



FIRM CHARACTERISTICS AND ACCRUAL-BASED EARNINGS MANAGEMENT IN PAKISTAN: A DYNAMIC PANEL GMM ANALYSIS OF LISTED NON-FINANCIAL FIRMS

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KEYWORDS	ABSTRACT
Earnings management; discretionary accruals; Modified Jones Model; dynamic panel GMM; Arellano-Bond; Pakistan Stock Exchange; non-financial firms	This study examines the association between firm-level characteristics and accrual-based earnings management among non-financial firms listed on the Pakistan Stock Exchange (PSX) for the period covered 2019–2025. Discretionary accruals are estimated using the Modified Jones Model and analyzed in both signed (DA) and absolute (DA) form to distinguish the direction from the magnitude of discretionary accrual activity. The final analytical sample comprises 150 continuously listed non-financial firms observed annually from 2019 to 2025, yielding 1,050 firm-year observations. The primary empirical analysis employs a two-step system-GMM specification with Windmeijer-corrected standard errors and collapsed instruments. For signed DA, profitability (ROA) is positive and statistically significant ($\beta = 0.422, p = 0.007$), while firm size, leverage and sales growth are not statistically significant; the lagged dependent variable is negative and marginally significant ($\rho = -0.100, p = 0.067$). For absolute DA, sales growth is positive and statistically significant ($\beta = 0.004, p = 0.039$), while firm size is negative and marginally significant ($\beta = -0.007, p = 0.065$); leverage, profitability and the lagged dependent variable are not statistically significant. Neither model rejects the absence of second-order serial correlation at the 5% level (AR (2) $p = 0.090$ and 0.935 , respectively). The Hansen test does not reject the instrument-validity null for signed DA ($p = 0.055$), whereas the baseline DA specification is marginally below the 5% threshold ($p = 0.049$), indicating specification sensitivity. Sensitivity analyses using alternative instrument windows provide partial reassurance but also reveal changes in coefficient significance. Overall, profitability shows a consistent positive association with the direction of discretionary accruals, while sales growth shows a positive association with their magnitude. Firm size provides weaker, specification-sensitive evidence for magnitude, whereas leverage is not statistically significant. The study contributes to the Pakistani earnings-management literature by distinguishing directional and magnitude-based discretionary accrual measures and by providing dynamic-panel estimates together with key specification diagnostics and robustness checks.
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Introduction

Financial reporting quality is a persistent concern in emerging capital markets, where investors typically face substantial information asymmetry, concentrated ownership, uneven external monitoring, and considerable variation in firms' reporting incentives. One example of this is earnings management, which occurs when managers manage the timing and/or the presentation of the reported performance within the accounting framework allowed for under financial reporting standards. An accrual-based approach is thus used to determine if the reported earnings include a discretionary element, which is not consistent with normal operating conditions (Jones, 1991; Dechow, Sloan and Sweeney, 1995).

The Pakistan Stock Exchange (PSX) can offer a suitable platform for this question. The market is rich in non-financial listed companies in diverse industries and the extent and the sources of financing, as well as profitability differ among companies, which generates materially different reporting incentives. Recent Pakistani evidence indicates that earnings management is not a single, uniform behavior: Shah et al. (2024) report that governance and ownership characteristics are related to whether earnings management is opportunistic or efficiency-driven, while, Khan and Arif (2026) document systematic differences in the level and determinants of earnings management between Sharia-compliant and non-Sharia-compliant PSX firms. These findings imply that current evidence needs to distinguish the direction and the magnitude of discretionary accruals rather than collapsing them into a single indicator.

The analysis focuses on firm size, leverage, profitability and sales growth as explanatory variables, estimated using both static two-way fixed-effects and a dynamic panel system-GMM specification. The dynamic specification is motivated by the possibility that discretionary accrual behavior is persistent (or reverses) over time and that time-invariant unobserved firm heterogeneity may be correlated with the explanatory variables. Because a dynamic specification with a lagged dependent variable requires internally consistent instruments and a battery of specification tests, this study reports the principal diagnostic set instrument count, number of groups, the Arellano–Bond AR(1)/AR(2) tests, and the Hansen test of overidentifying restrictions for both the signed-DA and absolute-DA models, together with the estimation specification in an appendix to support replication and reviewer assessment.

Although prior studies have examined earnings management among firms listed on the Pakistan Stock Exchange, several gaps remain. First, existing Pakistani evidence reports mixed findings regarding the roles of firm size, leverage, profitability and sales growth, while limited attention has been given to distinguishing signed discretionary accruals (DA), which capture the direction of accrual adjustments, from absolute discretionary accruals ($|DA|$), which capture their magnitude. Second, there is comparatively limited evidence on the dynamic behaviour of discretionary accruals and the role of lagged earnings-management behaviour in Pakistani non-financial firms. Third, updated evidence covering the 2019–2025 period using a common set of firm-level characteristics and consistent measures of discretionary accruals remains limited. The present study addresses these gaps by examining 150 continuously listed non-financial PSX firms over 2019–2025, yielding 1,050 firm-year observations, and by combining two-way fixed-effects estimates

with a dynamic two-step system-GMM model. The study further strengthens the analysis through Arellano-Bond serial-correlation tests, Hansen overidentification tests and alternative instrument-window specifications.

The study pursues four specific objectives:

- To examine the association between firm size and accrual-based earnings management among listed non-financial firms in Pakistan.
- To assess the association between leverage and accrual-based earnings management among listed non-financial firms in Pakistan.
- To evaluate the association between profitability and accrual-based earnings management among listed non-financial firms in Pakistan.
- To determine the association between sales growth and accrual-based earnings management among listed non-financial firms in Pakistan.

The study provides four contributions to the earnings-management literature that have emerged from Pakistan. Firstly, it offers a new 7-year empirical panel up to FY 2025. Second, it requires transparency in the Modified Jones construction and treats sign of the signed DA as a proxy for the absolute DA throughout the study, instead of treating the sign of the residual DA as a proxy for the magnitude of the earnings management. Third, it fits a system-GMM model with a dynamic specification, and presents the key specification diagnostics for the model, making the maintained exogeneity assumptions transparent. Fourth, it validates the dynamic results using two-way fixed-effects estimates and alternative windows for instruments; it also ensures that the sample for the first-stage accrual-estimation step matches the smaller fully-balanced panel that is needed to construct instruments in the dynamic GMM framework.

Literature Review and Hypotheses Formulation

Earnings management has been the main topic of financial reporting research because of the fact that the numbers reported in accounting statements can be an outcome of both economic performance and managerial decisions regarding accounting recognition, measurement and timing. Healy (1985) defined earnings management as managerial discretion over accounting accruals, especially when managers have incentives to manipulate reported earnings based on contractual and/or performance-related factors. Dechow and Skinner (2000) later emphasized that the nature of the accounting choice and the divergence between the underlying economic performance of the firm and the interpretation of earnings management are important. This distinction is very relevant in the empirical study in that earnings management is not directly observable. Because of this, researchers use indirect measures that attempt to eliminate abnormal or discretionary elements from reported earnings.

Accrual-based earnings management is one of the most commonly studied methods of earnings management. The principle is that accounting earnings include accruals, which spread out

economic transactions over periods, and provide opportunities for managerial judgment that may not be associated with the changes in cash flows for the period. The accrual model, developed by Jones (1991), has proven to be influential in this area because the total accruals are tied to changes in revenue and changes in property, plant, and equipment to estimate the accruals that are expected, or the non-discretionary part of the accruals. Dechow et al. (1995) made modifications to the Jones specification to account for changes in receivables. The Modified Jones Model has since been among the most frequently used methods for the estimation of discretionary accruals in earnings-management studies. It is further supported by its capacity to systematically capture the abnormal accruals component even though the residual represents a proxy for managerial discretion, and not a direct observation of managerial intent.

The general earnings quality literature also warns about the use of discretionary accruals as an ideal proxy for opportunistic behavior. Dechow et al. (2010) provide evidence that earnings quality measures such as accrual-based measures are affected by the reporting firm's basic characteristics as well as the economic environment in which the reporting occurs. Furthermore, when managers are not actively trying to manipulate earnings the estimation of abnormal accruals can be influenced by operating performance. Kothari et al. (2005) therefore propose performance-matched discretionary-accrual measures and show that matching on return on assets can improve the reliability of inferences when performance itself is not the primary variable of interest. This issue is directly relevant to the present study because profitability is included as an explanatory variable while discretionary accruals are estimated from accounting performance. The study consequently treats DA as an empirical proxy for discretionary accrual behavior rather than as direct evidence of managerial opportunism.

An additional consideration is that earnings management can occur through both accrual choices and real operating decisions. Roychowdhury (2006), for example, documents real activities manipulation involving temporary sales incentives, overproduction and reductions in discretionary expenditures. This distinction is relevant because evidence obtained from accrual-based measures does not capture the full range of managerial actions that may affect reported earnings. The present study is a study of accrual-based earnings management and does not aim at measuring real earnings management. This is a more focused approach that allows the analysis to be consistent to the Modified Jones approach and also offers time-series analysis of the relationship between firm characteristics and discretionary accruals.

One methodological difference between the present study and many others is that both signed discretionary accruals (DA) and absolute discretionary accruals ($|DA|$) were used. The sign of DA reflects the direction of discretionary accrual activity (i.e., income-increasing or income-decreasing), while the absolute value of DA reflects the size of the discretionary accrual activity, irrespective of direction. This distinction is important because having a positive coefficient on signed DA does not necessarily imply that the firm is practicing more aggressive earnings management overall, it may instead imply that the firm is more likely to practice income increasing accrual adjustments. In contrast, absolute discretionary accruals do not account for direction and thus serve as a proxy for the amount or magnitude of discretionary accrual activity. This distinction

is important if explanatory variables can affect direction and magnitude of reporting discretion in different ways. The present study consequently treats the two outcomes as complementary rather than interchangeable.

The Pakistani context provides a particularly relevant setting for examining these relationships because previous research documents substantial variation in earnings-management behavior across firms and corporate characteristics. Kamran and Shah (2014), for example, investigate listed Pakistani firms using several established discretionary-accrual models and find that profitability, growth and leverage are associated with earnings-management behaviour, while institutional investors appear to constrain discretionary accruals. Asim and Ismail (2019), using 159 non-financial Pakistani firms and the Modified Jones Model, report a positive and significant relationship between leverage and earnings management and also identify significant effects for other firm characteristics, while growth is not significant in their model.

Bashir et al. (2024), using 111 PSX-listed non-financial firms over 2016–2021, likewise report relationships between firm characteristics and earnings management and identify profitability, growth and leverage as relevant control variables. Recent evidence by Shah et al. (2024) further suggests that earnings management among Pakistani listed firms has an opportunistic dimension and that firm-level conditions influence the extent and form of earnings-management behavior.

The existing Pakistani evidence, however, does not establish a single consistent relationship between firm characteristics and discretionary accruals. Differences in sample composition, time periods, industries, estimation models, governance environments and definitions of earnings management can generate different empirical results. More recent PSX evidence by Khan and Arif (2026), for example, examines a considerably larger balanced panel of 2,900 firm-year observations from 2016–2025 and reports that governance quality and financial distress are significant determinants of earnings management among non-Sharia-compliant firms, while different characteristics are relevant for Sharia-compliant firms. These findings reinforce the argument that earnings management in Pakistan is heterogeneous and that firm-level characteristics should be investigated within a clearly defined institutional and econometric framework.

Firm size is one of the most established firm-level characteristics considered in the earnings-management literature. The relationship can be explained through competing monitoring and incentive mechanisms. From a political-cost perspective, larger firms are more visible to regulators, investors, analysts, auditors and the wider public and may therefore face greater costs from aggressive financial reporting. Increased visibility can improve monitoring and deter the decision of discretionary reporting options. Meanwhile, large companies tend to have more diverse activities, more complicated transactions and more resources to allocate internally to managers, all of which may give managers more flexibility in deciding how to account for the transactions. There is therefore, *a priori*, some ambiguity in the relationship that is expected, although the monitoring and political-cost arguments can be used to predict a negative relationship.

This ambiguity is reflected in the empirical evidence in Pakistan. So far, the Pakistani textile sector showed that organizational size was positively related to earnings management, suggesting that the larger the organization the more possible it is to engage in discretionary reporting. Conversely, evidence concerning governance and sustainability suggests that larger Pakistani firms may face stronger mechanisms that constrain earnings-management behavior. Recent evidence from Indonesian industrial firms also reports a negative and marginal relationship between firm size and the magnitude of discretionary accruals, which is consistent with stronger monitoring or political-cost pressures among larger firms. The mixed evidence indicates that size should not be assumed to have a uniform effect across institutional settings and measures of earnings management. For the present study, the political-cost and monitoring arguments provide the directional basis for expecting larger firms to exhibit lower discretionary-accrual activity. Therefore:

H1a: Firm size is negatively associated with signed discretionary accruals, consistent with stronger scrutiny and political-cost pressures in larger firms.

H1b: Firm size is negatively associated with absolute discretionary accruals, consistent with stronger scrutiny and political-cost pressures in larger firms.

Leverage provides another important theoretical explanation for managerial reporting discretion. Highly leveraged firms may experience pressure from creditors, lenders and debt markets and may be subject to accounting-based debt covenants. Positive accounting theory predicts that managers facing potential covenant constraints may have incentives to select reporting choices that increase current-period earnings or assets, thereby improving reported financial condition and reducing the likelihood of covenant violations (Watts and Zimmerman, 1986). The debt-covenant hypothesis therefore provides a direct theoretical rationale for a positive relationship between leverage and income-increasing discretionary accruals. In a magnitude framework, high leverage may also increase the overall extent of discretionary reporting adjustments if managers face stronger pressure to influence reported performance.

Nevertheless, leverage may also have a constraining effect. Creditors and lenders have direct incentives to monitor highly indebted firms, and tighter contractual restrictions may reduce managerial discretion rather than increase it. Accordingly, the net empirical association depends on the relative strength of reporting incentives and creditor monitoring.

Evidence from Pakistan provides support for the incentive-based argument. Asim and Ismail (2019) report a positive and significant relationship between leverage and earnings management among 159 non-financial PSX firms using the Modified Jones Model. Kamran and Shah (2014) similarly report that Pakistani firms with higher leverage actively manage reported earnings. More recent emerging-market evidence remains less definitive, with some studies identifying positive but statistically weak leverage relationships. The existing evidence therefore provides sufficient theoretical and empirical justification for testing both the directional and magnitude dimensions of discretionary accruals. Therefore:

H2a: Leverage is positively associated with signed discretionary accruals, consistent with debt-covenant and financing incentives.

H2b: Leverage is positively associated with absolute discretionary accruals, consistent with debt-covenant and financing incentives.

Profitability introduces a more complex relationship because firm performance can simultaneously create reporting incentives and affect the measurement of discretionary accruals. Managers of profitable firms may have incentives to sustain favorable earnings trajectories, meet analyst or investor expectations, preserve managerial reputation or achieve accounting-based compensation targets. Under the bonus-plan perspective, managers whose compensation is linked to accounting performance may have incentives to influence reported income when performance affects remuneration (Watts & Zimmerman, 1986). Profitability may therefore be associated with income-increasing signed discretionary accruals.

However, profitability can also influence the absolute magnitude of discretionary accruals in an opposite direction. Firms with strong underlying performance may have less need to manipulate reported results because their fundamental performance already generates favorable earnings. Increased visibility can increase monitoring and deter discretionary reporting options. Concurrently, large firms tend to have more diverse operations, more complex transactions and have more organizational resources, which may provide opportunities for managers to have greater discretion in accounting. The relationship is therefore theoretically uncertain, but can be predicted to be negative based on monitoring and political-cost reasons.

This is seen in the empirical research carried out in Pakistan. Previous findings in the Pakistani textile industry revealed that higher organizational size is associated with higher earnings management, suggesting that larger organizations do not limit discretionary reporting. The signed-DA association between ROA and reporting direction is treated as an empirical finding rather than being used to test H3. Therefore:

H3: Profitability is negatively associated with absolute discretionary accruals because stronger underlying performance is expected to reduce the need for aggressive earnings adjustments.

Another possible source of earning-management incentives is sales growth. A small growing business can be subjected to increased demands for the heights of reported growth rates, market expectations, investor confidence that the business will continue to grow and for access to funding for their working needs. Increased growth may also lead to changes in accounts receivable, inventory, and discretionary changes to accruals in other operating activities, so distinguishing between the normal operating accruals and discretionary items becomes important. The result is that the magnitude of discretionary-accrual growth can be related to sales growth even if the sales growth is not consistently in the same direction as the residual accrual growth.

The empirical literature provides support for this expectation. Evidence from Pakistani firms indicates that growth is associated with earnings-management behavior in several samples, although the strength and statistical significance of the relationship vary by specification. Shah et al. (2024) similarly report greater earnings-management tendencies among faster-growing firms. More recent evidence from Indonesian industrial firms identifies sales growth as a particularly important positive correlate of discretionary-accrual magnitude. This is consistent with the

argument that rapid expansion increases both performance pressure and working-capital volatility. Therefore:

H4: Sales growth is positively associated with absolute discretionary accruals because rapidly growing firms may face stronger market and performance pressures and greater working-capital volatility.

The literature also suggests that the interpretation of accrual-based earnings management depends on the institutional environment and on the particular measure used. Dechow et al. (2010) emphasize that no single earnings-quality measure captures every dimension of reporting quality and that the relationship between accounting outcomes and underlying economic performance must be considered when interpreting accrual-based proxies. Similarly, the existence of alternative earnings-management strategies, including real activities manipulation, means that evidence based exclusively on discretionary accruals should not be interpreted as evidence that managers rely exclusively on accrual choices. The present study therefore deliberately limits its conclusions to accrual-based earnings management as proxied by Modified Jones discretionary accruals.

Overall, the literature provides theoretical reasons to expect firm size, leverage, profitability and sales growth to be associated with discretionary accrual behavior, but the empirical evidence remains mixed. Firm size may reduce discretionary activity through stronger monitoring and political costs, but organizational complexity may create countervailing opportunities.

Reporting incentives may be enhanced by debt-covenant pressures and managerial discretion may be limited by creditor monitoring. Profitability will create an incentive to maintain the level of reported performance and could lead to earnings adjustments decreasing if the underlying performance is positive. The size of discretionary accruals can increase as a result of the market pressure and working-capital volatility driven by sales growth. Increased magnitude of discretionary accruals can be caused by the market pressure and working-capital volatility induced by sales growth. This competitive effect is a reason why previous research does not yield uniform results on a cross-country and on a sample basis.

To fill the gap, this study used a common panel to analyze the four firm level characteristics of the non-financial firms listed on the Pakistan Stock Exchange from 2019 to 2025. More importantly, the study is able to distinguish between signed and absolute discretionary accruals, and it is able to distinguish whether firms exhibit relatively more income-increasing or income-decreasing accruals from whether their discretionary-accrual activity is large. A two-way fixed-effects specification is used as a static baseline for the empirical design, and a dynamic 2-step system-GMM specification is applied as the primary specification, acknowledging that discretionary-accrual behavior may be temporally dependent and that the dynamic panel estimation specification must be explicitly specified for instrument validity and serial correlation. The four hypotheses are then tested on the outcome that they conceptually predict: H1a and H2a are tested with signed DA; H1b, H2b, H3 and H4 with |DA|. This structure brings together the arguments in theory, previous evidence, and hypotheses, and subsequent empirical analysis.

Firm Characteristics and Accrual-Based Earnings Management

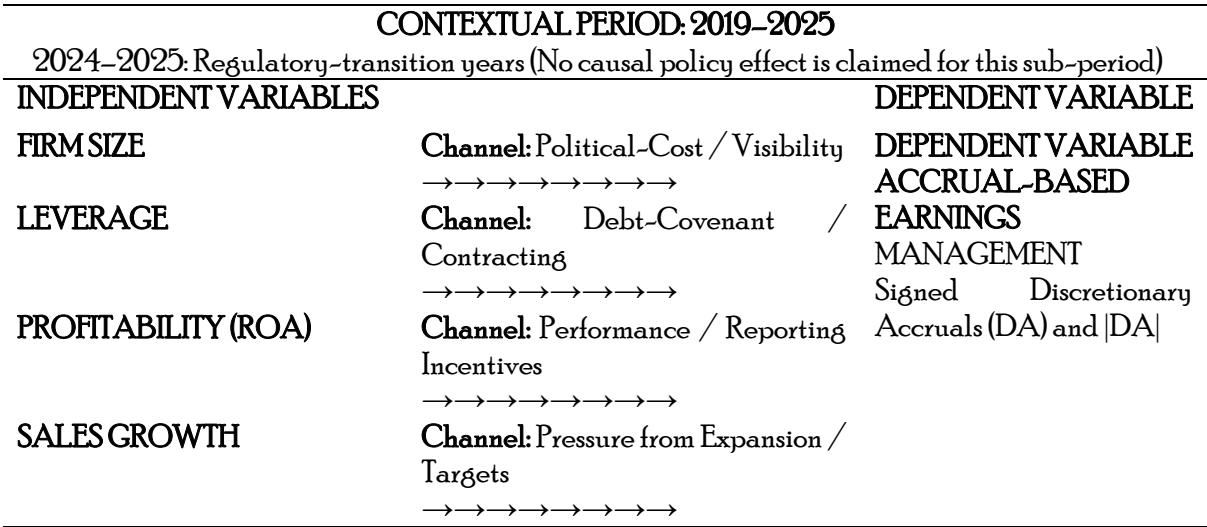


Figure 1. Conceptual Frame work,

Methodology

Research Approach and Design

This study, utilizes quantitative paradigm which applies statistical techniques to arrive at results and conclusions (Butt & Yazdani, 2023; Akhtar et al., 2024).Following quantitative research approach, uses longitudinal panel data design to explore the relationship between firm-specific characteristics and accrual-based earnings management of the listed non-financial firms in Pakistan. Only secondary data from financial statements, publicly released data, is used for the study. It is not experimental and it looks at statistical relationships, not treatment effects.

Population, Sample, and Reconciliation of Sample Sizes

The population is non-financial companies listed on the Pakistan Stock Exchange. Financial-sector firms are excluded, consistent with standard practice, because their accrual-generating process and regulatory capital requirements differ fundamentally from non-financial firms.

Two samples are used at two distinct stages of the analysis, and the relationship between them is stated explicitly here to avoid the ambiguity noted in an earlier draft of this manuscript. First-stage discretionary-accrual estimation (the Modified Jones residual underlying DA and |DA|) draws on a broader, unbalanced accounting panel of PSX non-financial firms covering 2018–2025, following the data-construction procedure summarized in Appendix C. Second-stage estimation — the static and dynamic panel models reported in Section 5 — requires several consecutive within-firm observations to construct valid lag-based instruments and to obtain well-behaved Arellano–Bond and Hansen diagnostics. The second-stage analysis is therefore restricted to the

subset of 150 non-financial firms with fully continuous, non-missing DA, |DA|, SIZE, LEV, ROA and GROWTH data in every year from 2019 to 2025, yielding a fully balanced panel of 1,050 firm-year observations. This is the analytical sample used throughout Section 5. The balanced-panel restriction is a deliberate sample-design choice intended to provide the same contiguous time structure and lag availability for all firms in the dynamic analysis. A balanced panel is not a general requirement for GMM, but using a common seven-year history simplifies instrument construction and makes the reported dynamic diagnostics directly comparable across firms; the trade-off is a smaller cross-section and potential survivorship bias.

Table 1: Sample Reconciliation

Stage	Description	Observations	Firms
First-stage accrual estimation	Modified Jones Model estimated on the broader unbalanced 2018–2025 PSX non-financial panel	Unbalanced panel (see Appendix C construction script)	PSX non-financial universe with usable accounting data
Second-stage analytical sample	Fully balanced panel, continuous 2019–2025 data on DA, DA , SIZE, LEV, ROA, GROWTH	1,050	150
Dynamic system-GMM estimation sample	Effective observations after first-differencing and constructing 2–4 period lag instruments (five usable periods per firm)	750	150

Note: the 750-observation dynamic-GMM estimation sample is not a further exclusion of firms; it reflects the periods lost to first-differencing and to the two-period minimum lag required before the GMM instrument set becomes available, applied uniformly across all 150 firms (five usable periods out of the seven-year window per firm).

Data Sources and Data Collection

The study uses secondary financial data obtained from published financial statements of non-financial companies listed on the PSX. Firm-year accounting information was compiled into an analytical panel ("EViews_Main_150") containing Company Name, Year, DA, |DA|, SIZE, LEV, ROA and GROWTH for the 150 firms retained for the second-stage analysis. The data were organized at the firm-year level to exploit both cross-sectional differences between firms and within-firm changes over time.

Variable Measurement

Table 2: Measurement of Variables

Variable	Type	Measurement
DA	Dependent	Signed residual from the Modified Jones Model

DA	Dependent	Absolute value of DA
SIZE	Independent	Natural logarithm of total assets
LEV	Independent	Total debt / total assets
ROA	Independent	Net income / total assets
GROWTH	Independent	$(Sales_t - Sales_{t-1}) / Sales_{t-1}$

Measurement of Accrual-Based Earnings Management

Accrual-based earnings management is estimated using the Modified Jones Model developed from Jones (1991) and modified by Dechow et al. (1995). Total accruals for firm in year t are computed as the difference between net income and operating cash flow, scaled by lagged total assets, and regressed on the inverse of lagged assets, the change in revenue net of the change in receivables, and gross property, plant and equipment, all scaled by lagged total assets, with sector and year effects included. The residual from this first-stage regression is signed discretionary accruals (DA); its absolute value is $|DA|$. This first-stage construction was performed upstream of the analytical file used in Section 5 (see Appendix C for the construction script), which supplies DA and $|DA|$ directly for the 150-firm balanced panel.

Econometric Model

Two complementary specifications are estimated for each dependent variable (DA and $|DA|$). The first is a static two-way fixed-effects model, used as a transparent baseline and cross-check:

$$DA_{it} \text{ (or } |DA|_{it}) = \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GROWTH_{it} + \text{FirmFE} + \text{YearFE} + \varepsilon_{it}$$

The second, and primary, specification is a dynamic panel model estimated by two-step system GMM (Arellano & Bond, 1991; Blundell & Bond, 1998), motivated by the possibility that discretionary-accrual behavior is persistent across years and that unobserved firm heterogeneity may be correlated with the regressors:

$$DA_{it} \text{ (or } |DA|_{it}) = \beta_0 + \rho DA_{i,t-1} \text{ (or } |DA|_{i,t-1}) + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 ROA_{it} + \beta_4 GROWTH_{it} + \eta_i + \lambda_t + \varepsilon_{it}$$

The lagged dependent variable is treated as endogenous and instrumented internally using its own lags 2 through 4, with the instrument set collapsed to limit instrument proliferation (Roodman, 2009); SIZE, LEV, ROA and GROWTH are treated as strictly exogenous instruments (equal to themselves), which is examined for sensitivity in Section 5.6. Standard errors use the Windmeijer (2005) finite-sample correction for the two-step estimator. The model is implemented in Python using the pydynpd package (Wu, Hua and Xu, 2023), which follows the same difference/system-GMM algorithm as Stata's xtabond2 (Roodman, 2009); the exact command specification for every model reported below is given in Appendix C so that the results can be independently replicated. Because ROA and sales growth can plausibly respond to contemporaneous firm performance and reporting choices, the strict-exogeneity treatment of the observed controls is a maintained identifying assumption rather than an established fact; this should be considered when interpreting the dynamic coefficients.

Diagnostic Tests

For the static models, multicollinearity is assessed with variance inflation factors and standard errors are clustered by firm. For the dynamic system-GMM models, the study reports the number of instruments, the number of groups, the Arellano-Bond test for first- and second-order serial correlation in the first-differenced residuals (AR(1) is expected to reject; AR(2) should not reject if the model is correctly specified), and the Hansen test of overidentifying restrictions (a non-rejection at conventional levels supports instrument validity, while an implausibly high p-value can itself indicate instrument weakness or proliferation). All four diagnostics are reported for both the DA and |DA| models in Section 5, together with a sensitivity check using an alternative instrument window.

Robustness Analysis

Robustness is assessed in three ways. First, the dynamic system-GMM results are compared against the static two-way fixed-effects estimates on the same 150-firm panel. Second, the baseline instrument window (lags 2–4) is compared against a narrower window (lags 2–3) and a wider window (lags 2–5), and against a difference-GMM specification without the level equation, to confirm that the substantive conclusions are not an artefact of a single instrument choice. Third, both the signed-DA and absolute-DA models are estimated under an identical specification (same instrument window, same estimator, same control set) so that any difference in results reflects the outcome variable rather than an inconsistent modelling choice across the two dependent variables.

Data Treatment

The first-stage Modified Jones regressors were winsorised at the 1st and 99th percentiles upstream of the analytical file used here (see Appendix C). No further trimming was applied to the 150-firm balanced panel used in Section 5; the panel contains no missing values on any of the six analysis variables.

Ethical Considerations and Data Integrity

The study uses secondary, publicly available financial information and does not involve human participants or personally identifiable information. The Modified Jones residual is treated as a proxy for discretionary accrual behaviour rather than a direct observation of managerial intent. The analysis therefore does not interpret the residual as definitive evidence of managerial opportunism.

Analysis and Results

Descriptive Statistics

Table 3 reports descriptive statistics for the 150-firm balanced panel (1,050 firm-year observations, 2019–2025).

Table 3: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Median	Max
DA	1,050	-0.002	0.134	-0.492	-0.003	0.768
DA	1,050	0.091	0.098	0.000	0.063	0.768
SIZE	1,050	15.904	1.941	7.441	16.021	21.227
LEV	1,050	0.577	0.564	0.010	0.518	8.457
ROA	1,050	0.033	0.158	-0.950	0.030	3.379
GROWTH	1,050	0.254	1.507	-1.000	0.121	29.770

Note: SIZE is measured in natural-log units; all other variables are ratios. The wide ranges for LEV, ROA and GROWTH reflect genuine cross-firm heterogeneity typical of a multi-sector PSX panel.

Correlation and Multicollinearity

Table 4 reports Pearson correlations. Signed DA is positively and strongly correlated with ROA ($r = 0.432, p < 0.001$) and negatively correlated with LEV ($r = -0.099, p = 0.001$); its correlations with SIZE and GROWTH are not statistically significant. Absolute DA is negatively correlated with SIZE ($r = -0.186, p < 0.001$) and positively correlated with LEV ($r = 0.138, p < 0.001$) and GROWTH ($r = 0.187, p < 0.001$). These are bivariate associations and are not interpreted as causal. Variance inflation factors (Table 5) are low across all four explanatory variables (mean VIF = 1.048, maximum = 1.085 for ROA), indicating that multicollinearity is not a material concern in either the static or the dynamic specification.

Table 4: Pearson Correlation Matrix

	DA	DA	SIZE	LEV	ROA	GROWTH
DA	1.000	0.093**	-0.019	-0.099**	0.432***	0.047
DA		1.000	-0.186***	0.138***	0.058*	0.187***
SIZE			1.000	-0.093**	0.164***	-0.047
LEV				1.000	-0.172***	-0.003
ROA					1.000	0.157***
GROWTH						1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ (two-tailed).

Table 5: Variance Inflation Factors

Variable	VIF
SIZE	1.038
LEV	1.035

ROA	1.085
GROWTH	1.032
Mean VIF	1.048

Static Two-Way Fixed-Effects Results

Table 6 reports the static baseline model with firm and year fixed effects and standard errors clustered at the firm level (150 firms, 1,050 observations).

Table 6: Static Two-Way Fixed-Effects Results (Firm-Clustered Standard Errors)

Variable	DA coef.	DA p-value	DA coef.	DA p-value
SIZE	0.0442	0.202	0.0049	0.707
LEV	0.0018	0.940	-0.0179	0.444
ROA	0.3739	0.008***	0.0607	0.456
GROWTH	-0.0048	0.554	0.0055	0.066*
Constant	-0.7178	0.196	0.0194	0.925
Within R ²	0.171		0.034	
F-statistic (robust)	6.91 (p<0.001)		6.50 (p<0.001)	

*** p<0.01, * p<0.10. Entity and time fixed effects included; F-test for poolability rejects pooled OLS in both models (p<0.001), supporting the fixed-effects specification.

Dynamic System-GMM Results — Signed DA

Table 7 reports the two-step system-GMM model for signed DA. The model uses a collapsed instrument set (lags 2–4 of DA), yielding 9 instruments for 150 groups — well below the number of groups, consistent with Roodman's (2009) guidance against instrument proliferation.

The AR(1) test rejects the null as expected ($z = -5.16$, $p < 0.001$), confirming the presence of first-order correlation mechanically induced by first-differencing, while the AR(2) test does not reject the null of no second-order serial correlation at the 5% level ($z = -1.70$, $p = 0.090$), and the Hansen test does not reject the joint validity of the instruments at the 5% level ($\chi^2(3) = 7.614$, $p = 0.055$).

Table 7. Dynamic Two-Step System-GMM Results — Dependent Variable: DA

Variable	Coefficient	Windmeijer SE	z	p-value
L1DA	-0.0997	0.0545	-1.83	0.067*
SIZE	-0.0057	0.0037	-1.55	0.121
LEV	-0.0059	0.0123	-0.48	0.634
ROA	0.4218	0.1571	2.68	0.007***
GROWTH	-0.0018	0.0056	-0.32	0.752
Constant	0.0750	0.0566	1.32	0.186

Number of observations = 750; number of groups = 150; number of instruments = 9.

Hansen test of overidentifying restrictions: $\chi^2(3) = 7.614$, $p = 0.055$.

Arellano–Bond AR(1): $z = -5.16$, $p < 0.001$. Arellano–Bond AR (2): $z = -1.70$, $p = 0.090$.

Dynamic System-GMM Results — Absolute DA

Table 8 reports the identically specified system-GMM model for $|DA|$. The AR(2) test does not reject the null of no second-order serial correlation ($z = 0.08$, $p = 0.935$). The Hansen test is marginally below the 5% threshold ($\chi^2(3) = 7.855$, $p = 0.049$), so the baseline $|DA|$ model should be interpreted cautiously.

Section 5.6 reports alternative instrument windows, including a lags 2–5 specification with a Hansen p -value of 0.095 and the same qualitative substantive pattern, providing useful but not definitive reassurance about instrument validity.

Table 8: Dynamic Two-Step System-GMM Results — Dependent Variable: $|DA|$

Variable	Coefficient	Windmeijer SE	z	p-value
L1 $ DA $	0.1287	0.0810	1.59	0.112
SIZE	-0.0066	0.0036	-1.84	0.065*
LEV	0.0130	0.0099	1.32	0.187
ROA	0.0914	0.0681	1.34	0.180
GROWTH	0.0041	0.0020	2.06	0.039**
Constant	0.1690	0.0640	2.64	0.008***

Number of observations = 750; number of groups = 150; number of instruments = 9.

Hansen test of overidentifying restrictions: $\chi^2(3) = 7.855$, $p = 0.049$.

Arellano–Bond AR (1): $z = -5.54$, $p < 0.001$. Arellano–Bond AR (2): $z = 0.08$, $p = 0.935$.

Robustness Checks

Table 9 summarizes sensitivity of the $|DA|$ model to the instrument window. Widening the window from lags 2–4 to lags 2–5 raises the Hansen p -value to 0.095 while preserving the direction of the SIZE, ROA and GROWTH coefficients; SIZE and ROA become statistically significant at 5% and GROWTH remains marginally significant, while AR (2) remains non-rejected ($p = 0.936$). This is supportive robustness evidence, but the change in inferential significance indicates some specification sensitivity. A narrower system-GMM window (lags 2–3) preserves the same qualitative pattern. The difference-GMM specification without the level equation preserves coefficient directions but yields substantially lower precision and does not retain the main significance for SIZE, ROA or GROWTH. The corresponding sensitivity checks for the DA model (lags 2–3, 2–5, and difference-GMM) likewise leave the significant positive ROA coefficient and

the marginally significant, negative lagged-DA coefficient intact; SIZE, LEV and GROWTH remain non-significant across all variants. The static two-way fixed-effects results in Table 6 corroborate the positive association of ROA with signed DA and the positive association of GROWTH with |DA|, although the exact coefficient magnitudes and significance levels differ across estimators. This cross-model consistency supports the substantive interpretation while not eliminating the specification uncertainty inherent in dynamic GMM.

Table 9. Sensitivity of the |DA| System-GMM Model to the Instrument Window

Instrument window	SIZE (p)	ROA (p)	GROWTH (p)	Hansen p	AR (2)p	Instruments
Lags 2–3	–0.0067 (0.066*)	0.0944 (0.129)	0.0040 (0.040**)	0.020	0.949	8
Lags 2–4 (main)	–0.0066 (0.065*)	0.0914 (0.180)	0.0041 (0.039**)	0.049	0.935	9
Lags 2–5	–0.0069 (0.036**)	0.1020 (0.022**)	0.0038 (0.052*)	0.095	0.936	10
Difference GMM (lags 2–4, no level eq.)	0.0291 (0.302)	0.0614 (0.557)	0.0016 (0.641)	0.234	0.716	7

Note: coefficients are for the |DA| dependent variable. Two-step system GMM uses Windmeijer-corrected standard errors. The baseline lags 2–4 specification has a Hansen p-value of 0.049; the lags 2–5 sensitivity specification raises this to 0.095. Because this change also affects coefficient significance, the robustness evidence is interpreted as supportive but not definitive.

Hypothesis Assessment

Table 10. Summary of Hypothesis Tests

Hypothesis	Prediction	Static FE	Dynamic GMM	Decision
H1a: SIZE → DA (–)	Negative	+0.044, ns	–0.006, ns	Not supported
H1b: SIZE → DA (–)	Negative	+0.005, ns	–0.007, p=0.065*	Weak support (dynamic model only)
H2a: LEV → DA (+)	Positive	+0.002, ns	–0.006, ns	Not supported
H2b: LEV → DA (+)	Positive	–0.018, ns	+0.013, ns	Not supported
H3: ROA → DA (–)	Negative	+0.061, ns	+0.091, ns	Not supported
H4: GROWTH → DA (+)	Positive	+0.006, p=0.066*	+0.004, p=0.039**	Supported

ns = not significant at 10%. The positive, significant association between ROA and signed DA (static FE $\beta=0.374$, $p=0.008$; dynamic GMM $\beta=0.422$, $p=0.007$) is a robust descriptive finding on the direction of accruals, but is not a test of H3, which concerns magnitude.

Discussion

Two principal findings are consistent across the static and main dynamic specifications, while the sensitivity analysis indicates some dependence on the instrument specification. First, profitability (ROA) shows a strong, consistently positive and statistically significant association with signed discretionary accruals (static FE $\beta = 0.374$, $p = 0.008$; dynamic GMM $\beta = 0.422$, $p = 0.007$): more profitable firms in this sample exhibit more income-increasing discretionary accruals. This is consistent with a performance/bonus-plan incentive under positive accounting theory (Watts and Zimmerman, 1986) and with Shah et al.'s (2024) finding that more profitable Pakistani firms display greater earnings-management tendencies. Importantly, this finding concerns the direction of accruals rather than the intensity of earnings management; ROA is not statistically significant in the $|DA|$ model, so H3 is not supported.

Second, sales growth shows a positive association with discretionary-accrual magnitude in the baseline system-GMM model ($\beta = 0.0041$, $p = 0.039$) and is marginally significant in the static fixed-effects model ($\beta = 0.0055$, $p = 0.066$), supporting H4. The coefficient remains positive across the alternative system-GMM windows, although the p -value moves to 0.052 under lags 2–5 and the relationship is not statistically significant under difference GMM. This is consistent with Srihastuti and Afzani's (2026) finding of a positive relationship between sales growth and discretionary-accrual magnitude and with the theoretical account that rapid expansion can increase reporting pressure and accrual-related measurement challenges associated with changing revenue and receivable balances.

Firm size receives only weak, specification-dependent support: it is negative and marginally significant for $|DA|$ in the baseline dynamic specification ($p = 0.065$) and remains negative at similar significance levels across the alternative system-GMM windows, but it is not statistically significant in the static fixed-effects model or for signed DA. This partial pattern is broadly consistent with Srihastuti and Afzani's (2026) similarly marginal size effect and does not support treating firm size as a strong, uniform correlate of earnings management in this sample. Leverage shows no statistically significant association with either DA or $|DA|$ in any specification, which does not corroborate the leverage relationship reported by Asim and Ismail (2018) for an earlier PSX sample; differences may reflect sample period, sector composition or variable measurement.

The lagged dependent variable is negative and marginally significant for signed DA ($p = 0.067$), suggesting a modest reversal in the direction of discretionary accruals from one year to the next, but is positive and not significant for $|DA|$, so no persistence claim is made for the magnitude of earnings management. Both dynamic models satisfy the Arellano–Bond AR(2) test and use parsimonious, collapsed instrument sets well below the number of groups. The Hansen result is acceptable for the DA model ($p = 0.055$) but marginal for the baseline $|DA|$ model ($p = 0.049$). Rather than obscuring this issue, the study reports alternative instrument windows; the lags 2–5 specification raises the $|DA|$ Hansen p -value to 0.095, although some coefficient significance levels change. The dynamic evidence should therefore be read as supportive but specification-sensitive rather than conclusive.

Conclusion

This study examined whether firm size, leverage, profitability and sales growth are associated with accrual-based earnings management among 150 continuously listed non-financial PSX firms over 2019–2025, using both static two-way fixed-effects and a dynamic two-step system-GMM specification with reported diagnostics for signed and absolute discretionary accruals. Profitability shows a consistent positive association with the direction of discretionary accruals, while sales growth shows a positive association with their magnitude in the baseline dynamic specification. Firm size receives weak, specification-sensitive support for magnitude, whereas leverage is not statistically significant in either specification or dependent variable. Both dynamic models do not reject the Arellano–Bond AR(2) test at the 5% level and use parsimonious instrument sets. The DA model does not reject the Hansen overidentification restrictions, while the baseline $|DA|$ model is marginal at the 5% threshold; the wider-window sensitivity specification provides more reassuring Hansen evidence but also confirms that coefficient significance is instrument-window sensitive.

Study Implications and Limitations

For regulators and auditors, the findings suggest that firms experiencing stronger sales growth may warrant closer scrutiny of accrual quality, although the evidence should not be interpreted as establishing a causal effect. For investors and analysts, the positive association between profitability and income-increasing signed accruals suggests that reported profitability trends in PSX non-financial firms should be assessed alongside accrual-quality indicators rather than interpreted in isolation.

The study has several limitations. First, the dynamic-GMM analytical sample is restricted to 150 firms with fully continuous 2019–2025 data, which is necessary for the common lag structure used in the analysis but excludes firms with gaps in reporting and may introduce survivorship or continuous-listing bias. Second, discretionary accruals estimated using the Modified Jones Model remain a proxy for, rather than a direct observation of, managerial intent. Third, the baseline $|DA|$ system-GMM model has a Hansen p -value of 0.049, indicating specification sensitivity; although alternative instrument windows provide partial reassurance, they also change coefficient significance. Fourth, the dynamic specification treats SIZE, LEV, ROA and GROWTH as strictly exogenous instruments. This is a maintained identifying assumption that cannot be fully verified from the current design, particularly because ROA and sales growth may respond to contemporaneous firm performance and reporting choices. Finally, the balanced sample and focus on non-financial PSX firms limit the generalisability of the findings to firms outside the selected sample and institutional context.

References

- Akhtar, Q., Butt, S., & Niaz, M. (2024). Time series analysis of poverty reduction indicators: Case of Pakistan, India and Bangladesh. *Qlantic Journal of Social Sciences and Humanities*, 5(2), 170–183.

- Arellano, M. and Bond, S. (1991) 'Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations', *Review of Economic Studies*, 58(2), pp. 277–297.
- Asim, A., & Ismail, A. (2019). Impact of leverage on earning management: Empirical evidence from the manufacturing sector of Pakistan. *Journal of Finance and Accounting Research*, 1(1), 70-91.
- Bashir, U., Rashid, A. and Bashir, S. (2024) 'Firm characteristics and earnings management: Evidence from the Pakistan Stock Exchange', *Pakistan Journal of Commerce and Social Sciences*, 18(1), pp. 45–68.
- Blundell, R. and Bond, S. (1998) Initial conditions and moment restrictions in dynamic panel data models', *Journal of Econometrics*, 87(1), pp. 115–143.
- Butt, S., & Yazdani, N. (2023). Implementation of quality management practices and firm's innovation performance: Mediation of knowledge creation processes and moderating role of digital transformation. *Pakistan Journal of Humanities and Social Sciences*, 11(4), 3881–3902.
- Dechow, P.M., Sloan, R.G. and Sweeney, A.P. (1995) 'Detecting earnings management', *The Accounting Review*, 70(2), pp. 193–225.
- Dechow, P.M. and Skinner, D.J. (2000). Earnings management: Reconciling the views of accounting academics, practitioners, and regulators. *Accounting Horizons*, 14(2), 235–250.
- Dechow, P.M., Ge, W. and Schrand, C. (2010). Understanding earnings quality: A review of the proxies, their determinants and their consequences. *Journal of Accounting and Economics*, 50(2–3), 344–401.
- Ehsan, S., Tariq, A., Nazir, M.S., Shabbir, M.S., Shabbir, R., Lopez, L.B. and Ullah, W. (2022) 'Nexus between corporate social responsibility and earnings management: Sustainable or opportunistic', *Managerial and Decision Economics*, 43(2), pp. 478–495.
- Healy, P.M. (1985). The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics*, 7(1–3), 85–107.
- Jones, J.J. (1991) 'Earnings management during import relief investigations', *Journal of Accounting Research*, 29(2), pp. 193–228.
- Kamran, K., & Shah, A. (2014). The impact of corporate governance and ownership structure on earnings management practices: Evidence from listed companies in Pakistan. *The Lahore Journal of Economics*, 19(2), 27–70.
- Khan, Z. and Arif, M. (2026) 'Determinants of earnings management: Empirical evidence from Sharia-compliant and non-Sharia-compliant firms of Pakistan Stock Exchange', *Journal of Management Science Research Review*, 5(2), pp. 1559–1572.
- Kothari, S.P., Leone, A.J. and Wasley, C.E. (2005) Performance matched discretionary accrual measures', *Journal of Accounting and Economics*, 39(1), pp. 163–197.
- McNichols, M.F. and Stubben, S.R. (2008). Does earnings management affect firms' investment decisions? *The Accounting Review*, 83(6), 1571–1603.

Mlawu, N., Matenda, F.R. and Sibanda, M. (2025) 'Determinants of accrual-based earnings management in emerging markets: A systematic review', *Cogent Economics & Finance* (forthcoming).

Rahman, F. and Farida, I. (2026) 'Profitability and earnings management: Evidence from Indonesian infrastructure firms', *Journal of Asian Finance, Economics and Business* (forthcoming).

Rahman, H.U., Zahid, M., Khan, P.A., Al-Faryan, M.A.S. and Hussainey, K. (2024) 'Do corporate sustainability practices mitigate earnings management? The moderating role of firm size', *Business Strategy and the Environment*, 33(6), pp. 5423–5444.

Roodman, D. (2009) 'How to do xtabond2: An introduction to difference and system GMM in Stata', *Stata Journal*, 9(1), pp. 86–136.

Roychowdhury, S. (2006) 'Earnings management through real activities manipulation', *Journal of Accounting and Economics*, 42(3), 335–370.

Shah, S.F., Mehmood, S., Khan, M.A. and Popp, J. (2024) 'Earnings management opportunistic or efficient in Pakistan? The role of corporate governance practices', *Cogent Business & Management*, 11(1), Article 2398716.

Srihastuti, E. and Afzani, N. (2026) 'Determinants of discretionary accruals: Evidence from Indonesian industrial firms', *International Journal of Accounting and Finance Studies* (forthcoming).

Watts, R.L. and Zimmerman, J.L. (1986) *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Windmeijer, F. (2005) 'A finite sample correction for the variance of linear efficient two-step GMM estimators', *Journal of Econometrics*, 126(1), pp. 25–51.

Wu, D., Hua, X. and Xu, X. (2023) 'pydynpd: A Python package for dynamic panel model', *Journal of Open-Source Software*, 8(83), 4416.

Appendix A. Variable Dictionary

Field	Role	Notes
Company Name	Panel identifier	150 continuously listed non-financial PSX firms
Year	Time identifier	2019–2025 (7 years, balanced)
DA	Dependent (signed)	Modified Jones residual
ABS_DA	Dependent (magnitude)	DA
SIZE	Control	ln(total assets)
LEV	Control	Total debt / total assets
ROA	Control	Net income / total assets
GROWTH	Control	(Sales _t – Sales _{t-1}) / Sales _{t-1}

Appendix B. Model Interpretation Guide

• Signed DA: positive coefficient = more income-increasing residual accruals; negative coefficient = more income-decreasing residual accruals. It is not a pure magnitude measure.

- Absolute DA: larger values indicate greater magnitude of discretionary accruals regardless of direction.
- Firm and year fixed effects (static model) identify relationships from within-firm changes over time and common annual shocks, respectively.
- In the dynamic GMM model, the lagged dependent variable absorbs persistence/reversal; remaining coefficients are interpreted net of that dynamic and of firm/year effects captured through the GMM transformation.

Appendix C. Replication Specification

Data construction (first stage). The Modified Jones discretionary-accrual construction for the broader PSX non-financial panel follows the procedure in the accompanying `build_accrual_panel.py` script: total accruals scaled by lagged assets, regressed on the inverse of lagged assets, Δ revenue net of Δ receivables, and gross PPE (all scaled by lagged assets), with sector and year controls, and 1st/99th-percentile winsorisation of first-stage regressors.

Second-stage estimation (this manuscript). All models below are estimated on the 150-firm, 1,050-observation balanced panel (`EVIEWS_Main_150`), with firm identifiers recoded to a numeric panel index and Year as the time index.

Static two-way fixed-effects (Python, linear models):

Panel OLS from formula(`DA ~ 1 + SIZE + LEV + ROA + GROWTH + Entity Effects + Time Effects`'), fit with `cov_type='clustered', cluster entity=True`. Identical specification for $|DA|$.

Dynamic two-step system GMM (Python, `pydynpd`; syntax follows Stata's `xtabond2`):

DA main model: `"DA L1.DA SIZE LEV ROA GROWTH | gmm(DA, 2:4) iv(SIZE LEV ROA GROWTH) | collapse"`

$|DA|$ main model: `"ABS_DA L1.ABS_DA SIZE LEV ROA GROWTH | gmm(ABS_DA, 2:4) iv(SIZE LEV ROA GROWTH) | collapse"`

Sensitivity variants: replace "2:4" with "2:3" or "2:5" for narrower/wider instrument windows; append "nolevel" for difference GMM.

Software note: `pydynpd` implements the same difference/system-GMM algorithm as Stata's `xtabond2` (Roodman, 2009), including Windmeijer (2005)-corrected two-step standard errors, the Arellano-Bond AR(1)/AR(2) tests and the Hansen overidentification test, so the reported diagnostics are directly comparable to a Stata `xtabond2` table.