

EXPLORING INTERRELATIONS AMONG THE DETERMINANTS OF BANK FINANCIAL PERFORMANCE: PANEL EVIDENCE FROM INDIAN SCHEDULED COMMERCIAL BANKS

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ABSTRACT

Over the past twenty years, Indian banks have experienced rapid growth, a bad-loan crisis and a recovery that came sooner than many expected. The researcher wanted to know which ratios really move a bank's return on assets over such a cycle, and how those ratios lean on one another. Design – The study draws on the Reserve Bank of India's Select Ratios of Scheduled Commercial Banks for 53 public and private sector banks, 2005–2025, giving 894 bank-year observations. Once the data were cleaned and winsorised, we compared the two ownership groups, examined the correlation structure and checked for multicollinearity. We then estimated pooled, fixed-effects, random-effects and two-way fixed-effects panel models. Specification tests decided between them, and the final estimates carry Driscoll–Kraay standard errors. Findings – Bad loans outweigh everything else. Each one-point increase in the net NPA ratio takes roughly 0.23 points off ROA, and in standardised terms the effect is more than double that of the next factor. Stronger capital and more fee income lift returns; higher operating costs drag them down. The CASA share, cost of funds and priority-sector lending, by contrast, show no independent effect once bank and year effects are in the model. Interestingly, a point of NPA reduces private banks' ROA far more than it reduces public banks'. Originality – Using a single, consistent regulatory source, the paper follows Indian banks through the whole pre-crisis, asset-quality-review and recapitalisation period. It also shows which apparent drivers of profit hold up under proper controls, and which turn out to reflect little more than differences between banks.

Keywords: Bank profitability performance, Return on assets (ROA), Non-performing assets of the Banks, Capital adequacy, Panel data, Indian banks.

INTRODUCTION

Indian banking has rarely sat still since 2005. For most of the late 2000s, credit expanded quickly and returns looked healthy. Underneath, though, stress was building. When the RBI ran its Asset Quality Review in 2015, banks could no longer roll over loans that had quietly gone bad. The public sector banks took the heaviest blow. Their average ROA in our data stayed below zero from 2016 to 2021 and touched –1.22 percent in 2019. Fresh government capital, the Insolvency and Bankruptcy Code and a round of mergers followed, and by 2025 the system's average ROA was back above 1 percent.

What makes a bank profitable one? Although this question has been widely studied, the evidence from India remains limited. Many studies examine only a small number of banks, cover short periods, or use a single estimation method. Studies ending in 2014, for example, miss the Asset Quality Review (AQR) and the changes that followed in the Indian banking sector. The choice of method also matters because the factors influencing profitability often overlap. Well-capitalised banks may also have better-quality loan portfolios, while banks with more low-cost deposits may operate wider branch networks. A simple correlation can therefore make one factor appear influential when the relationship is partly explained by another.

That is the problem we try to address here. With two decades of RBI ratios, we first look at how the main variables move together and where public and private banks part ways. We then fit panel models that hold constant both the lasting character of each bank and the shocks that hit every bank in the same year. The paper adds to the literature in three ways. It spans the full 2005–2025 cycle with one consistent dataset. It separates the determinants that survive these controls from those that do not. And it asks whether a given factor matters equally for public and private banks.

LITERATURE REVIEW AND HYPOTHESES

Research on bank profitability builds largely on the cross-country studies of Bourke (1989) and Molyneux and Thornton (1992). Athanasoglou et al. (2008) organised its determinants into three categories: bank-specific, industry-specific and macroeconomic factors. Subsequent studies have generally found that bank-specific factors explain the largest share of variation in profitability (Dietrich and Wanzenried, 2011; Menicucci and Paolucci, 2016). Since our dataset consists of bank-level ratios, we focus on these factors and include year effects to account for common economic conditions affecting banks in each year.

Capital. The relationship between capital and profitability can work in either direction. A larger capital cushion may reduce returns because equity is a relatively costly source of funding. However, stronger capital may also lower borrowing costs and help banks continue lending during difficult periods. Berger (1995) found support for this positive relationship in US banks, with similar findings reported by Athanasoglou et al. (2008) and García-Herrero et al. (2009).

H1: Capital adequacy is positively related to return on assets (ROA).

Asset quality. A bad loan costs a bank twice. It stops paying interest, and it forces a provision that comes straight out of profit. Berger and DeYoung (1997) add that weak loans and weak cost control tend to travel together. Given how far NPAs climbed in India after 2015, this looked to us like the likeliest source of the largest effect. H2: The net NPA ratio is negatively related to ROA.

Operating efficiency. The ratio of operating cost to assets tells us what a bank spends to carry out its basic business. Unless that spending brings in matching revenue, it eats into profit (Kosmidou, 2008; Dietrich and Wanzenried, 2011). H3: Operating cost is negatively related to ROA.

Income diversification. Fees as well as commissions provide an additional source of earnings beyond lending and may support bank profitability. However, non-interest income does not always offer stability, as it can also be volatile (Stiroh, 2004).

H4: Non-interest income is positively related to return on assets (ROA).

Funding structure and intermediation. Current and savings (CASA) deposits are both cheap and stable. A larger CASA share should therefore pull down the cost of funds and leave a wider margin. The credit–deposit ratio works differently: a higher ratio puts more deposits to work in loans that earn more, though it may also raise risk. H5: CASA share is positively, and cost of funds negatively, related to ROA. H6: The credit–deposit ratio is positively related to ROA.

Directed lending and bank productivity. Priority-sector lending requirements may limit profitability by directing credit to smaller borrowers who can carry higher credit risk. Business per employee reflects labour productivity, with higher values indicating that a bank handles more business through its manpower.

H7: Priority-sector lending share is negatively related to ROA, while labour productivity is positively related to ROA.

Ownership. Public and private banks are governed differently, carry different mandates and recover loans in different ways. It would be surprising if a given factor worked with the same force in both. H8: The effects of the determinants differ between public and private sector banks.

DATA AND METHODOLOGY

Data source and cleaning

Our data are the RBI's *Select Ratios of Scheduled Commercial Banks*, published in its Statistical Tables Relating to Banks in India. The file gives 35 ratios as on 31 March for every scheduled commercial bank between 2005 and 2025, which comes to 1,867 bank-year rows. We kept only the public and private sector banks. Foreign banks, small finance banks and payments banks follow quite different business models, and their Indian histories are short or uneven; a few foreign branches even report credit–deposit ratios above 500 percent. Each bank's group was taken from the RBI's own classification for that year. IDBI Bank therefore sits with the public banks until 2018 and with the private banks from 2019, following the RBI's reclassification.

Table 1 summarises how the data was cleaned. Researcher combined records under the old and new names of IDBI Limited/IDBI Bank and IDFC Bank/IDFC FIRST Bank. Bharatiya Mahila Bank was kept aside because its capital ratios exceeded 100 percent during its start-up period. Researcher also kept aside Bandhan and IDFC observations for 2016 and IDBI observations for 2005–06, as initial operations or conversion-related balance-sheet features distorted their ratios. Rows containing missing values, recorded as “–” in the RBI file, were dropped through listwise deletion. All continuous variables were then winsorised at the 1st and 99th percentiles. This retained extreme observations, including Yes Bank's 2020 loss, while reducing their influence on the estimates.

Table 1. Sample construction

Step	Bank-years	Banks
Public and private sector bank-years in source file	933	60
Less Bharatiya Mahila Bank (start-up, CAR > 100%)	929	59

Step	Bank-years	Banks
Less first-year/conversion distortions	925	59
Less missing values (listwise)	905	59
Less banks with fewer than 3 years	894	53

What remains is an unbalanced panel of 894 observations on 53 banks, split between 465 public and 429 private bank-years. On average, each bank appears for 16.9 years.

VARIABLES

Table 2. Variable definitions (all RBI ratios, %)

Variable	Definition	Expected sign
ROA	Net profit / total assets (dependent)	
ROE	Net profit / equity (robustness)	
CAR	Capital to risk-weighted assets ratio	+
NNPA	Net NPA / net advances	–
OPEX	Intermediation (operating) cost / total assets	–
NII	Non-interest income / total assets	+
CASA	Demand and savings deposits / total deposits	+
CDR	Credit / deposits	+
COF	Cost of funds	–
PSL	Priority-sector advances / total advances	–
lnBPE	Natural log of business per employee (₹ lakh)	+
PRIVATE	1 if private sector bank, 0 otherwise	?

Net interest margin and operating profit are left out on purpose. Both are pieces of ROA itself, and putting them on the right-hand side would amount to explaining profit with profit.

ANALYTICAL STRATEGY

We organise the analysis into five stages. First, descriptive statistics provide an overview of the data, while Welch's t-tests and Mann–Whitney tests assess differences between public and private banks. Second, Pearson correlations show how the variables are related. Third, variance inflation factors help identify potential multicollinearity among the explanatory variables. Fourth, we estimate the following baseline model:

That picks up each bank's stable traits, such as its governance and franchise, and picks up events that touched every bank in a given year: the AQR, demonetisation, COVID-19. We estimate the model by pooled OLS, one-way fixed effects (FE), random effects (RE) and two-way FE, and let the F-test, the Breusch–Pagan LM test and the Hausman (1978) test to select the appropriate model. The fifth stage checks whether the residuals exhibit heteroskedasticity, serial correlation (Wooldridge, 2010) or cross-sectional dependence (Pesaran, 2004). Since all three are detected, we base statistical inference on Driscoll and Kraay (1998) standard errors. We then check the robustness of the findings by replacing ROA with ROE, using explanatory variables lagged by one year, and analysing public and private banks separately.

RESULTS

Descriptive statistics and group differences

Private banks achieved an average ROA of 0.92 percent over the study period, compared with 0.43 percent for public banks. As Table 3 shows, they also maintained stronger capital positions, reported fewer bad loans and earned more fee income. However, they faced higher operating costs and funding costs. Public banks recorded higher CASA deposit shares and greater business per employee. Differences were significant at the 1 percent level except for priority-sector lending share, while the evidence for ROE was mixed. The ROE gap was significant under the t-test but not the Mann–Whitney test, suggesting that large losses at a few public banks may partly explain the difference in average returns.

Table 3. Descriptive statistics and public–private comparison (N = 894)

Variable	Mean	SD	Min	Max	Public mean	Private mean	Welch t
ROA	0.67	0.92	−2.95	2.18	0.43	0.92	−8.34***
ROE	8.47	13.78	−49.65	27.16	7.33	9.70	−2.60***
CAR	14.00	3.27	8.98	27.55	12.68	15.42	−13.43***
NNPA	2.24	2.41	0.12	12.01	2.89	1.53	9.03***
OPEX	2.07	0.64	1.11	4.66	1.76	2.41	−17.35***
NII	1.19	0.45	0.45	2.59	1.03	1.37	−12.03***
CASA	32.85	9.03	12.84	55.50	34.04	31.56	4.10***

Variable	Mean	SD	Min	Max	Public mean	Private mean	Welch t
CDR	72.98	11.33	46.75	108.46	69.91	76.30	-8.62***
COF	5.91	1.11	3.61	8.36	5.79	6.03	-3.33***
PSL	35.85	8.75	18.50	71.59	35.31	36.44	-1.90*
lnBPE	6.89	0.61	5.45	8.02	6.96	6.80	3.99***

Note: Values after 1%/99% winsorisation. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

These averages flatten a dramatic cycle. Between 2005 and 2014, both groups earned close to 1 percent on assets (public 0.86, private 0.97). From 2015 to 2019 the paths split. Public-bank ROA dropped to -0.46 as their net NPAs rose to 6.51 percent, while private banks held on at 0.81. Over 2020–2025 public banks climbed back to an average of 0.30, and by the last year of the sample they were above 1 percent again.

Public-bank ROA turned negative as their net NPAs peaked in 2018

Mean ratio by bank group, Indian public and private sector banks, fiscal years 2005–2025

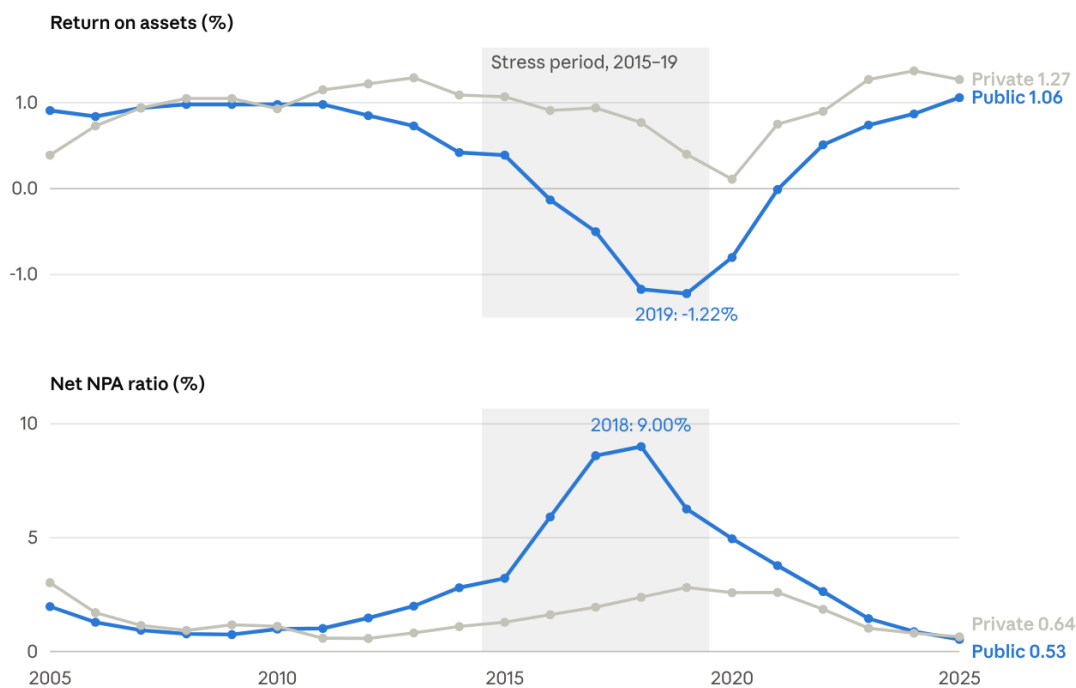


Figure 1. Source: RBI, Select Ratios of Scheduled Commercial Banks; authors' calculations on the cleaned sample (N = 894), 2005–2025

Figure 1 makes the pattern plain. For public banks, the two lines are close to mirror images: as net NPAs rose, ROA fell, and it recovered only as they came down. Private banks went through a much gentler version of the same swing.

Correlations and multicollinearity

Table 4 shows that ROA is strongly associated with lower net NPAs ($r = -0.77$), positively associated with capital adequacy ($r = 0.47$) and the credit–deposit ratio ($r = 0.35$). However, these correlations cannot establish the separate contribution of each factor because the explanatory variables are also related. Banks with higher capital adequacy generally have fewer bad loans ($r = -0.35$), while a larger CASA deposit share is associated with lower funding costs ($r = -0.61$). Operating costs and fee income also move together ($r = 0.50$), indicating that banks with higher operating expenses tend to earn more fee income.

Table 4. Pearson correlation matrix

	ROA	CAR	NNPA	OPEX	NII	CASA	CDR	COF	PSL
CAR	0.47*								
NNPA	-0.77*	-0.35*							
OPEX	0.08*	0.28*	-0.18*						
NII	0.30*	0.30*	-0.19*	0.50*					
CASA	-0.02	0.15*	0.11*	0.20*	0.16*				
CDR	0.35*	0.38*	-0.31*	0.21*	0.36*	-0.07*			
COF	0.01	-0.23*	-0.04	-0.12*	-0.05	-0.61*	0.22*		
PSL	-0.07*	0.21*	0.17*	0.17*	-0.00	0.06	-0.23*	-0.10*	
lnBPE	-0.17*	0.10*	0.24*	-0.36*	-0.15*	0.08*	0.20*	-0.06	-0.08*

Note: * $p < 0.05$.

Even so, none of these links is strong enough to upset the estimates. The highest variance inflation factor is 2.06, for OPEX, and the mean is 1.72, comfortably under the common cut-off of 10.

Results of Model Selection and Diagnostic Tests

The test results reported in Table 5 favour a two-way fixed-effects model. Significant bank effects indicate persistent differences across banks that need to be accounted for. The Hausman test rejects random effects, suggesting that unobserved bank characteristics are correlated with the explanatory variables. Year effects are also jointly significant. Residual tests identify heteroskedasticity, first-order serial correlation and strong cross-sectional dependence. Common shocks during the AQR and the pandemic may partly explain this dependence across banks. We therefore use a two-way fixed-effects model with Driscoll–Kraay standard errors for the main analysis.

Table 5. Specification and diagnostic tests

Test	Statistic	p-value	Decision
F-test, bank effects	$F(52, 831) = 3.50$	< 0.001	FE over pooled OLS

Test	Statistic	p-value	Decision
Breusch–Pagan LM	$\chi^2(1) = 69.00$	< 0.001	RE over pooled OLS
Hausman	$\chi^2(9) = 62.20$	< 0.001	FE over RE
F-test, bank and year effects	$F(72, 811) = 5.53$	< 0.001	Two-way FE
Modified Wald (heteroskedasticity)	$\chi^2(53) = 8,719$	< 0.001	Heteroskedastic
Wooldridge (serial correlation)	$F(1, 52) = 20.66$	< 0.001	Autocorrelated
Pesaran CD (cross-section dependence)	$CD = 23.50$	< 0.001	Dependent

Determinants of ROA

Table 6 sets out the estimates. In the preferred model (column 4), five variables are significant, and none of them changes sign from one estimator to the next. Net NPAs have by far the biggest effect. A one-point rise in the ratio cuts ROA by 0.23 points, and the standardised coefficient of -0.62 is more than twice that of any other variable. Operating cost follows (-0.27 standardised), then capital adequacy ($+0.24$) and non-interest income ($+0.21$). The credit–deposit ratio has a small positive effect, significant at the 10 percent level.

Table 6. Panel estimates of the determinants of ROA

Variable	(1) Pooled OLS	(2) RE	(3) FE	(4) Two-way FE (DK)
CAR	0.059*** (4.33)	0.061*** (4.31)	0.068*** (5.03)	0.068*** (3.68)
NNPA	−0.253*** (−14.46)	−0.245*** (−14.10)	−0.234*** (−13.77)	−0.234*** (−9.24)
OPEX	−0.428*** (−6.06)	−0.379*** (−5.78)	−0.341*** (−5.12)	−0.388*** (−4.85)
NII	0.382*** (5.62)	0.365*** (5.06)	0.364*** (4.55)	0.432*** (4.62)
CASA	0.009** (2.42)	0.004 (1.19)	−0.002 (−0.46)	0.001 (0.18)
CDR	0.007* (1.82)	0.007 (1.59)	0.007 (1.33)	0.008* (1.93)
COF	0.028 (1.19)	0.029 (1.09)	0.011 (0.45)	−0.060 (−0.94)
PSL	0.005 (1.59)	0.002 (0.48)	−0.003 (−0.51)	0.001 (0.24)
lnBPE	−0.192*** (−3.72)	−0.184*** (−3.55)	−0.193*** (−3.18)	−0.098 (−0.61)

Variable	(1) Pooled OLS	(2) RE	(3) FE	(4) Two-way FE (DK)
PRIVATE	0.068 (1.04)	0.025 (0.33)	–	–
Bank effects	No	Random	Yes	Yes
Year effects	No	No	No	Yes
R ² (within)	0.650	0.656	0.659	0.641
R ² (overall)	0.700	0.697	0.687	0.684
N / banks	894 / 53	894 / 53	894 / 53	894 / 53

Note: t-statistics in parentheses. Columns 1–3 use bank-clustered standard errors; column 4 uses Driscoll–Kraay errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The more detailed models tell a different story in three respects. First, CASA share loses its statistical significance once bank effects are included, suggesting that its apparent advantage stems mainly from differences across banks. Second, the negative association between productivity and ROA becomes insignificant after controlling for both bank and year effects, pointing to a possible role for common trends over time. Third, the PRIVATE dummy is insignificant in the model that estimates it. After capital, asset quality and costs are considered, the results provide no clear evidence of an additional profitability advantage associated with private ownership.

Robustness

Table 7. Robustness checks (two-way FE, Driscoll–Kraay errors)

Variable	(5) ROE	(6) Lagged regressors	(7) Public banks	(8) Private banks
CAR	0.563* (1.69)	0.048*** (5.60)	0.067* (1.93)	0.062*** (4.60)
NNPA	−4.023*** (−12.29)	−0.243*** (−11.17)	−0.157*** (−5.12)	−0.357*** (−11.94)
OPEX	−5.045*** (−4.03)	−0.015 (−0.21)	−0.467* (−1.85)	−0.361*** (−5.23)
NII	5.578*** (4.56)	0.032 (0.66)	0.380* (1.81)	0.465*** (4.37)
CASA	−0.032 (−0.57)	0.006 (1.07)	−0.003 (−0.34)	0.004 (0.48)
CDR	0.151** (2.28)	−0.004 (−0.83)	0.014** (2.11)	−0.001 (−0.26)
COF	−0.092 (−0.09)	−0.072*** (−3.38)	−0.065 (−0.93)	−0.062 (−0.76)
PSL	0.055 (0.84)	0.005* (1.81)	0.006 (0.90)	−0.001 (−0.21)

Variable	(5) ROE	(6) Lagged regressors	(7) Public banks	(8) Private banks
lnBPE	−0.160 (−0.08)	−0.171*** (−2.79)	0.174 (1.11)	−0.049 (−0.21)
R ² (within)	0.643	0.632	0.531	0.638
N	894	841	465	429

Note: t-statistics are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The main results hold up reasonably well under the alternative specifications. Replacing ROA with ROE leaves the signs of all coefficients unchanged. Capital and net NPAs remain strongly significant with a one-year lag, indicating that their associations with profitability are not limited to the current year. Operating costs and fee income lose significance when lagged, suggesting a more immediate relationship with earnings. In contrast, funding costs have a significant negative coefficient in the lagged model. One possible explanation is that higher funding costs take time to affect profitability as loans and deposits are repriced.

The separate analyses of public and private banks support H8. The NPA coefficient is -0.357 for private banks, more than twice the magnitude of the public-bank coefficient of -0.157 . This difference is statistically significant ($z = 4.67$, $p < 0.001$). The credit–deposit ratio is significant only for public banks. In contrast, the capital coefficients are nearly identical, with no significant difference between the groups ($z = 0.12$, $p = 0.90$).

DISCUSSION

Taken together, the evidence supports H1, H2, H3, H4 and H8, gives partial support to H6, and does not support H5 or H7 in their same-year form (Table 8).

Table 8. Summary of hypothesis tests

Hypothesis	Expected	Result (two-way FE)	Verdict
H1 Capital adequacy → ROA	+	+0.068***	Supported
H2 Net NPA → ROA	−	−0.234***	Supported
H3 Operating cost → ROA	−	−0.388***	Supported
H4 Non-interest income → ROA	+	+0.432***	Supported
H5 CASA (+), cost of funds (−)	+/−	Insignificant; COF −0.072*** at one-year lag	Not supported (lagged COF only)
H6 Credit–deposit ratio → ROA	+	+0.008*	Weakly supported (public banks)

Hypothesis	Expected	Result (two-way FE)	Verdict
H7 PSL (-), productivity (+)	-/+	Insignificant	Not supported
H8 Effects differ by ownership	$\neq$	NPA effect differs, $z = 4.67^{***}$	Supported

The weight of asset quality is hard to miss. It fits Berger and DeYoung's (1997) argument, and it fits what Indian banks went through after the AQR. In standardised terms, the NPA effect is bigger than the effects of capital and fee income put together. For a bank board, the lesson is blunt: trimming costs or chasing fees will not make up for a poor loan book.

Capital, too, behaves as Berger (1995) and Athanasoglou et al. (2008) would predict, and its effect is still there a year later. Rather than paying a penalty for holding expensive equity, well-capitalised banks appear better able to grow and to absorb losses. That is good news for the Basel III framework and for the government's recapitalisation of public banks. It is also worth noting that the effect is about the same size for public and private banks.

Operating cost and fee income pull in opposite directions, but they are not independent of each other. The two ratios rise together ($r = 0.50$), since fee business needs staff, systems and distribution. A one-point rise in the fee-income ratio adds 0.43 points to ROA; a one-point rise in the cost ratio takes away 0.39. Diversification pays, then, only when fees grow faster than the costs of earning them, a point close to Stiroh's (2004) warning.

The ownership results are perhaps the most revealing part of the study. Because the PRIVATE dummy is insignificant, being a private bank does not, in itself, lift ROA. Private banks do better because their ratios are better, not because of the label. Yet each point of NPA costs a private bank more than twice as much ROA as it costs a public one. A plausible explanation is that private banks have less state backing to lean on and face quicker market discipline, so stress hits their profits straight away. Public banks have often spread the recognition of losses over several years and have received capital from the government along the way.

What does not matter is informative as well. CASA share and priority-sector exposure look important when banks are simply compared, but within a given bank over time they have no separate effect. Their apparent influence comes from lasting differences between banks. Studies built on pooled cross-sections may therefore be overstating how much funding mix and directed lending matter.

CONCLUSION, IMPLICATIONS AND LIMITATIONS

Drawing on 21 years of RBI data for 53 Indian banks, we find that profitability rests on four levers: asset quality, capital, operating cost and fee income. Of these, asset quality matters most by a wide margin. Funding mix, priority-sector exposure, productivity and ownership all seem to matter in a side-by-side comparison, but their influence disappears once we allow for lasting differences between banks and for shocks common to all of them.

Implications for bank management. Sound credit appraisal and early recognition of stress should come first on management's list. Cost and fee strategies are best judged together, because

fee growth that demands a matching rise in spending leaves returns where they were. Private banks especially should take note of how fast asset-quality trouble reaches the bottom line.

Implications for regulators and policymakers. The findings back the RBI's insistence on transparent NPA recognition and robust capital buffers. Capital supports profitability instead of undermining it, and it does so to the same extent in public and private banks. Since the PRIVATE dummy carries little weight, better public-bank performance seems to depend more on credit discipline and efficiency than on a change of ownership alone.

Limitations and future research. Our model relies on bank-level ratios, with the macro environment absorbed by year effects; later work could bring in GDP growth, inflation and policy rates directly. The RBI file does not report bank size in absolute terms, so we could not test for size effects. Profitability also tends to carry over from one year to the next, which a dynamic estimator such as system GMM could capture. Foreign, small finance and payments banks were set aside here and merit a study of their own. Lastly, an event-study design could isolate the effect of the 2017–2020 bank mergers.

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