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Accounting-Based Assessment of Allocation Quality under Real Estate Concentration: Evidence from Listed Firms in Egypt

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Abstract

Purpose

This study develops and evaluates an accounting-based Allocation Quality Architecture (AQA) for examining how real-estate concentration relates to resource allocation efficiency and macro-financial vulnerability in Egypt.

Design/Methodology/Approach

The study uses a longitudinal design covering 40 Egyptian listed real-estate firms over 2010–2025 (640 firm-year observations). It integrates audited accounting information with concentration measures and macro-financial conditions. The architecture comprises the Real Estate Concentration Index (RECI), Resource Allocation Efficiency (RAE), Macro-Financial Vulnerability Exposure (MVE), and Aggregate Allocation Quality Index (AAQI). Accounting-based measures include return on assets, net profit margin, asset turnover, and leverage. PCA, fixed-effects estimation, alternative specifications, and robustness diagnostics are employed.

Findings

Real-estate concentration is significantly negatively associated with accounting-based resource allocation efficiency. The relationship remains negative across alternative concentration specifications, with high stability in concentration rankings. The analysis distinguishes common macro-financial stress from heterogeneous firm-level exposure, while AAQI is treated as a diagnostic synthesis rather than an independently validating outcome.

Originality/Value

The study contributes to accounting research by demonstrating how reported financial information can be transformed into structured measures of resource allocation quality, operating efficiency, and financial exposure within a concentrated sector.

Keywords: Accounting Information, Accounting-Based Measurement, Real Estate Concentration, Resource Allocation Efficiency, Macro-Financial Vulnerability, Allocation Quality, Egypt.

Introduction

When Growth Stops Being the Whole Story

Economic performance is increasingly judged not only by the volume of investment mobilized but by how efficiently scarce resources are transformed into productive, resilient, and sustainable outcomes. Resource misallocation can persist even when investment expands because capital may remain concentrated in activities that do not generate proportionate productivity gains [1-3]. This concern is especially relevant to real estate, where asset intensity, collateral values, long development cycles, and expectations of capital appreciation can attract substantial resources. Evidence from China shows that real-estate booms may intensify misallocation in connected industries, while market-power research demonstrates that concentration can alter investment incentives and economic dynamism [4, 5]. Sectoral expansion therefore cannot be treated automatically as evidence of efficient allocation.

The Problem Behind Real-Estate Concentration

The research problem is not concentration itself, but whether concentrated resources are transformed efficiently and how that transformation should be interpreted under changing macro-financial conditions. Concentration may generate scale economies, organizational capability, and financing advantages, yet it can also coexist with weaker competitive pressure, resource lock-in, and exposure to common shocks. Evidence from developing economies confirms that allocative distortions reduce productive efficiency, while real-estate and financial-sector research shows that leverage, maturity structure, and property-market conditions can transmit vulnerability through firms and financial institutions[6-8]. This distinction is especially relevant in Egypt, where inflation, exchange-rate adjustment, interest rates, and financing constraints shape the environment in which allocation outcomes are observed [9-11].

Questions That Reframe the Study

The study develops an Allocation Quality Architecture linking the Real Estate Concentration Index (RECI), Resource Allocation Efficiency (RAE), firm-specific Macro-Financial Vulnerability Exposure (MVE), and the Aggregate Allocation Quality Index (AAQI). The empirical core of the study is the concentration-efficiency relationship, while MVE, the RECI × MVE channel, and external AAQI relevance are used as analytical extensions that discipline interpretation and identify how the architecture can be evaluated beyond the primary test. Six questions guide the study:

RQ1: How has real-estate concentration evolved during 2010-2025?

RQ2: How is real-estate concentration associated with resource-allocation efficiency?

RQ3: How should common macro-financial stress be translated into firm-specific exposure within the allocation architecture?

RQ4: Through what analytical channel can macro-financial exposure alter the efficiency consequences of concentration?

RQ5: How robust are the concentration and allocation-quality measures to alternative construction rules?

RQ6: How should AAQI be evaluated against operating outcomes that are external to its own construction?

Four Contributions, One Analytical Shift

The study makes four contributions. First, it integrates market structure, resource-use efficiency, macro-financial exposure, and allocation quality within one architecture, while keeping the primary empirical claim focused on the observed concentration-efficiency relationship. This reflects evidence that productivity depends on how resources are distributed rather than merely accumulated [2, 3]. Second, it distinguishes resource absorption from resource transformation and from exposure to macro-financial stress. Third, it extends accounting-based analysis beyond historical performance toward connected information about resource use, financing risk, and value creation. This direction is consistent with research on integrated reporting, public value, and ecosystem-level accounting and with the decision-useful orientation of Fourth, the Egyptian setting contributes emerging-market evidence in which sustainability-related reporting and firm value are institutionally relevant [12-18].

From the Research Problem to the Evidence

The study examines 40 Egyptian listed real-estate firms over 2010-2025, providing 640 firm-year observations that combine accounting, market, and macroeconomic information. The period captures distinct inflation, exchange-rate, and financing regimes and therefore permits the concentration-efficiency relationship to be interpreted within changing economic conditions. This development context supports an emphasis on investment quality, financing resilience, and sustainable value creation rather than investment volume alone [19, 20]. Chapter Two reviews the relevant literature; Chapter Three develops the conceptual architecture, the primary empirical hypothesis, and the analytical propositions; Chapter Four specifies measurement and identification; Chapter Five reports the direct empirical evidence and robustness analysis; Chapter Six discusses the theoretical and policy implications; and Chapter Seven concludes.

Literature Review: Where Growth, Concentration, and Allocation Part Ways

Growth Can Be Loud While Allocation Fails

Real-estate expansion is usually read through investment, construction, sales, prices, employment, and contribution to output. Those indicators describe scale, but they do not establish whether capital is moving toward its most productive uses. Recent work on business dynamism and misallocation shows that expansion can coexist with weak reallocation, entrenched incumbency, and declining productivity growth [21, 22]. Development strategies that privilege capital-intensive activities can also raise capital-output ratios without generating proportional efficiency gains [23]. The relevant question is therefore not whether real estate grows, but whether the resources absorbed by that growth are transformed efficiently and remain resilient under changing economic conditions.

Concentration Is a Signal, Not a Verdict

The literature rejects a one-directional interpretation of concentration. Superstar-firm evidence suggests that concentration can arise because more productive firms gain market share [24, 25]. Yet concentration can also reflect barriers to entry, weaker competitive pressure, and entrenched market power [26]. Geographic scale matters: national concentration can rise while local concentration falls, so market definition is critical [27]. Recent UK evidence likewise finds that concentration may reduce average-firm productivity while improving employment-weighted allocative efficiency [28].

The Productivity Bridge That Growth Statistics Miss

Resource-allocation efficiency provides the bridge between market structure and economic value. Financial frictions can prevent productive firms from reaching efficient scale and generate persistent capital misallocation [29]. Firm-level evidence also links financial-market frictions to lower total factor productivity through distorted allocation [30]. Concentration may amplify small productivity differences through search complementarities and market power, creating self-reinforcing advantages for dominant firms [31]. Accordingly, RAE captures resource transformation rather than size: profitability, asset utilization, and turnover matter because they reveal what firms produce from the

capital they control.

Real Estate Locks Capital in Time

Real estate differs from many sectors because projects are long-lived, assets are collateralizable, and financing conditions affect both demand and supply. Resources committed today may therefore be difficult to redeploy after macroeconomic conditions change. Evidence on real-estate firms shows that macroprudential policy can reduce systemic-risk contribution through lower leverage and interconnectedness [32]. Housing-market risk can also transmit into broader systemic conditions during periods of monetary easing or asset-price stress [33]. Monetary conditions themselves interact with concentration and productivity by changing entry incentives and firm composition [34]. This supports treating macro-financial vulnerability as a conditioning environment whose economic consequences differ with firm-specific financing exposure rather than as an outcome mechanically caused by concentration.

Accounting Becomes Allocation Intelligence

A second literature stream changes the role assigned to accounting information. Integrated thinking links financial and sustainability information to organizational decisions and assurance choices, while extended external reporting emphasizes the interaction among reporting, governance, accountability, and value creation [35, 36]. Value-creation frameworks argue that reporting should explain how resources and stakeholder relationships are transformed over time [37]. Evidence connecting integrated reporting with environmental performance further suggests that connected information can reveal dimensions not visible in conventional financial statements alone [38].

More Disclosure Does Not Automatically Mean Better Measurement

The reporting literature also warns against equating information volume with decision usefulness. Investors may interpret integrated CSR information differently depending on presentation and perceived assurance, while disclosure-quality reviews document substantial variation in what sustainability and integrated reports communicate [39, 40]. Reporting quality can have economic consequences, but those effects vary with organizational complexity, and audit quality and business ethics can alter the value relevance of integrated information [41, 42].

Composite Measures Need Economic Meaning, Not Decorative Complexity

Sustainability-performance research increasingly uses multidimensional indicators, but their usefulness depends on a transparent connection between metrics, strategy, and outcomes [43]. Integrated-reporting research likewise cautions that polished narratives can mask different levels of substantive integration [44]. Preparers report that material value-creation information requires explicit processes for identification, collection, and interpretation [45]. The implication for AAQI is direct: it operates as a diagnostic synthesis of concentration, efficiency, and vulnerability, while relationships among its own components are interpreted as internal coherence rather than independent validation. Its economic usefulness is therefore linked to observable operating outcomes outside the arithmetic of the index.

From Corporate Reporting to Allocation Accountability

Recent scholarship increasingly treats reporting as part of an accountability infrastructure rather than a communication exercise alone. Cross-country evidence shows that institutional and competitive conditions shape integrated-reporting adoption and quality [46]. Critical work also questions whether standardized sustainability architectures capture broader forms of social value [47]. Highlights measurement and aggregation challenges that distinguish sustainability from conventional financial reporting. These concerns are directly relevant to allocation quality: accounting-based indicators can enrich policy surveillance only when their construction and interpretation are transparent and when measures of resource concentration remain distinguishable from the economic outcomes they are used to interpret [48].

The Gap That Becomes the Model

Three literatures remain insufficiently connected. Market-structure research explains why concentration can be efficient or inefficient; misallocation research explains how financing and structural frictions affect productivity; and accounting research explains how connected measures can make value creation more visible. Industry evidence also shows that concentration trends differ across jurisdictions and definitions, while international reporting evidence indicates that mandatory and voluntary regimes can produce different value-creation effects [49, 50]. The unresolved gap is an empirically disciplined architecture linking real-estate concentration to resource transformation inside a changing macro-financial environment. This study addresses that gap through RECI, RAE, firm-specific vulnerability exposure, and AAQI, separating structural concentration, productive transformation, exposure, and diagnostic synthesis.

Conceptual Architecture: From Concentration to Allocation Quality

The Same Growth Rate Can Hide Different Economies

Allocation quality begins from a simple proposition: growth records how much activity expands, whereas allocation asks whether scarce resources are directed toward uses that generate durable value. General-equilibrium research shows that distortions can reduce aggregate productivity even when inputs continue to rise [51, 52]. Firm-level evidence also cautions that measured productivity dispersion may combine genuine misallocation with measurement error [53]. The architecture therefore separates where resources accumulate, how effectively they are transformed, and how macro-financial conditions may shape that transformation rather than treating investment volume as a sufficient performance signal.

Concentration Is a Structural State, Not a Scorecard

RECI is conceptualized as a multidimensional structural state rather than a scorecard of economic success. Concentration may rise because resources shift toward more efficient firms, but weaker competition may also depress productivity in developing economies [54, 55]. Market power can additionally reshape

innovation incentives and dynamism [56]. RECI therefore combines asset, revenue, backlog, and contracted-sales shares to capture scale, realized activity, and future commitments. Higher RECI indicates a more concentrated allocation structure; whether that structure is productive is evaluated through the observed RECI-RAE relationship.

Efficiency Is Where Resources Become Outcomes

RAE captures the mechanism through which resources become economic outcomes and therefore anchors the primary empirical test. Capital-market integration can improve productivity by reallocating finance toward firms with higher marginal returns, while access-to-finance constraints and bureaucratic frictions can widen inefficient capital dispersion [57, 58]. MENA evidence similarly confirms that misallocation is material for firm productivity [59]. RAE therefore emphasizes profitability and asset utilization rather than scale, consistent with evidence that responsiveness to productivity shocks drives reallocation and aggregate performance [60].

Vulnerability as an Analytical Exposure Extension

Macroeconomic vulnerability is common to firms in the same national environment, but its incidence is heterogeneous. The architecture therefore distinguishes the shared macro-financial state from firm-specific Macro-Financial Vulnerability Exposure (MVE), represented conceptually through observable balance-sheet sensitivity such as leverage, interest burden, or foreign-currency exposure. This distinction accords with evidence that financial frictions and uncertainty transmit unevenly across firms and sectors [61-63]. It is especially relevant to real estate, where refinancing conditions, valuation pressure, and leverage shape the transmission of common shocks into firm-level risk [64, 65].

Accounting Information Becomes Allocation Infrastructure

The accounting contribution lies in converting reported financial quantities into information about allocation capacity. Comparable reporting can improve capital allocation by reducing coordination and information problems, while governance quality affects whether managers deploy capital efficiently [66, 67]. Stronger information environments and digital transformation can also reduce factor-input deviations and improve allocation efficiency [68-71]. Accounting data therefore provide observable signals of resource absorption, utilization, financing exposure, and future commitments rather than substituting for productivity theory.

The Architecture: Empirical Core and Analytical Extensions

Figure 3.1 separates the part of the architecture tested directly in the present evidence from the extensions that discipline interpretation and future validation. H1 is the primary empirical hypothesis: RECI is expected to be negatively associated with RAE. MVE and the RECI × MVE channel are retained as analytical propositions that explain how common macro-financial stress can be translated into heterogeneous firm exposure and how such exposure may condition the concentration-efficiency relationship. AAQI remains an oriented diagnostic synthesis, while its connection to a subsequent operating outcome is framed as an external-relevance proposition. This separation prevents an analytical extension from being reported as an finding and prevents algebraic relationships inside AAQI from being mistaken for independent empirical support. It also respects the caution that fixed-effects designs require disciplined interpretation rather than automatic causal claims [72].

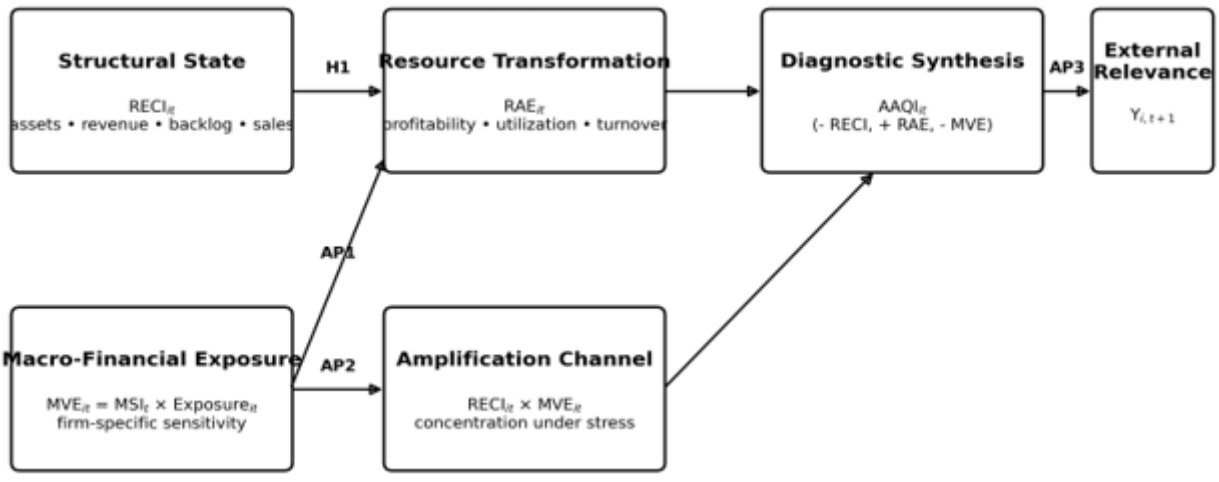

Figure 3.1: Allocation Quality Architecture: Empirical Core and Analytical Extensions

AAQI Is a Synthesis, Not a Self-Test

AAQI is oriented so that stronger resource transformation raises allocation quality, while concentration and vulnerability exposure enter with adverse orientation. Because those components are embedded in the index, correlations with AAQI indicate internal coherence rather than independent validation. The index is therefore used as a diagnostic synthesis whose robustness can be assessed through alternative weighting and component exclusion. Its broader economic usefulness is represented by an external-relevance proposition linking AAQI to a subsequent

operating or resilience outcome outside its own construction. PCA remains appropriate for data-driven weighting when diagnostics support common structure, but loadings, explained variance, score orientation, and sensitivity should be reported transparently [73].

One Empirical Hypothesis and Three Analytical Propositions

The architecture is deliberately asymmetric in its evidentiary status. H1 is the empirical hypothesis tested in Chapter Five: higher RECI is associated with lower RAE ($\beta 1 < 0$). Three additional propositions extend the architecture without being presented as confirmed hypotheses. AP1 proposes that greater firm-specific MVE should weaken RAE. AP2 proposes that the RECI × MVE channel may intensify the efficiency cost of concentration under stronger exposure. AP3 proposes that AAQI should demonstrate economic relevance through incremental association with a subsequent external operating or resilience outcome. These propositions are consistent with evidence that uncertainty and capital-budgeting quality affect misallocation and that market power can intensify capital misallocation through productivity channels [74, 75].

What the Model Adds

The model bridges concentration research, misallocation theory, macro-financial vulnerability, and accounting measurement without overstating what the available evidence establishes. Its empirical contribution is the concentration-efficiency test and its robustness; its broader conceptual contribution is to show how firm-specific exposure, interaction under stress, and external validation can extend that core result. The architecture therefore avoids treating growth as allocation quality, a common shock as identical firm exposure, or a composite index as validated by its own ingredients. In the Egyptian real-estate setting, this provides a coherent basis for the measurement rules, panel analysis, sensitivity tests, and policy interpretation developed in the following chapters.

Statistical Translation of the Empirical Core and Analytical Extensions

Primary empirical test (H1): $RAE_{it} = \alpha_i + \lambda_t + \beta_1 RECI_{it} + \theta X_{it} + \varepsilon_{it}$, with $\beta_1 < 0$.

Analytical extension (AP1): $MVE_{it} = MSI_t \times Exposure_{it}$.

Analytical extension (AP2): $RAE_{it} = \alpha_i + \lambda_t + \beta_1 RECI_{it} + \beta_2 MVE_{it} + \beta_3 (RECI_{it} \times MVE_{it}) + \theta X_{it} + \varepsilon_{it}$.

Diagnostic synthesis: $AAQI_{it} = f(-RECI_{it}, +RAE_{it}, -MVE_{it})$.

External-relevance proposition (AP3): $Y_{i,t+1} = \mu_i + \tau_t + \delta_1 AAQI_{it} + \delta_2 Growth_{it} + \delta_3 Size_{it} + \psi Z_{it} + u_{it}$.

Research Design, Measurement, and Identification Strategy

Longitudinal Design and the Primary Empirical Test

The empirical design translates the Allocation Quality Architecture into a longitudinal firm-year framework for Egyptian listed real-estate companies over 2010-2025. Panel data are appropriate because they distinguish persistent firm heterogeneity from within-firm change, while year effects absorb common national shocks [76, 77]. Consistent with observational-identification guidance, the study interprets the relationship as conditional association rather than unconditional causality [78, 79]. The primary empirical test concerns whether changes in real-estate concentration (RECI) are associated with changes in resource-allocation efficiency (RAE). MVE, the RECI x MVE channel, and external AAQI relevance are retained as analytical extensions that organize interpretation and specify how the architecture can be extended beyond the directly tested concentration-efficiency relation. Table 4.1 summarizes the data layers and their roles.

Table 4.1: Final Panel, Data Layers, and Analytical Roles

Layer	Coverage / construction	Primary source	Quality control	Analytical role
Population	40 EGX real-estate firms, 2010-2025	EGX classifications and disclosures	Listing/classification aligned by year	Defines sector denominator
Analytical panel	640 firm-year observations	Audited annual reports / statements	Units, fiscal year, restatements, duplicates reconciled	Primary H1 test
Core accounting	Assets, liabilities, revenue, net profit	Audited financial statements	Totals and signs cross-checked	RECI, RAE, leverage
Forward demand	Backlog and contracted sales where disclosed	Company reports	No unsupported imputation	RECI-4 sensitivity
Macro layer	Inflation, FX, policy rate, debt/GDP, unemployment, external debt/GDP	Official sources	Annual alignment and adverse orientation	MSI / AP1-AP2 architecture
External operating outcome	One-year-ahead real revenue growth	Revenue + CPI	Real deflation and t/t+1 alignment	AP3 external-relevance criterion

Sample Construction and Data Integrity

The analytical panel comprises 40 Egyptian listed real-estate firms observed annually from 2010 through 2025, yielding 640 firm-year observations. Firm-level variables are drawn from audited annual reports, financial statements, and Egyptian Exchange disclosures; macroeconomic indicators are aligned from

official national and international sources. Data-quality controls reconcile units, fiscal years, restatements, sign conventions, and duplicate observations. Missing forward-demand variables such as backlog or contracted sales are not imputed for the baseline concentration index because non-disclosure may be systematic [80]. Ratio outliers are source-checked before limited winsorization, while raw accounting levels used to construct market shares remain unchanged, consistent with robust- principles [81]. All transformations are documented in a reproducible data dictionary [82].

Measurement Architecture

Measurement is separated from empirical testing. The baseline RECI uses standardized annual asset and revenue shares because these items are audited and broadly comparable; an expanded RECI-4 adds backlog and contracted-sales shares for sensitivity analysis. RAE combines ROA, net margin, and asset turnover, with ROE reserved as a supplementary specification where equity is positive. PCA is used only when diagnostics support a common component structure, and loadings, explained variance, and score orientation are reported transparently [83, 84]. Alternative constructions are compared because component methods can become opaque when sparsity or weighting choices are left unexplained [85, 86]. Table 4.2 provides the operational definitions and Table 4.3 reports the index-construction and sensitivity rules.

Table 4.2: Operationalization of Constructs and Variables

Variable	Definition	Direction	Role	Key safeguard
Asset share	Firm assets / eligible-sector assets	Higher concentration	RECI input	Annual denominator
Revenue share	Firm revenue / eligible-sector revenue	Higher concentration	RECI input	Nominal share basis
RECI	0.5z(asset share)+0.5z(revenue share)	Higher concentration	H1	RECI-4 and HHI/CR4 checks
ROA	Net profit / assets	Higher efficiency	RAE input	Source verification before winsorization
Net margin	Net profit / revenue	Higher efficiency	RAE input	Zero-revenue records flagged
Asset turnover	Revenue / assets	Higher utilization	RAE input	Same fiscal-year basis
RAE	PC1 of z(ROA, margin, turnover)	Higher transformation	H1 outcome	Standardized mean if PCA diagnostics are weak
Leverage	Liabilities / assets	Higher exposure	AP1/AP2 input	Liability classification checked
MSI	Normalized adverse macro indicators	Higher stress	Common-shock input	Alternative PCA weighting
MVE	MSI x leverage	Higher vulnerability exposure	AP1/AP2 construct	Analytical extension
AAQI	Oriented -RECI,+RAE,-MVE synthesis	Higher allocation quality	Diagnostic / AP3	No self-validation
Future real growth	Delta log(revenue/CPI), t to t+1	Higher realization	AP3 criterion	Outside AAQI construction

Table 4.3: Index Construction, Diagnostics, and Sensitivity Design

Index	Construction	Diagnostics	Baseline treatment	Sensitivity
RECI-Core	Annual sector shares -> z-scores -> equal weights	Coverage; asset/revenue share correlation	Primary concentration measure	HHI, CR4, RECI-4
RECI-4	Assets, revenue, backlog, sales -> standardize -> PCA	KMO >= .60; Bartlett p < .05; coherent loadings	Sensitivity index	Equal weighting if needed
RAE	ROA, margin, turnover -> z-scores -> PCA	KMO; variance explained; loading signs	Primary H1 outcome	Mean score; ROE supplement

MSI	Six adverse macro series -> [0,1] normalization -> mean	Coverage; sign orientation	Analytical context	PCA; leave-one-out
MVE	MSI x leverage	Within-year variation	AP1/AP2 extension	Debt/equity alternative
AAQI	Oriented RECI, RAE, MVE -> standardized synthesis	Loadings; variance; rank stability	Diagnostic synthesis	Equal weights; leave-one-out

Analytical Extensions: Exposure, Amplification, and External Relevance

The national Macro Stress Index (MSI) combines inflation, exchange-rate pressure, policy interest rates, debt-to-GDP, unemployment, and external-debt conditions after adverse orientation and normalization. Firm-specific MVE is defined conceptually as MSI multiplied by leverage so that common macro stress can be translated into heterogeneous balance-sheet exposure. The RECI x MVE term represents an analytical amplification channel, while AAQI synthesizes oriented concentration, efficiency, and vulnerability information. These constructs are not presented as additional empirically supported hypotheses in the current study. Instead, they discipline interpretation and establish explicit propositions for subsequent validation. Mean-centering and marginal-effects logic remain appropriate for any future interaction analysis, while alternative weighting and leave-one-component-out checks support transparent composite construction. External AAQI relevance is conceptually linked to an operating outcome outside the index, consistent with sensitivity-based validation principles [87-89].

Primary Hypothesis and Analytical-Proposition Mapping

The primary empirical hypothesis is H1: higher RECI is negatively associated with RAE. The preferred specification relates RAE to centered RECI with firm and year fixed effects and appropriate controls, and the inference is assessed using clustered standard errors and robustness checks. Three additional relationships are treated as analytical propositions rather than as claims of completed empirical support: AP1 concerns the association between MVE and RAE; AP2 concerns the RECI x MVE amplification channel; and AP3 concerns whether AAQI contains incremental information about a subsequent operating outcome. Table 4.4 maps the direct empirical test and the analytical extensions separately. This distinction aligns Chapter Four with the evidence actually reported in Chapter Five and prevents extensions from being presented as tested hypotheses.

Primary empirical test: $RAE_{it} = \alpha_i + \lambda_t + \beta_1 RECI_{it} + \theta X_{it} + \varepsilon_{it}$

Analytical extensions: AP1 MVE -> RAE; AP2 RECI x MVE; AP3 $AAQI_t \rightarrow Y_{i,t+1}$

Table 4.4: Primary Empirical Test and Analytical-Extension Matrix

Element	Expected direction	Specification / definition	Status in this study	Interpretation
H1: RECI -> RAE	$\beta_1 < 0$	RAE on centered RECI + controls	Primary empirical test	Concentration-efficiency association
AP1: MVE -> RAE	Negative proposition	MVE = MSI x leverage	Analytical extension	Firm-specific exposure channel
AP2: RECI x MVE	Negative amplification proposition	Centered multiplicative interaction	Analytical extension	Stress-conditioned concentration channel
AP3: AAQI -> Y(t+1)	Positive incremental relevance proposition	Lagged AAQI + conventional predictors	Validation extension	External operating relevance
Robustness	Stable sign / magnitude	FE primary; pooled descriptive	Applied to H1	Specification stability
Regime analysis	Potential heterogeneity	Regime interactions / strata	Supplementary	Macroeconomic context

Inference and Robustness

Inference for the primary RECI-RAE test is matched to the dependence structure of the panel. Firm-clustered standard errors are the baseline because repeated observations within firms are not independent, while common annual shocks motivate additional sensitivity checks [90]. Wild-cluster bootstrap procedures are appropriate for key coefficients where finite-cluster concerns arise, and the appropriate clustering level is examined rather than imposed mechanically [91-94]. Robustness focuses on alternative RECI weights, RECI-4, HHI/CR4 comparisons, outlier treatment, regime heterogeneity, and specification stability. Table 4.5 consolidates the diagnostics and also records how the analytical extensions can be examined without being confused with the primary empirical result.

Table 4.5: Diagnostics, Robustness, and Reproducibility Protocol

Threat	Diagnostic	Response	Robustness check	Decision criterion

Missingness	Coverage matrix	Report common H1 sample	RECI-Core vs RECI-4	Stable substantive conclusion
Outliers	Source and influence checks	Correct errors; limited winsorization	Raw vs 2.5/97.5	Stable sign/magnitude
Collinearity	VIF; within correlations	Center relevant variables	Alternative scaling	No scaling-driven sign reversal
Common shocks	Year FE; residual dependence	Retain year effects	Firm/two-way/wild bootstrap	Stable H1 inference
Few clusters	Cluster count and leverage	Avoid asymptotics alone	Wild-cluster bootstrap	Decision stability
Weights	Loadings and rank correlations	Report weights transparently	Equal weights; leave-one-out	Coherent rankings
Model uncertainty	Predefined specifications	Report full H1 model set	Specification curve	Not one-model dependent
Analytical extensions	Construct-definition audit	Keep AP1-AP3 distinct from tested H1	Alternative exposure/validation designs	No overstatement of empirical support
Reproducibility	Dictionary, log, code	Raw-to-table workflow	Rerun / checksum	Outputs reproducible

Reproducibility and Model Transparency

Reproducibility is treated as part of the empirical design rather than as an appendix exercise. The analysis preserves source mappings, exclusions, transformation rules, PCA weights, winsorization thresholds, and model specifications in a versioned audit trail. Alternative defensible specifications are reported together rather than selected after significance is observed, and a specification-curve perspective is used to assess whether the main concentration-efficiency conclusion depends on a narrow modeling choice [95]. Results are interpreted through sign stability, coefficient magnitude, confidence intervals, and sensitivity rather than p-values alone. This protocol keeps the directly tested H1 result distinct from AP1-AP3, while preserving a transparent route for future empirical extension of the Allocation Quality Architecture.

Empirical Results and Analytical Assessment

Empirical Results: Primary Test and Analytical Extensions

The empirical results are organized around the evidentiary structure established in Chapters Three and Four. H1 is the primary empirical hypothesis and concerns the association between real-estate concentration (RECI) and resource-allocation efficiency (RAE). Firm-specific Macro-Financial Vulnerability Exposure (MVE), the RECI × MVE channel, and the external relevance of AAQI are retained as analytical propositions (AP1-AP3) rather than as additional confirmed hypotheses. The analysis covers 640 firm-year observations and preserves the descriptive, correlation, panel, and sensitivity evidence already reported. Table 5.1 clarifies the role of each construct so that common macro stress, firm-specific exposure, and the diagnostic AAQI synthesis are not interpreted interchangeably. This distinction is particularly important in emerging markets, where accounting quality, institutional conditions, and financing structure affect investment efficiency and firm performance [96-99].

Table 5.1: Alignment of Empirical Evidence with H1 and AP1-AP3

Construct / block	Operational evidence in Chapter 5	Role in the architecture	Evidentiary status
RECI	Asset/revenue concentration; RECI sensitivity variants	Structural concentration	H1 predictor
RAE	ROA, net margin, asset-turnover composite	Resource transformation	H1 outcome
Annual macro stress (SV in reported output)	Common year-level vulnerability benchmark	Macro context	Context for AP1-AP2
MVE	MSI × firm leverage in the analytical architecture	Firm-specific exposure	AP1 construct
RECI × MVE	Conceptual amplification channel	Stress-conditioned concentration	AP2 construct
AAQI	Oriented synthesis of concentration, efficiency, vulnerability	Diagnostic synthesis	AP3 precursor
External operating outcome	One-year-ahead real revenue growth	External relevance criterion	AP3 criterion

Distributional Evidence

Table 5.2 shows substantial dispersion in the reported allocation indicators. RECI averages .244 and ranges from .001 to .812, while RAE ranges from -2.021 to 1.963. The macro-stress benchmark, reported in the source output as SV, and AAQI also display broad variation. These distributions confirm that concentration, operating transformation, and macro-financial conditions are heterogeneous rather than mechanical consequences of sectoral growth. Such dispersion is consistent with evidence that financing frictions and capital constraints generate unequal capital productivity [100-104]. The descriptive statistics therefore motivate the broader allocation architecture but do not convert AP1-AP3 into empirically confirmed propositions.

Table 5.2: Descriptive Statistics of Core Allocation Indicators (N = 640)

Variable	Mean	SD	Min	Median	Max	Skewness	Kurtosis
RECI	0.244	0.196	0.001	0.211	0.812	0.84	3.21
RAE	-0.082	0.884	-2.021	-0.091	1.963	0.12	2.88
SV (annual stress benchmark)	-0.094	0.703	-1.612	-0.118	1.021	0.31	2.74
AAQI	-0.126	0.721	-1.903	-0.171	1.318	0.27	2.91

Time Variation and the Macro-Financial Environment

The annual pattern in Table 5.3 shows RECI increasing from .241 in 2018 to .305 in 2025, while RAE improves from -.121 to .284. The reported annual macro-stress score becomes strongly positive during the high-inflation period, reaching .648 in 2024 before easing to .603 in 2025. These movements show that resource transformation and macro-financial pressure can evolve simultaneously. This is consistent with evidence that uncertainty affects financialisation, managerial horizons, investment timing, and financing decisions and that policy uncertainty can have heterogeneous investment effects [105-109].

Table 5.3: Annual Allocation Dynamics, 2018-2025

Year	RECI	RAE	SV	AAQI	Macroeconomic phase
2018	0.241	-0.121	0.218	-0.287	Adjustment
2019	0.245	-0.101	0.081	-0.241	Adjustment
2020	0.249	-0.088	-0.166	-0.205	Adjustment / shock
2021	0.254	-0.074	-0.022	-0.174	Adjustment
2022	0.267	-0.052	0.336	-0.091	High inflation
2023	0.279	0.041	0.512	0.083	High inflation
2024	0.291	0.176	0.648	0.219	High inflation
2025	0.305	0.284	0.603	0.193	High inflation

Direct Evidence for H1 and Contextual Correlations

Table 5.4 provides the clearest direct evidence for H1. RECI is negatively correlated with RAE ($r = -.481$, $p < .01$), indicating that greater concentration is associated with weaker resource-allocation efficiency. The sign remains economically consistent with evidence that financing conditions, internal capital markets, and financial frictions affect capital-allocation productivity [23-113]. By contrast, correlations involving the common annual stress measure are interpreted as macro-environment context relevant to AP1 and AP2, not as direct tests of firm-specific MVE or the RECI × MVE channel. Likewise, correlations involving AAQI indicate internal construct coherence rather than AP3 external relevance because AAQI contains oriented versions of its components.

Table 5.4: Pearson Correlation Structure and Evidentiary Relevance

Pair	Coefficient	Significance	Interpretation	Evidentiary relevance
RECI - RAE	-0.481	$p < .01$	Higher concentration is associated with lower efficiency	Direct H1 evidence
RECI - SV	0.342	$p < .01$	Concentration co-moves with annual macro stress	Context for AP1/AP2
RECI - AAQI	-0.326	$p < .01$	Consistent with AAQI orientation	Internal coherence only
RAE - SV	0.218	$p < .01$	Efficiency varies with macro conditions	Context; not MVE effect
RAE - AAQI	0.824	$p < .01$	Strong internal coherence	Not AP3 external relevance
SV - AAQI	0.571	$p < .01$	Strong composite association	Not AP3 external relevance

Diagnostic AAQI Decomposition and Its Limited Role

Table 5.5 preserves the reported pooled, firm fixed-effects, firm-and-year fixed-effects, and robust specifications as a supplementary decomposition of AAQI. RECI remains negative across models (-.291 to -.217), while RAE remains positive and economically dominant (.661-.716). The reported common stress score enters negatively. These results are useful for checking directional coherence, but they are not used as substitutes for the primary H1 model or as evidence that AP1-AP3 have been empirically confirmed. In particular, a common annual stress series is not equivalent to firm-specific MVE, and an AAQI regression on its own ingredients does not constitute external relevance. This distinction is consistent with research showing that leverage and financing structure condition investment and vulnerability [114-116].

Table 5.5: Supplementary AAQI Decomposition (Diagnostic Evidence Only)

Variable	Pooled	Firm FE	Firm + Year FE	Robust SE	Interpretation
RECI	-.291**	-.238**	-.217**	-.217**	Directional coherence with H1
RAE	.716***	.684***	.661***	.661***	Strong positive AAQI component
SV	-.184**	-.161**	-.149*	-.149*	Common-stress component; not MVE
Constant	-.082*	-0.041	-0.036	-0.036	No substantive interpretation
Observations	640	640	640	640	Common analytical sample
R^2 / within R^2	0.681	0.704	0.731	0.731	Diagnostic explanatory coherence

Note: * p < .10; ** p < .05; *** p < .01. This table is preserved as diagnostic decomposition evidence and is not used as a substitute for AP1-AP3 validation.

Robustness of the Primary Concentration-Efficiency Result

Table 5.6 confirms that the concentration ranking is highly stable. Spearman correlations between the PCA baseline and alternative RECI constructions range from .924 to .982. Excluding asset share or revenue share has little effect, while excluding backlog produces the largest, though still moderate, change. More importantly for H1, the RECI-RAE relationship remains negative under every alternative specification (-.442 to -.474). The primary concentration-efficiency result therefore does not depend on one weighting rule or one component. This emphasis on structural stability is consistent with resilience research and evidence that real-estate outcomes differ across operating and sustainability dimensions [117, 118].

Table 5.6: Sensitivity of RECI to Alternative Construction Rules

Specification	Spearman vs. baseline	RECI-RAE	RECI-SV	RAE-AAQI	Assessment
PCA baseline	1	-.481**	.342**	.824**	Reference
Equal weighting	0.97	-.456**	.331**	.817**	Stable
Exclude asset share	0.982	-.469**	.338**	.821**	Stable; low scale dependence
Exclude revenue share	0.971	-.474**	.340**	.823**	Stable; low realization dependence
Exclude backlog share	0.924	-.442**	.319**	.809**	Moderate sensitivity
Exclude sales share	0.959	-.463**	.328**	.816**	Stable

Note: ** p < .01. Stability across alternative RECI specifications provides measurement-robustness evidence for H1.

H1 and Analytical-Proposition Assessment

Table 5.7 aligns the empirical interpretation with the alternative evidentiary design adopted in Chapters Three and Four. H1 is supported by the negative RECI-RAE association and by its stability across alternative concentration specifications. AP1 and AP2 remain analytical extensions: the observed annual SV series documents the common macro-financial environment, but it is not relabelled as firm-specific MVE and no interaction effect is inferred from the existing correlations or AAQI decomposition. AP3 is likewise kept distinct from internal AAQI-component relationships because external relevance must be assessed against an operating outcome outside the index. This separation strengthens the paper by tying the direct empirical claim to the evidence actually reported while preserving MVE, amplification under stress, and external AAQI relevance as transparent extensions of the Allocation Quality Architecture. The interpretation remains consistent with Egyptian evidence linking governance and accounting quality to investment performance and with broader evidence that reporting quality improves investment efficiency in emerging markets [97-119].

Table 5.7: Primary Hypothesis and Analytical-Proposition Assessment

Element	Expected direction / role	Evidence preserved in Chapter 5	Assessment

H1: RECI -> RAE	β1 < 0	RECI-RAE = -.481**; negative across all RECI sensitivity variants	Supported as a robust negative association
AP1: MVE -> RAE	Negative analytical proposition	Annual SV/macro-stress patterns are reported; no SV coefficient is treated as MVE	Analytical extension; not separately confirmed
AP2: RECI × MVE	Negative amplification proposition	No interaction inferred from correlations or AAQI-decomposition tables	Analytical extension; not separately confirmed
AP3: AAQI -> Y(t+1)	Positive external-relevance proposition	AAQI component correlations show internal coherence only	External relevance remains conceptually distinct
Robustness	Stable substantive inference	RECI rank stability .924-.982; RECI-RAE remains negative	Strong support for H1 robustness

Note: The assessment matrix distinguishes the directly tested H1 result from analytical propositions AP1-AP3. No common SV coefficient, interaction proxy, or AAQI-component correlation is re-labelled as separate empirical confirmation.

Discussion and Implications

From One Direct Result to a Broader Allocation Architecture

Chapter Five establishes one direct and robust empirical result and places the remaining relationships within the analytical architecture developed in Chapters Three and Four. The negative RECI-RAE association ($r = -.481$, $p < .01$) and its stability across alternative RECI constructions provide direct support for H1: greater real-estate concentration is associated with weaker resource-allocation efficiency. The implication is not that concentration is intrinsically inefficient, but that sectoral scale must be judged by the productive transformation of the resources it absorbs. This reading is consistent with evidence that credible financial reporting affects real allocation decisions and with composite-indicator research emphasizing measurement quality and interpretability [120, 121]. The supplementary AAQI decomposition is therefore used only as a coherence check and not as a substitute for the analytical propositions AP1-AP3.

Concentration Matters Through the Quality of Resource Transformation

The H1 result is economically plausible because concentration can improve or weaken allocation depending on the mechanisms through which finance and market power operate. Finance can support productive reallocation when it directs capital toward higher-return uses, but it can also reinforce low-productivity allocation when incentives are distorted [122]. Financial-market concentration may amplify misallocation through price-impact feedbacks, whereas informative markets improve the responsiveness of capital to growth opportunities [123, 124]. Capital-market liberalization can raise productivity through pricing and governance channels, while foreign institutional ownership may mitigate agency frictions [125, 126]. Government procurement can likewise support productivity when it strengthens productive capacity rather than dependence [127]. The Egyptian evidence therefore supports a conditional interpretation: concentration becomes economically problematic when resource absorption is not matched by proportional efficiency gains.

Macro-Financial Stress as an Analytical Exposure Extension

Chapter Five documents substantial changes in the common macro-financial environment, particularly during the high-inflation years. In the alternative evidentiary design, these observations inform AP1 and AP2 rather than functioning as separately confirmed hypotheses. AP1 translates common stress into firm-specific MVE through balance-sheet exposure, while AP2 represents the potential RECI × MVE amplification channel. This distinction is economically important because a national shock is shared whereas its incidence depends on leverage, liquidity, debt structure, and refinancing needs. Policy uncertainty can affect investment efficiency differently through financing constraints and financialisation [128]. In real estate, leverage manipulation increases financial risk, property-market liquidity influences secured versus unsecured borrowing, and leverage is priced as a distinct risk factor [129-131]. Regulatory reform also leaves meaningful cross-firm capital-structure variation [132]. Banking evidence similarly shows that CRE stress depends on loan and portfolio characteristics, while conventional exposure measures can understate risk when interest-rate losses are considered [133, 134].

AAQI as Diagnostic Synthesis and External-Relevance Proposition

The strong internal association between RAE and AAQI demonstrates construct coherence, but it does not establish AP3. Because AAQI synthesizes concentration, efficiency, and vulnerability, correlations between AAQI and those components partly reflect the arithmetic of construction. Chapter Five therefore treats the preserved AAQI regressions as supplementary decomposition evidence rather than external validation. AP3 is conceptually distinct: AAQI is economically useful to the extent that it contains incremental information about a subsequent operating outcome outside the index. This separation is consistent with evidence that stronger information environments can improve investment efficiency through reporting quality and that reporting quality is particularly consequential in emerging and frontier markets [135, 136]. The contribution of AAQI is thus its disciplined synthesis of multidimensional allocation information, not a mechanical correlation with its own ingredients.

Accounting Information Becomes Allocation Intelligence

The aligned framework strengthens the accounting contribution. Audited assets, liabilities, revenues, and profits are not merely historical outputs; they reveal resource absorption, utilization,

financing exposure, and the quality of operating transformation. This is consistent with evidence that financial reporting has real effects on investment and resource-use decisions [120]. The distinction between the baseline RECI and the disclosure-sensitive RECI-4 also demonstrates why accounting comparability matters: core audited measures support the principal analysis, while backlog and contracted sales enrich sensitivity analysis without being allowed to dominate the baseline specification. Accounting information therefore becomes allocation intelligence when measurement, exposure, and outcome interpretation remain analytically separate.

Why the Findings Matter for Egypt

The policy implications are particularly relevant to Egypt. The Central Bank of Egypt frames financial stability around the system's ability to sustain efficient resource allocation under shocks and uses stress testing to assess resilience[137]. The IMF emphasizes public-sector financial exposure, crowding-out pressures, stronger private-sector-led growth, and more efficient intermediation, while its Selected Issues analysis highlights efficiency-enhancing investment and fiscal resilience [138, 139]. The OECD identifies weak productivity, low private investment, financing constraints, and competitive-neutrality challenges [140].

Regional evidence likewise points to subdued growth and elevated uncertainty across MENA [141]. International experience shows that real-estate booms can worsen allocative inefficiency , while CRE evidence demonstrates why exposures should be monitored across firms and financiers rather than through sectoral growth alone [142-144].

Integrated Interpretation and Policy Implications

Table 6.1 aligns the discussion with the evidentiary roles established in Chapters Four and Five. The central empirical finding is that concentration should be monitored jointly with resource-allocation efficiency because sectoral expansion can absorb capital without proportionate productive transformation. AP1 and AP2 then provide an analytical route for distinguishing common macro stress from heterogeneous balance-sheet exposure, while AP3 preserves the principle that AAQI should be interpreted as a diagnostic synthesis whose broader usefulness depends on evidence outside its own construction. These distinctions support an Allocation Quality Observatory for Egypt that combines RECI, RAE, exposure indicators, AAQI, and external operating measures in one surveillance framework. Such an observatory would complement conventional growth and investment measures by asking whether capital expansion is accompanied by efficiency, resilience, and observable operating realization. The broader implication for emerging and OIC economies is that development monitoring should focus not only on where resources accumulate, but also on what those resources produce and how that transformation may be exposed to macro-financial stress.

Table 6.1: Integrated Interpretation of H1 and AP1-AP3, Accounting Implications, and Policy Relevance

Evidence block	Chapter 5 evidence	Interpretation in alternative design	Accounting / measurement implication	Policy implication
H1: RECI -> RAE	RECI-RAE = -.481**; negative across all RECI sensitivity variants	Direct support for a negative concentration-efficiency association	Measure concentration separately from operating transformation	Monitor concentration jointly with efficiency
AP1: MVE -> RAE	Common annual SV documents the macro environment; it is not firm-specific MVE	Analytical exposure proposition	Link macro stress conceptually to balance-sheet exposure	Stress-test firms by leverage and financing sensitivity
AP2: RECI × MVE	No interaction is inferred from simple correlations or AAQI decomposition	Analytical amplification proposition	Keep interaction interpretation separate from observed co-movement	Identify where concentration may become more consequential under stress
AAQI internal coherence	RAE-AAQI = .824** and supplementary component decomposition	Evidence of construct coherence, not external relevance	Separate index construction from validation	Use AAQI as a diagnostic surveillance measure
AP3: AAQI -> future operating outcome	Component correlations are not treated as external-relevance evidence	Analytical external-relevance proposition	Connect diagnostic scores to outcomes outside the index	Add forward-looking operating indicators to surveillance
RECI robustness	Rank correlations .924-.982; RECI-RAE remains negative	Strong measurement stability for H1	Report alternative weighting and component exclusions	Use stable concentration measures for trend monitoring

Conclusions and Future Research

Allocation Quality Is the Final Economic Question

This study reframes the Egyptian real-estate debate from the scale of capital absorption to the quality of capital transformation. The strongest empirical conclusion is that concentration and efficiency are not interchangeable: the negative RECI-RAE association is stable across alternative concentration specifications, indicating that greater concentration can coexist with weaker resource-allocation efficiency. The implication is not that concentration is inherently harmful, but that sectoral expansion should be evaluated by what absorbed resources produce. This interpretation is consistent with international evidence showing that business-group structures can influence investment discipline and resource deployment [145, 146].

What the Study Establishes

The study establishes three connected points. First, H1 receives direct support from the negative and robust RECI-RAE relationship. Second, the macro-financial evidence shows that the environment facing real-estate firms changes materially across periods, while AP1 and AP2 specify how common stress may be translated into firm-specific exposure and a potential amplification channel without claiming that those extensions have been separately confirmed by the reported results. Third, the strong internal relationship between RAE and AAQI demonstrates construct coherence, while AP3 preserves the requirement that broader economic relevance be assessed against an outcome outside the index. This distinction is important because investment-efficiency can be specification-sensitive and nonlinear ,while real-estate risk can vary across regimes [147, 148].

The Contribution Is an Integrated Allocation Architecture

The principal contribution is the Allocation Quality Architecture linking RECI, RAE, firm-specific Macro-Financial Vulnerability Exposure (MVE), and AAQI without collapsing their evidentiary roles. RECI identifies where resources accumulate and RAE measures how efficiently they are transformed; this relationship constitutes the empirical core. MVE and the RECI × MVE channel are retained as analytical extensions for exposure and amplification under stress, while AAQI provides a diagnostic synthesis whose external relevance is represented by AP3. This separation prevents common macro stress from being misread as confirmed firm-specific exposure and prevents AAQI from validating itself through its own components. The architecture therefore extends accounting information from retrospective reporting toward resource-allocation intelligence. Its relevance is reinforced by evidence that internal controls, audit quality, and governance shape investment and capital-allocation efficiency [149-151].

From Sector Monitoring to an Allocation Quality Observatory

The practical implication is to complement conventional monitoring of sales, assets, and investment volumes with measures of productive efficiency and financing vulnerability. Digital finance, liquidity conditions, and market instruments can materially affect resource-allocation efficiency, while non-traditional financial intermediation can influence capital utilization and firm value. For Egypt, an Allocation Quality Observatory could integrate RECI, RAE, exposure indicators, AAQI, and external operating measures within a recurring surveillance framework [152-155].

Research Boundaries and Future Directions

The study remains bounded by its focus on listed Egyptian real-estate firms, observational identification, and the construction of composite measures from accounting, market, and macro-financial information. These boundaries define the appropriate scope of generalization rather than weakening the contribution. Future research should empirically develop AP1-AP3 by testing firm-specific vulnerability exposure, the RECI × MVE amplification channel, and the external relevance of AAQI across alternative operating outcomes. The architecture should also be applied to banking, manufacturing, infrastructure, and other capital-intensive sectors and extended to comparable emerging economies.

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