

FLUIDCLUSTER & ECOMPENSA 2.0

FINANCIAL RECONSTRUCTION MONOGRAPH:

DEBT-TO-EQUITY SWAPS AND ABCP RESTRUCTURING

Abstract: Under the legal framework of Portuguese Decree-Law no. 150/2019, voluntary credit clearing provides a robust mechanism to extinguish bilateral and circular liabilities without cash mobilization. This white paper explores the ultimate realization of the Ecompensa 2.0 ecosystem: the absolute elimination of fiat currency and debt-based accounting. By converting un-netted residual deltas (Model 5 Set-Off) into Asset-Backed Commercial Paper (ABCP) and tokenized common stock on Zama's Fully Homomorphic Encryption Virtual Machine (fhEVM), the network establishes a zero-debt, asset-based sovereign economy. Backed by the national Mutual Guarantee System (SNGM), these instruments isolate risk, compress Weighted Average Cost of Capital (WACC), and incentivize productive economic agents in total privacy.

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RESEARCH PARTNERS: FLUIDCLUSTER SOVEREIGN SYSTEMS DESIGN STUDIO

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1. Introduction: The Portuguese Liquidity Paradox

European small-and-medium enterprises (SMEs) are chronically constrained by mercantile payment gridlock, with over EUR 97.5 Billion in working capital permanently trapped in outstanding accounts-payable and accounts-receivable (AP/AR) circles. Standard commercial banking systems fail to resolve this bottleneck, instead offering high-cost factoring and debt financing that further inflates and destabilizes corporate balance sheets. In Portugal, the promulgation of Decree-Law no. 150/2019 established the Electronic Compensation System (Ecompensa) to validate voluntary, irrevocable, and opposable credit clearing on-chain. This legal finality provides a pristine vector to optimize short-term capital requirements.

However, when circular netting algorithms are executed to their absolute mathematical limit (known as the Model 5 Set-Off/Zero-Risk model), there invariably remain un-netted residual deltas due to structural asymmetries in the network. Traditionally, resolving these residuals requires central bank liquidity or centralized TARGET2 wholesale CBDC settlement. FluidCluster 2.0 introduces a radical alternative: instead of settling remaining debts with fiat currency or CBDCs, the system uses Zama's Fully Homomorphic Encryption (FHE) on-chain to swap outstanding debt for tokenized equity and securitized Asset-Backed Commercial Paper (ABCP). This eliminates the dependency on fiat cash and initiates the paradigm shift toward a purely asset-based economy.

2. Structuring ABCP and the Mutual Guarantee Core

Asset-Backed Commercial Paper (ABCP) acts as the primary short-term securitized settlement instrument in Ecompensa 2.0, governed legally by Portugal's Regime Geral da Titularização de Créditos (Ley n.º 69/2019) and European STS (Simple, Transparent, Standardized) specifications. When an SME's residual debt is identified, the claims are aggregated by the platform and securitized into fractional ABCP portfolios, completely eliminating the need for bank loans and interest-bearing liabilities.

To back these short-term papers and resolve counterparty risk without debt expansion, Ecompensa 2.0 integrates directly with Portugal's national Mutual Guarantee System (SNGM - Sistema Nacional de Garantia Mútua). Managed by the SPGM, the SNGM operates as a robust multi-layered reselling and counter-guarantee framework, backed by the FCGM (Fundo de Contragarantia Mútuo) and the State's personal guarantee (Portaria n.º 1354-A/99). This integration implements the strategic segregation of credit and risk management: the Mutual Guarantee System assumes 100% of the default risk on the underlying commercial faturas, which stabilizes pricing, underwrites risk parameters on first demand, and subsidizes SRE-slashing penalties inside the enclaves.

Specification	Bilateral Debt	TARGET2 CBDC	Tokenized ABCP & SNGM
Legal Standard	Código Civil Art. 847	ECB Pontes / ESMIG	DL 150/2019 / Ley 69/2019
Counterparty Risk	High (Unsecured)	Sovereign Gated	Zero (SNGM Underwritten)
Liquidity Cost	Varies (High)	Low (RTGS)	None (Asset Swap Invariant)
Privacy Level	Publicly Auditable	Centralized Observer	100% FHE Enclave Private

Table 1: Comparative operational properties of settlement structures in FluidCluster 2.0.

3. The Swap Mechanics: Agent 10 and Fusion Invariants

When circular netting has been cleared to its mathematical limit on the fhEVM, the remaining residual trade liabilities are routed to Ecompensa's autonomous **Fusion Agent (Agent 10)**. The Fusion Agent operates entirely within secure Trusted Execution Environments (TEEs) and continuously scans corporate exposure sub-graphs to detect logistics and supplier redundancies. Instead of forcing cash-settlement or defaulting, the Agent generates a smart debt-to-equity restructuring proposal. The debtor converts their accounts payable into fractional common stock, while the creditor swaps their claim for immediate equity, optimizing the capital structure on both sides of the balance sheet.

These swaps are modeled on the client-side using the interactive parameters developed in Ecompensa's fusion.html dashboard. Key mathematical variables are dynamically adjusted off-chain before being signed via WebCrypto and committed to the fhEVM:

- **Haircut Risk (%)**: The agreed write-down applied to the outstanding gross debt to align with the asset's true market value.
- **Target Valuation (€)**: The corporate valuation calculated via Leontief input-output matrices, which determines the baseline denominator of equity pricing.
- **Dilution/Equity Swap Ratio (%)**: The resulting percentage of Common Stock issued, calculated vectorially as $\text{Equity_Pct} = (\text{Outstanding_Debt} / \text{Valuation}) * 100$.
- **WACC Reduction (%)**: The direct reduction in Weighted Average Cost of Capital, achieved by replacing high-cost short-term payables with stable common equity.

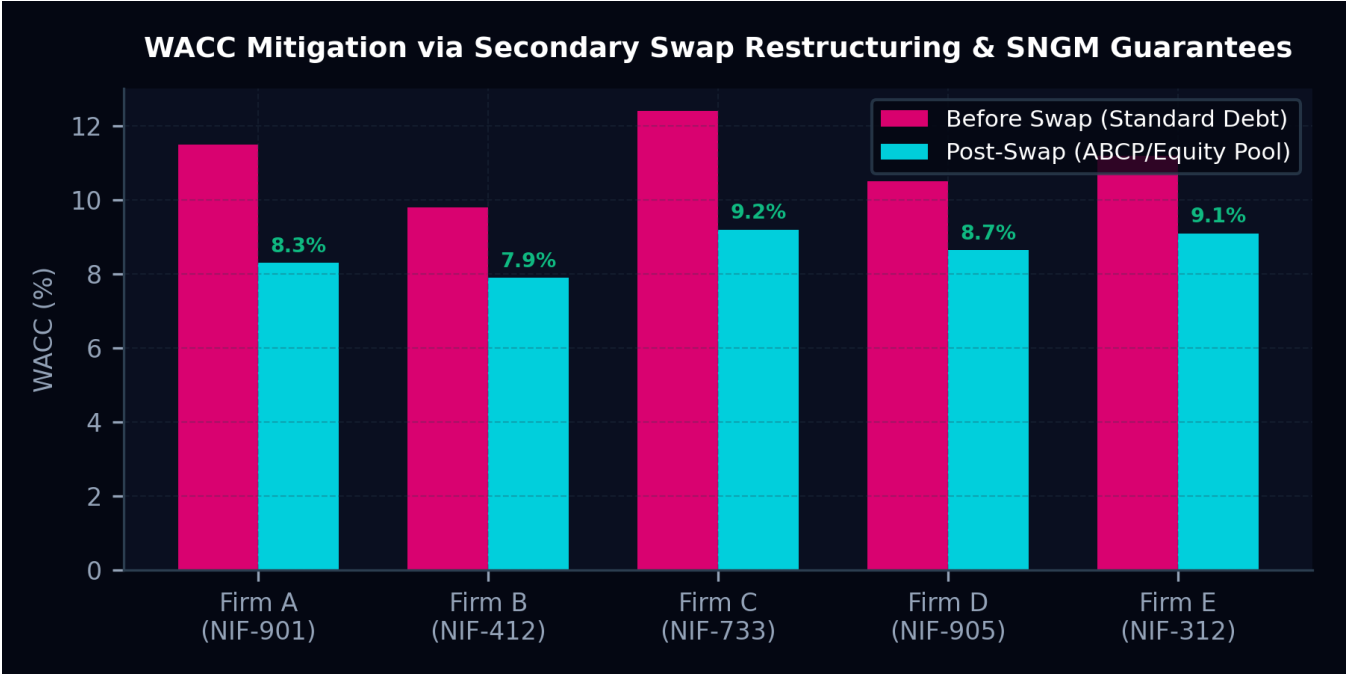


Figure 1: WACC compression across five corporate nodes post-M5 clearing and Agent 10 equity swaps.

4. The End Game: Establishing the True Asset-Based Economy

The integration of ABCPs, SNGM Mutual Guarantees, and autonomous FHE-based equity swaps represents the ultimate realization of the Encrypted Economy: **the total eradication of fiat currency, debt, and the need for Central Bank Digital Currencies (CBDCs)**. Under standard macroeconomic assumptions, fiat currency is a zero-sum, central-observer mechanism that introduces inflation, collateral manipulation, and constant surveillance risks. By bypassing bank wire-transfers and replacing them with $O(1)$ loop compensations, FluidCluster removes the requirement for a physical medium of exchange.

When debt is permanently converted into direct, productive asset shares, the economy shifts from a debt-fueled model to a pure **asset-based economy**. In this paradigm, value is not biased by credit expansion or bank interest rates. Value is fully represented in real-time as fractional ownership in productive corporate assets, with complete freedom of choice and total transactional privacy secured by Fully Homomorphic Encryption. Productive agents are fully incentivized because they are rewarded with direct ownership stakes rather than inflating liabilities, marking the emergence of a truly fair, post-quantum capitalist marketplace.

5. Cryptographic Integrity and Audit Trails

While transactional privacy is preserved end-to-end, Ecompensa 2.0 maintains strict compliance with the Portuguese IRN (Instituto dos Registos e do Notariado) and the Tax Authority (AT) through an on-chain zero-knowledge audit trail. By verifying ZK-Nullifiers (SHA256 ATCUD hashes) and generating Type II and Type III range proofs on the client side, validators can confirm that every transaction is valid, un-manipulated, and mathematically conserves balances before execution, preventing any fraudulent or unauthorized asset creation.

This white paper is issued for academic, regulatory, and educational purposes under the guidelines of the Portuguese Technological Free Zone Sandbox (ZLT#13). All simulated data and cryptographic models are mathematically grounded in the Ecompensa 2.0 codebase.