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AML/CFT risk Management and Bank Profitability: a Covariance-Based Assessment Framework for Azerbaijan

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Abstract. This paper develops a covariance-based framework for incorporating anti-money laundering and counter-terrorist financing (AML/CFT) risk into bank profitability assessment. AML/CFT obligations generate direct compliance expenditure, while inadequate controls may produce regulatory, operational, reputational and correspondent-banking losses. The framework treats credit, liquidity, operational and AML/CFT compliance risks as interdependent components of a bank-wide risk portfolio, represents their joint effect through a variance-covariance matrix, and links it to risk-adjusted profitability. The study is conceptual and scenario-based: it neither assigns unobservable AML/CFT risk scores to Azerbaijani banks nor claims causal estimates. It instead specifies measurable variables, equations and a future empirical protocol. The model indicates a potentially non-linear profitability effect: stronger controls raise current operating costs but may reduce expected losses from sanctions, remediation, reputational damage and de-risking. Azerbaijan is a relevant setting because institutional assessments identify banking as an important risk-bearing sector while comparable public bank-level AML/CFT outcome data remain limited. The paper offers a transparent methodological bridge between AML/CFT management, multivariate risk analysis and bank profitability research.

Keywords: AML/CFT risk, bank profitability, covariance matrix, compliance risk, operational risk, risk-adjusted return.

1. INTRODUCTION

Banks perform an intermediary function under several simultaneous constraints. They must generate sustainable returns, preserve capital and liquidity, manage credit and market exposures, and protect the integrity of the financial system. Anti-money laundering and counter-terrorist financing requirements are therefore not a separate legal formality. They form part of bank-wide risk management because a weakness in customer due diligence, transaction monitoring, sanctions screening or suspicious transaction reporting can be transmitted into financial loss, operational disruption and

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reputational damage.

The Financial Action Task Force (FATF) places the risk-based approach at the centre of AML/CFT systems. Banks are expected to identify, assess and understand their money-laundering and terrorist-financing exposure and apply controls proportionate to the identified risk [1]. The Basel Committee similarly defines compliance risk through the possibility of legal or regulatory sanctions, material financial loss and loss of reputation resulting from failure to comply with applicable rules and standards [2]. Both approaches imply that AML/CFT risk cannot be evaluated only through the formal existence of policies. It should be assessed through exposure, control effectiveness, residual risk and potential economic consequences.

The profitability effect is ambiguous. Expenditure on specialised staff, screening databases, monitoring software, data remediation, training and independent assurance reduces current income. Conversely, weak controls may create much larger future losses through penalties, restrictions, remediation programmes, termination of correspondent relationships, customer attrition and management distraction. Accordingly, either maximal control expenditure or minimal compliance expenditure may be inefficient. The relevant problem is the selection of a control intensity that limits expected loss without producing disproportionate cost or indiscriminate de-risking.

This paper develops a conceptual framework that connects AML/CFT risk management with the multivariate logic of portfolio risk. Markowitz demonstrated that the risk of a portfolio depends not only on the variance of each component but also on the covariance among components [3]. The present study transfers that insight from financial assets to an integrated set of banking risks. The objective is not to claim that non-financial risks are tradable assets; it is to provide a disciplined aggregation mechanism that recognises their dependence. The resulting framework is designed for Azerbaijan, where the banking sector has been identified as a relevant sector in national ML/TF risk assessment, but publicly available bank-level outcome measures remain insufficient for causal estimation [4].

2. LITERATURE REVIEW

The literature suggests that AML/CFT regulation affects financial institutions through both cost and risk channels. Balani's event-study analysis found that different United

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States AML regulatory events produced different valuation effects, indicating that markets may price both the benefits of stronger oversight and the burden of compliance [5]. Nobanee and Ellili used content analysis to construct an AML disclosure measure for banks and reported that disclosure on bank websites exceeded disclosure in annual reports [6]. Their approach is relevant to emerging markets, but it also demonstrates a crucial distinction: public disclosure measures transparency, not necessarily the underlying level of ML/TF exposure or control effectiveness.

The regulatory incentive structure may also produce inefficient behaviour. Takáts formalised the 'crying wolf' problem: when expected penalties encourage excessive suspicious-activity reporting, the informational value of individual reports can fall [7]. This result is important for profitability analysis because an increase in the volume of controls or reports is not automatically equivalent to an increase in effectiveness. Poorly calibrated monitoring generates false positives, investigation workload and customer friction, all of which consume resources without necessarily reducing residual risk.

Reputational and operational channels strengthen the case for an integrated model. Fiordelisi, Soana and Schwizer show that reputational damage following operational losses is related to bank characteristics, including profits, size and capitalisation [8]. AML/CFT failures frequently originate in operational processes but can subsequently affect funding access, franchise value and customer confidence. Treating the associated losses as independent therefore understates tail exposure.

A separate strand of literature considers de-risking. FATF has clarified that the risk-based approach requires case-by-case management rather than the wholesale termination of customer categories [9]. Pavlidis argues that disproportionate implementation can contribute to financial exclusion and other unintended consequences [10]. For banks, excessive de-risking may reduce compliance exposure in the short run, yet it can also eliminate legitimate fee income, shrink the customer base and move financial activity outside regulated channels. Thus, both under-compliance and over-compliance may reduce risk-adjusted profitability.

The portfolio literature provides the mathematical foundation for combining these channels. In a mean-variance setting, total risk reflects individual variances and

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pairwise covariances. The application proposed here differs from classical security selection because the bank cannot freely trade or eliminate its legal obligations. Nevertheless, covariance remains useful for identifying whether AML/CFT losses tend to intensify when credit, liquidity or operational conditions deteriorate. The framework therefore uses portfolio theory as an aggregation analogy and not as a claim that all risk categories share identical probability distributions.

3. MATERIALS AND METHODS

The study uses conceptual modelling, structured synthesis of international standards and scenario analysis. No confidential information, individual suspicious transaction reports or internal bank ratings are used. The country context is drawn from publicly available institutional assessments. Azerbaijan's national risk assessment process identified tax-related crime, corruption, drug trafficking and smuggling among important predicate-crime categories and identified banking, real estate and legal-person transactions as comparatively risky sectors [4]. MONEYVAL's fifth-round assessment and subsequent follow-up materials provide the external institutional context, while not supplying a public, comparable AML/CFT risk score for each bank [11].

The unit of analysis is a bank-period. Four risk blocks are defined: credit risk (CR), liquidity risk (LR), operational risk (OR), and AML/CFT compliance risk (AR). AR is defined as the expected economic consequence of inadequate or inefficient AML/CFT risk management, including direct compliance expenditure and expected losses associated with control failure. It is not equivalent to the amount of illicit money potentially passing through a bank.

Table 1

Transmission of AML/CFT risk into bank profitability

AML/CFT channel	Immediate effect	Risk interaction	Profitability consequence
Compliance resources	Staff, systems, data and assurance costs	Operational risk and cost efficiency	Higher operating expenses; potentially lower future loss
Control failure	Missed high-risk activity or deficient due diligence	Operational and legal risk	Expected penalties, remediation and investigation cost

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Table continuation 1

AML/CFT channel	Immediate effect	Risk interaction	Profitability consequence
Reputational event	Adverse publicity and loss of confidence	Liquidity and franchise risk	Deposit/customer attrition; higher funding cost
Correspondent restriction	Reduced access to cross-border channels	Liquidity and strategic risk	Lower fee income and payment capacity
Excessive de-risking	Termination of legitimate relationships	Strategic and conduct risk	Lost revenue and financial-exclusion effects
Credit-quality channel	Hidden ownership or illicit cash-flow dependence	Credit and concentration risk	Higher expected credit loss and NPL pressure

Source: Developed by the author from FATF [1, 9], BCBS [2] and the reviewed literature [5–10].

3.1. Risk vector and covariance structure

For bank i in period t , the standardised risk vector is defined as:

$$r_{it} = [CR_{it}, LR_{it}, OR_{it}, AR_{it}]^T \tag{1}$$

Standardisation is required because the components may initially be expressed in different units. Credit risk may be represented by the NPL ratio or expected credit loss; liquidity risk by liquidity gaps or funding concentration; operational risk by loss-event frequency and severity; and AML/CFT risk by validated residual-risk indicators and realised compliance-loss measures. If only disclosure data are available, the resulting variable must be labelled an AML/CFT disclosure index and must not be interpreted as residual risk.

The covariance between two risk components j and k is:

$$\text{Cov}(r_j, r_k) = E[(r_j - \mu_j)(r_k - \mu_k)] \tag{2}$$

The integrated variance-covariance matrix is represented as:

$$\Sigma = \begin{bmatrix} [\sigma^2_{CR}, \sigma_{CR,LR}, \sigma_{CR,OR}, \sigma_{CR,AR}], & [\sigma_{LR,CR}, \sigma^2_{LR}, \sigma_{LR,OR}, \sigma_{LR,AR}], \\ [\sigma_{OR,CR}, \sigma_{OR,LR}, \sigma^2_{OR}, \sigma_{OR,AR}], & [\sigma_{AR,CR}, \sigma_{AR,LR}, \sigma_{AR,OR}, \sigma^2_{AR}] \end{bmatrix} \tag{3}$$

The diagonal elements measure the variance of each risk block; the off-diagonal elements measure their co-movement.

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A positive covariance between AR and OR, for example, represents the proposition that AML/CFT control failures and operational losses may intensify together because both depend on data quality, governance, technology and staff capability.

3.2. Integrated risk and profitability equations

Let w denote a vector of risk weights reflecting economic exposure, risk appetite or validated internal capital allocation. The variance of the integrated banking-risk portfolio is:

$$\sigma^2_{BRP} = w^T \Sigma w \tag{4}$$

For four risk blocks, equation (4) contains four weighted variance terms and six pairwise covariance terms. Diversification reduces aggregate volatility only when correlations are sufficiently low. In AML/CFT, some dependencies are structural; for example, inadequate customer data can simultaneously impair credit underwriting, sanctions screening and transaction monitoring. Such common drivers limit diversification benefits.

Expected AML/CFT-related economic cost is decomposed as follows:

$$E(C_{AML}) = C_D + p_{RLR} + p_{REPLREP} + p_{CBLCB} + p_{OPLop} \tag{5}$$

where C_D is direct compliance expenditure; p_{RLR} is expected regulatory and remediation loss; $p_{REPLREP}$ is expected reputational loss; p_{CBLCB} is expected correspondent-banking or de-risking loss; and p_{OPLop} is the AML/CFT-attributable part of operational loss. Probabilities and loss severities must be estimated from validated internal or external event data. They must not be assigned arbitrarily to individual banks.

Risk-adjusted return on assets can then be expressed as:

$$RAROA = \frac{NI - E(C_{AML}) - \lambda \cdot Cov_{AML}}{AA} \tag{6}$$

where NI is net income before the AML/CFT economic adjustment, AA is average assets, λ is a prudently calibrated risk-aversion or capital-conversion parameter, and Cov_{AML} summarises weighted covariance terms involving AR. The equation distinguishes current compliance cost from expected failure loss and from dependence with other risk categories.

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3.3. Scenario protocol and empirical roadmap

In the absence of consistent bank-level AML/CFT outcome data, the framework should first be used as a scenario tool. Scenarios are directional configurations rather than claims about a named bank. A future empirical application should replace scenario assumptions with observed time-series or loss-event data.

Table 2

Scenario structure for applying the framework

Scenario	Control position	Expected covariance pattern	Interpretation
Preventive investment	Higher current control expenditure; improving data and monitoring	AR-OR covariance declines over time	Short-run cost pressure with potential long-run loss reduction
Control weakness	Low preventive expenditure; high residual exposure	Positive AR-OR and AR-reputation dependence	Reported profit may overstate sustainable risk-adjusted return
Reputational stress	Public compliance event and customer concern	AR co-moves with liquidity and funding risk	Non-linear loss through funding and franchise channels
Over-compliance	Broad customer exits and excessive alerts	Lower selected exposure but higher strategic/conduct cost	Risk reduction may be offset by revenue loss and inefficiency

Source: Author’s conceptual scenarios; no bank-specific numerical values are assumed.

For empirical implementation, a minimum multi-year bank-level dataset should contain profitability measures (ROA, ROE and net interest margin), conventional controls (size, capital adequacy, liquidity, NPL and cost-to-income ratio), direct AML/CFT resource measures, residual-risk ratings, alert and case-quality indicators, realised remediation costs, and correspondent-banking events. Fixed-effects or dynamic panel estimation may subsequently test profitability associations, while the covariance matrix should be estimated using consistently defined and sufficiently frequent observations. Robustness analysis should use alternative risk weights, winsorisation, lag structures and rank correlations.

4. ANALYTICAL RESULTS

Because the paper is conceptual, its results take the form of model-derived propositions rather than estimated

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coefficients. This distinction is necessary: numerical findings without observable bank-level AML/CFT outcomes would create false precision.

First, AML/CFT control intensity has a potentially non-linear relationship with profitability. At a low control level, additional investment may reduce expected regulatory and reputational loss more than it increases operating cost. Beyond an effectiveness threshold, poorly targeted controls may generate excessive alerts, duplicate reviews and unnecessary customer exits. The economically relevant objective is therefore not the minimisation of compliance expenditure but the minimisation of total expected AML/CFT-related economic cost.

Second, covariance can materially change the assessment of risk-adjusted return. A bank may appear adequately protected when each risk is reviewed independently, yet remain vulnerable if the same data-quality or governance weakness drives several risks. Positive AR-OR covariance raises aggregate risk even when the standalone variance of AR appears moderate. Similarly, an AML/CFT event that damages reputation may increase withdrawal sensitivity or funding cost, creating positive dependence between AR and LR.

Third, diversification has limits. Markowitz diversification is effective when exposures do not move together. In the present setting, merely distributing AML/CFT responsibilities among business lines does not diversify risk if all lines rely on the same customer master data, screening engine or governance process. Genuine resilience requires different controls, independent testing, escalation capacity and credible contingency arrangements.

Fourth, accounting profitability and economic profitability may diverge. Current-period ROA can be higher when preventive expenditure is deferred, while expected future loss simultaneously rises. Equation (6) makes this divergence explicit by deducting both expected AML/CFT cost and covariance-related risk. The framework therefore supports a longer-term interpretation of profitability consistent with sustainable banking rather than a single-period cost-minimisation approach.

Fifth, public disclosure cannot substitute for residual-risk data. Published policies support transparency analysis [6], but neither silence proves absence of control nor detailed disclosure proves operating effectiveness. A disclosure index should populate AR only when conclusions are explicitly limited to transparency.

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5. DISCUSSION

The framework integrates AML/CFT with bank management without reducing the subject to a legal checklist. Control decisions should be evaluated against total expected cost. Better customer data may simultaneously improve credit assessment, fraud prevention, sanctions screening and transaction monitoring, while weak data governance can create correlated failures across several risk categories.

For Azerbaijan, this approach is relevant for three reasons. First, the national risk assessment recognises the banking sector as an important channel of exposure [4]. Second, MONEYVAL has evaluated the effectiveness and technical compliance of the national framework [11]. Third, publicly available information is not yet sufficient to estimate comparable bank-level residual-risk series. A conceptual framework with an explicit data roadmap is therefore more defensible than assigning unsupported scores to banks.

The model is consistent with proportionality: the risk-based approach is not a zero-failure model [1], and resources should follow material exposure, control effectiveness and expected loss rather than the raw number of alerts or customer exits. Important limitations remain. Covariance is sensitive to frequency, structural breaks and short series; AML/CFT losses may be heavy-tailed; and reputational loss is difficult to isolate. Linear covariance may therefore understate extreme joint events. Future work should compare it with stress testing, expected shortfall, copulas or Bayesian networks and should validate all risk weights. An empirical extension should use an anonymised bank-year panel to distinguish immediate compliance cost from avoided operational, funding and reputational loss. Until then, the scenarios support analytical comparison, not bank ranking.

6. CONCLUSIONS

The paper develops a covariance-based framework that treats AML/CFT compliance risk as an interdependent component of bank-wide risk. It identifies direct compliance expenditure, regulatory and remediation loss, reputational damage, correspondent restrictions and operational loss as profitability channels. The effect of control intensity is potentially non-linear, while positive covariance with operational, liquidity and credit risks can amplify aggregate loss. Public disclosure cannot substitute for validated residual-risk information.

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For Azerbaijan, the research priority is a consistent data architecture separating inherent risk, control effectiveness, residual risk, realised loss and compliance resources. The paper claims no bank-specific causal effect and uses no invented AML/CFT score. Its contribution is a testable methodological link between AML/CFT management, multivariate risk analysis and sustainable bank profitability.

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References:

- [1] Financial Action Task Force. Guidance for a Risk-Based Approach: The Banking Sector. Paris: FATF; 2014. Available at: <https://www.fatf-gafi.org/en/publications/Fatfrecommendations/Risk-based-approach-banking-sector.html>
- [2] Basel Committee on Banking Supervision. Compliance and the Compliance Function in Banks. Basel: Bank for International Settlements; 2005. Available at: <https://www.bis.org/publ/bcbs113.htm>
- [3] Markowitz H. Portfolio selection. The Journal of Finance. 1952;7(1):77–91. <https://doi.org/10.1111/j.1540-6261.1952.tb01525.x>
- [4] Financial Monitoring Service of the Republic of Azerbaijan. Process of national risk assessment in the field of AML/CFT carried out in the Republic of Azerbaijan. 2022. Available at: <https://fiu.gov.az/en/blog/215>
- [5] Balani H. Assessing the introduction of anti-money laundering regulations on bank stock valuation: an empirical analysis. Journal of Money Laundering Control. 2019;22(1):76–88. <https://doi.org/10.1108/JMLC-03-2018-0021>
- [6] Nobanee H, Ellili NOD. Anti-money laundering disclosures and banks' performance. Journal of Financial Crime. 2018;25(1):95–108. <https://doi.org/10.1108/JFC-10-2016-0063>
- [7] Takáts E. A theory of 'crying wolf': the economics of money laundering enforcement. Journal of Law, Economics, and Organization. 2011;27(1):32–78. <https://doi.org/10.1093/jleo/ewp018>
- [8] Fiordelisi F, Soana MG, Schwizer P. The determinants of reputational risk in the banking sector. Journal of Banking & Finance. 2013;37(5):1359–1371. <https://doi.org/10.1016/j.jbankfin.2012.04.021>
- [9] Financial Action Task Force. FATF clarifies risk-based approach: case-by-case, not wholesale de-risking. Paris: FATF; 2014. Available at: <https://www.fatf-gafi.org/en/publications/Fatfgeneral/Rba-and-de-risking.html>
- [10] Pavlidis G. The dark side of anti-money laundering: mitigating the unintended consequences of FATF standards. Journal of Economic Criminology. 2023;2:100040. <https://doi.org/10.1016/j.jeconc.2023.100040>
- [11] MONEYVAL. Anti-money laundering and counter-terrorist financing measures: Azerbaijan, Fifth Round Mutual Evaluation Report. Strasbourg: Council of Europe; 2024. Available at: <https://www.fatf-gafi.org/en/publications/Mutualevaluations/Azerbaijan-MER-2023.html>