

ASSET LIQUIDITY CONCENTRATION AND ASSET LIQUIDATION STRUCTURE AS PERCENTILE-BASED RISK INDICATORS IN PUBLIC OFFICIALS' WEALTH DISCLOSURE: EVIDENCE FROM INDONESIA

CONCENTRAÇÃO DE LIQUIDEZ DE ATIVOS E ESTRUTURA DE LIQUIDAÇÃO DE ATIVOS COMO INDICADORES DE RISCO BASEADOS EM PERCENTIL NA DIVULGAÇÃO DE PATRIMÔNIO DE FUNCIONÁRIOS PÚBLICOS: EVIDÊNCIAS DA INDONÉSIA

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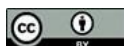
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Abstract

Public sector asset disclosure systems face persistent challenges in converting compliance data into actionable oversight intelligence. This study introduces two preventive forensic accounting measures Asset Liquidity Concentration (ALC) and Asset Liquidity Structure (ALS) analyzed through percentile-based benchmarking to enable risk-stratified governance oversight. Examining the complete population of 992,081 asset disclosure reports from Indonesia's LHKPN system during 2020–2022, the study documents extreme concentration of illiquid assets (median illiquid asset ratio: 95.9%), accompanied by substantial heterogeneity across government sectors and administrative area. Percentile analysis indicates that officials in the upper quartile (P75) hold 99.3% of their assets in illiquid forms, whereas those in the lower quartile (P25) maintain 84.8% illiquidity. Sectoral analysis reveals that executive branch officials exhibit the highest variability in asset liquidity (IQR: 0.174), while legislative officials display the most concentrated illiquid asset profiles (P75: 99.6%). The ALS complexity index (median: 0.614) suggests a level of portfolio diversification that substantially increases verification burdens.

Resumo

Os sistemas de divulgação de ativos do setor público enfrentam desafios persistentes na conversão de dados de conformidade em inteligência de supervisão acionável. Este estudo apresenta duas medidas preventivas de contabilidade forense: Concentração de Liquidez de Ativos (ALC) e Estrutura de Liquidez de Ativos (ALS), analisadas por meio de benchmarking baseado em percentis para permitir a supervisão da governança estratificada por risco. Examinando a população completa de 992.081 relatórios de divulgação de ativos do sistema LHKPN da Indonésia durante 2020-2022, o estudo documenta uma concentração extrema de ativos ilíquidos (rácio mediano de ativos ilíquidos: 95,9%), acompanhada por uma heterogeneidade substancial entre os setores governamentais e a área administrativa. A análise percentual indica que os funcionários no quartil superior (P75) detêm 99,3% dos seus ativos em formas ilíquidas, enquanto os do quartil inferior (P25) mantêm 84,8% de iliquidez. A análise setorial revela que os funcionários do poder executivo apresentam a maior variabilidade na liquidez dos ativos (IQR: 0,174), enquanto os funcionários do poder



Analysis by administrative area further shows that central government officials maintain more complex asset structures (mean ALS: 0.627) compared to regional government officials (mean ALS: 0.626). These percentile-based thresholds facilitate systematic identification of statistical outliers warranting enhanced scrutiny, without presuming misconduct. Overall, the study advances preventive forensic accounting by demonstrating how structural asset characteristics, when assessed using distributional benchmarks, can transform passive compliance systems into active, risk-based governance tools under conditions of limited oversight resources.

Keywords: Asset Liquidity Concentration. Asset Liquidation Structure. Percentile Benchmarking. Preventive Forensic Accounting. Wealth Disclosure. Public Sector Governance. Risk-Based Oversight.

legislativo apresentam os perfis de ativos ilíquidos mais concentrados (P75: 99,6%). O índice de complexidade ALS (mediana: 0,614) sugere um nível de diversificação da carteira que aumenta substancialmente os encargos de verificação. A análise por área administrativa mostra ainda que os funcionários do governo central mantêm estruturas de ativos mais complexas (ALS médio: 0,627) em comparação com os funcionários do governo regional (ALS médio: 0,626).

Palavras-chave: Concentração de Liquidez de Ativos. Estrutura de Liquidação de Ativos. Benchmarking Percentual. Contabilidade Forense Preventiva. Divulgação de Patrimônio. Governança do Setor Público. Supervisão Baseada Em Riscos.

1 INTRODUCTION

Asset disclosure requirements for public officials have become a cornerstone of anti-corruption and integrity frameworks worldwide (OECD, 2011; World Bank Group, 2012). By mandating periodic reporting of financial positions, these systems are intended to reduce information asymmetry, enhance transparency, and deter illicit wealth accumulation (Djankov et al., 2010; Rossi et al., 2017). Over the past two decades, asset disclosure regimes have been widely adopted across both developed and developing economies, positioning disclosure compliance as a central pillar of public sector accountability.

Despite their widespread adoption, a persistent challenge remains: the gap between formal compliance and effective governance oversight. Asset disclosure systems often succeed in collecting large volumes of data, yet struggle to convert these data into actionable oversight intelligence. In Indonesia, the State Officials' Wealth Reporting System (LHKPN) receives nearly one million submissions annually, creating a scale of information that exceeds the analytical and verification capacity of oversight institutions (KPK, 2022). As a result, disclosure compliance does not automatically translate into effective monitoring or risk-informed governance intervention.

Prior research on public sector asset disclosure has predominantly emphasized legal frameworks, institutional design, and compliance behavior (Kolstad & Wiig, 2009; Messick, 2009). A parallel stream of studies has examined asset disclosure data through investigative or enforcement-oriented lenses, often in response to suspected misconduct. While these approaches provide important insights, they offer limited guidance for proactive and resource-efficient governance oversight, particularly in contexts where verification capacity is constrained. Recent developments in forensic accounting scholarship suggest a shift toward preventive and diagnostic functions, positioning forensic tools as mechanisms for governance support rather than solely post hoc investigation (Kranacher et al., 2010); Singleton & Singleton, 2010; (Crumbley et al., 2015).

One structural dimension that remains underexplored in the asset disclosure literature is the composition and liquidity profile of declared assets. Asset liquidity defined as the ease with which assets can be converted into cash without significant value loss fundamentally affects valuation discretion, verification effort, and monitoring complexity (Amihud & Mendelson, 1986; Pástor & Stambaugh, 2003). Unlike absolute measures of wealth, structural indicators capture how assets are configured rather than how much wealth is accumulated, making them particularly suitable for non-accusatory governance analysis (Nigrini, 2012). From an oversight perspective, asset structure may therefore provide early signals of verification burden and monitoring risk without implying wrongdoing.

This study addresses this gap by introducing and empirically validating two preventive forensic accounting measures: Asset Liquidity Concentration (ALC) and Asset Liquidity Structure (ALS). Rather than relying on arbitrary thresholds, the study employs percentile-based benchmarking to enable relative risk stratification. This approach recognizes that governance risk is inherently distributional; officials whose asset structures deviate substantially from sectoral or administrative norms may warrant proportionately greater oversight attention, independent of absolute wealth levels.

Using the complete population of 992,081 asset disclosure reports submitted to Indonesia's LHKPN system during 2020–2022, the study pursues three objectives. First, it characterizes system-wide asset liquidity patterns using ALC, documenting the concentration of liquid and illiquid assets across distributional percentiles. Second, it

assesses portfolio complexity through ALS, capturing diversification patterns that influence informational opacity and verification burden. Third, it demonstrates how percentile-based thresholds can be applied for sectoral and administrative-area benchmarking, enabling systematic identification of statistical outliers that merit enhanced scrutiny without presuming misconduct.

This study contributes to the literature in several important ways. To the best of our knowledge, it represents the first large-scale, population-based empirical analysis of asset liquidity structure and concentration within a national public asset disclosure system. Theoretically, it extends forensic accounting beyond reactive investigation toward proactive governance diagnostics. Methodologically, it demonstrates how percentile benchmarking transforms structural asset indicators into scalable risk-stratification tools. Empirically, it provides the first comprehensive characterization of asset liquidity patterns in a developing country context. Practically, the findings offer oversight institutions and anti-corruption agencies evidence-based methods for allocating limited verification resources more effectively within risk-based governance frameworks.

2 LITERATURE REVIEW AND RESEARCH FRAMEWORK

2.1 Preventive forensic accounting in public sector governance

Forensic accounting traditionally emphasizes fraud detection, investigation, and litigation support (Hopwood et al., 2012; Kranacher et al., 2010). However, contemporary scholarship increasingly recognizes preventive and diagnostic functions that precede misconduct (Crumbley et al., 2015). Preventive forensic accounting employs analytical techniques to identify governance risks, enhance monitoring efficiency, and support evidence-based decision-making without requiring accusatory triggers (Okoye & Gbegi, 2013; Singleton & Singleton, 2010).

In public sector contexts, preventive approaches transform transparency mechanisms from passive compliance exercises into active governance intelligence systems (Nigrini, 2012). Rather than awaiting allegations, preventive analytics enable systematic assessment of structural characteristics affecting monitoring requirements (Albrecht et al., 2015). This paradigm shift is particularly critical in developing countries

where verification capacity systematically lags disclosure volume (Rose-Ackerman & Palifka, 2016).

2.2 Asset disclosure systems: from compliance to intelligence

Asset disclosure systems for public officials have proliferated globally as anti-corruption instruments (OECD, 2011; Rossi et al., 2017). These systems mandate periodic reporting of officials' financial positions including assets, liabilities, income, and expenditures with objectives of deterring illicit enrichment and facilitating public accountability (Trapnell, 2015; World Bank Group, 2012).

Empirical evidence on disclosure effectiveness yields mixed findings. While some studies document associations between disclosure requirements and reduced corruption perceptions (Kolstad & Wiig, 2009), others highlight implementation challenges, particularly where verification capacity remains limited (Djankov et al., 2010; Messick, 2009). A recurring tension emerges: high compliance rates do not automatically translate into effective oversight when analytical capacity remains constrained (UNODC, 2015).

This study repositions asset disclosure data as governance intelligence rather than merely compliance documentation. By analyzing structural characteristics embedded in disclosure patterns, oversight institutions can allocate limited resources more strategically (Janssen & Helbig, 2018; Rossi et al., 2017).

2.3 Asset liquidity and complexity as structural governance indicators

Asset liquidity the ease with which assets convert to cash without significant value loss is well-established in finance literature (Amihud & Mendelson, 1986; Pástor & Stambaugh, 2003). Liquid assets (cash, demand deposits, marketable securities) have objectively verifiable values and transparent pricing mechanisms. Illiquid assets (real estate, vehicles, collectibles, business interests) involve greater valuation discretion, documentation complexity, and verification effort (Goetzmann & Kumar, 2008).

From a governance perspective, asset liquidity concentration affects monitoring complexity. Officials with predominantly illiquid portfolios require intensive verification procedures: property appraisals, ownership documentation review, market comparability

analysis, and beneficial ownership investigation. In contrast, liquid positions can be verified through banking system integration and financial institution reporting (Amihud, 2002).

Similarly, asset composition complexity the degree of diversification across asset categories influences informational opacity. Diversified portfolios spanning multiple categories increase cognitive and administrative burden, as each category may require specialized expertise and distinct verification protocols (Campbell, 2006; Goetzmann & Kumar, 2008).

Critically, neither liquidity concentration nor portfolio complexity inherently indicates misconduct. Instead, these structural characteristics determine resource requirements for effective oversight. Preventive forensic accounting recognizes this distinction, positioning structural indicators as diagnostic tools rather than investigative triggers (Nigrini, 2012); (Crumbley et al., 2015).

2.4 Percentile-based benchmarking in governance analytics

Traditional forensic analytics often employ absolute thresholds to flag anomalies (Nigrini, 2011). However, in public governance contexts, such approaches may inadequately account for legitimate heterogeneity across sectors, administrative area levels, and regional contexts (Janssen & Helbig, 2018). Percentile-based benchmarking addresses this limitation by establishing relative risk thresholds grounded in empirical distributions (Tukey, 1977).

Percentile benchmarks enable several advantages: (1) they accommodate legitimate variation in asset structures across contexts, (2) they identify statistical outliers without presuming misconduct, (3) they support sector-specific and administrative area-specific risk stratification, and (4) they facilitate transparent, evidence-based resource allocation (Albrecht et al., 2015). This approach aligns with contemporary emphasis on proportionate, risk-based oversight in resource-constrained settings (OECD, 2011).

2.5 Conceptual framework

This study adopts a preventive forensic accounting framework positioning asset structure indicators as non-accusatory governance diagnostics. The framework comprises two complementary measures:

1. Asset Liquidity Concentration (ALC): Quantifies the proportion of liquid versus illiquid assets within individual disclosures and across the system. High illiquidity concentration signals greater verification requirements and potential valuation discretion.
2. Asset Liquidation Structure (ALS): Measures portfolio diversification across asset categories, capturing informational opacity. Higher ALS values indicate increased cognitive burden and specialized expertise requirements for verification.

Together, ALC and ALS analyzed through percentile-based benchmarking provide system-level intelligence supporting risk-based resource allocation without individual-level accusation. This approach aligns with evidence-based, proportionate oversight under fiscal and administrative constraints (Janssen & Helbig, 2018; Rose-Ackerman & Palifka, 2016).

3 METHODOLOGY

3.1 Research design and philosophical approach

This study adopts a positivist research paradigm employing a census-based descriptive design (Salkind, 2010). Unlike sampling-based research relying on inferential statistics, we analyze the complete population of asset disclosures, enabling comprehensive system-level assessment without sampling error. The analytical approach is structural and distributional, focusing on percentile-based characterization rather than causal inference.

Positioned within preventive forensic accounting framework (Kranacher et al., 2010; Okoye & Gbegi, 2013), this study emphasizes diagnostic analytics for governance oversight rather than investigative or enforcement purposes. The indicators developed

ALC and ALS are explicitly non-accusatory tools designed to support risk-based resource allocation in monitoring systems.

3.2 Data source and population coverage

3.2.1 Data source

Data derive from Indonesia's electronic State Officials' Wealth Reporting System (e-LHKPN), administered by the Corruption Eradication Commission (Komisi Pemberantasan Korupsi, KPK). The e-LHKPN constitutes a mandatory disclosure system for all public officials across central and regional governments, established under Law No. 28/1999 and strengthened through subsequent regulatory amendments (KPK, 2022).

Use of publicly available administrative data is consistent with established public sector research practices and aligns with transparency and data accessibility principles (OECD, 2011). All individual identifiers have been removed to ensure anonymity while preserving analytical utility.

3.2.2 Population definition and data cleaning

To ensure data quality and analytical consistency, the study applies a systematic data screening process to the full population of asset disclosure reports submitted during the period 2020–2022. Starting from the complete set of reported disclosures, observations that did not meet minimum validity and consistency criteria were excluded prior to analysis. Table 1 summarizes the data screening stages and presents the final study population used in this research.

Table 1*Data Screening and Final Study Population (2020–2022)*

Data Screening Stage	Number of Reports
Total asset disclosure reports submitted (2020–2022)	1,039,829
Less: Reports with missing or zero total assets	32,847
Less: Reports with negative values indicating data errors	8,921
Less: Duplicate submissions	5,98
Final population analyzed	992,081

Source: Author's elaboration based on LHKPN data

3.3 Variable construction and measurement

3.3.1 Asset Liquidity Concentration (ALC)

ALC measures the concentration of asset holdings across liquidity categories. Following Amihud & Mendelson (1986) and Pástor & Stambaugh (2003), we classify assets into liquid and illiquid categories based on convertibility to cash:

- a. Liquid Assets: Cash and equivalents, demand deposits, savings accounts, time deposits, money market instruments, marketable securities (stocks, bonds, mutual funds).
- b. Illiquid Assets: Real estate (land, buildings), vehicles (cars, motorcycles), equipment, livestock, other physical assets, receivables, business interests, and other non-marketable assets.

We compute two complementary ALC measures:

$$\text{Liquid Ratio} = \frac{\text{Liquid Assets}}{\text{Total Assets}} \quad (1)$$

$$\text{Illiquid Ratio} = \frac{\text{Illiquid Assets}}{\text{Total Assets}}$$

Both ratios range from 0 to 1 and sum to 1 for each disclosure. Higher illiquid ratios indicate greater verification complexity and potential valuation discretion.

3.4 Asset Liquidation Structure (ALS)

ALS captures portfolio complexity through diversification across asset categories. Following Goetzmann & Kumar (2008), we construct a normalized index reflecting the degree of asset class diversification:

$$ALS = \frac{(Number\ of\ Asset\ Categories - 1)}{(Maximum\ Categories - 1)} \quad (2)$$

The e-LHKPN system categorizes assets into six main types: (1) Land, (2) Buildings, (3) Vehicles, (4) Other movable assets, (5) Securities and savings, (6) Cash. ALS ranges from 0 (single category) to 1 (all six categories), with higher values indicating greater portfolio complexity and monitoring burden.

3.5 Percentile-based benchmarking methodology

Rather than establishing arbitrary thresholds, we employ empirical percentile distributions to enable relative risk assessment. For each measure (liquid ratio, illiquid ratio, ALS), we compute key percentiles: P10, P25 (first quartile), P50 (median), P75 (third quartile), and P90.

Percentile benchmarks serve multiple functions:

1. Identify statistical outliers (values beyond P90 or below P10) warranting enhanced scrutiny;
2. Establish sector-specific and administrative area-specific normal ranges;
3. Enable comparative risk assessment across government units;
4. Support evidence-based resource allocation without presuming misconduct.

We also compute interquartile ranges ($IQR = P75 - P25$) to measure dispersion and identify sectors or administrative area with greater heterogeneity.

3.6 Analytical strategy

Our analytical strategy proceeds in three stages:

Stage 1: System-Wide Characterization. Compute descriptive statistics and percentile distributions for ALC and ALS across the complete population. Document central tendency, dispersion, skewness, and temporal stability (2020–2022).

Stage 2: Sectoral Benchmarking. Stratify analysis by government sector (BUMN/BUMD, Executive, Legislative, Judiciary) to establish sector-specific percentile benchmarks and identify cross-sectoral heterogeneity.

Stage 3: Administrative Area Benchmarking. Stratify by governmental level (Central, Provincial, District/Municipal) to characterize area patterns and enable level-appropriate risk assessment.

All analyses employ Stata 17 (StataCorp, 2021) for statistical computation and percentile calculations.

4 RESULTS AND DISCUSSION

4.1 Results

4.1.1 System-wide asset liquidity concentration patterns

Table 2 presents the distributional characteristics of asset liquidity concentration across the complete population of 992,081 disclosures. The results reveal extreme illiquidity concentration in Indonesian public officials' declared assets. The median official holds only 4.06% of total assets in liquid form, with 95.94% concentrated in illiquid assets. This pattern demonstrates remarkable consistency: the mean illiquid ratio (87.6%) substantially exceeds the liquid ratio (12.4%), indicating systemic preference for illiquid asset holdings.

Table 2*Percentile Distribution of Asset Liquidity Concentration Ratios*

Percentile	Liquid Ratio	Illiquid Ratio
P10	0.0003	0.6346
P25	0.0074	0.8480
P50 (Median)	0.0406	0.9594
P75	0.1520	0.9926
P90	0.3654	0.9997
Mean	0.124	0.876
IQR (P75-P25)	0.1446	0.1446

Source: Author's elaboration based on LHKPN data

Percentile analysis reveals substantial right-skewness in liquidity distribution. While the bottom quartile (P25) maintains only 0.74% liquid assets, the top quartile (P75) holds 15.2% in liquid form a 20-fold difference. The P90 threshold (36.5% liquid) identifies officials whose portfolios deviate markedly from modal patterns. The interquartile range (IQR = 0.1446) indicates moderate dispersion, suggesting that while extreme illiquidity dominates, meaningful heterogeneity exists for risk stratification purposes.

4.1.2 Asset liquidation structure complexity

Table 3 presents the distributional characteristics of portfolio complexity as measured by the Asset Liquidation Structure (ALS) index. The median ALS value of 0.614 indicates that typical officials declare assets spanning approximately 60% of available categories. This moderate diversification level suggests non-trivial portfolio complexity requiring multi-category verification expertise.

Table 3*Percentile Distribution of Asset Liquidation Structure Index*

Percentile	ALS Index
P10	0.390
P25	0.483
P50 (Median)	0.614
P75	0.779
P90	0.909
Mean	0.632
IQR (P75-P25)	0.296

Source: Author's elaboration based on LHKPN data

The percentile distribution shows meaningful variation: the bottom quartile (P25 = 0.483) declares assets in approximately half of available categories, while the top quartile (P75 = 0.779) spans nearly 80% of categories. The P90 threshold (0.909) identifies officials with highly diversified portfolios requiring comprehensive multi-specialty verification. The substantial IQR (0.296) indicates that portfolio complexity varies considerably, enabling stratified oversight resource allocation.

4.1.3 Sectoral percentile benchmarking

Table 4 presents sector-specific percentile benchmarks for illiquid asset concentration, revealing systematic heterogeneity across government sectors. Executive branch officials demonstrate the highest liquidity variability (IQR = 0.174), suggesting diverse asset management strategies within this sector. In contrast, legislative officials exhibit the most concentrated illiquid profiles (P75 = 99.6%), indicating near-universal preference for illiquid holdings.

Table 4

Sectoral Percentile Benchmarks: Illiquid Asset Concentration

Sector	P25	P50	P75	Mean	IQR
BUMN/BUMD	0.037	0.130	0.302	0.463	0.265
Executive	0.010	0.052	0.184	0.360	0.174
Legislative	0.005	0.029	0.119	0.506	0.114
Judiciary	0.008	0.045	0.166	0.233	0.158

Source: Author's elaboration based on LHKPN data

BUMN/BUMD officials demonstrate substantially lower illiquidity concentration (median = 13.0%) compared to other sectors, likely reflecting compensation structures that include equity-based instruments and performance-linked securities. The substantial sectoral heterogeneity documented validates the percentile benchmarking approach: sector-blind thresholds would misclassify officials whose asset structures align with sectoral norms.

4.1.4 Administrative area percentile benchmarking

Table 5 presents percentile benchmarks of Asset Liquidity Structure (ALS) stratified by administrative area of government. Central government officials exhibit moderately more complex asset structures (mean ALS = 0.627) compared to provincial (0.634) and district/municipal officials (0.626). Nevertheless, all three administrative areas display substantial within-group heterogeneity, as reflected in their comparable interquartile range (IQR) values.

Table 5

Administrative Area Percentile Benchmarks: Asset Liquidation Structure

Administrative Area	P25	P50	P75	Mean	IQR
Central Government	0.077	0.045	0.165	0.627	0.088
Provincial Government	0.076	0.045	0.165	0.634	0.089
District/Municipal	0.077	0.044	0.163	0.626	0.086

Source: Author's elaboration based on LHKPN data

The relatively modest differences across administrative areas suggest that portfolio complexity patterns are more strongly determined by sectoral affiliation than by administrative area distinctions. This finding validates sector-specific benchmarking as the primary stratification dimension, with administrative area benchmarking serving a supplementary role in the analytical and oversight framework.

4.2 Discussion

4.2.1 Extreme illiquidity concentration and governance implications

The documented extreme illiquidity concentration with median officials holding 95.9% of assets in illiquid forms carries significant governance implications. This pattern substantially exceeds illiquidity levels observed in household financial portfolios in developed economies (Campbell, 2006) and emerging markets (Goetzmann & Kumar, 2008). While cultural preferences, limited financial market access, and real estate-centric wealth accumulation may partially explain these patterns (Guiso et al., 2003), the systematic nature suggests structural implications for oversight capacity.

From a preventive forensic accounting perspective, widespread illiquidity concentration generates several challenges. First, illiquid assets require specialized valuation expertise that may exceed oversight agencies' internal capacity, necessitating external appraisals that increase costs and time requirements (Amihud, 2002). Second, valuation discretion inherent in illiquid assets creates information asymmetry that complicates anomaly detection (Pástor & Stambaugh, 2003). Third, ownership verification for illiquid assets demands cross-institutional coordination (land registries, vehicle departments, corporate databases) that resource-constrained agencies may struggle to sustain systematically.

However, the substantial percentile-based variation documented with top quartile officials maintaining 99.3% illiquidity versus bottom quartile 84.8% enables proportionate resource allocation. Officials in the top decile (P90 = 99.97% illiquidity) warrant enhanced scrutiny not because extreme illiquidity inherently signals misconduct, but because verification complexity increases disproportionately with illiquidity concentration. This distinction—between structural risk indicators and investigative triggers is central to preventive forensic accounting's non-accusatory governance function (Nigrini, 2012).

4.2.2 Portfolio complexity as informational opacity indicator

The median ALS value of 0.614 indicates that typical officials declare assets spanning approximately 60% of available categories, reflecting moderate portfolio diversification. This complexity level necessitates multi-category verification protocols, increasing cognitive burden on oversight personnel (Goetzmann & Kumar, 2008). The percentile analysis reveals that officials in the top quartile (P75 = 0.779) maintain portfolios spanning nearly 80% of categories, while top decile officials (P90 = 0.909) approach maximum diversification.

Portfolio complexity warrants governance attention for three reasons. First, each additional asset category potentially requires distinct verification expertise real estate appraisers for land holdings, automotive specialists for vehicle valuations, securities analysts for marketable instruments (Albrecht et al., 2015). Resource-constrained agencies may lack comprehensive in-house expertise across all categories. Second,

complex portfolios increase opportunities for valuation manipulation through cross-category asset shifting that exploits verification specialists' limited holistic perspective (Campbell, 2006). Third, complexity itself may signal sophisticated financial management capacity that merits proportionate oversight rigor.

The percentile benchmarking approach enables stratified responses: officials above P75 ($ALS > 0.779$) receive comprehensive multi-specialty verification, those between P25–P75 undergo category-focused verification emphasizing higher-value holdings, while those below P25 ($ALS < 0.483$) receive streamlined verification appropriate to simpler portfolios. This stratification optimizes limited verification capacity allocation without presuming that complexity indicates misconduct.

4.2.3 Sectoral heterogeneity and context-appropriate benchmarking

The substantial sectoral heterogeneity documented particularly BUMN/BUMD officials' markedly lower illiquidity (median = 13.0%) compared to other sectors validates sector-specific percentile benchmarking. BUMN/BUMD compensation structures frequently include equity instruments, performance-linked securities, and stock option plans that naturally increase liquid asset holdings (OECD, 2011). Applying sector-blind thresholds would systematically misclassify BUMN/BUMD officials whose asset structures align with sectoral norms.

Conversely, legislative officials demonstrate extreme illiquidity concentration (P75 = 99.6%), potentially reflecting lower base salaries supplemented by allowances that officials channel toward real estate investments (Rossi et al., 2017). The executive branch's highest liquidity variability (IQR = 0.174) likely reflects heterogeneous positions spanning technical specialists with conventional salaries to senior executives with complex compensation packages.

These sector-specific patterns demonstrate that effective percentile benchmarking requires stratification by institutional context. Officials whose asset structures exceed their sector's P90 threshold merit enhanced scrutiny, while those conforming to sectoral norms even if deviating from system-wide patterns do not. This approach acknowledges legitimate structural heterogeneity while identifying statistically anomalous cases warranting verification resource prioritization.

4.3 Percentile benchmarking as risk-based governance tool

The percentile-based approach demonstrated here addresses a fundamental challenge in public sector governance: allocating limited oversight resources without presuming misconduct. Traditional approaches either verify all disclosures uniformly (resource-prohibitive) or apply absolute thresholds (context-insensitive). Percentile benchmarking enables a third approach: *relative risk assessment* that identifies statistical outliers while acknowledging legitimate variation (Albrecht et al., 2015; Janssen & Helbig, 2018).

Consider an executive branch official with illiquid ratio of 0.95 (95%). While this appears extreme in absolute terms, it falls near the sectoral median (P50 = 0.948 for executive), suggesting normative patterns within that context. In contrast, a BUMN/BUMD official with identical 0.95 illiquidity substantially exceeds sectoral norms (P90 = 0.698), warranting enhanced scrutiny. Percentile benchmarking enables this context-sensitive distinction.

Operationally, oversight agencies can implement tiered verification protocols:

- a. Tier 1 (Below P25): Streamlined verification focusing on completeness and internal consistency;
- b. Tier 2 (P25–P75): Standard verification with category-specific expertise as needed;
- c. Tier 3 (P75–P90): Enhanced verification including comprehensive documentation review;
- d. Tier 4 (Above P90): Intensive verification with external expertise and cross-institutional coordination.

This stratification enables systematic resource allocation grounded in empirical risk indicators rather than arbitrary thresholds or individual suspicion (OECD, 2011; Rose-Ackerman & Palifka, 2016).

4.3.1 Limitations and future research directions

Several limitations warrant acknowledgment. First, this study employs cross-sectional analysis of three years' data; longitudinal tracking of individual officials' asset

trajectories over extended periods could reveal additional governance-relevant patterns. Second, asset values are self-reported without independent verification; percentile analysis of discrepancies between declared and verified values where verification occurs could enhance risk assessment. Third, beneficial ownership structures and complex asset arrangements may not be fully captured in current disclosure categories.

Fourth, while percentile benchmarking identifies statistical outliers, it cannot definitively distinguish legitimate variation from misconduct. Enhanced verification of high-percentile cases may reveal entirely legitimate asset structures that deviate from norms for valid reasons. Percentile benchmarking should thus be positioned as resource allocation tool rather than accusatory instrument.

Future research could extend this framework in several directions: (1) longitudinal percentile analysis tracking temporal shifts in individuals' positions within distributions, (2) integration with lifestyle expenditure analysis to identify wealth-income inconsistencies, (3) network analysis examining asset concentration patterns among connected officials, and (4) experimental evaluation of percentile-based verification protocols' effectiveness in detecting undisclosed wealth.

5 CONCLUSION

This study introduces Asset Liquidity Concentration (ALC) and Asset Liquidation Structure (ALS) as preventive forensic accounting measures for public sector governance, demonstrating their application through percentile-based benchmarking. Analyzing 992,081 asset disclosures from Indonesia's LHKPN system (2020–2022), we document extreme illiquidity concentration (median 95.9%), substantial portfolio complexity (median ALS 0.614), and significant sectoral heterogeneity that validates context-specific benchmarking.

Percentile benchmarking enables several practical applications. First, it supports tiered verification protocols that allocate intensive resources to statistical outliers (above P90) while maintaining proportionate oversight for normative cases. Second, sector-specific and administrative area-specific benchmarks accommodate legitimate structural variation without compromising anomaly detection. Third, percentile distributions

provide transparent, empirically grounded criteria for resource allocation that withstand scrutiny better than arbitrary thresholds.

Theoretically, this study extends forensic accounting beyond investigative applications toward preventive governance functions. ALC and ALS, analyzed through distributional benchmarks, transform passive compliance data into active governance intelligence. This approach acknowledges that effective oversight under resource constraints requires strategic prioritization grounded in structural risk indicators rather than universal verification or reactive investigation.

For anti-corruption agencies and oversight institutions in resource-constrained settings, percentile-based structural indicators offer evidence-based methods for converting high-volume disclosure data into actionable oversight intelligence. While these measures cannot replace investigative capacity, they enable systematic identification of cases warranting enhanced scrutiny without presuming misconduct a critical distinction in governance contexts requiring proportionate, non-accusatory oversight.

The extreme illiquidity and moderate complexity documented in Indonesian public officials' disclosed assets underscore the magnitude of verification challenges facing governance systems. Percentile benchmarking provides one pathway toward addressing these challenges through strategic resource allocation informed by empirical risk indicators. As asset disclosure systems proliferate globally, preventive forensic accounting frameworks positioning structural indicators as governance tools rather than investigative triggers offer promising approaches for enhancing accountability under realistic capacity constraints.

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Authors’ Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study’s findings are fully available within the article.

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