BANKS' NONINTEREST INCOME AND MACROPRUDENTIAL POLICY

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Abstract

- Using a global sample of up to 7,368 banks over 1990-2022, we find that a range of macroprudential policies have a significant positive effect on banks' noninterest income, particularly those focused on loan supply/demand and capital measures. Similar results are found for a range of disaggregated samples for type of noninterest income, country development, bank size, pre and post crisis and three robustness checks. These positive effects may offset negative effects of macroprudential policy on other profitability components, but may also affect bank risk adversely, as highlighted widely in the literature and also with our dataset. There are important implications both for regulators and bank management.

Introduction

- An important aspect of recent financial change is a relative shift of banks' revenue from net interest income to noninterest income, which is in turn composed of fee income, net capital gains, dividend income and other income. Underlying factors include increased competition in loan markets due to deregulation and the rise of securities markets, growth of off-balance-sheet activities and tighter capital adequacy requirements which limit higher-risk lending.

- There is an extensive literature on effects of noninterest exposure on bank risks and profitability, but relatively few papers focus on determinants of noninterest income, and none to date look at effects of macroprudential policy on noninterest income.

- We seek to fill these gaps by providing an assessment of factors underlying the level of noninterest income, using a global sample of up to 7,368 banks over 1990-2022, followed by testing of effects thereon of macroprudential policy.

- We assess not only the global sample but also subgroups for the effects on fees and other noninterest income, advanced and emerging market economies, large and small banks and pre and post crisis. The results are complemented by three robustness checks and estimates with our extensive dataset of the relation of noninterest income and its components to bank risk.

Literature

- Bulk of work on noninterest income focuses on **link to profitability and risk**.

- Goddard et al (2013), EU banks engaging more on non-traditional lines of business were more profitable on average, possibly due to benefits from economies of scope. Saunders et al (2020) profitability was raised by noninterest income for US banks. Saona (2016) Latin American banks showed negative relationship between revenue diversification and the net interest margin.

- Elsas et al (2010) and Sanya and Wolf (2011) - diversification not only improved profitability but also reduced risk. Davis et al (2020) found both provisions/loans and non-performing loans/total loans were lower when noninterest income is higher, across over 100 national banking sectors.

- Stiroh and Rumble (2006) US financial holding companies - diversification increased banks' exposure to risk and impacted the trade-off of risk and return, since noninterest activities are much more volatile but not necessarily more profitable than interest-generating activities. Chen et al (2017) both trading and non-trading noninterest revenue positively and significantly affected US bank risk. Brunnermeier et al (2019) US banks with higher noninterest income made a higher contribution to systemic risk via its subcomponents tail risk and interconnectedness risk.

- Risk link also found outside US. Antao and Karnik (2022) income diversification raised risk (measured using the Z-Score) for Asian banks. Maudos (2017) European banks with a more diversified income structures riskier and had a higher probability of insolvency, notably prior to the 2008 crisis. Kamani (2019) European small banks' exposure to systemic risk rose with noninterest income.

- Relatively few studies of **determination of noninterest income**

- Hahm (2008) 662 banks in 29 OECD countries over 1992-2006; larger banks with lower net interest margins, higher impaired loan ratios, higher returns on assets and higher cost-income ratios, in countries with lower growth and inflation and highly-developed stock markets, tended to have higher noninterest income shares. Higher noninterest income accompanies higher profit volatility.

- Meng et al (2018) for 88 Chinese banks over 2003-10, risk (the Z-score) as well as higher cost-asset ratios, capital adequacy, bank size and foreign ownership were positively related to the noninterest income to assets ratio.

- Ammar and Boughrara (2019) in MENA countries over 1998-2015, overall profitability, liquidity, credit risk, deposits/assets, the cost-asset ratio and GDP growth had a positive effect on income diversification, while capitalisation was negatively related.

- Haubrich and Young (2019) larger banks in the US over 2001-18 were more dependent on noninterest income. Before the global financial crisis, there was a positive relation of net interest income to the share of noninterest income, whereas afterwards this relation was negative. The term spread had a positive effect but only before the crisis.

- Some recent work has focused on the potential effect on noninterest income of the environment of low interest rates in the period from 2008 to 2021. We note rather small and sometimes geographically narrow samples and short periods.

- Borio et al (2017) - 109 major international banks from 1995-2012 and found a positive effect of asset price growth as well as the bank liquidity ratio, and a negative effect of asset price volatility on noninterest income. Also short term interest rate and the yield curve have a negative effect, attributed to pressure on net interest margins when interest rates are low.

- Molyneux et al (2020) found negative effect of the short rate on fee income for 440 Italian banks over 2007-2016, along with a negative effect of size and liquidity and a positive effect of the cost to income ratio and non performing loans.

- Altavilla et al (2019) with 288 Eurozone banks from 2000 to 2016, found no effect of interest rate levels or yield curve slopes on noninterest income, with only a positive effect of expected GDP growth and a negative effect of VIX volatility.

- Extensive literature on **effects of macroprudential policy on banks**, notably on lending and risk (Claessens et al (2013), Altunbas et al (2018)); results generally favour decline in lending and a reduction in risk when macroprudential policy is tightened.

- Davis et al (2022) effects on bank profitability with a global sample; capital measures tended to reduce profitability whereas loan supply/demand measures had a zero or positive effect. Meuleman and Vander Vennet (2022) Eurozone banks reduced lending and risk in response to macroprudential policy tightening, net interest margins tended to decline.

- Absence of empirical work on effects of macroprudential policy on noninterest income is a paradox in the light of the work cited above regarding noninterest income, profitability and risk and also the literature on macroprudential policy, not least because specific channels for such effects can be envisaged.

- Main components of noninterest income are net trading income/dividends/other income and net fees and commissions. As macroprudential policy typically constrains balance sheet in terms of risk and return, any reduction in profitability is likely to be met by pressure to raise such fee and trading income. This should be the case especially for loan-targeted measures. Capital measures may also encourage fee and trading income, although capital limits do bear on trading income, while fee income may be partly tied to loan emission which capital measures may restrict.

Methodology and data

- Noninterest income model is derived from the references above:

- $NIIAA_{ijt}$ or $NIR_{ijt} = \alpha_{it} + \beta_1 NIIAA_{ijt-1}$ or $\beta_1 NIR_{ijt-1} + \beta_2 Internal_{ijt-1} + \beta_3 Macro_{jt} + \beta_4 Industry_{ijt} + \varepsilon_{ijt}$ i indicates an individual bank, j refers to the country and t indicates time period.

- Two measures used, ratio of noninterest income to average total assets (NIIAA) and ratio of noninterest income to gross operating income (NIR). Former shows the contribution of noninterest income to profitability (the other components being net interest income, noninterest costs and provisions), the latter shows income diversification. Noninterest income also divided in subsamples into fee (NIFEEAA/NIFEER) and nonfee (net capital gains, dividend income and other income – NINONFEEAA/NNNONFEER) components

- Internal, bank-specific, controls are bank size (log total assets), capital adequacy (equity/assets) credit risk (provisions/gross loans), portfolio balance (gross loans/total assets), liquidity risk (deposits/total liabilities) and management efficiency (the cost-income ratio). We added profitability measures: the return on average assets (ROAA) and the net interest margin/average assets.

- Industry variables are banking crisis dummy and Lerner Index showing bank-level market power.

- Macro controls comprise real GDP growth and CPI Inflation. Central bank interest rates were tried but were not significant, in contrast to some recent work.

- All variables apart from crisis and macroprudential variables winsorised at 99%.
- Estimation is by panel OLS with bank-level and time fixed effects; bank variables were lagged to reduce the risk of endogeneity. We clustered standard errors by country, since the effects of policy are also country-specific (Altunbas et al 2018). Given use of lags, as well as issues of lack of precision and loss of observations, we prefer this approach to GMM – used rather as robustness check.
- Empirical testing used data from up to 7,368 banks from 100 advanced and developing countries sourced from the Fitch-Connect database, macro variables are from the IMF and the World Bank.
- Macroprudential data are from the IMF IMAPP database of policy actions for 1990-2021 as introduced in Alam et al (2019). We use both individual measures and their aggregated summary measures.
- Data annualised and cumulated (to show the policy stance) following approach of Bergant et al (2020). Meuleman and Vander Vennet (2020) noted cumulation is important since macroprudential measures can have effects not just initially but also in the longer term, and the specific point at which the policy becomes binding is not observable.
- Macroprudential policy measures are also lagged, to limit risk of endogeneity and reverse causality, as macroprudential authorities may react to bank-level developments. This also allows for lags in the adjustment of banks' behaviour to macroprudential measures.

Descriptive statistics (global sample)

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
NIIAA	2.210	1.080	26.628	-1.212	3.863	103195
NIR	32.728	28.880	123.167	-49.176	27.550	110895
NIFEEAA	1.135	0.619	12.780	-0.540	1.865	95673
NIFEER	19.419	16.324	90.666	-27.541	18.833	101610
NINONFEEAA	0.841	0.282	13.366	-1.811	1.935	95673
NINONFEER	12.892	7.934	101.972	-42.760	20.281	101610
BANK SIZE	21.218	21.178	27.170	15.948	2.324	112971
CAPITAL ADEQUACY	0.132	0.090	0.908	0.003	0.148	112936
CREDIT RISK	1.371	0.580	16.981	-2.790	2.667	92137
COST/INCOME	64.490	61.660	250.734	1.650	32.719	111144
LOAN/ASSET RATIO	0.575	0.605	0.998	0.004	0.234	109869
RETURN ON AVERAGE ASSETS	1.221	0.950	13.080	-11.150	2.742	102550
NET INTEREST MARGIN	4.128	2.840	28.850	-1.720	4.490	101854
LERNER INDEX	0.229	0.240	0.657	-0.908	0.207	94431
DEPOSITS/LIABILITIES	0.679	0.753	0.993	0.002	0.266	104144
GDP GROWTH	3.024	3.071	11.795	-10.000	3.713	241386
INFLATION	9.853	3.079	299.510	-0.923	32.956	235225
BANKING CRISIS	0.090	0.000	1.000	0.000	0.287	244068
CENTRAL BANK RATE	6.659	4.229	69.97	0.000	9.811	180379

Results for noninterest income determination

Equations are estimated by panel OLS with time and bank dummies and country-clustered standard errors Coefficient values are reported and the t-statistics are reported in parenthesis. *** Significant at 1%, ** significant at 5%, * significant at 10%.

REGION	GLOBAL	
DEPENDENT	NIIAA	NIR
C	5.83***	34.8***
	(7.7)	(5.4)
LAGGED DEPENDENT(-1)	0.551***	0.394***
	(17.7)	(22.9)
BANK SIZE(-1)	-0.25***	-0.96***
	(7.2)	(3.2)
CAPITAL ADEQUACY (-1)	0.62*	
	(1.9)	
CREDIT RISK(-1)	-0.0221*	0.303***
	(1.9)	(4.3)
COST/INCOME(-1)		0.0674***
		(5.6)
ROAA(-1)	-0.052***	0.316**
	(3.8)	(2.5)
NET INTEREST MARGIN(-1)	0.0403***	-0.5***
	(3.3)	(4.1)
LOAN-ASSET RATIO(-1)	-0.232**	-6.395***
	(2.4)	(5.3)
	-0.614***	
LERNER INDEX(-1)	(4.2)	
	-0.0818*	
CRISIS	(1.8)	
INFLATION	-0.0084*	0.0419**
	(1.9)	(2.0)
GROWTH		
R^2	0.65	0.57
SE	1.34	13.56
PERIODS	31	32
OBS	73637	82598
BANKS	5862	6211

Results for summary macroprudential variables

Note - MAPP INDEX is the sum of dummies for all of 17 categories. The LOAN TARGETED group consists of the "Demand" and the "Supply-loans" instruments. DEMAND comprises: LTV and DSTI. SUPPLY-LOANS is loan growth limits, provision measures, loan measures, limits to the loan to deposit ratio, and limits to foreign currency loans. SUPPLY-GENERAL is reserve requirements, liquidity requirements, and limits to FX positions. SUPPLY-CAPITAL is leverage, countercyclical buffers, conservation buffers, and capital requirements. Equations include the control variables in the baseline

DEPENDENT	NIIAA	NIR
MAPP-INDEX (-1)	0.0098*** (3.7)	0.0531 (1.1)
LOAN-TARGETED (-1)	0.021*** (3.0)	0.0628 (0.6)
DEMAND (-1)	0.024** (2.3)	-0.0781 (0.5)
SUPPLY-ALL (-1)	0.0099*** (3.0)	0.0702 (0.2)
SUPPLY-LOANS (-1)	0.0342*** (3.1)	0.239 (1.4)
SUPPLY-GENERAL (-1)	0.0056 (0.7)	0.0844 (0.8)
SUPPLY-CAPITAL (-1)	0.0214** (2.7)	0.09 (0.9)

Results for individual macroprudential variables

DEPENDENT	NIIAA	NIR
COUNTERCYCLICAL BUFFER(-1)	0.035 (1.5)	0.179 (0.7)
CONSERVATION BUFFER(-1)	0.044** (2.6)	0.727*** (3.9)
CAPITAL REQUIREMENTS(-1)	0.017* (1.9)	-0.152 (1.1)
LEVERAGE REQUIREMENTS(-1)	0.02 (0.7)	0.178 (0.3)
PROVISIONING REQUIREMENTS(-1)	0.0464* (1.7)	0.325 (1.1)
CREDIT GROWTH LIMITS(-1)	0.109 (1.2)	-0.3 (0.3)
LOAN RESTRICTIONS(-1)	0.055*** (3.9)	0.419* (1.7)
LIMITS ON FOREIGN CURRENCY LOANS(-1)	0.0187 (1.2)	0.477 (1.4)
LOAN TO VALUE LIMITS(-1)	0.0254** (2.1)	-0.054 (0.2)
DEBT TO INCOME LIMITS(-1)	0.057 (1.5)	-0.267 (1.1)
LEVY/TAX ON FINANCIAL INSTITUTION(-1)	0.0106 (0.8)	-0.174 (0.7)
LIQUIDITY MEASURES(-1)	0.0203 (1.6)	0.36** (2.2)
LOAN TO DEPOSIT LIMITS(-1)	-0.144*** (3.3)	-2.81*** (4.6)
LIMITS ON FX OPERATIONS(-1)	-0.044 (0.9)	-0.661 (1.5)
RESERVE REQUIREMENTS(-1)	0.004 (0.4)	0.051 (0.4)
SIFI SURCHARGES(-1)	0.042* (2.2)	0.539** (2.2)
OTHER MACROPRUDENTIAL MEASURES(-1)	0.03* (1.8)	0.32 (1.4)

Disaggregation by income type

REGION	FEE INCOME		NON-FEE NONINTEREST INCOME	
DEPENDENT	NIFEEAA	NIFEER	NIINONFEEAA	NINONFEER
C	2.69*** (6.6)	33.42*** (9.6)	2.588*** (6.8)	9.628*** (4.7)
LAGGED DEPENDENT(-1)	0.665*** (29.8)	0.564*** (27.7)	0.416*** (19.0)	0.342*** (18.3)
BANK SIZE(-1)	-0.119*** (6.4)	-1.144*** (6.7)	-0.101*** (5.8)	
CAPITAL ADEQUACY (-1)	0.256* (1.8)		0.649* (2.2)	
CREDIT RISK(-1)				0.257*** (3.9)
COST/INCOME(-1)	0.00081*** (3.3)	- 0.0647*** (7.2)		0.0653*** (7.2)
ROAA(-1)				0.204** (2.1)
NET INTEREST MARGIN(-1)		-0.186*** (3.3)		-0.27** (2.3)
LOAN-ASSET RATIO(-1)			-0.192** (2.6)	-6.513*** (6.2)
LERNER INDEX(-1)		-4.506*** (4.1)	-0.547*** (4.8)	
DEPOSITS/LIABILITIES(-1)		1.777*** (2.8)		-2.33*** (3.6)
CRISIS			-0.0911* (1.9)	
INFLATION	0.002* (2.0)		0.00716** (2.1)	0.0487** (2.2)
GROWTH	0.00821* (1.8)	0.137*** (4.5)	-0.015*** (2.7)	-0.194*** (3.2)
R^2	0.822	0.697	0.487	0.4
SE	0.628	7.77	0.959	12.16
PERIODS	31	32	31	32
OBS	85521	73658	68265	74409
BANKS	6274	5732	5477	5681

Results for summary macroprudential variables

DEPENDENT	Fee Income		Non-fee noninterest income		Memo: Total noninterest income	
	NIFEEAA	NIFEER	NIRESAA	NIRESR	NIIAA	NIR
MAPP-INDEX (-1)	0.00477*** (2.7)	0.0203 (0.6)	0.0039* (2.0)	0.0167 (0.9)	0.0098*** (3.7)	0.0531 (1.1)
LOAN-TARGETED (-1)	0.00829* (1.9)	0.0175 (0.2)	0.008 (1.6)	0.047 (0.9)	0.021*** (3.0)	0.0628 (0.6)
DEMAND (-1)	0.0103* (1.8)	0.0472 (0.4)	0.0025 (0.3)	-0.118 (1.3)	0.024** (2.3)	-0.0781 (0.5)
SUPPLY-ALL (-1)	0.00546** (2.2)	0.02 (0.5)	0.0046* (1.7)	0.169 (0.8)	0.0099*** (3.0)	0.0702 (0.2)
SUPPLY-LOANS (-1)	0.013* (1.7)	0.0027 (0.1)	0.0191** (2.6)	0.224** (2.6)	0.0342*** (3.1)	0.239 (1.4)
SUPPLY-GENERAL (-1)	0.00884** (2.2)	0.037 (0.5)	-0.00003 (0.1)	-0.0334 (0.7)	0.0056 (0.7)	0.0844 (0.8)
SUPPLY-CAPITAL (-1)	0.0059 (1.3)	0.037 (0.7)	0.0129** (2.5)	0.0345 (0.5)	0.0214** (2.7)	0.09 (0.9)

Results for individual macroprudential variables

DEPENDENT	Fee Income		Non-fee noninterest income		Memo: Total noninterest income	
	NIFEEAA	NIFEER	NRESAA	NIRESR	NIIAA	NIR
COUNTERCYCLICAL BUFFER(-1)	0.02 (1.4)	0.34** (2.0)	0.0078 (0.5)	-0.222 (0.1)	0.035 (1.5)	0.179 (0.7)
CONSERVATION BUFFER(-1)	0.017 (1.7)	0.297** (2.5)	0.0219* (1.9)	0.236 (1.5)	0.044** (2.6)	0.727*** (3.9)
CAPITAL REQUIREMENTS(-1)	0.000268 (0.1)	-0.066 (0.8)	0.0137** (2.1)	-0.0018 (0.1)	0.017* (1.9)	-0.152 (1.1)
LEVERAGE REQUIREMENTS(-1)	0.0183 (0.6)	-0.098 (0.4)	0.0171 (1.0)	0.079 (0.3)	0.02 (0.7)	0.178 (0.3)
PROVISIONING REQUIREMENTS(-1)	0.00672 (0.5)	-0.345** (2.3)	0.0344 (1.6)	0.627** (2.6)	0.0464* (1.7)	0.325 (1.1)
CREDIT GROWTH LIMITS(-1)	0.0682* (1.8)	0.0363 (0.1)	0.031 (0.8)	-0.469 (1.1)		-0.3 (0.3)
LOAN RESTRICTIONS(-1)	0.024** (2.4)	0.153 (0.9)	0.0249*** (2.7)	0.169* (1.7)	0.055*** (3.9)	0.419* (1.7)
LIMITS ON FOREIGN CURRENCY LOANS(-1)	-0.00078 (0.1)	0.131 (0.8)	0.0161 (1.3)	0.442** (2.3)	0.0187 (1.2)	0.477 (1.4)
LOAN TO VALUE LIMITS(-1)	0.0184** (2.0)	0.141 (0.7)	-0.0054 (0.7)	-0.263*** (2.9)	0.0254** (2.1)	-0.054 (0.2)
DEBT TO INCOME LIMITS(-1)	0.0029 (0.3)	-0.124 (0.6)	0.0262 (0.8)	0.119 (0.4)	0.057 (1.5)	-0.267 (1.1)
LEVY/TAX ON FINANCIAL INSTITUTION(-1)	0.0063 (0.8)	-0.038 (0.2)8	-0.002 (0.2)	0.0191 (0.1)	0.0106 (0.8)	-0.174 (0.7)
LIQUIDITY MEASURES(-1)	0.0103 (0.5)	0.214 (1.3)	0.0053 (0.5)	0.0331 (0.3)	0.0203 (1.6)	0.36** (2.2)
LOAN TO DEPOSIT LIMITS(-1)	-0.0527** (2.3)	-0.679** (2.1)	-0.0581** (2.4)	-0.862* (1.8)	-0.144*** (3.3)	-2.81*** (4.6)
LIMITS ON FX OPERATIONS(-1)	-0.0114 (0.5)	-0.215** (2.6)	-0.0188 (0.7)	-0.489 (1.6)	-0.044 (0.9)	-0.661 (1.5)
RESERVE REQUIREMENTS(-1)	0.00952** (2.0)	0.034 (0.4)	-0.0006 (0.1)	-0.032 (0.7)	0.004 (0.4)	0.051 (0.4)
SIFI SURCHARGES(-1)	0.0215** (2.2)	0.37** (2.1)	0.016 (1.3)	0.167 (1.2)	0.042* (2.2)	0.539** (2.2)
OTHER MACROPRUDENTIAL MEASURES(-1)	0.0113 (1.1)	-0.096 (0.8)	0.0193* (1.7)	0.445*** (3.7)	0.03* (1.8)	0.32 (1.4)

Summary for country and size disaggregation

DEPENDENT	ADVANCED COUNTRIES		EMERGING AND DEVELOPING ECONOMIES		LARGE BANKS		SMALL BANKS	
	NIIAA	NIR	NIIAA	NIR	NIIAA	NIR	NIIAA	NIR
MAPP-INDEX (-1)	0.0042* (1.9)	-0.0177 (0.3)	0.0117** (2.4)	0.105* (1.8)	0.00555* (1.8)	0.0243 (0.4)	0.0104* (1.8)	0.0944 (1.5)
LOAN-TARGETED (-1)	0.0109*** (2.9)	0.0366 (0.4)	0.0241 (1.4)	0.135 (0.8)	0.00982* (1.7)	-0.0087 (0.1)	0.031** (2.3)	0.265* (1.7)
DEMAND (-1)	0.0184*** (3.0)	-0.0136 (0.1)	0.008 (0.2)	-0.1 (0.3)	0.00526 (0.7)	-0.2 (1.1)	0.0515** (2.3)	0.297 (1.2)
SUPPLY-ALL (-1)	0.003 (0.8)	-0.0014 (0.1)	0.0131** (2.4)	0.123* (1.7)	0.00683* (1.7)	0.046 (0.7)	0.0055 (0.8)	0.0793 (1.0)
SUPPLY-LOANS (-1)	0.012* (1.7)	0.162 (0.8)	0.045** (2.1)	0.329 (1.4)	0.0213** (2.0)	0.142 (0.7)	0.0333 (1.5)	0.431** (2.0)
SUPPLY-GENERAL (-1)	-0.00149 (0.1)	-0.152 (0.5)	0.0098 (0.8)	0.136 (1.0)	0.0056 (0.7)	0.0671 (0.6)	-0.0062 (0.5)	0.0409 (0.3)
SUPPLY-CAPITAL (-1)	0.004 (0.7)	0.142 (0.1)	0.0349** (2.0)	0.274** (2.3)	0.0161** (2.2)	0.0621 (0.5)	0.0121 (0.9)	0.0329 (0.2)

Summary for pre and post crisis

DEPENDENT	1990-2007		2008-2022	
	NIIAA	NIR	NIIAA	NIR
MAPP-INDEX (-1)	0.001	-0.0561	0.0138***	0.0932**
	(0.1)	(0.3)	(3.6)	(2.2)
LOAN-TARGETED (-1)	0.029	-0.226	0.0231**	0.15
	(0.1)	(0.4)	(2.4)	(1.5)
DEMAND (-1)	0.0395	-0.326	0.0173	-0.0198
	(0.9)	(0.4)	(1.1)	(0.1)
SUPPLY-ALL (-1)	-0.005	-0.0724	0.016***	0.124**
	(0.3)	(0.3)	(4.0)	(2.2)
SUPPLY-LOANS (-1)	0.0373	-0.271	0.0467***	0.432***
	(1.0)	(0.5)	(3.5)	(2.7)
SUPPLY-GENERAL (-1)	-0.0053	-0.021	0.014	0.0753
	(0.4)	(0.1)	(1.4)	(0.6)
SUPPLY-CAPITAL (-1)	-0.118	-1.147	0.0277***	0.225*
	(1.2)	(1.6)	(3.1)	(1.9)

Summary for robustness checks

REGION: GLOBAL	WITH WORLD BANK REGULATION VARIABLES		WITH BANK CLUSTERED STANDARD ERRORS		WITH DIFFERENCE GMM	
DEPENDENT	NIIAA	NIR	NIIAA	NIR	NIIAA	NIR
MAPP-INDEX (-1)	0.004 (1.1)	0.315 (0.7)	0.0095*** (5.2)	0.0529*** (3.3)	0.0058*** (2.7)	0.0726* (1.8)
LOAN-TARGETED (-1)	0.0173*** (4.1)	0.054 (0.7)	0.0207*** (5.6)	0.0627* (1.7)	0.0126*** (2.8)	0.112 (1.2)
DEMAND (-1)	0.0192** (2.4)	-0.0853 (0.8)	0.0245*** (4.4)	-0.076 (1.3)	0.0159** (2.2)	0.0131 (0.1)
SUPPLY-ALL (-1)	0.0031 (0.6)	0.046 (0.9)	0.00944*** (3.8)	0.0696*** (3.3)	0.0059* (1.9)	0.0872 (1.6)
SUPPLY-LOANS (-1)	0.028*** (3.3)	0.229 (1.6)	0.0335*** (4.9)	0.238*** (3.8)	0.02*** (2.7)	0.284* (2.0)
SUPPLY-GENERAL (-1)	-0.0082 (0.6)	0.246 (0.3)	0.0049 (1.2)	0.0829*** (2.4)	0.0023 (0.3)	0.108 (1.1)
SUPPLY-CAPITAL (-1)	0.0121* (1.7)	0.0585 (0.6)	0.0206*** (3.6)	0.089* (1.8)	0.0146*** (2.8)	0.104 (1.2)

Results for bank risk determination (coefficients on noninterest measures as independent variable)

DEPENDENT: LOG Z SCORE	NIIAA	NIR	NIFEEAA	NIFEER	NIRESAA	NIRESR
Global sample	-0.016*** (4.4)	-0.0015*** (3.7)	-0.0051 (0.8)	0.0014** (2.1)	-0.0338*** (5.2)	-0.0024*** (5.2)
Large banks	-0.0088 (1.6)	-0.00127** (2.0)	0.0163 (1.3)	0.0019 (1.6)	-0.0282*** (3.4)	-0.0024*** (4.3)
Small banks	-0.0191*** (4.3)	-0.0016*** (2.9)	-0.014 (1.7)	0.00053 (0.8)	-0.036*** (5.8)	-0.0021*** (3.5)
Advanced countries	-0.0223*** (4.2)	-0.00231*** (4.5)	-0.0228** (2.5)	0.001 (1.2)	-0.0494*** (5.5)	-0.003*** (7.1)
Emerging market and developing countries	-0.0145*** (3.4)	-0.00131** (2.5)	0.0025 (0.4)	0.00235*** (3.1)	-0.0288*** (4.3)	-0.00252*** (4.2)
1990-2007	-0.024*** (4.5)	-0.00194*** (4.1)	0.00828 (0.8)	0.00212** (2.5)	-0.0434*** (5.8)	-0.00317*** (5.7)
2008-2022	-0.0177*** (3.4)	-0.00148** (2.5)	-0.0132 (1.6)	0.00179** (2.4)	-0.0322*** (3.7)	-0.00224*** (3.3)
DEPENDENT: NPL/LOANS	NIIAA	NIR	NIFEEAA	NIFEER	NIRESAA	NIRESR
Global sample	0.0384 (1.2)	0.00264 (0.8)	-0.0746 (1.3)	-0.0035 (0.6)	0.0981* (1.7)	0.006 (1.4)
Large banks	0.057 (1.6)	-0.005 (1.6)	-0.059 (0.6)	-0.0046 (0.8)	0.093* (1.8)	-0.00254 (0.8)
Small banks	0.0394 (1.1)	0.00835 (1.6)	-0.0764 (1.3)	-0.00173 (0.2)	0.12 (1.5)	0.0136* (2.0)
Advanced countries	0.0417 (0.2)	-0.00206 (0.6)	-0.0404 (0.4)	-0.001 (0.1)	0.0653 (0.9)	0.0002 (0.1)
Emerging market and developing countries	0.0052 (0.1)	0.0077* (1.7)	-0.133 (1.6)	-0.0058 (0.6)	0.0619 (1.0)	0.0115** (2.0)
1990-2007	-0.074 (1.7)	0.00321 (0.5)	-0.079 (0.7)	0.0137 (1.3)	-0.0123 (1.6)	0.0015 (0.2)
2008-2022	-0.0013 (0.1)8	-0.006 (1.6)	-0.191*** (3.0)	-0.017** (2.8)	0.0568 (0.9)	0.00163 (0.4)

Conclusions

- Global results for 100 countries show noninterest income is persistent over time and negatively related to bank size and the loan/asset ratio. The ratio to average assets links positively to capital adequacy and the net interest margin, and negatively to credit risk the return on average assets, market power, bank crises and inflation. The ratio to total income links positively to credit risk, the cost/income ratio, the return on average assets and inflation, and negatively to the net interest margin.

- A number of measures of macroprudential policy influence noninterest income, and the significant effects are positive. From the summary measure results, the effects appear to be stronger for the measure noninterest income/average assets than for noninterest income's share in total income.

- In terms of individual measures, loan-targeted policies have a positive effect across global banks, while capital measures also boost noninterest income in a number of cases. Only tighter loan/deposit ratios have a consistently negative effect.

- These results for determinants are also largely apparent for disaggregation by type of noninterest income, region and bank size, and also in three robustness checks. One interesting contrast, however, is that fee income is boosted by economic growth whereas nonfee income rises in recession..

- Especially for the summary measures, macroprudential policy effects are also similar and positive across subsamples. Unlike the global sample, there are a number of positive effects of macroprudential policy categories on the share of noninterest income, notably for EMDE banks, nonfee income and small banks. We also find the effects of macroprudential are mainly from the period since 2008 – summary effects are insignificant although a number of individual measures were effective before 2008

- These results are of considerable relevance to regulators. Notably, the results for the ratio of noninterest income to average assets suggest that negative effects of macroprudential policies on net interest margins (Meuleman and Vander Vennet 2022), are at least partly offset by such diversification. This reduces concern that banks may be less able to accumulate capital when macroprudential policy is tightened.

- On the other hand, there may be grounds for caution if a rise in dependence on noninterest income due to macroprudential policy increases bank risk, as has been found widely in the literature and in our own dataset. We also find that banks facing higher credit risks seek higher noninterest income.

- Digging deeper, we find nonfee noninterest income boosts risk consistently at a bank level (as measured by the log Z score) as opposed to in the loan book (NPL/loan ratio). Higher fee income tends to lower risk or have a zero effect, but not in advanced countries or since the subprime crisis when it raises risk.

- This raises further regulatory issues in terms of a possible need to encourage fee as opposed to nonfee income generation, both when macroprudential policy is tightened and in general terms and how that could be accomplished. Given the inverse relation of nonfee income to economic growth, recessions would need particular vigilance for this reason also.

- Choice of macroprudential policy is also relevant in this context since we find both types of noninterest income are boosted by macroprudential policy tightening, although fee income is raised by both demand and supply measures while nonfee is largely affected by supply measures.

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