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Article

Do Shocks in Financial Risk Affect the Financial Performance of Indian Microfinance Institutions?

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Abstract: This study examines the financial performance sustainability of Indian microfinance institutions (MFIs). In the wake of the Andhra Pradesh Crisis, the study tries to align the key reasons for the crisis by using financial theories like Agency Theory, Free Cash Flow Hypothesis, Pecking Order Theory, Investment Theory, and Profitability Theory. The present study uses panel data of sixteen MFIs selected for the period 2010 to 2019 from the MIX market database. Panel structural vector autoregression model was used to analyze the data, as it accounts for any structural breaks present in the dataset. The findings reveal that high-interest coverage positively affects profitability, supporting agency theory. Operational self-sufficiency has a positive impact on profitability while operating cash flow has a negative impact, which highlights a need to manage the cash flows among Indian MFIs. Investment theory states that capital allocation significantly improves operational profits. The study confirms the pecking order theory in Indian MFIs and finds volatility in running income, affecting shareholder's wealth significantly. The study finds the underlying issues and provides policy recommendations to improve the management of free cash flows and increase shareholder wealth which shall lead to internal sustainability among Indian MFIs.

Keywords: Financial Theory; Indian MFIs; SVAR; IRF; Variance Decomposition

1. Introduction

There are a certain number of financial theories that align with the relationship between profitability and financial (risk) variables, which explain how the financial variables impact the profitability of a concern. Understanding these underlying financial theories may help in identifying and analyzing the movement of profitability indicators along with the variables that impact the profitability of the firm. The present study focuses on the profitability of the Indian microfinance institutions (MFIs) as it is an integral part of the Indian economy for the cause that they provide funding and investments for various small and micro-sized businesses. They usually lend to small businesses that have no access to bank loans. MFIs are crucial for societal upliftment such as poverty reduction, women empowerment, and socio-economic development.

The Indian microfinance institution faced a severe crisis during the period 2010. The key reason for the emerging crisis could be attributed to a phenomenon known as the 'aspiration paradox.' The aspiration paradox was addressed before the Andhra Pradesh Crisis of 2010 [1]. The paradox is said to occur when a person/group of persons invests in luxuries using credit, without realizing that the debts are piling up, which can be a cause of bankruptcy. The "Veblen Effect" inversely impacts the

demand theory, which states that people tend to buy expensive goods, just to satisfy their living style. To worsen the scenario, some of the MFIs collaborated with some consumer durable companies [2], and as a result, the borrowings from the MFIs significantly increased. It turned out that the poor borrowers eventually defaulted on their loans and suffered from the coercive methods of loan recovery. When the situation became worse, these borrowers committed suicide. A government report on 3rd December 2010 reported that the Andhra Pradesh Government noticed seventy-five suicide cases. The Andhra Pradesh Microfinance Institutions (Regulation of Money Lending) Ordinance, 2010, was introduced to curb the oversupply of microcredit and to keep control of coercive methods of loan recovery. Financial crises are inevitable, they may arise anytime, and in any form. Hence, it is imperative to understand its profitability and its financial determinants, so that these MFIs are prepared by planning and monitoring their activities to manage their operating and equity profitability efficiently. We shall start by understanding the relevant financial theories, which shall be the guiding path of the present study.

The "Agency Theory" states that the relationship between the principals (e.g. stakeholders) and the agents (e.g. management) on the grounds of "performing a service on their behalf which involves delegating some decision-making authority to the agent" [3]. The principal's objective is to maximize their returns in the form of returns to shareholders, which is possible by efficient utilization of the company's assets. Since the major activity of the MFIs is borrowing and lending money, the impact of interest coverage may be taken as a mechanism to monitor how the borrowed funds are utilized and what its impact on the profitability of the concern. Another theory relating to the agency problem is the "Free Cash Flow Hypothesis", which states excess "free" cash flows may be tempted to utilize them for unprofitable projects which may reduce the shareholder's wealth [4]. The operating cash flows and operational self-sufficiency [5] are the variables that deal with the free cash flows in Indian MFIs. Hence, the relationship between these variables and profitability can be a mechanism to monitor the free cash flow hypothesis. Some "Investment Theories" suggest that capital structure does not impact the value of the firm. [6]. Hence, there should be no, or a very weak relation between the capital asset ratio and the profitability measures. The "Pecking Order Theory" suggests that firms have a specific hierarchy to use their funds – firstly, they would prefer to use their internal capital, such as retained earnings, then they would switch to debt funds, and if these are not sufficient, they will move to equity funds, to improve their operational profits [7]. Hence, the relationship between profitability and leverage ratios such as debt-to-capital ratio, debt-equity ratio, and total debt-to-total asset ratio may serve as the metrics to measure the Pecking Order Theory. A negative relationship between profitability and the leverage ratios may hold the theory. The "Profitability Theory" is a very generalized and most widely studied theory as per the literature. The operating income and return on equity are expected to have a positive relationship using DuPont analysis. Since return on assets measures the operational efficiency of a firm, it is expected to have a positive relationship with operating income. Table A2 in the appendix shows the relationship of the models specified with the theories discussed in this section.

The main aim of the study is to align financial theories to understand how several variables related to financial risk (debt-equity ratio, debt-capital ratio, capital-asset ratio, interest coverage ratio, total debt-total asset ratio, operational self-sufficiency ratio, operating cash flow ratio, and interest coverage ratio) influence profitability (return on assets and return on equity) in the long run. The present study uses the application of the panel structural vector autoregression model. [8] To

understand the long-run shocks in financial risk and its influence on the returns on assets and equity of Indian microfinance institutions. During the period of the study, 256 Indian MFIs are operating across the country [22]. A purposive sampling was done for 16 MFIs, which accounted for 6.25% of the entire population for understanding the impact of financial shocks on the profitability of Indian microfinance institutions, for a period of ten years (i.e., 2010-2019). The justification for choosing 2010 as a starting point of the study can be attributed to the enactment of the Andhra Pradesh Microfinance Institutions (Regulation of Money Lending) Act, 2010 [9]. The study provides ground for future researchers with more broad datasets to understand the variables influencing profitability and/or other metrics overall, to plan and monitor the activities accordingly.

To fulfill the aims of the study, following research questions are imperative: (1) how does financial risk variables influence the profitability of Indian MFIs in the long run? (2) How does interest coverage ratio and return on assets align with agency theory? (3) Does Operational Self-Sufficiency ratio and operating cash flow ratio reflect the principle of free cash flow hypothesis? (4) How does leverage ratios validate the Pecking Order Theory in the operational strategies of Indian MFIs? (5) To what extent does operating income influence return on assets and equity?

The study is divided into five sections, viz., Introduction, which provides the background and significance of the study, literature review, and research gap provides the past studies done on microfinance institutions to understand the variables and expected relations, aligned to the theories provided in the introduction, research methodology provides a brief description of the data and theoretical explanation of structural VAR, data analysis and findings provides the empirical evidence of the financial theories in the Indian MFIs, the final section concludes the study by providing policy implications.

2. Literature Review and Research Gap

2.1. Studies on Microfinance Institutions – Global and Indian Scenario

There is no direct study in the microfinance sector that measures the effect of long-run shocks in risk variables to return variables. A study analyzing the effect of borrowed capital on the operational self-sufficiency of the MFIs all over the world, i.e., Africa, South Asia, Latin America, Eastern Europe & Central Asia, Middle East, and North America, and East Asia and the Pacific showed that increased use of grants leads to a decline in operational self-sufficiency [10].

The impact of capital structure variables such as long-term and short-term debt to total assets and total debt to total assets, on the return on equity of 454 service sector industries and 342 manufacturing industries in the United States [11]. The study concluded that capital structure has a significant positive impact on the return on equity of the companies. The Effect of capital structure on the profitability of the Listed firms in Ghana [12]. The study took short-term debt-to-assets and long-term debt-to-asset ratios along with the total debt-to-asset ratios as independent variables and conducted three separate regression analyses taking a return on equity as the proxy for the financial performance. The study concluded with a significant negative relationship between long-term debt and return on equity along with same results on total debts and return on equity.

A study confirms that there is a negative relationship between profitability and total debt-to-asset ratios [13]. Another study concluded that there is a growth opportunity with the capital structure of companies [14]. Therefore, improved capital structure can provide growth opportunities. Other studies

regarding banking companies in Nigeria show that there is a significant positive relationship between capital structure and financial performance [15]. The effects of capital structure on profitability in the listed companies in the National Stock Exchange (India) were analyzed by [16]. The study found a significant positive relationship between the capital-asset ratio and return on assets and a negative relationship between ROE and capital-asset ratio, which was significant. It implies that the capital structure of a firm has an impact on profitability and by controlling the capital structure a firm can improve its performance. Theoretically, capital structure is decided to make an appropriate mix of capital so that the cost of capital is minimal. An inflated cost of capital leads to a decline in a company's returns on equity. Therefore, it is important to control the capital structure of a company to control its performance.

The financial performance of Indian microfinance institutions was analyzed [5]. The study was employed for 5 years from 2007-2011. The study found that Indian MFIs have better Return on Equity and Operational Self-Sufficiency, but they did not examine relationship among the financial performance indicators in this research. The issue was further addressed in a study that analyzed the financial performance of Indian MFIs concerning selected parameters. The study found that Average Loan Balance per Borrower/GNI Per capita, Return on Asset, and Yield on Gross Profit Portfolio were the factors that adversely affected overall performance [17]. Financial performance and return on assets were found to be negatively related, and operational self-sufficiency was found to be positively related to financial performance. A study was also done on the data from 2007-2011. Graphical analysis was done on Indian MFIs to understand the functioning and reasons for failure [18]. Based on two MFIs – the study concluded that S.M.I.L.E. Microfinance Limited had a better performance than Village Financial Services Limited. Since the study was limited to only two MFIs, it does not provide the overall picture of the financial performance of Indian MFIs. A comparative study based on three MFIs – Fusion, BFIL, and Satin- was conducted [19]. The study found that the operational self-sufficiency ratio was different in those three MFIs for the years 2013-14 to 2017-18. The same result was found for Return on Assets and portfolio to assets. Return on equity and yield on portfolio were indifferent in those three MFIs. They did the study for a five-year period and found that Operational Self-Sufficiency and Return on Assets were changing with time and return on equity throughout the same period. Therefore, here also one question arises – how do performance indicators of MFIs change over an extended period?

The capital structure and financial performance of microfinance institutions in Bangladesh were analyzed in a study by [20]. Return on Assets and Net Income to Expenditure were Dependent Variables and Equity Asset Ratio, Debt to Loan Ratio, Deposit to Loan Ratio, and Deposit to Asset Ratio as Independent Variables. They also took two control variables - Risk and Size. The study concluded with a random effect model as an appropriate model. It concluded that the Deposit to Assets ratio was not significantly related to ROA. A study investigated the financial performance and its determinants by considering the MFIs of Ethiopia. They studied for over eight years from 2010 to 2018. Return on assets was the financial performance measure and they found that no meaningful relationship exists between ROA and Portfolio at risk at time t, and Loan loss ratio at time t. However, Debt-Equity ratio, Liquidity ratio, Operational Self Sufficiency ratio, Operating expense ratio, financial self-sufficiency ratio, and Size had a significant effect on ROA [21].

2.2. Research Gap

The above literature states that very few studies exist on financial performance and capital structure. Therefore, the present research shall fill this research gap in the existing literature, which shall enable to explain the financial performance with capital structure in the Indian microfinance institutions. The present study applies the Structural vector autoregression model to understand the shocks in the returns on assets and return on equity by the financial risk variables to align with the agency theory, pecking order theory, free cash flow theory, investment theory, and profitability theory.

3. Research Methodology

3.1. Data

The present study employed data from the MIX World Bank dataset [22]. The MIX data set contained data from 1999 to 2019 for 256 Indian MFIs. After a rigorous cleaning of missing data, a purposive selection of sixteen Indian MFIs (Table 1) for ten variables was selected for the study, as complete data was available for that set. The objective of the study is to understand the effect of financial risk variables on profitability. The panel data used in our study is a balanced short panel, with N=16 and T=10, totaling 160 Observations. The variables are mentioned in Table A1, appendix.

Table 1. Microfinance institutions under study.

Sl. No.	MFI ID [1]	MFI Name	Sl. No.	MFI ID [1]	MFI Name
1.	101858	Adhikar	9.	102205	Equitas
2.	101367	Arohan	10.	102627	Samasta
3.	111778	ASA India	11.	100021	Sarvodaya Nano
4.	104541	Asirvad	12.	100020	Satin
5.	101870	Asomi	13.	104310	SMILE
6.	100050	BSFL	14.	104175	Suryoday
7.	101488	BWDA	15.	100992	Ujjivan
8.	106069	Chaitanya	16.	100033	Village Financial

[1] MIX Dataset [22].

3.2. The Panel Structural Vector Autoregressive Model

This section outlines the methodological framework used in the present study. In the present study, the panel structural vector autoregression is extended with cross-sectional dependence adjustment using the common correlated estimator (CCE) [23]. The panel structural vector autoregression (PSVAR) model is the extension to the baseline SVAR model [8]. The data analysis in the present study is conducted using EViews 10.

3.2.1. Baseline PSVAR Model

Equation (1) shows the baseline PSVAR model used under study, the estimation of which involves decomposing A0 into just identified parameters using MLE. The impulse response function and the variance decomposition are also based on this framework.

$$\boldsymbol{A_0} y_{it} = \boldsymbol{A}(L) y_{it-k} + e_{it}, \quad (1)$$

Where:

y_{it} is the vector of endogenous variables,

$\boldsymbol{A_0}$ is the contemporaneous matrix of the coefficients (i.e., the long-run estimators or $\boldsymbol{F}$ matrix),

$A(L)$ is a matrix of lag coefficients,

e_{it} is a vector of structural shocks, assumed i.i.d. with $E[e_{it}e_{it}'] = \boldsymbol{I}$, where $\boldsymbol{I}$ is the identity matrix.

3.2.2. CCE-PSVAR Model

If cross-sectional dependence is present within the panel data, it is not possible to run a pooled model. To control the unobserved common factors, the CCE estimator is included in the (1) to control the unobserved common factor between the cross sections as in (2).

$$y_{it} = \boldsymbol{B}(L)y_{ti-1} + \Lambda_i \mathbb{f}_t + \varepsilon_{it}, \tag{2}$$

Where:

$\boldsymbol{B}(L)$ captures the coefficients of lagged variables,

$\mathbb{f}_t$ are the unobserved common factors,

Λ_i denotes the factor loadings that vary across cross-sections,

ε_{it} is the random error term.

To estimate $\mathbb{f}_t$ and control the cross-sectional effects, averages of cross-sectional variables are included in the PSVAR model as the added regressors, as shown in (3):

$$y_{it} = \boldsymbol{B}(L)y_{ti-1} + \Phi\bar{y}_t + \varepsilon_{it}, \tag{3}$$

Where: $\bar{y}_t$ is the vector of cross-sectional averages and the structural matrix $\boldsymbol{A_0}$ is then estimated after adjusting for $\boldsymbol{\Phi}$.

3.2.3. Impulse Response Function and Variance Decomposition

The IRF traces the time path of the effect of one unit shock on one variable itself as well as other variables. The structural shocks (ε_{it}) are orthogonalized using the Cholesky decomposition of A0. The IRFs are computed on both normal PSVAR and CCE-PSVAR (as far as the case is concerned) to examine the robustness of the results.

The variance decomposition quantifies the proportion of forecast error variance of each variable attributable to shocks in each variable. Variance decomposition is performed using the orthogonalized shocks from the estimated A0. The decomposition is shown in the study for 1, 5, 15, and 20 time periods to see both short- and long-term contributions.

4. Data Analysis and Findings

4.1. Preliminary Testing

The preliminary tests included tests for cross-section dependence and unit root tests. The Pesaran CD test [24] and Breusch Pagan LM test [25, 26] was used to understand the cross-sectional dependence in the variables. To compute CD statistics, first the pairwise correlations between the residuals of the regression equations for each cross-section unit is computed across time. Suppose the correlation measured by $\hat{\rho}_{ij}$, and $\hat{\mu}_{ij}$ is the residual sum of squares is obtained from the regressions on own lagged values, then the CD statistic is computed as shown in (4).

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right), \tag{4}$$

In (4), the ($\hat{\rho}_{ij}$) is the correlation between the residuals of the cross sections given by (5).

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T} \hat{\mu}_{it}\hat{\mu}_{jt}}{\sqrt{\sum_{t=1}^{T} \hat{\mu}_{it}^2} \sqrt{\sum_{t=1}^{T} \hat{\mu}_{jt}^2}}, \quad (5)$$

The Breusch and Pagan LM statistic is based on pair-wise correlations of the residual terms of cross sections. The LM statistics is distributed χ^2 with $\frac{N(N-1)}{2}$ degrees of freedom (df) (6).

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \ , \quad (6)$$

Table 2 shows the cross-sectional dependence using the Pesaran CD statistic and Breusch-Pagan LM statistic for the variables selected under the study. The table shows that cross sectional dependence is present in five variables, except for return on equity. It indicates that return on equity is homogeneous across all the Indian MFIs selected under study. Since the Pesaran CD statistics are more robust to the cross-sectional dependence tests, we shall conclude the rejection of the null hypothesis for Interest-Coverage Ratio, Operating Income Ratio and return on Assets ratio. The analysis shall be done by introducing Common Correlated Effects (CCE) estimators along with these variables under study [23, 27]. The method suggests that the variables which are having a cross-sectional independence is due to an "unobservable" factor. Therefore, cross-sectional dependence is addressed [23] by including the cross-sectional averages across time periods in the equation.

The CIPS Unit root test was used in the study as the data are stationary at difference, I (1) and I (2) [28]. The unit root test is based on Panel CIPS, which is built on CADF unit root tests. The CADF unit root test shown by (7).

$$\Delta x_{it} = \alpha_i + p_i x_{it-1} + c_i \bar{x}_{t-1} + \sum_{j=0}^{n} d_{ij} \Delta \bar{x}_{it-1} + \sum_{j=0}^{n} \beta_{ij} \Delta x_{it-1} + \varepsilon_{it} \quad (7)$$

Table 2. Tests for Cross Sectional Dependence (*H₀: No Cross Section dependence*).

Variable	Pesaran CD Statistic	Prob.	Breusch-Pagan LM Statistic [1]	Prob.
CA	1.120	0.263	204.796	0.000
DC	0.104	0.917	347.782	0.000
DE	2.071	0.038	217.9682	0.000
IC	4.747	0.000	189.7871	0.000
OCF	-0.802	0.423	191.043	0.000
OI	3.332	0.001	173.777	0.001
OPSS	2.426	0.015	194.275	0.000
ROA	3.403	0.001	181.693	0.000
ROE	-0.423	0.673	115.371	0.602

[1] The Breusch-Pagan LM Statistic is distributed Chi-Squared with 120 DF.

In (7), α_i is the intercept and Δx_{it} denotes variable under observation. The cross-sectional average denoted by $\bar{x}$ and the error term denoted by ε_{it}. The null hypothesis assumes stationarity at level and/or difference. The CIPS statistics are the cross-sectional average of t-statistics from the regression (7) and represented by (8).

$$\text{CIPS} = \frac{1}{\text{N}}\sum_{i=1}^{N} t_i(N.T) \quad (8)$$

Table 3. Tests for Unit Root (*H₀: Not Stationary*).

Variable	Level	Prob.	Difference	Stationary at	Prob.
CA	-2.686	0.004	-2.862	I (1)	0.002
DC	0.726	0.766	-2.250	I (1)	0.012
DE	-2.154	0.016	-3.253	I (1)	0.001
IC	-0.257	0.398	-3.466	I (1)	0.000
OCF	-2.310	0.010	-5.274	I (1)	0.000
OI	-1.293	0.098	-4.160	I (1)	0.000
OPSS	-1.336	0.091	-3.909	I (1)	0.000
ROA	-1.885	0.030	-3.460	I (1)	0.000
ROE	-4.037	0.000	-5.677	I (1)	0.000
AVG_ROA	-1.502	0.067	-3.477	I (1)	0.000
AVG_DE	-0.759	0.224	-15.790	I (1)	0.000
AVG_IC	4.942	1.000	-4.494	I (2)	0.000
AVG_OPSS	-0.470	0.319	-4.120	I (1)	0.000
CA	-2.686	0.004	-2.862	I (1)	0.002

4.2. Findings and Discussion

4.2.1. Agency Theory

Table 4. Estimated F-matrix for ΔROA, ΔROE, and ΔIC.[3]

(a) Estimations for ROA.[1]

	ΔROA	**ΔIC**	**ΔAVG_ROA**	**Δ₂AVG_IC**
ΔROA	3.451***	0.000	0.000	0.000
ΔIC	0.316***	0.764***	0.000	0.000
ΔAVG_ROA	0.246***	-0.11	0.881***	0.000
Δ₂AVG_IC	-0.002	0.039***	-0.002	0.167***

(b) Estimations for ROE.[2]

	ΔROE	**ΔROE**	**Δ₂AVG_IC**
ΔROE	897.188***	0.000	0.000
ΔIC	0.345***	0.859***	0.000
Δ₂AVG_IC	0.050	0.105***	0.309***

[1] Log Likelihood = -717.140

[2] Log Likelihood = -1272.998

[3] Significance codes: *** 0.01 level; ** 0.05 level; * 0.1 level; insignificant.

Table 4 presents the estimates for return on assets and return on equity using interest coverage ratio. The responses in the table show that the return on equity and assets is greatly and favorably affected by the interest coverage ratio. One of the variables with the first difference is displayed. The first-differenced variables' response is displayed in Figure A1 and A2, appendix. The following insights are drawn from the impulse response functions and variance decompositions: The return on assets shows a stable response to their own shocks. A steady response over time is seen in the interest coverage ratio, while oscillatory behavior was seen in the average return on assets and average interest coverage ratio (figure A1). An oscillatory response was seen to its shocks in return on equity, and a stable response was seen in the interest coverage ratio, increasing over two time periods, and

then stable across periods, which might decline eventually. It says that a rising interest coverage ratio may positively affect the return on equity eventually.

Table 5. Variance Decomposition for ΔIC.

(a) Variance explained in ROA.

Period	S.E.	ΔROA	ΔIC	Δ2AVG_IC	ΔAVG_ROA
			Subpanel A1: ΔROA		
1	5.40	100.00	0.00	0.00	0.00
5	6.15	90.39	1.80	3.17	4.63
10	6.26	87.43	2.14	3.93	6.50
15	6.31	86.09	2.19	4.31	7.40
20	6.33	85.46	2.21	4.49	7.83
			Subpanel A2: ΔIC		
1	5.40	100.00	0.00	0.00	0.00
5	6.15	90.39	1.80	3.17	4.63
10	6.26	87.43	2.14	3.93	6.50
15	6.31	86.09	2.19	4.31	7.40
20	6.33	85.46	2.21	4.49	7.83
			Subpanel A3: Δ2AVG_IC		
1	0.27	0.70	4.48	12.64	82.18
5	0.50	1.51	4.60	28.69	65.19
10	0.59	1.52	4.63	28.76	65.09
15	0.63	1.52	4.64	28.77	65.07
20	0.65	1.52	4.64	28.77	65.06
			Subpanel A4: ΔAVG_ROA		
1	1.16	4.63	1.58	93.79	0.00
5	1.92	2.82	3.45	55.93	37.80
10	2.22	2.48	3.77	48.86	44.89
15	2.35	2.38	3.87	46.62	47.13
20	2.42	2.33	3.91	45.71	48.04

(b) Variance explained in ROE.

Period	S.E.	ΔROA	ΔIC	Δ2AVG_IC	ΔAVG_ROA
			Subpanel B1: ΔROE		
1	2585.31	100.00	0.00	0.00	2585.31
5	5522.17	93.60	6.17	0.23	5522.17
10	7563.79	91.65	8.00	0.35	7563.79
15	9675.68	90.77	8.85	0.38	9675.68
20	12096.1	90.28	9.30	0.41	12096.1
			Subpanel B2: ΔIC		
1	1.46	0.73	99.27	0.00	1.46
5	1.63	1.32	90.95	7.73	1.63
10	1.70	2.76	84.58	12.67	1.70
15	1.76	4.81	79.50	15.69	1.76
20	1.80	6.45	75.98	17.57	1.80
			Subpanel B3: Δ2AVG_IC		
1	0.34	3.13	5.06	91.81	0.34
5	0.53	4.24	5.43	90.32	0.53
10	0.66	4.64	5.40	89.96	0.66
15	0.74	4.78	5.52	89.70	0.74
20	0.79	4.71	5.68	89.61	0.79

The average interest coverage ratio (differenced in two periods) shows an oscillatory response to return on equity and interest coverage ratio. It shows that eventually, a never-declining positive relation shall exist between the interest coverage and return on equity (figure A2). Short-term shocks

have an impact on both the interest coverage ratio and returns on assets (table 5). The average interest coverage ratio over time explains the difference between return on equity and return on assets, highlighting the significance of the interest coverage ratio in enhancing operational success as measured by return on assets. The findings suggest that high interest coverage ratio shall contribute towards improving the operational performance of the Indian MFIs. Findings suggest that debt, if used judiciously, can function as a disciplinary mechanism which incentivizes the managers to act in the best interest of their principals, improving the operational profit of the institutions.

4.2.2. Free Cash Flow Hypothesis

Table 6. Estimated F-matrix for ΔROA, ΔROE, ΔOPSS and ΔOCF.[3]

(a) Estimations for ROA.[1]

	ΔROA	**ΔOPSS**	**ΔOCF**	**ΔAVG_ROA**	**ΔAVG_OPSS**
ΔROA	3.088***	0.000	0.000	0.000	0.000
ΔOPSS	8.822***	7.499**	0.000	0.000	0.000
ΔOCF	-6.827***	1.192	14.565***	0.000	0.000
ΔAVG_ROA	0.306***	0.015	0.103	0.942***	0.000
ΔAVG_OPSS	0.930**	0.078	0.287	2.877***	0.517***

(b) Estimations for ROE.[2]

	ΔROE	**ΔOPSS**	**ΔOCF**	**ΔAVG_OPSS**
ΔROE	897.920***	0.000	0.000	0.000
ΔOPSS	1.700*	10.316***	0.000	0.000
ΔOCF	-2.037	-4.631***	17.957***	0.000
ΔAVG_OPSS	-0.162	0.619**	0.115	3.037***

[1] Log Likelihood = -1803.192

[2] Log Likelihood = -2501.942

[3] Significance codes: *** 0.01 level; ** 0.05 level; * 0.1 level; insignificant.

The relationship between operating cash flow and operational self-sufficiency, two free cash flow variables, is explained in Table 6. Operational self-sufficiency has a favorable effect on return on assets, while operating cash flow has a negative effect. On the other hand, operational cash flow has a negligible negative effect on return on equity, while operational self-sufficiency has a substantial positive influence. The following are the salient features of the variance decomposition and impulse responses:

Up until the fifteenth period, both operating cash flow and operational self-sufficiency remain steady. After that, operating cash flow shocks caused a drop in return on equity and a rise in return on assets. The relationship between return on equity and return on assets is the opposite: as the operational cash flow rises, return on equity falls while return on assets rises. On the other hand, operational self-sufficiency shocks lower return on assets and raise return on equity. Own shocks have a detrimental effect on operating cash flow and operational self-sufficiency (figure A3 and A4)

The operating cash flow is shown as an important metric which shares the largest variance (~82%) in return on assets and (~95%) in return on equity, eventually. Initially, the own variance is strong in return on assets and equity, which decline over time, showing a weak persistence to own shocks. The variance decomposition says that operating cash flow is the key driver in the profitability of the MFIs.

The free cash flow hypothesis states that excess cash flow may deviate the agents to invest in unworthy projects, which might lead to a downfall in the operating efficiency of the concern. In terms

of operational profits, i.e., return on assets, the free cash flow hypothesis is supported in the Indian MFI Industry.

Table 7. Variance Decomposition for ΔOPSS and ΔOCF.

(a) Variance explained in ROA.

Period	S.E.	ΔROA	ΔOPSS	ΔOCF	ΔAVG_ROA	ΔAVG_OPSS
			Subpanel A1: ΔROA			
1	4.84E+00	100.00	0.00	0.00	0.00	0.00
5	3.48E+02	0.35	17.38	82.24	0.02	0.00
10	8.20E+05	0.34	17.38	82.26	0.02	0.00
15	1.93E+09	0.34	17.38	82.26	0.02	0.00
20	4.55E+12	0.34	17.38	82.26	0.02	0.00
			Subpanel A2: ΔOPSS			
1	1.57E+01	46.46	53.54	0.00	0.00	0.00
5	2.71E+02	0.53	17.18	82.26	0.03	0.00
10	3.02E+06	0.34	17.38	82.26	0.02	0.00
15	7.12E+09	0.34	17.38	82.26	0.02	0.00
20	1.68E+13	0.34	17.38	82.26	0.02	0.00
			Subpanel A3: ΔOCF			
1	8.87E+01	0.10	13.96	85.94	0.00	0.00
5	4.69E+04	0.34	17.38	82.26	0.02	0.00
10	1.10E+08	0.34	17.38	82.26	0.02	0.00
15	2.60E+11	0.34	17.38	82.26	0.02	0.00
20	6.13E+14	0.34	17.38	82.26	0.02	0.00
			Subpanel A4: ΔAVG_ROA			
1	1.47E+00	8.29	0.52	0.19	91.00	0.00
5	1.22E+02	0.34	17.39	82.24	0.03	0.00
10	2.88E+05	0.34	17.38	82.26	0.02	0.00
15	6.77E+08	0.34	17.38	82.26	0.02	0.00
20	1.60E+12	0.34	17.38	82.26	0.02	0.00
			Subpanel A5: ΔAVG_OPSS			
1	4.50E+00	7.55	0.97	0.39	83.03	8.05
5	3.89E+02	0.34	17.39	82.24	0.04	0.00
10	9.15E+05	0.34	17.38	82.26	0.02	0.00
15	2.16E+09	0.34	17.38	82.26	0.02	0.00
20	5.08E+12	0.34	17.38	82.26	0.02	0.00

(b) Variance explained in ROE.

Period	S.E.	ΔROE	ΔOPSS	ΔOCF	ΔAVG_OPSS
			Subpanel B1: ΔROE		
1	2.68E+03	100.00	0.00	0.00	0.00
5	2.84E+04	4.19	4.17	91.62	0.02
10	1.76E+07	0.09	4.24	95.65	0.01
15	1.13E+10	0.09	4.25	95.65	0.01
20	7.22E+12	0.09	4.25	95.65	0.01
			Subpanel B2: ΔOPSS		
1	1.46E+01	0.73	99.27	0.00	0.00
5	7.54E+02	0.16	4.34	95.48	0.01
10	4.82E+05	0.09	4.25	95.65	0.01
15	3.09E+08	0.09	4.25	95.65	0.01
20	1.97E+11	0.09	4.25	95.65	0.01
			Subpanel B3: ΔOCF		
1	1.04E+02	0.12	6.93	92.95	0.00
5	2.02E+04	0.10	4.25	95.64	0.01
10	1.29E+07	0.09	4.25	95.65	0.01

15	8.26E+09	0.09	4.25	95.65	0.01
20	5.28E+12	0.09	4.25	95.65	0.01
			Subpanel B4: ΔAVG_OPSS		
1	4.57E+00	0.38	5.31	1.08	93.23
5	1.60E+02	0.08	4.30	95.52	0.10
10	1.02E+05	0.09	4.25	95.65	0.01
15	6.53E+07	0.09	4.25	95.65	0.01
20	4.18E+10	0.09	4.25	95.65	0.01

4.2.3. Investment Theory

The capital-asset ratio and return on assets are positively related, as Table 8 (a) proves. Nonetheless, the table shows that there is no meaningful linear correlation between the capital asset ratio and return on equity (table 8 (b)). The following conclusions are drawn from variance decomposition and impulse response:

Table 8. Estimated F-matrix for ΔROA, ΔROE, and ΔCA.[3]

(a) Estimations for ROA.[1]

	ΔROA	**ΔCA**	**ΔAVG_ROA**
ΔROA	2.196***	0.000	0.000
ΔCA	8.942***	21.159***	0.000
ΔAVG_ROA	0.318***	-0.015	1.032****

(b) Estimations for ROE.[2]

	ΔROE	**ΔCA**
ΔROE	552.969***	0.000
ΔCA	1.754	15.409***

[1] Log Likelihood = -1043.174

[2] Log Likelihood = -1512.951

[3] Significance codes: *** 0.01 level; ** 0.05 level; * 0.1 level; insignificant.

The capital asset ratio has a consistent, but long-term negative, impulse reaction to return on assets. Self-reaction, or the response to return on assets, is first decreasing but eventually stabilizes. In terms of return on equity, an upward trend with oscillatory behavior was noted, suggesting that the capital asset ratio finally tends to increase return on equity. The own shock in this case is also oscillatory, showing uncertainties, but an upward rising trend confirms the positive relation over time (figure A5 and A6).

According to the variance decomposition table, the capital asset ratio accounts for 19% of the variation in return on assets. The variance explained in return on equity is trending upward, according to the capital asset ratio. There is truly little evidence in the current study to support the claim that a high capital-asset ratio is necessary for an increase in return on equity (table 9).

The investment theory held in this study assumed no linear relationship between profitability and capital asset ratio. The study accepts the investment theory partially, as return on equity has no significant linear relationship over time with the capital-asset ratio. The study also contradicts the assumption, as linear relationship between capital asset ratio and return on assets ratio contradicts the investment theory.

4.2.4. Pecking Order Theory

Table 9. Variance Decomposition for ΔCA.

(a) Variance explained in ROA.

Period	S.E.	ΔROA	ΔCA	ΔAVG_ROA
			Subpanel A1: ΔROA	
1	3.64	100.00	0.00	0.00
5	5.64	62.04	37.53	0.42
10	5.72	61.32	38.18	0.49
15	5.73	61.27	38.24	0.49
20	5.73	61.26	38.24	0.49
			Subpanel A2: ΔCA	
1	32.12	17.27	82.73	0.00
5	34.85	19.65	79.89	0.46
10	35.06	19.60	79.92	0.48
15	35.07	19.60	79.92	0.48
20	35.07	19.60	79.92	0.48
			Subpanel A3: ΔAVG_ROA	
1	1.51	3.60	0.39	96.01
5	1.60	4.66	3.14	92.20
10	1.60	4.74	3.29	91.97
15	1.60	4.74	3.30	91.96
20	1.60	4.74	3.30	91.96

(b) Variance Explained in ROE.

Period	S.E.	ΔROE	ΔCA
		Subpanel B1: ΔROE	
1	1926.85	100.00	0.00
5	4025.02	75.51	24.49
10	4977.88	70.24	29.76
15	5237.03	69.84	30.16
20	5400.57	69.98	30.02
		Subpanel B2: ΔCA	
1	31.48	49.58	50.42
5	53.99	55.50	44.50
10	64.48	57.21	42.79
15	69.77	59.33	40.67
20	73.41	60.27	39.73

Table 10 explains the relationship between return on assets and return on equity with debt-to-equity ratio and debt-to-capital ratio (as the leverage ratios), to understand the pecking order theory in Indian MFIs. A significant negative relationship between return on assets, debt-to-equity and debt-to-capital ratio confirms the pecking order theory with operational profits. The insignificant relationship with return on equity ratio holds that the MFIs are not using financial leverage to increase shareholders' wealth. The insights from impulse response function and variance decomposition are as follows:

The accumulated response functions show that the response of debt-to-equity ratio to debt to capital is stable eventually. Response of debt-to-equity to return on assets is increasing in the short run and is stable eventually. Stable relation between the leverage and return on assets exists eventually. The debt to equity and debt to capital show an oscillating response to return on equity, showing an unstable relation eventually (figure A7 and A8).

The variance decomposition shows a weak explanatory power of debt-to-equity ratio and debt-to-capital ratio on return on assets (~30% for debt-to-equity and ~0.60% for debt-to-capital).

Conversely, an increasing trend in variance is seen with return on equity (~0.94-35.50% for debt-to equity and ~11.68-65.08% for debt-capital) (table 11).

Table 10. Estimated F-matrix for ΔROA, ΔROE, ΔDE and ΔDC.[3]

(a) Estimations for ROA.[1]

	ΔROA	**ΔDE**	**ΔDC**	**ΔAVG_ROA**	**ΔAVG_DE**
ΔROA	2.692***	0.000	0.000	0.000	0.000
ΔDE	-0.772***	1.335***	0.000	0.000	0.000
ΔDC	-0.025*	0.047***	0.150**	0.000	0.000
ΔAVG_ROA	0.353***	0.058	-0.069	0.841***	0.000
ΔAVG_DE	-0.072***	-0.006	0.026	-0.169***	0.078***

(b) Estimations for ROE.[2]

	ΔROE	**ΔDE**	**ΔDC**	**ΔAVG_DE**
ΔROE	899.711***	0.000	0.000	0.000
ΔDE	0.178	6.151***	0.000	0.000
ΔDC	-0.071	Restricted (1)	0.291***	0.000
ΔAVG_DE	0.031	0.335***	0.091**	0.173***
		LR test for over-identification.		
Chi-Sq. (1)	350.99***		Prob.	0.000

[1] Log likelihood = -726.6652

[2] Log likelihood = -1575.577

[3] Significance codes: *** 0.01 level; ** 0.05 level; * 0.1 level; insignificant.

The observations align with the pecking order theory. The significant negative relationship with return on assets and leverage ratios highlights the reliance on internal funds rather than debt financing. However, the insignificant relationship shows that the MFIs do not maximize shareholder's wealth. A stable relationship with return on assets and instable relationship with return on equity, with increasing variance over time supports the theory of the capital structure preferences.

Table 11. Variance Decomposition for ΔDE and ΔDC.

(a) Variance Decomposition for ROA.

Period	**S.E.**	**ΔROA**	**ΔDE**	**ΔDC**	**ΔAVG_ROA**	**ΔAVG_DE**
			Subpanel A1: ΔROA			
1	4.30	100.00	0.00	0.00	0.00	0.00
5	5.64	66.88	22.42	9.83	0.84	0.00
10	5.71	66.36	22.46	10.03	1.10	0.00
15	5.72	66.31	22.45	10.07	1.11	0.00
20	5.72	66.31	22.45	10.08	1.11	0.00
			Subpanel A2: ΔDE			
1	2.38	0.27	99.73	0.00	0.00	0.00
5	3.32	30.63	61.51	6.03	1.74	0.08
10	3.36	30.69	60.85	6.42	1.94	0.09
15	3.36	30.69	60.8	6.47	1.95	0.09
20	3.36	30.69	60.8	6.47	1.95	0.09
			Subpanel A3: ΔDC			
1	0.23	0.46	3.36	96.19	0.00	0.00
5	0.25	0.60	3.58	95.22	0.60	0.00
10	0.25	0.62	3.60	95.15	0.63	0.00
15	0.25	0.62	3.60	95.14	0.63	0.00

20	0.25	0.62	3.60	95.14	0.63	0.00
			Subpanel A4: ΔAVG_ROA			
1	1.46	12.73	1.08	3.37	82.83	0.00
5	1.62	12.26	1.23	4.98	80.41	1.13
10	1.63	12.21	1.23	5.11	80.28	1.16
15	1.64	12.21	1.23	5.12	80.28	1.16
20	1.64	12.21	1.23	5.12	80.28	1.16
			Subpanel A5: ΔAVG_DE			
1	0.31	8.10	1.42	3.31	56.11	31.06
5	0.42	8.56	1.11	4.17	57.39	28.77
10	0.42	8.54	1.12	4.45	57.44	28.46
15	0.42	8.54	1.12	4.45	57.45	28.44
20	0.42	8.54	1.12	4.45	57.45	28.44

(b) Variance Decomposition for ROE.

Period	**S.E.**	**ΔROE**	**ΔDE**	**ΔDC**	**ΔAVG_DE**
			Subpanel B1: ΔROE		
1	2708.19	100.00	0.00	0.00	0.00
5	5587.46	99.86	0.02	0.03	0.10
10	7698.38	99.75	0.02	0.03	0.20
15	9682.82	99.66	0.03	0.03	0.28
20	12172.22	99.69	0.03	0.03	0.26
			Subpanel B2: ΔDE		
1	3.49	0.94	99.06	0.00	0.00
5	4.42	4.19	94.05	1.20	0.56
10	4.66	13.06	84.96	1.10	0.89
15	5.05	26.08	72.15	0.94	0.84
20	5.41	35.50	62.90	0.82	0.78
			Subpanel B3: ΔDC		
1	0.23	11.68	1.16	87.16	0.00
5	0.26	20.54	1.00	78.37	0.10
10	0.30	40.79	0.75	58.36	0.09
15	0.34	52.77	0.61	46.46	0.17
20	0.40	65.08	0.45	34.28	0.19
			Subpanel B4: ΔAVG_DE		
1	0.47	0.41	1.40	5.05	93.13
5	0.77	6.02	1.34	4.12	88.52
10	0.9	25.19	1.09	3.17	70.56
15	1.05	44.68	0.81	2.33	52.18
20	1.15	54.29	0.67	1.92	43.12

4.2.5. Profitability Theory

The coefficient estimates for return on equity and return on assets in relation to operating income are displayed in Table 12. When running income and return on assets have a strong positive correlation, it means that rising operating income will eventually raise return on assets. Nonetheless, the profitability argument was confirmed by the effect of operating income on return on assets.

The notion that increasing operating income will increase MFIs' return on assets is supported by the long-term stability of the link between operating income and ROA. However, an increase in operating income causes volatility in return on equity since higher revenue leads to higher profits, which impact shareholder wealth (e.g., dividend payments) (figure A9 and A10). This is clear from the fact that corporations may pay out dividends to shareholders when operational income increases, which might eventually create a change in return on equity.

Table 12. Estimated F-matrix for ΔROA, ΔROE, and ΔOI.[3]

(a) Estimations for ROA.[1]

	ΔROA	**ΔOI**	**ΔAVG_ROA**	**ΔAVG_OI**
ΔROA	16.011***	0.000	0.000	0.000
ΔOI	208.499***	10.025***	0.000	0.000
ΔAVG_ROA	0.039	-0.013	-0.788***	0.000
ΔAVG_OI	0.499	-0.107	-10.098***	-0.806***

(b) Estimations for ROE.[2]

	ΔROE	**ΔOI**	**ΔAVG_OI**
ΔROE	1040.906***	0.000	0.000
ΔOI	99.448***	167.068***	0.000
ΔAVG_OI	6.753	32.793***	79.848***

[1] Log likelihood=-1718.993

[2] Log likelihood=-2496.314

Significance codes: *** 0.01 level; ** 0.05 level; * 0.1 level; insignificant.

Table 13. Variance Decomposition for ΔOI.

(a) Variance Decomposition for ROA.

Period	**S.E.**	**ΔROA**	**ΔOI**	**ΔAVG_ROA**	**ΔAVG_OI**
			Subpanel A1: ΔROA		
1	3.21E+00	100.00	0.00	0.00	0.00
5	4.19E+03	1.30	3.41	60.20	35.08
10	3.44E+08	1.31	2.80	60.58	35.30
15	2.83E+13	1.31	2.80	60.58	35.30
20	2.32E+18	1.31	2.80	60.58	35.30
			Subpanel A2: ΔOI		
1	3.36E+02	0.32	99.68	0.00	0.00
5	4.84E+05	1.31	2.83	60.56	35.29
10	3.97E+10	1.31	2.80	60.58	35.30
15	3.26E+15	1.31	2.80	60.58	35.30
20	2.68E+20	1.31	2.80	60.58	35.30
			Subpanel A3: ΔAVG_ROA		
1	4.58E-01	2.04	1.83	96.13	0.00
5	4.19E+03	1.31	2.80	60.59	35.30
10	3.44E+08	1.31	2.80	60.58	35.30
15	2.83E+13	1.31	2.80	60.58	35.30
20	2.32E+18	1.31	2.80	60.58	35.30
			Subpanel A4: ΔAVG_OI		
1	5.83E+01	1.38	2.80	64.04	31.78
5	4.84E+05	1.31	2.80	60.58	35.30
10	3.97E+10	1.31	2.80	60.58	35.30
15	3.26E+15	1.31	2.80	60.58	35.30
20	2.68E+20	1.31	2.80	60.58	35.30

(b) Variance Decomposition for ROE.

Period	**S.E.**	**ΔROE**	**ΔOI**	**ΔAVG_OI**
		Subpanel B1: ΔROE		
1	2626.19	100.00	0.00	0.00
5	7424.86	49.83	48.67	1.51
10	11682.46	34.52	63.58	1.89
15	14031.43	33.29	64.66	2.06
20	16532.01	32.22	65.60	2.19
		Subpanel B2: ΔOI		

1	337.51	0.14	99.86	0.00
5	396.77	0.23	97.36	2.41
10	397.45	0.29	97.29	2.42
15	397.75	0.33	97.25	2.42
20	398.08	0.38	97.20	2.42
		Subpanel B3: ΔAVG_OI		
1	78.93	0.30	5.73	93.98
5	87.95	7.03	13.33	79.64
10	102.03	14.46	25.76	59.77
15	116.72	17.00	36.78	46.22
20	125.68	18.35	41.48	40.17

The variance decomposition in table 13 shows that in the long run, operating income is explained (~60%) by average return on assets. The volatility in the return on equity suggests that there may be other factors influencing the relationship between return on equity and operating income. The study concluded that according to the profitability theory, an increase in operating income increases return on assets, but also brings a volatility in return on equity.

5. Conclusion and Policy Recommendations

The findings of the present study offer significant insights to the financial dynamics of Indian microfinance institutions. The study tried to uncover the relation between the risk and return variables by using five financial theories viz., agency theory, free cash flow hypothesis, pecking order theory, investment theory and profitability theory in the context of Indian MFIs. The selection of these five financial theories is relevant to the context of Andhra Pradesh Microfinance crisis, as it offers comprehensive guidance to understand how financial metrics drive the profitability of the concern and promote sustainable growth in the microfinance sector.

The Andhra Pradesh crisis was a result of poor managerial policies. This throws light on the agency problem, where the conflicts between the agents and the principals might have led to incorrect decision making. Agency theory emphasizes aligning managerial goals with institution's goals and minimizing risks of loan defaults. During crisis, excessive disbursement of loans without due diligence highlights the needs for monitoring mechanisms. The findings of the study are consistent with the agency theory—the interest coverage ratio significantly affects profitability. High interest coverage ratio ensures managerial discipline, as it creates financial pressure and encourages the managers to prioritize the interest of the principals.

The free cash flow hypothesis is a subpart of the agency theory. The fact that MFIs in Andhra Pradesh collaborated with consumer durable companies, was a scenario of over-utilizing the funds, due to excess availability of cash flows. This theory highlights that by focusing upon the operational self-sufficiency and operating cash flow ratio, the MFIs can distribute their resources efficiency thereby reducing financial risks. Operational Self-Sufficiency was a positive driver for return on equity, while operating cash flow ratio showed mixed effects on the profitability ratios. This shows that there still exists a potential risk of managing the cash flow among the MFIs.

The MFIs' reliance on outside funding was exposed during the crisis, which boosted their influence. According to the pecking order idea, giving internal funds precedence over external ones might offer insightful insight. Excessive debt consumption can have a cascading impact that could result in an economic disaster. A preference for internal financing over debt financing is shown by a negative relation between profitability ratios and leverage ratios. This illustrates MFIs' cautious

strategy to continue depending on internal funding. Leverage and return on equity have an erratic connection, which shows that capital structure management is still lacking.

The investment and profitability theories also align with the Andhra Pradesh crisis, by not keeping the best balance between capital structure and operational profits. Investment theory helps to understand the relationship between capital-asset ratio and profitability, which is critical for internal sustainability. The partial support for the investment theory in this study provides a limited evidence of asset allocation using the capital of Indian MFIs. The profitability theory is essential to understand how operational efficiency translates into financial stability. However, it is imperative that increasing profitability should not include predatory lending practices. The profitability analysis in the present study states that operating income significantly boosts the return on assets, which in turn is a challenge for managing shareholders' wealth, thus, requiring a framework for a balanced approach towards profit use and increasing shareholder value.

Considering the above findings, the following policy recommendations are provided as an outcome of the study:

1) Strengthening Managerial Accountability

The focus on aligning managerial actions that improve the MFI's goals should be prioritized. Improving managerial discipline by keeping an eye on interest coverage ratio by incentivizing managers by making certain investments, which keeps the ICR of the industry high, may lower the risks of future defaults.

2) Perfect Cash Flows

The free cash flows should be checked properly among Indian MFIs. This could be achieved by investing the free cash flow into profitable ventures. Policies to check and distribute the cash flows towards the investments which yield returns, and are of minimum risk, should be improvised. Effective hedging mechanisms for such investments should be provided to safeguard the free funds.

3) Adopting Efficient Leverage Practices

Policies which cap excess borrowing should be implemented. The negative relationship between leverage and profitability shows that interest rate caps introduced by the Andhra Pradesh Microfinance Institutions (Regulation of Money Lending) Act, 2010 has successfully helped the MFIs to adopt internal fund-sustainability.

4) Leveraging Assets

Policies on keeping the best capital-asset ratio such that equity return is also maximized, should be introduced to provide of use on the assets on the MFIs, rather than depending on external funds.

5) Promoting Sustainable Growth

Since operating income is the key driver of operational profits, it should be strategically managed along with stabilizing the ROE. Policies may include promotion of reinvestment of profits to mitigate the shareholder wealth risk. Focusing reducing the volatility in the revenue can help the MFIs sustain both operational and shareholder's returns.

The present study addressed sixteen Indian microfinance institutions over a ten-year period from 2010-2019, which is a quite old-time frame selected for the study. The main aim of the study was to provide a framework for future studies and to understand the application of how financial risk impacts profitability by analyzing panel data using structural vector auto regression using common correlation estimators. Further studies may include the application for Threshold Vector Autoregressions (TVAR) to understand the non-linear dynamics of the Indian MFI Industries.

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Appendix

Table A1. Variables used under the study.

Sl. No.	Ratio Name	Code	Formula
1	Capital-Asset Ratio	CA	Total Equity/Total Assets
2	Debt-to-Capital Ratio	DC	Total Liabilities / (Total Liabilities + Total Assets)
3	Debt-to-Equity Ratio	DE	Total Liabilities/Total Equity
4	Interest-Coverage Ratio	IC	Net Operating Income / Interest in Long term Borrowings
5	Operating Cash Flow Ratio	OCF	Operating Cash Flow / Current Liabilities
6	Operating Income Ratio	OI	Net Operating Income / Financial Revenue
7	Operational Self Sufficiency	OPSS	Financial Revenue / (Financial Expense + Net Impairment Loss + Operating Expense)
8	Return on Assets	ROA	(Net Operating Income - Taxes) / Average Total Assets
9	Return on Equity	ROE	(Net Operating Income - Taxes) / Average Total Equity

Table A2. Models and their relevant theories.

Model No.	Endogenous	Exogenous	Relevant Theory	Expected Relationship
1	ROA	Interest-Coverage Ratio	Agency Theory	+
2	ROE	Interest-Coverage Ratio		+
3	ROA	Operational Self-Sufficiency Ratio	Free Cash Flow Hypothesis	+
		Operating Cash Flow Ratio		-
4	ROE	Operational Self-Sufficiency Ratio		+
		Operating Cash Flow Ratio		-
5	ROA	Capital-Asset Ratio	Investment Theory	No Linear Relationship
6	ROE	Capital-Asset Ratio		No Linear Relationship
7	ROA	Debt-to-Equity Ratio	Pecking Order Theory	-

		Debt-to-Capital Ratio		-
8	ROE	Debt-to-Equity Ratio		-
		Debt-to-Capital Ratio		-
9	ROA	Operating Income Ratio	Profitability Theory	+
10	ROE	Operating Income Ratio		+

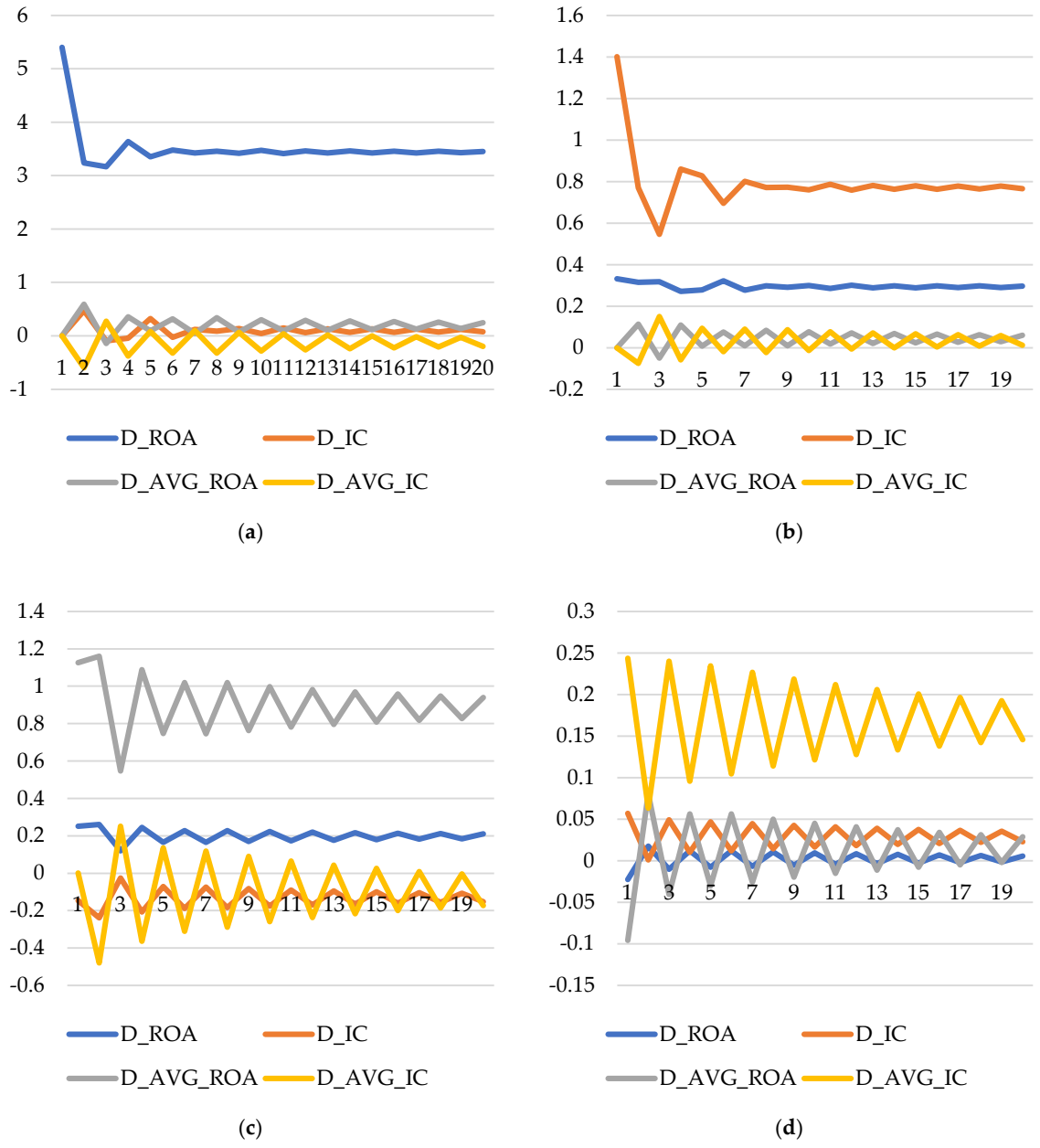


Figure A1. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROA (Agency Theory). (a) Accumulated Response of D_ROA to Innovations; (b) Accumulated Response of D_IC to Innovations; (c) Accumulated Response of D_AVG_ROA to Innovations; (d) Accumulated Response of D_AVG_IC to Innovations.

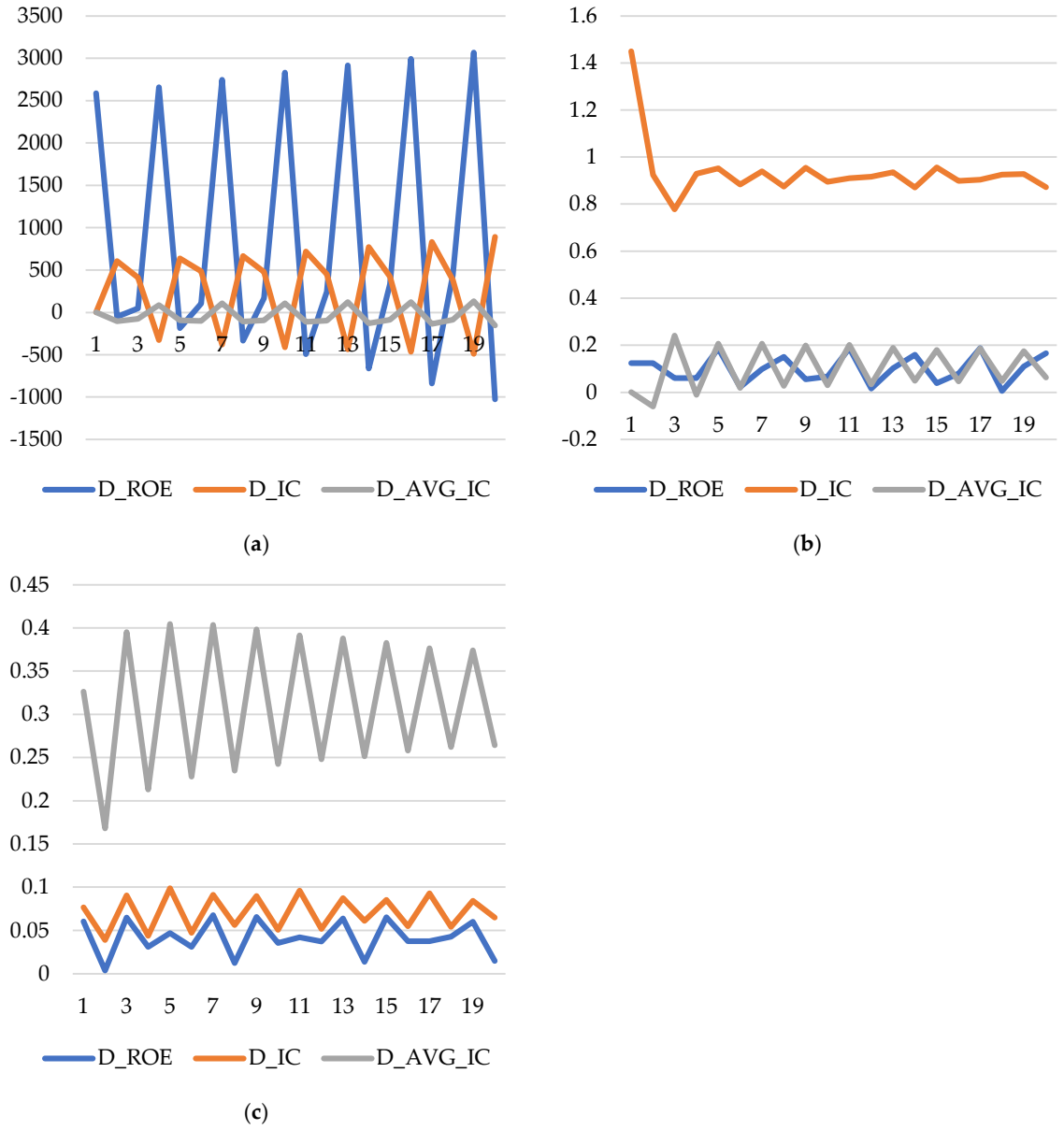
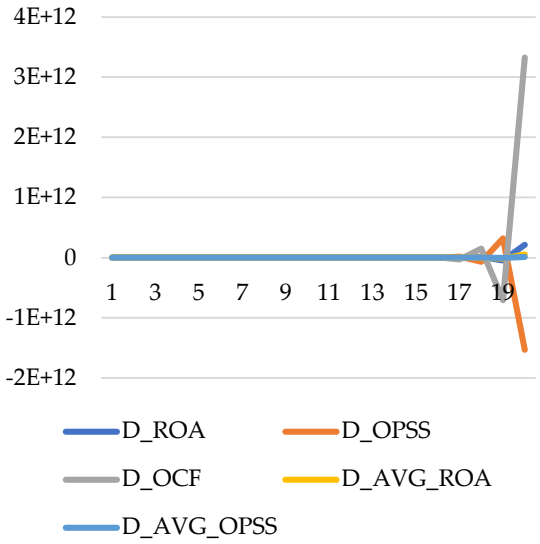
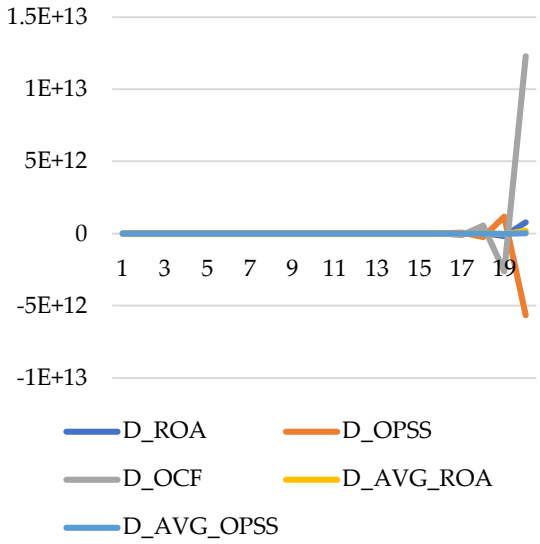


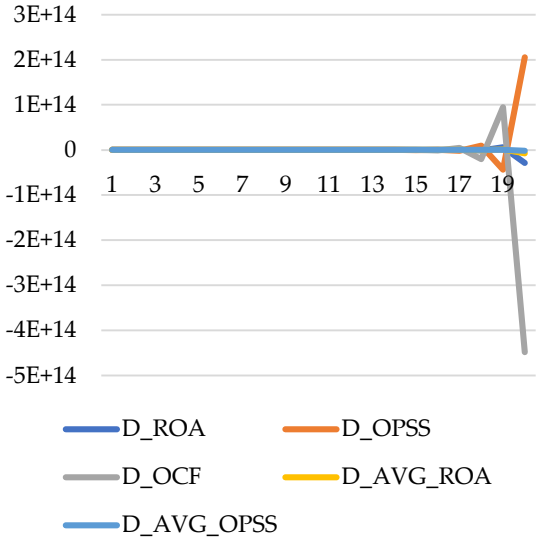
Figure A2. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROE (Agency Theory). (a) Accumulated Response of D_ROE to Innovations; (b) Accumulated Response of D_IC to Innovations; (c) Accumulated Response of D_AVG_IC to Innovations.


4E+12
3E+12
2E+12
1E+12
0
-1E+12
-2E+12
1 3 5 7 9 11 13 15 17 19
D_ROA
D_OPSS
D_OCF
D_AVG_ROA
D_AVG_OPSS

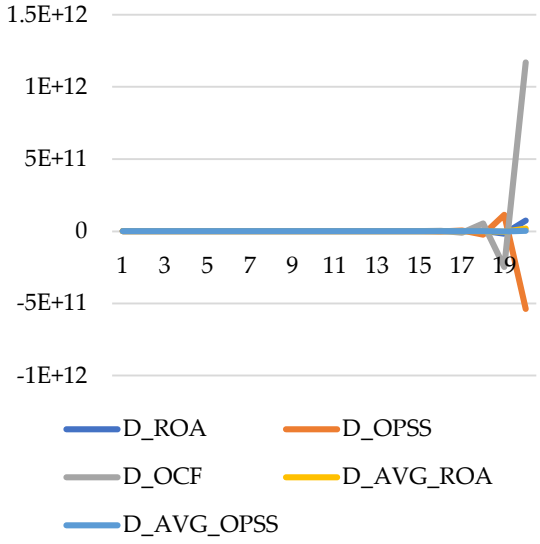
(**a**)


1.5E+13
1E+13
5E+12
0
-5E+12
-1E+13
1 3 5 7 9 11 13 15 17 19
D_ROA
D_OPSS
D_OCF
D_AVG_ROA
D_AVG_OPSS

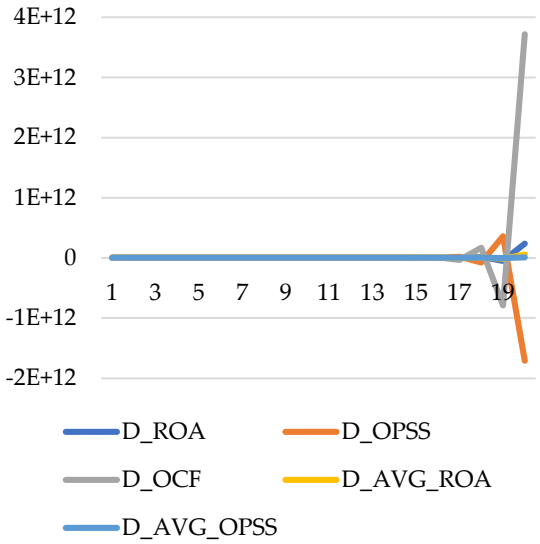
(**b**)


3E+14
2E+14
1E+14
0
-1E+14
-2E+14
-3E+14
-4E+14
-5E+14
1 3 5 7 9 11 13 15 17 19
D_ROA
D_OPSS
D_OCF
D_AVG_ROA
D_AVG_OPSS

(**c**)


1.5E+12
1E+12
5E+11
0
-5E+11
-1E+12
1 3 5 7 9 11 13 15 17 19
D_ROA
D_OPSS
D_OCF
D_AVG_ROA
D_AVG_OPSS

(**d**)


4E+12
3E+12
2E+12
1E+12
0
-1E+12
-2E+12
1 3 5 7 9 11 13 15 17 19
D_ROA
D_OPSS
D_OCF
D_AVG_ROA
D_AVG_OPSS

(**e**)

Figure A3. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROA (Free Cash Flow Hypothesis). (a) Accumulated Response of D_ROA to Innovations; (b) Accumulated Response of D_OPSS to Innovations; (c) Accumulated Response of D_OCF to Innovations; (d) Accumulated Response of D_AVG_ROA to Innovations; (e) Accumulated Response of D_AVG_OPSS to Innovations.

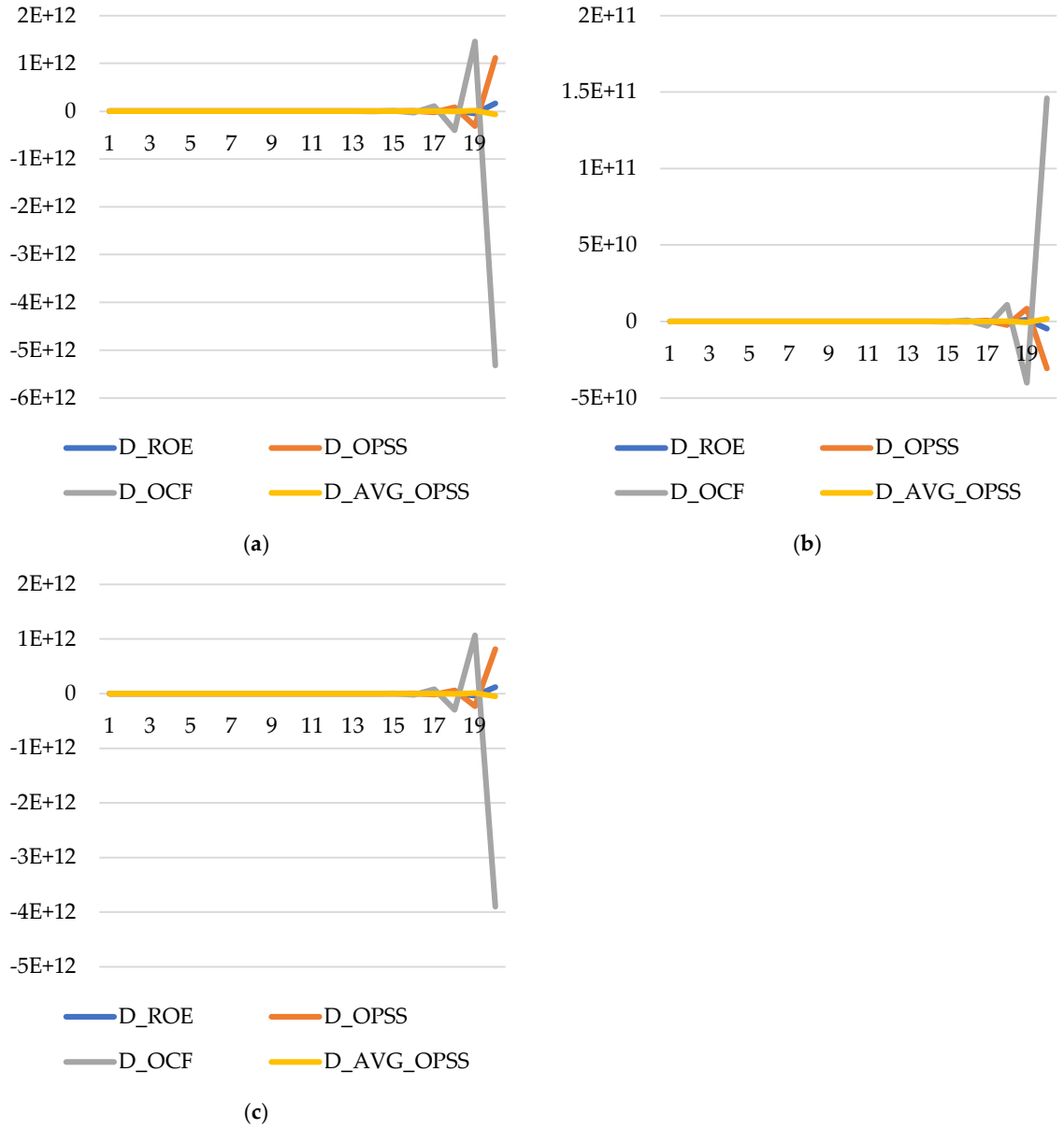


Figure A4. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROE (Free Cash Flow Hypothesis). (a) Accumulated Response of D_ROE to Innovations; (b) Accumulated Response of D_OPSS to Innovations; (c) Accumulated Response of D_OCF to Innovations.

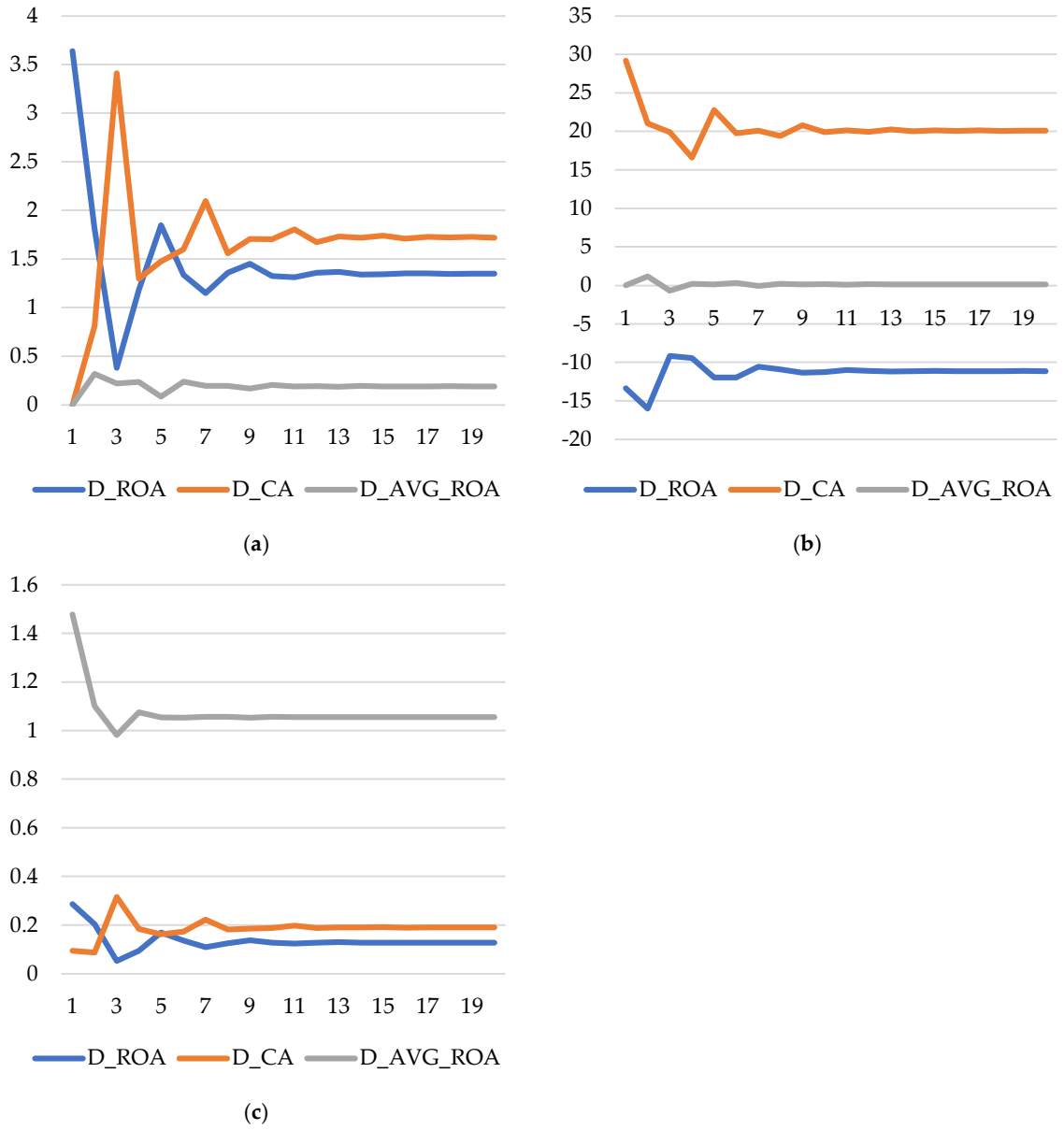


Figure A5. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROA (Investment Theory). (a) Accumulated Response of D_ROA to Innovations; (b) Accumulated Response of D_CA to Innovations; (c) Accumulated Response of D_AVG_ROA to Innovations.

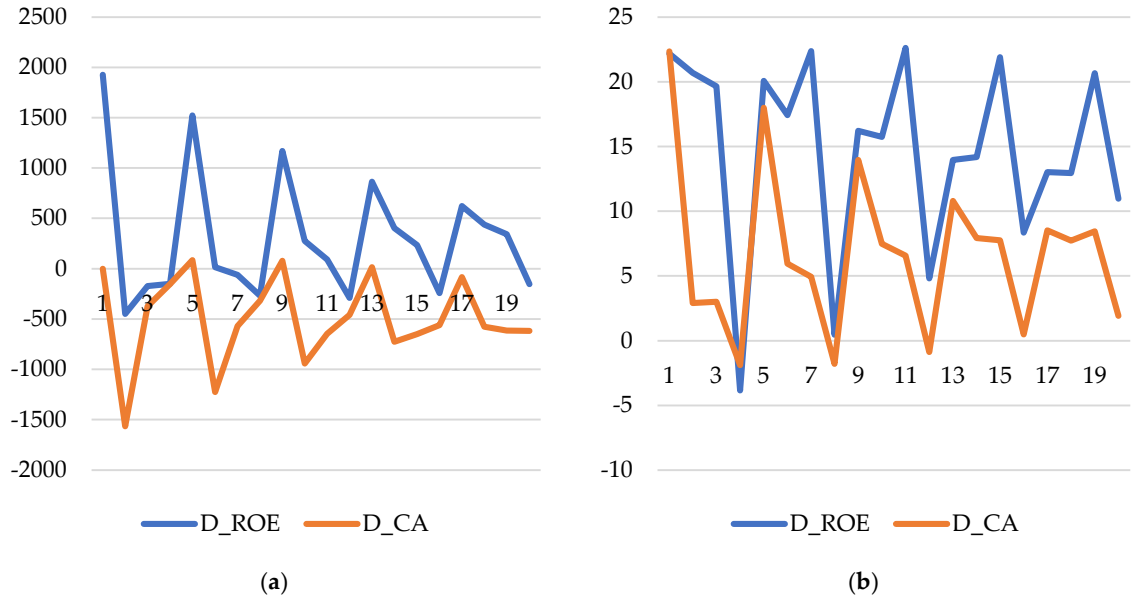
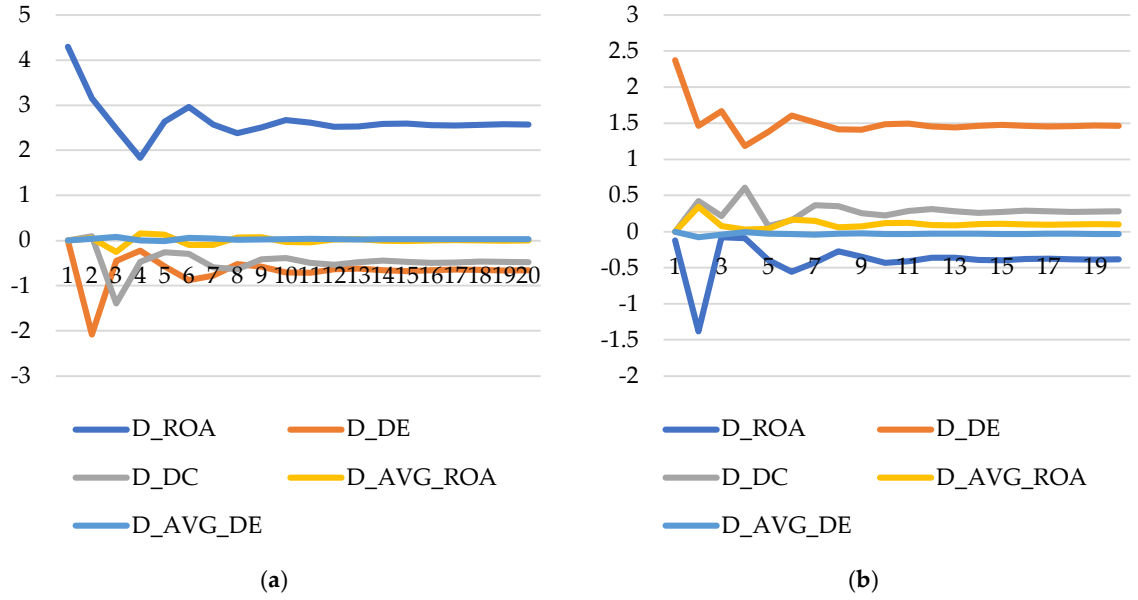


Figure A6. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROE (Investment Theory). (a) Accumulated Response of D_ROE to Innovations; (b) Accumulated Response of D_CA to Innovations.



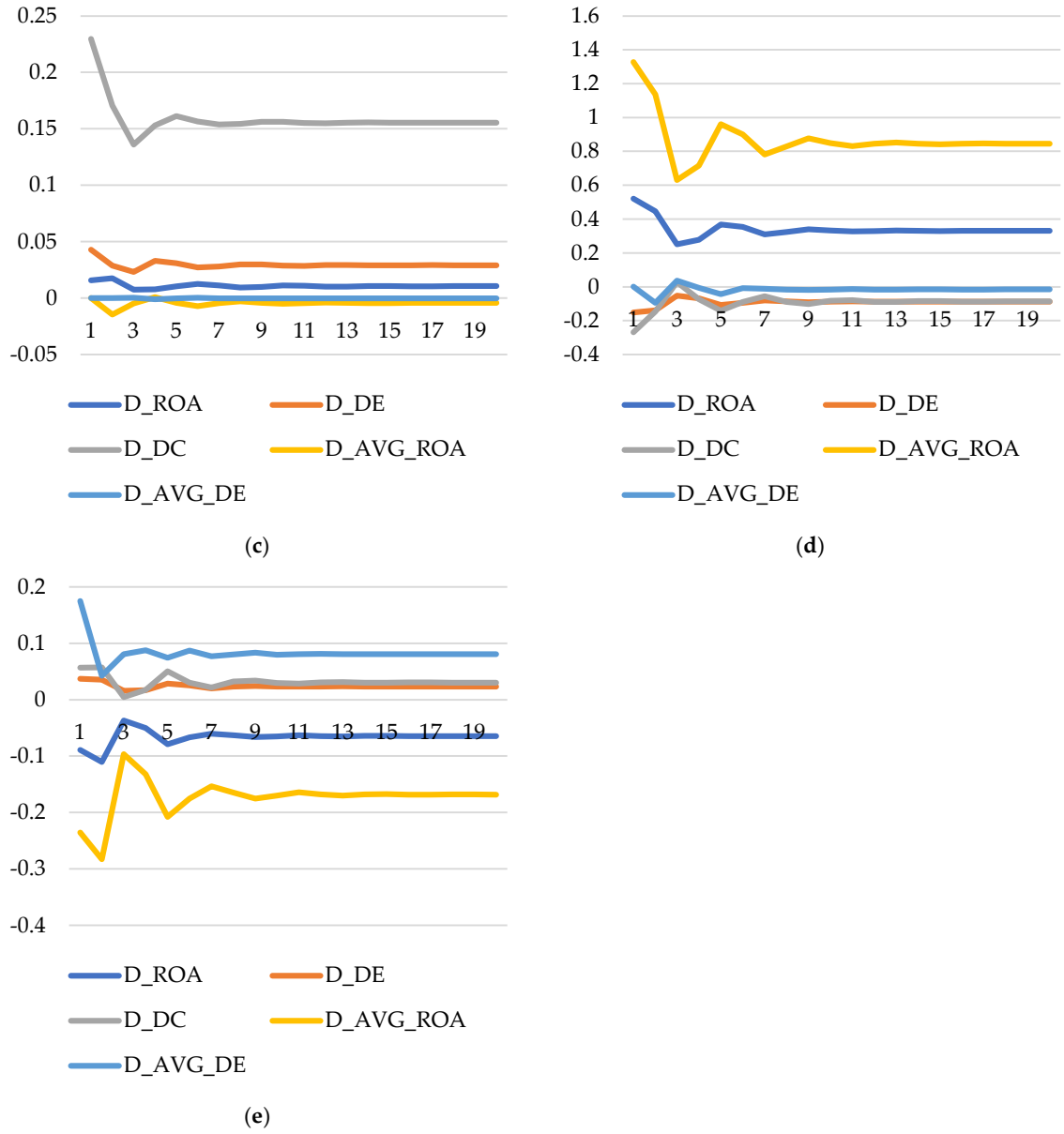


Figure A7. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROA (Pecking Order Theory). (a) Accumulated Response of D_ROA to Innovations; (b) Accumulated Response of D_DE to Innovations; (c) Accumulated Response of D_DC to Innovations; (d) Accumulated Response of D_AVG_ROA to Innovations; (e) Accumulated Response of D_AVG_DE to Innovations.

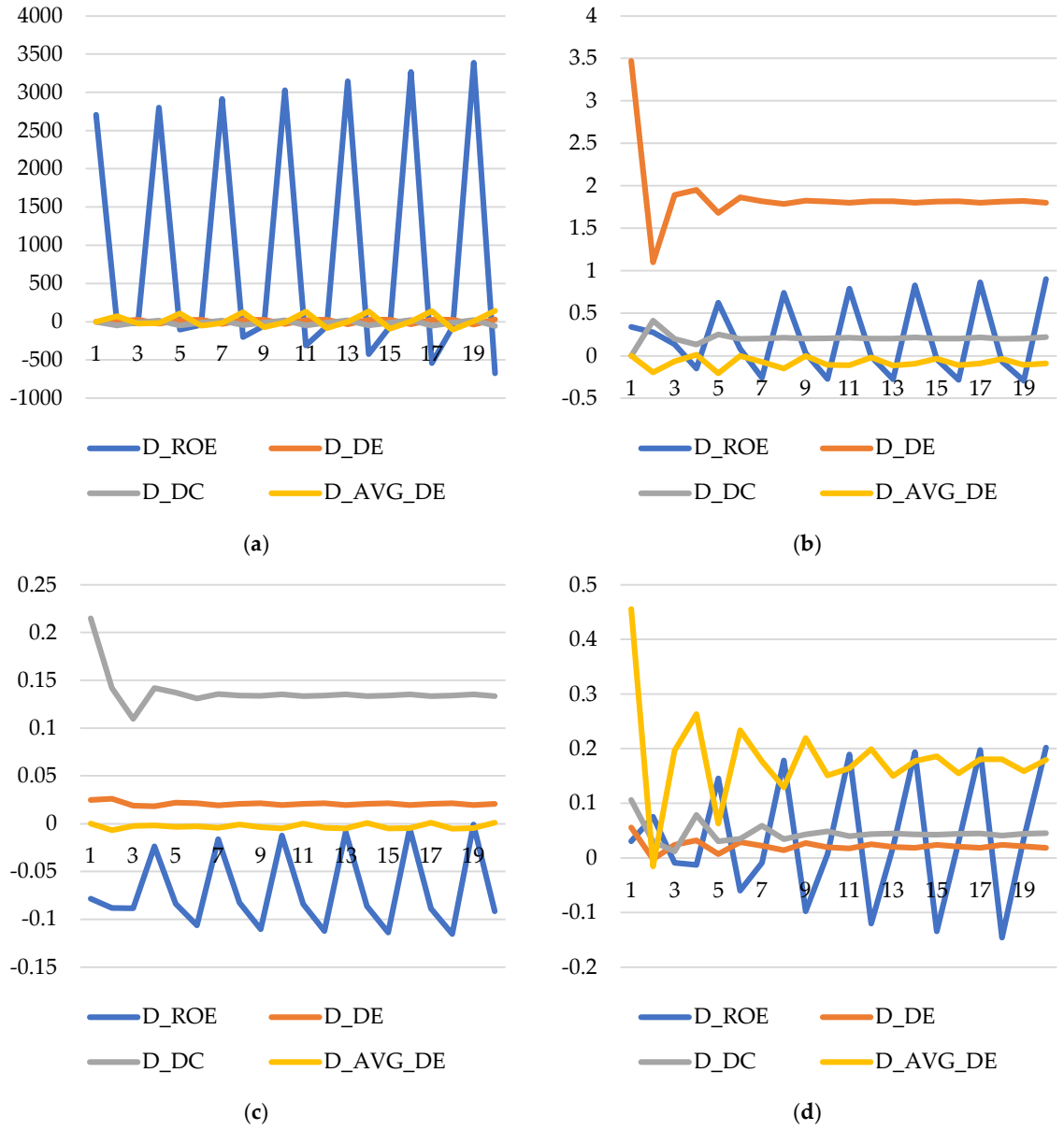


Figure A8. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROE (Pecking order Theory). (a) Accumulated Response of D_ROE to innovations; (b) Accumulated Response of D_DE to Innovations; (c) Accumulated Response of D_DC to Innovations; (d) Accumulated Response of D_AVG_DE to Innovations.

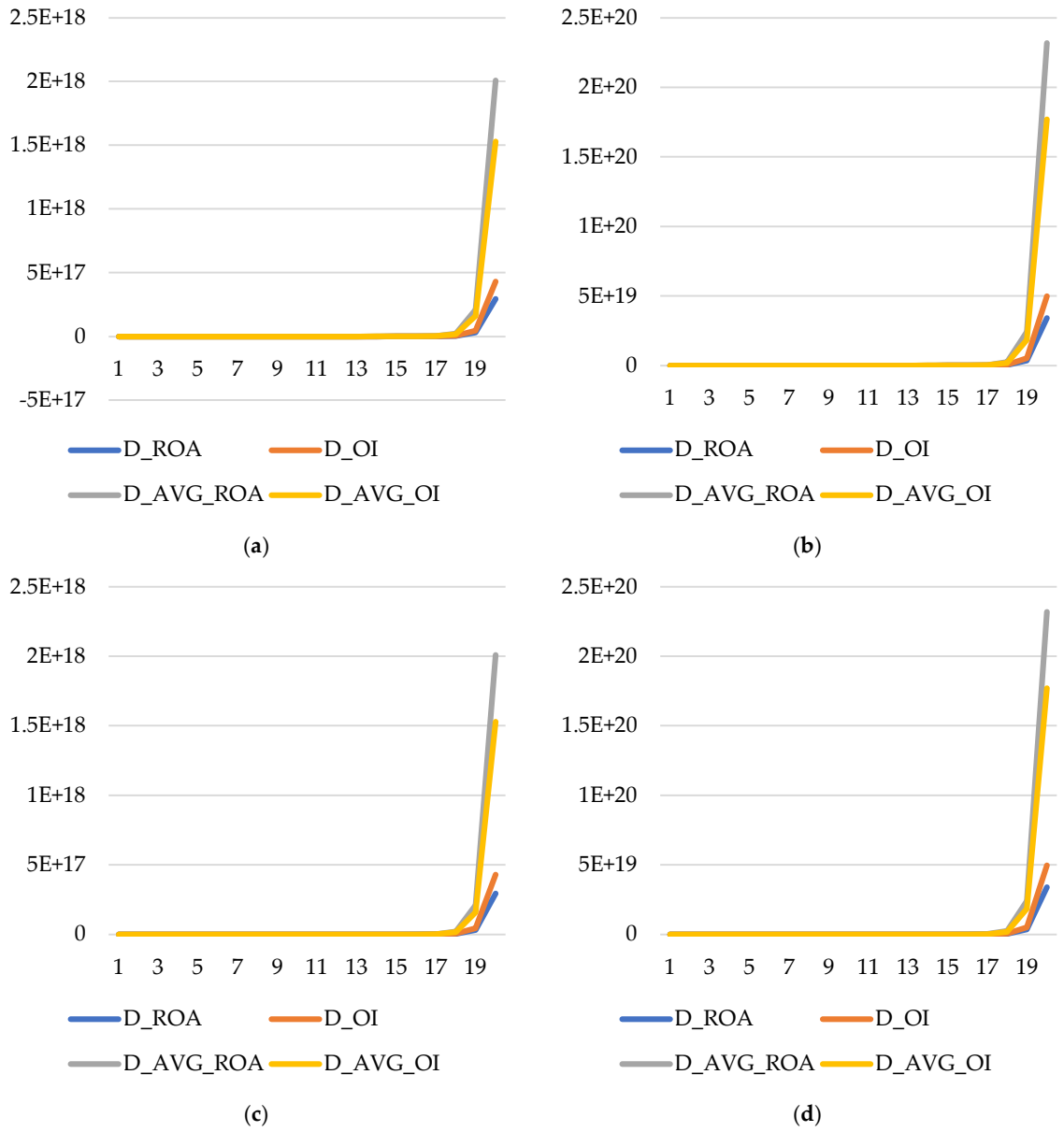


Figure A9. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROA (Profitability Theory). (a) Accumulated Response of D_ROA to Innovations; (b) Accumulated Response of D_OI to Innovations; (c) Accumulated Response of D_AVG_ROA to Innovations; (d) Accumulated Response of D_AVG_OI to Innovations.

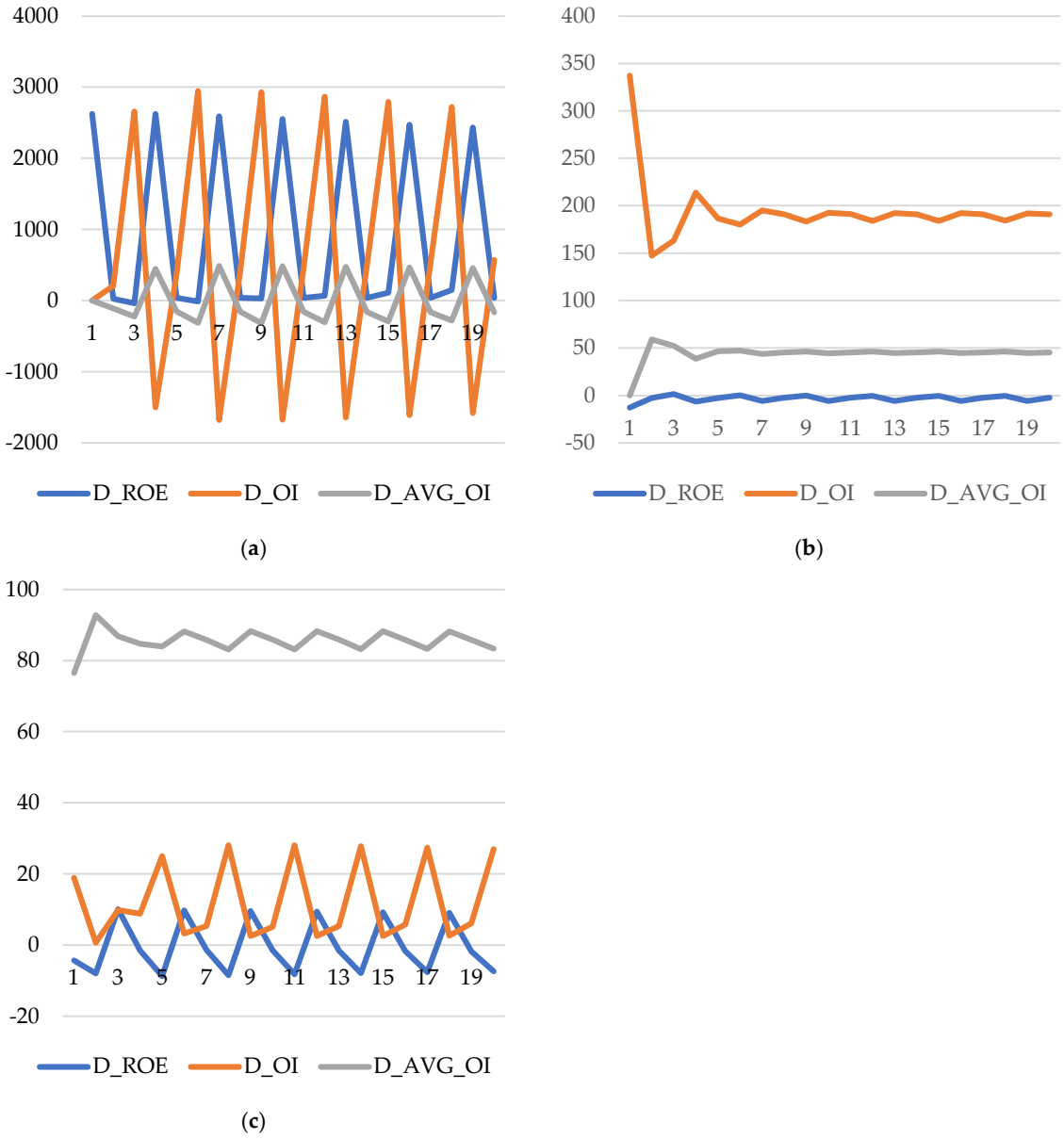


Figure A10. Accumulated responses to Cholesky One S.D. (d.f. adjusted innovations) for ΔROE (Profitability Theory). (a) Accumulated Response of D_ROE to Innovations; (b) Accumulated Response of D_OI to Innovations; (c) Accumulated Response of D_AVG_OI to Innovations.

References

[1] Olsen, W. K. (2008). Aspiration Paradox in Indian Micro-Finance: A Difficulty and an Opportunity for Debate. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1265628

[2] Priyadarshee, A., & Ghalib, A. K. (2011). The Andhra Pradesh Microfinance Crisis in India: Manifestation, Causal Analysis, and Regulatory Response. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1983206

[3] Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

[4] Jensen, M. C. (1996). Agency costs of free cash flow, corporate finance, and takeovers. In J. S. Bhandari & L. A. Weiss (Eds.), Corporate Bankruptcy (1st ed., pp. 11–16). Cambridge University Press. https://doi.org/10.1017/CBO9780511609435.005

[5] Rupa, P., & Manoharan, P. (2014). A Study on Financial Performance of MFIs in India. The International Journal of Business & Management, 2(10), 187–193.

[6] Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. The American Economic Review, 48(3), 261–297.

[7] Myers, S. C. (1984). The Capital Structure Puzzle. The Journal of Finance, 39(3), 574–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

[8] Pedroni, P. (2013). Structural Panel VARs. Econometrics, 1(2), 180–206. https://doi.org/10.3390/econometrics1020180

[9] Kaur, P., & Dey, S. (2013). Andhra Pradesh Microfinance Crisis and its Repercussions on Microfinancing Activities in India. Global Journal of Management and Business Studies, 3(7), 695–702.

[10] Bogan, V. L. (2008). Microfinance Institutions: Does Capital Structure Matter? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1144762

[11] Gill, A., Biger, N., & Mathur, N. (2011). The Effect of Capital Structure on Profitability: Evidence from the United States. International Journal of Management, 8(4), 3–15.

[12] Addae, A. A., Nyarko-Baasi, M., & Hughes, D. (2013). The Effects of Capital Structure on Profitability of Listed Firms in Ghana. European Journal of Business and Management, 5(31), 215-229.

[13] Abeywardhana, D. K. Y. (2015). Capital Structure and Profitability: An Empirical Analysis of SMEs in the UK. Journal of Emerging Issues in Economics, Finance and Banking, 4(2), 1-14.

[14] Chandra, T., Junaedi, A. T., Wijaya, E., Suharti, S., Mimelientesa, I., & Ng, M. (2019). The effect of capital structure on profitability and stock returns: Empirical analysis of firms listed in Kompas 100. Journal of Chinese Economic and Foreign Trade Studies, 12(2), 74–89. https://doi.org/10.1108/JCEFTS-11-2018-0042

[15] Adesina, J. B., Nwidobie, B. M., & Adesina, O. O. (2015). Capital Structure and Financial Performance in Nigeria. International Journal of Business and Social Research, 5(2), 21-31.

[16] Singh, N. P., & Bagga, M. (2019). The Effect of Capital Structure on Profitability: An Empirical Panel Data Study. Jindal Journal of Business Research, 8(1), 65–77. https://doi.org/10.1177/2278682118823312

[17] Rupa, P. (2015). Financial performance of MFIs in India – a multiple regression analysis. International Journal of Management and Social Science Research Review, 1(13), 148–159.

[18] Sultaniya, S., Shaikh, M., & Hj, R. (2019). Comparative Study of Microfinance Institutions in India. International Journal of Business and Management Invention, 8(1), 55-61.

[19] Dhanrajani, A. (2019). Financial Performance Analysis of Selected Microfinance Institutions in Delhi. Journal of Xi'an University of Architecture & Technology, 11(12), 184-193.

[20] Parvin, S. S., Hossain, B., Mohiuddin, M., & Cao, Q. (2020). Capital Structure, Financial Performance, and Sustainability of Micro-Finance Institutions (MFIs) in Bangladesh. Sustainability, 12(15), 6222. https://doi.org/10.3390/su12156222

[21] Amanu, A. D., Rajendran, M. M. A., & Nedelea, A.-M. (2021). Analyzing Determinants of Financial Performance of Micro Finance Companies in Ethiopia from 2010-2018. Empirical Evidence from Ethiopian Micro Finance Companies. Ecoforum, 10(1(24)), 1-7.

[22] World Bank Group. (2024). MIX Market [Dataset]. World Bank Database.

[23] Pesaran, M. H. (2006). Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure. Econometrica, 74(4), 967–1012. https://doi.org/10.1111/j.1468-0262.2006.00692.x

[24] Pesaran, M. H. (2021). General diagnostic tests for cross-sectional dependence in panels. Empirical Economics, 60(1), 13–50. https://doi.org/10.1007/s00181-020-01875-7

[25] Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. The Review of Economic Studies, 47(1), 239. https://doi.org/10.2307/2297111

[26] De Hoyos, R. E., & Sarafidis, V. (2006). Testing for Cross-Sectional Dependence in Panel-Data Models. The Stata Journal: Promoting Communications on Statistics and Stata, 6(4), 482–496. https://doi.org/10.1177/1536867X0600600403

[27] Omay, T., Akdi, Y., Emirmahmutoglu, F., & Eryılmaz, M. (2024). The Refinement of a Common Correlated Effect Estimator in Panel Unit Root Testing: An Extensive Simulation Study. Mathematics, 12(22), 3458. https://doi.org/10.3390/math12223458

[28] Li, B., & Haneklaus, N. (2022). Reducing CO2 emissions in G7 countries: The role of clean energy consumption, trade openness and urbanization. Energy Reports, 8, 704–713. https://doi.org/10.1016/j.egyr.2022.01.238

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