.00834 (1.50)	0.0216*** (3.70)	-0.0200*** (-2.77)	-0.0112 (-1.26)
log(assets)		0.0354*** (5.14)		0.0423*** (4.57)
equity		0.974** (2.53)		1.125** (2.43)
N	1320	1303	1280	1264
R-sq	0.318	0.348	0.146	0.164

Return Regression

	1996-2006 (1) ROE	1996-2006 (2) ROA	1996-2006 (3) Sharpe	2007-2010 (4) ROE	2007-2010 (5) ROA	2007-2010 (6) Sharpe
$niIncome$	0.163***	0.00543***	3.895**	-0.233	0.00150	0.449
	(6.22)	(6.33)	(2.05)	(-0.56)	(0.68)	(0.18)
$assetsHHI$	0.0807	0.00288	16.70	-5.275	-0.0200	-45.70**
	(0.42)	(0.33)	(0.79)	(-1.12)	(-1.33)	(-2.48)
$log(assets)$	-0.00389	0.0000547	-0.652*	-0.0410	0.000254	0.0555
	(-0.67)	(0.32)	(-1.88)	(-0.44)	(0.75)	(0.13)
$niIncome^*assetsHHI$	-0.388**	0.00132	-26.86	5.017	0.0284*	-5.731
	(-2.03)	(0.13)	(-1.34)	(1.09)	(1.88)	(-0.39)
$loans$	0.0891**	0.00674***	10.71***	-0.00128	0.00287	0.209
	(2.55)	(5.17)	(3.97)	(-0.00)	(0.95)	(0.05)
$equity$	-0.745**	0.0741***	-40.42***	-4.759	0.0117	-9.375
	(-2.09)	(8.39)	(-3.51)	(-0.71)	(1.20)	(-0.63)
NPL	-2.376***	-0.0546***	-68.29**	2.281	-0.178***	-150.9***
	(-3.67)	(-3.25)	(-2.14)	(0.22)	(-4.50)	(-4.54)
$nonDepFunding$	-0.148**	-0.00616***	-4.660*	-1.066	-0.00262	-2.471
	(-2.39)	(-3.89)	(-1.80)	(-0.81)	(-1.03)	(-0.62)
N	992	992	786	333	333	329
adj. R-sq	0.162	0.696	0.166	-0.060	0.516	0.286

Robustness

- MES is a good predictor of equity losses in the Asian and recent financial crises (2007-2009).

- Alternate measures of non-interest income like, non-interest income/net interest income, yield similar results.

- MES regression results with non-interest income as independent variable are robust to different timeframes. (before and during the crisis).

- Results hold even when developing countries are added to the sample.

- Alternate measures of calculating Herfindahl index using loans or deposits yield similar results.

Conclusion

▶ Even though non-interest income may decrease individual riskiness, it is correlated with higher levels of systemic risk, as theorized by Wagner (2010).

Conclusion

- Even though non-interest income may decrease individual riskiness, it is correlated with higher levels of systemic risk, as theorized by Wagner (2010).
- There are distinct effects of non-interest income on systemic risk in markets with different concentration levels. These could be due to:
  - A difference in size of non-interest income brought upon by competitive pressure.
  - The nature of non-interest income can be different. This could be recognized by the equity markets in terms of tail risk of equity returns.