

A Funding-Ratio-Based Framework for the Consolidation of Military Shareholder Mutual Benefit Funds (MTS–MTN–MTA)

Dr. Ioannis Aznaouridis

Accredited Lecturer, University of Derby / Mediterranean College

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Author Note: Economist; Social and Political Scientist; Lieutenant General (Ret.), Hellenic Army; Honorary Director of Finance, Hellenic Army General Staff (HAGS).

ABSTRACT

This paper develops a funding-ratio-based analytical framework for evaluating the consolidation of military shareholder mutual benefit funds (MTS, MTN, MTA). When participating funds enter a merger with heterogeneous pre-merger funding ratios, naïve pooling of assets and actuarial liabilities can embed implicit value transfers, raising fairness and legitimacy concerns. We formalize each fund's position using assets, actuarial liabilities, and the funding ratio $FR_i = A_i/L_i$, and introduce budget-balanced side payments as an explicit compensation instrument. This yields an adjusted funding ratio $AFR_i(s) = (A_i + s_i)/L_i$ that makes redistribution transparent and testable. Two widely invoked safeguards, FR-based "no gain–no loss" and "non-dilution", are then stated as axioms under budget balance, and we derive an impossibility result showing that these strong adequacy-preservation requirements collapse to the trivial zero-transfer outcome. Building on this boundary, we propose an implementable rule that equalizes adjusted funding ratios to the pooled benchmark $FR^{tot} = A/L$, producing a closed-form, budget-balanced side-payment vector. The framework offers both a diagnostic tool to detect implicit transfers and a constructive mechanism for designing transparent consolidation policies.

Keywords: Pension fund consolidation; funding ratio; actuarial liabilities; side payments; redistribution; fairness axioms; impossibility theorem; military mutual benefit funds; liquidity diagnostics; political economy of pensions.

JEL codes: H55, G23, D63, D70, H77.

1. Introduction

The Mutual Funds of the Army (MTS), Navy (MTN), and Air Force (MTA) are shareholder-based military mutual benefit funds (“Metochika Tameia”) operating within the institutional ecosystem of the Hellenic Armed Forces. They provide supplementary benefits to their beneficiaries through a long-term liability structure financed by member-related contributions and additional revenue streams, while managing accumulated assets under actuarial sustainability constraints (Aznaouridis, 2015).

Policy discussions regarding the potential consolidation of MTS–MTN–MTA often emphasize economies of scale, administrative simplification, and the prospect of improved governance and unified financial planning (Kangur, et al. 2021). Yet the consolidation of multiple benefit funds raises a central quantitative difficulty: when pre-merger financial positions differ, a naïve pooling of assets and liabilities can generate implicit value transfers across participating funds. In practical terms, beneficiaries affiliated with a financially stronger fund may subsidize those affiliated with a weaker fund unless the merger rule explicitly specifies a compensating mechanism (Aznaouridis, 2011, Department for Work and Pensions, 2023). The research problem addressed in this paper is therefore to define a mathematically coherent consolidation rule that operationalizes fairness and identifies, under explicit constraints, when “no transfer” claims are feasible.

In recent policy work, *consolidation* is often treated as both administrative integration (merging/reorganising schemes for simplification and governance) and functional integration (harmonising the underlying rule-set and risk/funding assessment so that consolidation is substantive rather than merely formal) (Bikker & Meringa, 2021; EIOPA, 2023). Moreover, when plans with heterogeneous funded positions are merged, consolidation can create distributional effects unless the consolidation rule explicitly specifies an allocation/compensation mechanism (Bégin et al., 2024). The purpose of this study is to develop a funding-ratio-based mathematical framework for analyzing the consolidation of MTS–MTN–MTA and to derive implementable side-payment rules that prevent undesired redistribution effects while remaining actuarially consistent. The study pursues four objectives: first, to formalize a consistent pre-merger accounting representation of each fund using assets, actuarial liabilities, and funding ratios; second, to introduce an adjusted funding ratio that incorporates budget-balanced side payments as a compensation mechanism; third, to state and examine two widely cited fairness requirements, no gain - no loss and non-dilution - and to derive a formal impossibility result under standard constraints; and fourth, to propose and characterize a practical consolidation rule that yields a closed-form side-payment vector and supports transparent policy evaluation.

These aims translate into the following research questions. How can the pre-merger financial position of each fund be represented in a comparable mathematical form using funding ratios? Under a budget-balance constraint, what do the fairness principles of no gain-no loss and non-dilution imply for the existence and structure of side payments? Is it possible to satisfy these fairness principles simultaneously while allowing non-zero side payments, and if not, what is the precise impossibility statement? Finally, what implementable consolidation rule can be used to prevent implicit value transfers, and what is the resulting closed-form characterization of side payments?

2. Related Literature and Contribution

2.1 Pension fund consolidation and plan mergers

A first strand of research and policy discussion focuses on consolidation as an institutional response to fragmentation in pension provision, emphasizing administrative efficiency, scale economies, and governance improvements. Empirical and supervisory work often frames consolidation as a route to lower cost margins, stronger oversight, and simplified scheme architecture, especially when small schemes face fixed governance and compliance burdens (Bikker & Meringa, 2021; European Insurance and Occupational Pensions Authority, 2023). In parallel, recent actuarial work on full plan mergers highlights that consolidation can generate measurable benefits, but also that merger gains are not automatic: they depend on the pre-merger heterogeneity of balance sheets and the way the merger rule maps heterogeneous positions into a post-merger allocation (Bégin et al., 2024). Policy-facing reports on pension markets likewise underline that scheme restructuring is frequently motivated by governance capacity and risk-management considerations, not only by “cost saving” narratives (Department for Work and Pensions, 2023).

However, in much of this literature, the consolidation problem is treated primarily as *an institutional design or governance* issue, with distributional consequences discussed qualitatively or as a secondary outcome of scale and efficiency objectives. When redistribution is acknowledged, it is typically described as an “implicit transfer” risk that needs monitoring, rather than formalized as an allocation rule that can be tested and implemented in closed form (Bégin et al., 2024; European Insurance and Occupational Pensions Authority, 2023). This leaves a gap between (i) consolidation arguments framed in terms of administrative integration and (ii) consolidation feasibility when heterogeneous adequacy positions must be reconciled under explicit constraints.

2.2 Risk-sharing and political economy perspectives on pooling

A second literature addresses consolidation and pooling through the lens of *risk-sharing* and *redistribution*. In collective pension settings, funded schemes can embed intergenerational (and cross-group) transfers that smooth shocks across cohorts or groups, typically trading off welfare stabilization against distributional acceptability (Cui, de Jong, & Ponds, 2010; Ma, 2024; Ponds, Cui, & de Jong, 2005). In public finance and fiscal federalism, pooling arrangements are similarly studied as mechanisms that can enhance insurance while creating political tension around who contributes, who benefits, and how transfers are legitimized (Asdrubali, Sørensen, & Yosha, 1996; Boadway & Shah, 2012; Oates, 1972). Related political-economy accounts stress that “risk sharing” is rarely neutral in practice: it interacts with bargaining power, institutional veto points, and contested narratives about historical burdens and cross-subsidies (D’ Amato & Galasso, 2010; Guardiancich & Guidi, 2022; Rodden, 2010).

This strand clarifies why consolidation debates can become politically fragile even when a pooled system is actuarially coherent: stakeholders can accept “pooling” as an idea while rejecting the implied redistribution once it is perceived as systematic or asymmetric. Yet, much of this work remains at the level of identifying channels and incentives rather than specifying implementable *allocation mechanisms* for a concrete consolidation setting with measurable balance sheets. In particular, the translation from “pooling implies transfers” to “which transfers, under what feasibility constraints, and with what closed-form rule?” is not always made explicit (Boadway & Shah, 2012; Cui et al., 2010).

2.3 Fairness and axiomatic allocation in pension design

A third relevant strand concerns *fairness as design constraints*—often expressed as axioms such as “no-one-is-worse-off,” “no gain–no loss,” or related non-dilution requirements in collective arrangements. In the funded-pension literature, such constraints are typically motivated as governance safeguards that protect legitimacy when risk-sharing or redistribution is present (Cui et al., 2010; Ma, 2024). In public finance, axiomatic and rule-based principles likewise appear in discussions of how to design transfer rules that are transparent, predictable, and defensible under political scrutiny (Boadway & Shah, 2012; Oates, 1972).

The difficulty is that fairness requirements are often invoked rhetorically (“no transfers,” “no losses,” “hold harmless”) without being translated into a formal feasibility problem. Once budget balance and a common accounting basis are imposed, certain combinations of fairness desiderata may be mutually incompatible unless the mechanism collapses to a trivial outcome. The literature provides strong intuition that such tensions exist, but it does not typically supply a funding-ratio-based, implementable framework that (i) states the constraints in operational form, (ii) identifies precise impossibility boundaries, and (iii) derives a usable allocation rule that policymakers can compute directly from balance-sheet primitives.

2.4 Contribution and roadmap of the paper

This paper contributes to the consolidation debate by moving from qualitative statements about redistribution and fairness to a *formal, implementable consolidation rule* expressed in funding-ratio terms.

Our contribution is threefold:

1. A funding-ratio-based consolidation framework with explicit compensation instruments. We model consolidation as an allocation problem over measurable pre-merger balance sheets and introduce budget-balanced side payments as an explicit compensation mechanism, allowing redistribution to be identified, quantified, and evaluated rather than left implicit (European Central Bank, 2020; De Nederlandsche Bank, n.d.; Cui et al., 2010).
2. A formal impossibility result for strong FR-based fairness requirements under budget balance. By expressing widely cited safeguards (e.g., “no gain–no loss” and “non-dilution”) directly in FR/AFR terms under a budget-balance constraint, the paper shows precisely when “fairness” claims collapse to a trivial zero-transfer outcome, thereby clarifying which policy slogans are infeasible when adequacy positions differ (Ma, 2024; Cui et al., 2010).
3. A closed-form, implementable allocation rule for fair consolidation. Building on the impossibility boundary, we propose a practical rule that equalizes adjusted funding ratios to a common benchmark for the consolidated entity, yielding an explicit, closed-form side-payment vector that is transparent and directly computable from assets and liabilities (European Central Bank, 2020; De Nederlandsche Bank, n.d.).

Roadmap: Section 3 introduces notation and the pre-merger accounting representation. Section 4 defines side payments and the adjusted funding ratio used to make redistribution explicit. Section 5 formalizes fairness axioms and derives the impossibility result under budget balance. Section 6 proposes the implementable consolidation rule and characterizes its properties. Section 7 discusses institutional and political-economy implications, and Sections 8–9 conclude and outline extensions.

3. Methodology

This study follows a normative–analytical research approach, grounded in mathematical modeling rather than econometric estimation. The methodology is designed to produce a rigorous, transparent framework for evaluating consolidation proposals among military shareholder mutual benefit funds, with a particular focus on identifying and preventing implicit

value transfers across participating entities. The analysis therefore prioritizes internal logical consistency, explicit assumptions, and derivation of closed-form results, instead of inference from time-series or micro-level data.

The unit of analysis is the fund itself. Specifically, we model the consolidation of three entities indexed by $i \in \{MTS, MTN, MTA\}$, where each index corresponds to one fund treated as a single balance-sheet unit. This “fund-as-unit” choice deliberately abstracts from within-fund heterogeneity (e.g., subgroups of beneficiaries) in order to provide an implementable and policy-relevant framework that can be applied whenever fund-level assets and actuarial liabilities can be measured consistently.

The core model inputs consist of two quantities for each fund i : an asset value A_i and an actuarial liability value L_i , both computed on a common valuation basis. Commonality of valuation assumptions is a methodological requirement: the framework presumes that assets and liabilities are measured in a way that supports meaningful cross-fund comparability. On this basis, each fund’s pre-merger financial position is summarized using a funding ratio, which serves as the key adequacy metric used throughout the analysis.

To represent consolidation design explicitly, the methodology introduces a compensation mechanism in the form of side payments. Side payments are modeled as a vector $s=(s_i)_i$ subject to a budget-balance constraint (the transfers must net to zero across funds). Side payments induce an adjusted adequacy measure - an adjusted funding ratio - that captures how a consolidation rule reallocates the consolidated balance sheet across participant funds and, consequently, whether the rule embeds redistribution. This modeling choice allows the consolidation problem to be stated as a mapping from pre-merger positions (A_i, L_i) to post-merger adjusted positions, under explicit feasibility conditions.

The evaluation of consolidation designs is conducted through formal fairness constraints that operationalize commonly stated policy requirements. In particular, the analysis examines the implications of (i) no gain–no loss, interpreted as the preservation of a fund’s pre-merger adequacy position under the consolidation mapping, and (ii) non-dilution, interpreted as the prohibition of any reduction in adequacy for any participating fund. The methodology then derives (a) an impossibility result showing that, under standard constraints, certain combinations of fairness requirements are incompatible with non-zero compensating transfers, and (b) an implementable consolidation rule based on a common adequacy target for the consolidated entity, yielding a closed-form side-payment characterization. Together, these steps provide both a diagnostic tool (to identify when a proposal implicitly transfers value) and a constructive tool (to design transparent compensation rules).

Finally, the methodology explicitly acknowledges its scope and limitations. The framework is intended as a theoretical foundation for consolidation design and assessment. It does not estimate behavioral or macroeconomic effects, nor does it require extensive longitudinal datasets. Its validity relies on the consistent measurement of fund-level assets and actuarial liabilities and is therefore sensitive to the valuation basis adopted. Within these boundaries, the methodology provides a clear analytical structure for distinguishing actuarially coherent consolidation designs from those that rely on unintended or opaque redistribution.

4. Notation and Pre-Merger Accounting

We consider a consolidation setting with three entities indexed by

$$i \in \{MTS, MTN, MTA\},$$

where each index corresponds to one military shareholder mutual benefit fund treated as a single unit of analysis. For each fund, we define two core balance-sheet quantities measured on a common valuation basis: $A_i \geq 0$, representing the market-consistent value of assets held by the fund, and $L_i > 0$, representing the actuarial present value of its liabilities (i.e., the present value of promised benefit obligations under the applicable benefit rules and actuarial assumptions). The requirement of a common valuation basis is essential: the framework presumes that assets and liabilities are computed in a manner that allows meaningful cross-fund comparability.

The pre-merger financial position of each fund is summarized by its funding ratio (European Central Bank, 2020), defined as

$$FR_i := \frac{A_i}{L_i}$$

The funding ratio provides a dimensionless measure of financial adequacy: values above unity indicate a relatively strong position in which assets exceed actuarial liabilities, whereas values below unity indicate that liabilities exceed assets under the chosen valuation assumptions.

At the aggregate level, the consolidated entity is characterized by total assets and total liabilities given by

$$A := \sum_i A_i, \quad L := \sum_i L_i \quad \text{or equivalently,}$$

$$A := \sum_{i \in \{MTS, MTN, MTA\}} A_i, \quad L := \sum_{i \in \{MTS, MTN, MTA\}} L_i$$

where the summation is taken over $i \in \{MTS, MTN, MTA\}$. The corresponding aggregate funding ratio of the hypothetical consolidated entity (prior to any compensating adjustments) is then defined as

$$FR^{tot} := \frac{A}{L}.$$

This aggregate ratio serves as a natural reference point for consolidation analysis, since it represents the funding adequacy of a pooled balance sheet obtained by simply adding the pre-merger assets and liabilities of the participating funds.

Finally, we emphasize that this notation captures a “fund-as-unit” consolidation perspective: each participating entity enters the merger with its own initial adequacy level FR_i , and any consolidation rule must specify how these heterogeneous initial positions are mapped into a post-merger allocation of the consolidated balance sheet. In subsequent sections, this mapping is formalized via compensating transfers (side payments) and fairness constraints designed to detect and prevent implicit value transfers across funds. Table 1 reports the underlying balance-sheet magnitudes and the implied funding ratios for each fund.

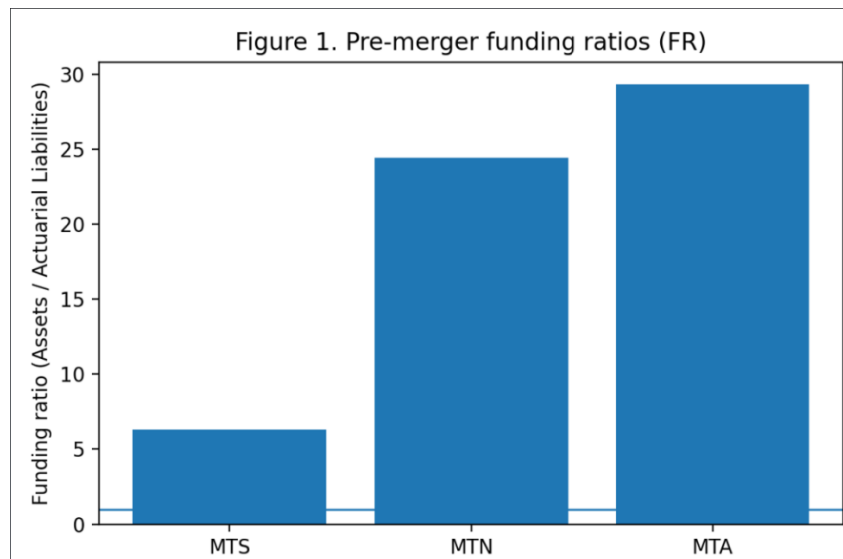
Table 1. Assets, liabilities and funding ratios (Total vs Current assets)

Fund	Total Assets (Ai)	Current Assets (CAi)	Liabilities (Li)	Total Funding Ratio (Ai/Li)	Current Funding Ratio (CAi/Li)
MTS	722,737	288,191	114,556	6.31	2.52
MTN	241,556	188,832	9,881	24.45	19.11
MTA	272,919	267,977	9,293	29.37	28.84

(Note: Units: as reported in the financial statements / actuarial report. Monetary amounts are reported in EUR millions; funding ratios are unit-free)

Current-asset ratios are reported as a liquidity diagnostic to illustrate that heterogeneity is even sharper on a liquid basis, although the formal model proceeds with total assets under a common valuation basis.

Figure 1 highlights the substantial heterogeneity in pre-merger funding ratios across the three funds, indicating markedly different initial adequacy positions prior to consolidation. This dispersion underscores that any consolidation rule must explicitly address the potential for implicit value transfers when financially unequal balance sheets are pooled.



5. Consolidation with Side Payments

To model consolidation in a way that makes redistribution explicit, we introduce a compensation mechanism in the form of side payments across the participating funds. The role of side payments is to neutralize implicit value transfers that can arise when funds enter a merger with heterogeneous pre-merger adequacy levels—an issue that is closely related to the broader literature on collective pension design, risk-sharing, and redistribution mechanisms within funded schemes (Ma, 2024; Cui, de Jong, & Ponds, 2010).

Formally, let

$$s_i \in \mathbb{R}, \quad i \in \{MTS, MTN, MTA\},$$

denote the net side payment associated with fund i . A positive value $s_i > 0$ represents a net transfer received by fund i , while a negative value $s_i < 0$ represents a net transfer paid by fund i . Consistent with standard consolidation accounting, side payments are assumed to satisfy budget balance, meaning that transfers net to zero across all funds:

$$\sum_{i \in \{MTS, MTN, MTA\}} s_i = 0.$$

This restriction captures the idea that compensating transfers do not create or destroy value at the system level; rather, they reallocate value across participating entities.

To evaluate how a given side-payment vector affects the post-merger position of each fund, we define an Adjusted Funding Ratio (AFR). Funding ratios are widely used as standardized

indicators of pension fund adequacy in supervisory and statistical contexts, which makes them a natural baseline for consolidation analysis (De Nederlandsche Bank, n.d.; European Central Bank, 2020). In line with this adequacy logic, we treat side payments as adjustments to assets while keeping liabilities unchanged, reflecting the interpretation that compensation mechanisms operate through the distribution of the pooled asset position rather than through immediate redefinition of promised obligations.

Accordingly, for each fund i , the adjusted funding ratio is defined as

$$AFR_i(s) := \frac{A_i + s_i}{L_i}.$$

The AFR representation provides a transparent test for implicit redistribution: if a fund's post-merger adequacy improves only because it receives a positive side payment, the associated redistribution becomes explicit through s_i . Conversely, if a fund pays a negative side payment, the adequacy cost of consolidation is made measurable and can be evaluated against fairness criteria. This "transfer-adjusted" accounting perspective is consistent with the idea that collective pension arrangements embed risk-sharing and redistribution channels which should be made explicit when designing or assessing institutional rules (Ma, 2024; Cui et al., 2010).

Finally, the side-payment formulation links directly to fairness requirements that will be formalized in the next section. In particular, fairness constraints can be stated as restrictions on $\{AFR_i(s)\}_i$ relative to pre-merger adequacy measures $\{FR_i\}_i$ or relative to a benchmark adequacy target for the consolidated entity. The subsequent analysis uses these definitions to examine which fairness principles are compatible with budget balance and whether non-trivial (non-zero) compensating transfers can exist under commonly stated requirements.

For additional intuition, Appendix A provides a schematic graphical interpretation of how the adjusted funding ratio can be viewed as a transfer-induced band around a baseline funding ratio, highlighting the role of admissible adjustment ranges and benchmark adequacy levels.

6. Axioms and Impossibility Results

This section formalizes two fairness requirements commonly stated in consolidation debates and collective pension design, expressed in funding-ratio (FR) terms and evaluated through the adjusted funding ratio $AFR_i(s)$ (Ma, 2024; Cui, de Jong, & Ponds, 2010). Throughout, we maintain the budget-balance constraint $\sum_i s_i = 0$ and assume $L_i > 0$ for all participating funds. We also treat funding ratios as standardized adequacy indicators, consistent with their widespread

use in supervisory and statistical contexts (De Nederlandsche Bank, n.d.; European Central Bank, 2020).

Axiom 1 (No gain–no loss; FR-based)

A consolidation with side payments s satisfies **no gain–no loss (in FR terms)** if each fund’s adjusted funding ratio equals its pre-merger funding ratio:

$$AFR_i(s) = FR_i \quad \forall i.$$

Equivalently, since $AFR_i(s) = \frac{A_i + s_i}{L_i}$ and $FR_i = \frac{A_i}{L_i}$ this condition implies

$$\frac{A_i + s_i}{L_i} = \frac{A_i}{L_i} \implies s_i = 0 \quad \forall i.$$

Thus, the FR-based no gain–no loss requirement permits only the trivial transfer vector $s=0$ ¹.

Axiom 2 (Non-dilution; FR-based)

A consolidation with side payments s satisfies **non-dilution (in FR terms)** if no fund’s adjusted funding ratio falls below its pre-merger funding ratio:

$$AFR_i(s) \geq FR_i \quad \forall i.$$

Equivalently,

$$\frac{A_i + s_i}{L_i} \geq \frac{A_i}{L_i} \iff s_i \geq 0 \quad \forall i.$$

where the equivalence follows from $L_i > 0$. In the context of collective pension arrangements, this axiom captures a strong “no-one-is-worse-off” requirement stated in terms of funding adequacy (Ma, 2024; Cui et al., 2010).

Theorem 1 (Impossibility under budget balance)

Under budget balance, the FR-based non-dilution axiom implies that no non-trivial side-payment vector can exist.

¹ $s=0$ denotes the identically zero side-payment vector, meaning that $s_i=0$ for all $i \in \{MTS, MTN, MTA\}$. In other words, no fund pays or receives any compensating transfer.

Proof. By Axiom 2, $s_i \geq 0$ for all i . Summing over all funds yields $\sum_i s_i \geq 0$. Budget balance requires $\sum_i s_i = 0$. Therefore $\sum_i s_i = 0$ with each $s_i \geq 0$ implies $s_i = 0$ for all i .

Corollary 1 (Joint impossibility)

If a consolidation rule is required to satisfy both FR-based no gain-no loss and FR-based non-dilution under budget balance, then the only feasible transfer vector is $s=0$. In other words, within this FR-based formulation, any attempt to allow compensating transfers while guaranteeing that no fund is worse off (and/or that each fund’s adequacy is preserved) collapses to the trivial case. This highlights a basic tension between strong adequacy-preservation requirements and the feasibility of explicit compensation mechanisms within consolidation design (Ma, 2024; Cui et al., 2010).

7. Implementable Fair Consolidation Rules

The impossibility result in the previous section shows that, under budget balance, strong FR-based “no-one-is-worse-off” constraints collapse to the trivial case $s=0$. This motivates an alternative notion of implementable fairness: rather than requiring each fund to preserve (or improve) its own pre-merger funding ratio, we require that the post-merger allocation be consistent with a common adequacy target for the consolidated entity.

7.1 A Common Adequacy Target

Let total assets and liabilities be

$$A := \sum_{i \in \{MTS, MTN, MTA\}} A_i, \quad L := \sum_{i \in \{MTS, MTN, MTA\}} L_i,$$

and define the aggregate funding ratio

$$FR^{tot} := \frac{A}{L}$$

We take FR^{tot} as the natural benchmark adequacy level of the pooled balance sheet.

7.2 Equalization Rule via Side Payments

We propose an implementable rule that equalizes all adjusted funding ratios to the aggregate benchmark:

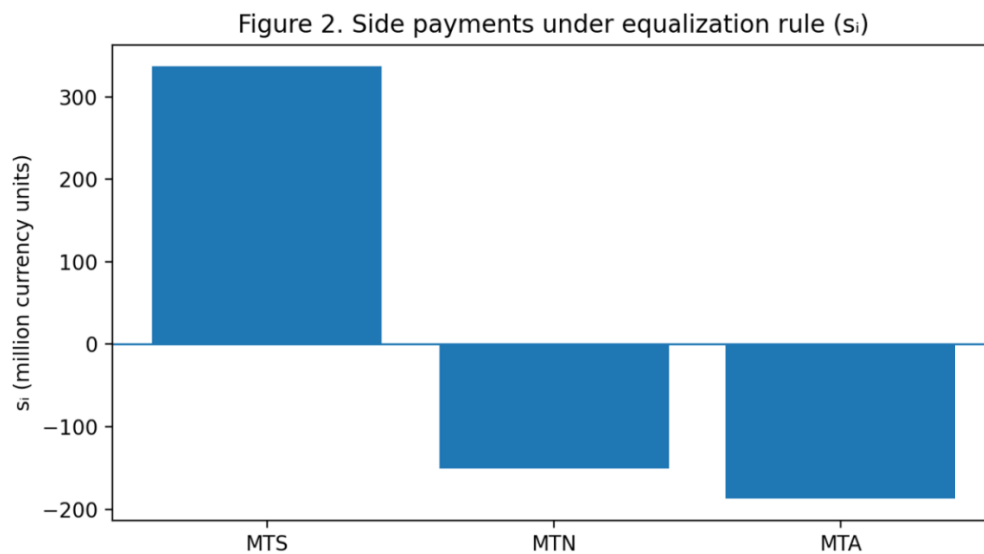
$$AFR_i(s) = FR^{tot} \text{ for all } i.$$

Substituting $AFR_i(s) = \frac{A_i + s_i}{L_i}$ yields

$$\frac{A_i + s_i}{L_i} = \frac{A}{L} \Rightarrow s_i = \frac{L_i}{L} A - A_i$$

Thus, each fund’s side payment is the difference between its “proportional share” of total assets - proportional to its share of total liabilities - and its own pre-merger assets.

Figure 2 reports the implied budget-balanced side payments under the equalization rule. MTS receives a positive transfer, while MTN and MTA make offsetting negative transfers, ensuring that the transfers sum to zero and that all funds converge to the common target funding ratio FR^{tot}



7.3 Properties of the Rule

(i) Budget balance. Summing the proposed transfers across funds gives

$$\sum_i s_i = \sum_i \left(\frac{L_i}{L} A - A_i \right) = \frac{A}{L} \sum_i L_i - \sum_i A_i = \frac{A}{L} L - A = 0,$$

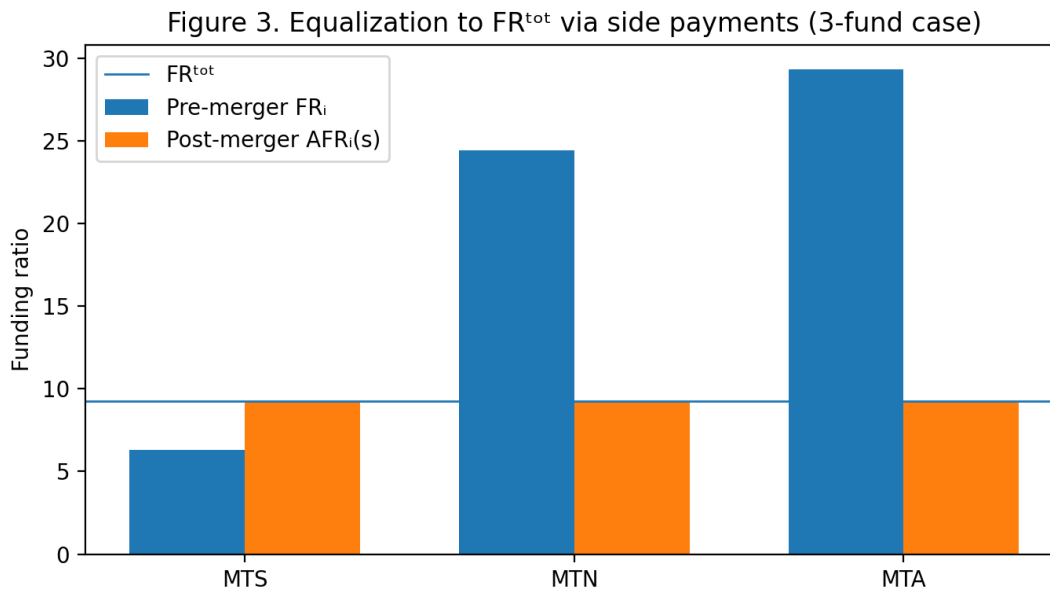
so the rule is budget-balanced.

(ii) Equalized adjusted adequacy. By construction,

$$AFR_i(s) = \frac{A_i + s_i}{L_i} = \frac{A_i + (\frac{L_i}{L}A - A_i)}{L_i} = \frac{\frac{L_i}{L}A}{L_i} = \frac{A}{L} = FR^{tot} \quad \forall i.$$

Therefore, all participating funds share a common post-merger adequacy level, equal to the adequacy of the pooled entity.

Figure 3 illustrates the equalization effect of the proposed consolidation rule. While the three funds exhibit markedly different pre-merger funding ratios, the budget-balanced side-payment mechanism reallocates assets so that all post-merger adjusted funding ratios $AFR_i(s)$ converge to the common benchmark FR^{tot} , i.e., the adequacy level of the pooled balance sheet.



(iii) Transparency of value transfers. The sign of s_i is informative: if a fund enters with assets below its proportional share $\frac{L_i}{L}A$, it receives a positive transfer; if it enters with assets above that share, it pays. Hence, the rule makes redistribution explicit and measurable.

7.4 Interpretation

The equalization rule does not attempt to preserve each fund’s pre-merger funding ratio; instead, it implements a neutral benchmark: each fund receives a post-merger allocation consistent with the consolidated entity’s aggregate adequacy. This provides a tractable and transparent consolidation mechanism, suitable for policy evaluation, and establishes a clear bridge between balance-sheet comparability and fairness design.

8. Discussion

The analysis in this paper treats consolidation as a balance-sheet allocation problem under heterogeneous pre-merger adequacy positions, and shows why “fairness” claims cannot be left implicit. The starting point is that MTS, MTN, and MTA enter any consolidation with markedly different funding ratios, implying that a naïve pooling of assets and liabilities risks embedding hidden value transfers unless an explicit allocation / compensation rule is specified (see Figure 1). Operationally, this also presupposes a common valuation basis so that funding ratios are meaningfully comparable across funds (European Central Bank, 2020, Aznaouridis, 2011).

A central contribution is to make redistribution operational and testable by introducing budget-balanced side payments and an adjusted funding ratio, $AFR_i(s) = (A_i + s_i) / L_i$. This “transfer-adjusted” accounting isolates the distributional content of any consolidation design: adequacy changes can be traced directly to the sign and magnitude of s_i , rather than being obscured by aggregation (Cui, de Jong, & Ponds, 2010; Ponds, et.al, 2005).

The impossibility result sharpens the policy message. If consolidation is required to satisfy strong FR-based safeguards - either exact preservation of each fund’s pre-merger adequacy (“no gain–no loss”) or a “no-one-is-worse-off” constraint (“non-dilution”) - then, under budget balance, the only feasible transfer vector is the trivial case $s=0$ (see Section 5, Theorem 1 and Corollary 1). In effect, within this FR-based formulation, strong adequacy-preservation requirements eliminate the very compensating mechanism that policy debates typically invoke to neutralize redistribution (Cui, de Jong, & Ponds, 2010; Ponds, et.al, 2005; Aznaouridis, 2015).

This motivates the paper’s implementable alternative: replacing fund-by-fund adequacy preservation with a common, system-consistent benchmark for the post-merger allocation, namely the pooled funding ratio $FR^{tot} = A/L$ (De Nederlandsche Bank, n.d.; European Central Bank, 2020). The equalization rule sets $AFR_i(s) = FR^{tot}$ for all i , yielding a closed-form side-payment vector that is budget-balanced and transparent: each fund receives (pays) the difference between its “liability-proportional” share of total assets and its own pre-merger assets (see Figures 2–3).

Crucially, the broader institutional debate around the “Metochika Tameia” (Shareholder-based Mutual Benefit Funds) suggests that consolidation is not only a mathematical allocation problem but also a governance and political-economy problem. The funds operate as supplementary, shareholder-based schemes (Gedeon, 2000; OECD, 2024) in a parallel institutional environment (outside e-EFKA), and their separate branch-based structure is widely viewed as a historical residue rather than a functional necessity; these features interact with entrenched interest structures that can impede reform. (OECD, 2024; Aznaouridis, 2025).

Moreover, even if one adopts an FR-based consolidation benchmark, the feasibility and perceived legitimacy of any transfer rule depends on pre-existing asymmetries in financing and benefit incidence, such as differences in per-capita contributions and benefits across funds, historically uneven social-resource flows, and the claim that MTS bears a disproportionate actuarial burden due to heterogeneous participant groups (including police participation with non-proportional contribution/benefit incidence). These documented asymmetries matter because they change how “fairness” is interpreted politically: a rule that is actuarially coherent at the fund level may still be contested if stakeholders believe that prior cross-subsidies (or prior underfunding) are being consolidated rather than corrected. (D’ Amato & Galasso, 2010; Aznaouridis, 2025; Guardiancich, Guidi, 2022).

Two implications follow. First, the paper’s framework can be used diagnostically: given measured (A_i, L_i) , any proposed consolidation can be decomposed into an adequacy benchmark and an implied transfer vector, making redistribution explicit and quantifiable. Second, the framework can be used constructively: policymakers may combine an implementable allocation rule (e.g., equalization to FR^{tot}) with institutional constraints (caps on transfers, phased implementation, or pre-merger “cleanup” measures) to address legitimacy concerns, without reverting to slogans such as “no transfers” that the model shows are generally incompatible with meaningful compensation (Oates, 1972; Boadway & Shah, 2012; Rodden, 2010).

Finally, the approach has clear limits. It is normative-analytical and relies on a common valuation basis for assets and actuarial liabilities; it does not model behavioral responses, political constraints endogenously, or transitional legal design. Nevertheless, by forcing consolidation proposals to state explicitly (i) a benchmark adequacy target and (ii) the side-payment mechanism needed to implement it, the framework advances transparency and reduces the scope for opaque redistribution in consolidation debates (Asdrubali, Sørensen & Yosha, 1996; Boadway & Shah, 2012).

9. Conclusions

A central implication of the framework is that consolidation among funds with heterogeneous pre-merger funding ratios is inherently distributional. A naïve pooling of assets and actuarial liabilities can generate implicit value transfers, meaning that beneficiaries affiliated with a financially stronger fund may end up subsidizing those affiliated with a weaker fund unless the consolidation rule specifies an explicit compensation mechanism.

This is precisely why political and institutional resistance is likely to emerge. Stakeholders tend to demand “no one is worse off” safeguards, but the analysis shows that strong FR-based

protections such as no gain–no loss or non-dilution, under a standard budget-balance constraint, collapse to the trivial outcome of zero transfers, making meaningful compensation infeasible.

For consolidation to be considered legitimate and policy-credible, it must therefore be framed as an explicit design problem rather than a rhetorical claim of “no transfers.” The proposed solution is to require every consolidation proposal to state clearly: (i) a benchmark adequacy target (e.g., the pooled funding ratio FR_{tot}) and (ii) the side-payment mechanism required to implement that target transparently. This approach strengthens accountability by making redistribution measurable, visible, and contestable, reducing the scope for opaque transfer effects in consolidation debates.

10. Final Remark: Liquidity-Heterogeneity-Political Economy of Consolidation

The analysis developed in this paper shows that the consolidation of pension funds is not a neutral accounting exercise, but rather an institutional intervention with potentially significant distributional consequences, which are already latent in the initial heterogeneity of the balance sheets. As indicated by Table 1, cross-fund divergence is not confined to the total funding ratio ($FR^{total} = A_i/L_i$), but becomes even more pronounced on a liquid basis ($FR^{current} = CA_i / L_i$) and, by extension, in liquidity composition (CA_i/A_i). This finding lends particular weight to the theoretical results of the paper: when consolidation is applied to “liquid” or “marketable” assets, the scope for implicit transfers widens, and the demand for institutional transparency becomes more acute.

The intensity of these effects is further amplified - at the level of institutional and political context - by the fact that funds typically differ not only in the liquidity and composition of their assets, but also in members’ historical and current contribution patterns, as well as in the level and profile of today’s benefits. Under such conditions, a consolidation process that directly engages the liquid/marketable segment of the asset base is more likely to be perceived as a transfer of wealth across distinct beneficiary groups. This makes it all the more necessary to adopt rules that do not merely produce a unified balance sheet, but explicitly determine how the costs and gains of the transition are allocated.

From this perspective, consolidation rules should be assessed not only as technical devices for balance-sheet unification, but as explicit choices of fairness and distribution. If the objective is to prevent hidden redistribution, the institutional solution must be accompanied by clear and verifiable compensation rules (side payments) and by realistic implementation constraints (e.g., caps, smoothing through gradual phase-in), so that the transition is not only theoretically coherent, but also administratively feasible and politically sustainable.

The consolidation of three pension funds with structurally unequal financial strength cannot be treated as a neutral administrative reform, but rather as a policy choice with clear liquidity and political–economic implications. Without an explicit and transparent compensation mechanism (explicit side payments), consolidation either remains largely symbolic - preserving the underlying heterogeneity - or it produces implicit and opaque redistribution through pooled balance sheets. In this sense, consolidation does not “create” sustainability; it determines how liquidity pressures and solvency risks are allocated, and according to which rule.

For this reason, a realistic and socially acceptable strategy is a two-stage approach. First, a stabilization and convergence phase should be implemented to improve the funding ratio (FR) of the structurally weaker fund (MTS), thereby reducing the scale of the required transfers and limiting the perception of consolidation as an immediate bailout. Second, consolidation can proceed under a clearly defined, rule-based, and time-bounded transfer framework, which makes redistribution explicit and therefore more transparent, institutionally legitimate, and economically credible.

11. Future Research

Future research can extend the framework in four directions. First, it can relax the assumption of a fully common valuation basis by introducing valuation uncertainty/heterogeneity (e.g., alternative discount rates or liability re-estimation) and testing how sensitive implied transfers are to measurement choices. Second, it can move beyond the fund-as-unit approach by modeling within-fund heterogeneity (cohorts, contribution histories, benefit incidence), so redistribution is assessed not only across funds but also across groups. Third, it can incorporate institutional feasibility constraints—transfer caps, phased implementation, and “hold-harmless” clauses—directly into the admissible side-payment set, linking actuarial design to legal and political implementability. Finally, the diagnostic decomposition into an adequacy benchmark and an implied transfer vector can be validated across cases and jurisdictions to support comparative policy evaluation.

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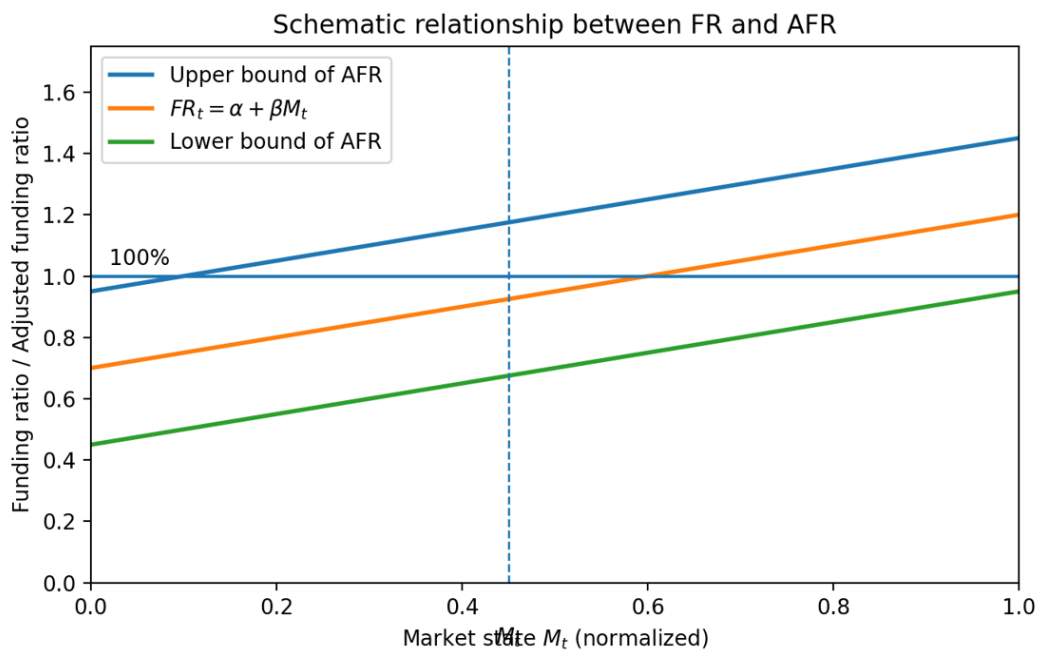
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Appendix A.

A schematic interpretation of the FR–AFR relationship

This appendix provides an intuitive graphical interpretation of the distinction between the baseline funding ratio and the adjusted funding ratio used in the main analysis. While the core model of the paper is defined at the fund level through (A_i, L_i) and transfer vectors s , the schematic representation in Figure A1 illustrates how “adequacy” can be viewed as an object that responds both to valuation conditions and to feasible compensating adjustments.



A.1 Baseline adequacy as a state-dependent funding ratio

Let FR_t denote a baseline (pre-adjustment) funding ratio at time t . In the figure, the baseline ratio is represented as a linear function of an abstract environment or market state M_t ,

$$FR_t = \alpha + \beta M_t,$$

where alpha α captures an intercept component of adequacy and beta β captures sensitivity to the state variable. The purpose of M_t is not econometric estimation, but rather the illustration of the idea that a funding ratio can shift systematically with valuation conditions (e.g., asset values, discount rates, or macro-financial factors that affect either assets or actuarial liabilities).

The time index t is used purely for schematic illustration and serves only to parameterize the figure; the main analysis is fund-indexed (i) and evaluated cross-sectionally at the consolidation (merger) date for $i \in \{MTS, MTN, MTA\}$.

A.2 Adjusted adequacy as an admissible band around the baseline

The key concept introduced in the main text is that consolidation can involve compensating adjustments, represented by side payments. At an intuitive level, these adjustments imply that the relevant post-adjustment adequacy measure is not simply the baseline funding ratio FR_t , but an **adjusted funding ratio** AFR_t that can deviate from baseline adequacy within some feasible range.

In the main model, the adjusted funding ratio is point-valued for a given transfer vector: $AFR_i(s) = (A_i + s_i) / L_i$. The interval depiction in Figure A1 should therefore be read as a feasibility envelope induced by constraints on admissible transfers, not as a definition of AFR .

Graphically, Figure A1 represents this idea through an upper and lower envelope around the baseline path:

$$AFR_t \in [FR_t - \Delta, FR_t + \Delta],$$

To connect the schematic band $[FR_t - \Delta, FR_t + \Delta]$ with the fund-level model, one may interpret Δ as arising from bounds on admissible transfers. For instance, if transfers are bounded by $|s_i| \leq \bar{s}_i$, then

$$AFR_i(s) = \frac{A_i + s_i}{L_i} \in \left[\frac{A_i - \bar{s}_i}{L_i}, \frac{A_i + \bar{s}_i}{L_i} \right] = \left[FR_i - \frac{\bar{s}_i}{L_i}, FR_i + \frac{\bar{s}_i}{L_i} \right].$$

Here Delta $\Delta > 0$ is an adjustment-capacity parameter summarizing admissible transfer bounds (e.g., of order \bar{s} / L_i); thus, for each state M_t , the consolidation mechanism can shift the effective adequacy measure upward or downward relative to FR_t , but only within a bounded band reflecting institutional, legal, or feasibility constraints on compensation.

A.3 Benchmark adequacy and the role of the 100% threshold

The horizontal line at **100%** corresponds to the adequacy benchmark $FR=1$, i.e.,

$$FR = 1 \Leftrightarrow A = L.$$

This benchmark is often used as a natural solvency or balance reference point: ratios above 1 indicate that assets exceed actuarial liabilities under the adopted valuation basis, whereas ratios below 1 indicate an actuarial deficit.

In the schematic, the baseline ratio FR_t may lie below or above the 100% threshold depending on the state M_t . However, the adjusted band may allow adequacy to cross the threshold even when baseline adequacy remains below it. This illustrates a key point aligned with the main paper: compensation mechanisms can change the effective adequacy position, but only to the extent that admissible transfers permit.

A.4 Interpretation for consolidation design

The conceptual message of Figure A1 is that consolidation rules implicitly define two components:

1. A baseline adequacy metric (captured here by FR_t), determined by a common valuation basis and the pre-merger balance-sheet position.
2. An admissible adjustment set, i.e., the range of deviations from baseline adequacy that the consolidation mechanism can implement through compensating transfers.

In the main model, this admissible adjustment is formalized through the side-payment vector $s=(s_i)_i$, the budget-balance constraint $\sum_i s_i=0$, and the adjusted funding ratios

$$AFR_i(s) = \frac{A_i + s_i}{L_i}$$

The figure provides a complementary interpretation: the consolidation rule can be seen as selecting an adjustment within a feasible envelope while attempting to satisfy fairness and adequacy requirements.

A.5 Link to the impossibility and to implementable rules

Finally, the schematic helps interpret two key results of the paper:

- Under strong non-dilution-style constraints (in FR terms) combined with budget balance, the feasible adjustment set may collapse to a trivial solution, meaning that transfers cannot move adequacy without making some participant worse off.
- Under implementable rules, such as equalization to a common benchmark FR^{tot} , the adjustment mechanism is used to make post-merger adequacy comparable across participants by mapping heterogeneous baseline positions into a shared adequacy target.

In this sense, Figure A1 is an intuition device: it visualizes how “adjusted adequacy” functions as a controlled deviation from baseline adequacy, and why consolidation design fundamentally requires explicit choices about the admissible scope of compensation.