

Regulatory Intensification and Pension Fund Performance: Evidence from Pension Funds in Brazil

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ABSTRACT

Purpose: This paper evaluates the causal impact of prudential regulatory intensification on Brazilian closed pension funds classified as systemically important (EFPC-ESI). The study aims to determine whether stricter governance, reporting, and compliance requirements, implemented as an asymmetric regulatory shock in 2019, produced structural improvements in these entities.

Design/methodology/approach: The study employed an empirical strategy using annual panel time-series data from 2014–2023. It compares EFPC-ESI (treatment group) with comparable non-ESI funds (control group). The methodology combines structural break tests and interaction-based regressions to distinguish persistent regulatory effects from transitory dynamics within the same institutional environment.

Findings: The results show that regulatory intensification generated statistically significant structural changes in capital-related indicators, particularly total assets and consolidated performance. However, effects on population and sustainability measures were found to be limited or non-persistent. The evidence suggests that heightened prudential supervision acts primarily as an amplifier of existing financial trajectories rather than producing broad structural shifts.

Research limitations/implications: The findings raise relevant questions about regulatory inflation and the cost–benefit trade-offs in pension fund supervision. A potential limitation involves the specific focus on the Brazilian institutional environment, which may require further comparative studies in other emerging markets to generalize the impact of asymmetric regulatory shocks.

Originality/value: This study contributes to the literature by providing a quasi-experimental analysis of regulatory shocks within the pension fund sector. It offers a unique perspective on how "systemically important" classifications affect institutional performance, shifting the debate from simple compliance to the actual structural efficacy of prudential supervision.

Keywords:

Intellectual Capital, ERM
Structure Practices,
Organizational Performance

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1. Introduction

Pension funds play a central role in modern financial systems by intermediating long-term savings, allocating capital, and contributing to macroeconomic stability. Because of their size, interconnectedness, and fiduciary responsibilities, large pension funds are often subject to heightened regulatory oversight, particularly when their potential failure poses systemic risks. As a result, regulators increasingly adopt differentiated supervisory regimes that impose stricter governance and compliance requirements on systemically important entities.

From an economic perspective, however, the effects of intensified prudential regulation are theoretically ambiguous. On the one hand, stronger supervision may enhance governance, reduce excessive risk-taking, and improve solvency, thereby increasing confidence among participants and beneficiaries. On the other hand, additional regulatory burdens may generate substantial compliance costs, reduce managerial flexibility, and divert resources away from productive investment activities, potentially leading to what the literature defines as regulatory or normative inflation (Stigler, 1971; Baldwin, Cave and Lodge, 2012).

This trade-off has gained renewed attention in recent empirical research. Contemporary studies emphasize that institutional and regulatory shocks rarely generate homogeneous effects, instead interacting with pre-existing

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structural characteristics of organizations and markets. Evidence from emerging economies suggests that regulatory intensity may amplify existing trajectories rather than induce broad-based structural transformation, particularly in highly regulated sectors (Andreoli, 2023; de Campos, 2023). These findings reinforce the importance of evaluating regulatory interventions through a causal and context-sensitive econometric lens.

The pension fund industry represents a particularly relevant environment for such analysis. Pension funds manage large pools of long-term savings, operate under strict fiduciary constraints, and are deeply embedded in financial markets. International regulatory frameworks, such as the OECD Core Principles of Private Pension Regulation and the G20/OECD Principles of Corporate Governance, explicitly recommend proportionality and risk-based supervision, arguing that regulatory intensity should reflect fund size, complexity, and systemic relevance (OECD, 2016; OECD, 2023). Despite these guidelines, recent studies highlight that the economic consequences of differentiated regulation remain underexplored, especially outside advanced economies (Smolski et al., 2024).

Brazil offers a unique institutional setting to address this gap. The Brazilian closed pension fund system (Entidades Fechadas de Previdência Complementar – EFPC) manages assets exceeding one trillion reais and represents a significant share of domestic long-term investment. In response to concerns related to governance failures, financial misconduct, and systemic risk, the national supervisory authority — the Superintendência Nacional de Previdência Complementar (Previc) — implemented a prudential framework that classifies a subset of large pension funds as systemically important entities (ESI). These funds became subject to enhanced supervision, stricter governance requirements, and additional reporting obligations, while other comparable funds continued to operate under the standard regulatory regime.

The consolidation of this differentiated supervisory framework around 2019 created an asymmetric regulatory shock within a homogeneous institutional environment. Systemically important pension funds were exposed to a discrete increase in regulatory intensity, whereas non-ESI funds were not. This setting enables a quasi-experimental evaluation of the economic effects of prudential regulatory intensification, isolating regulatory impacts from broader macroeconomic dynamics affecting the pension fund sector as a whole.

This paper examines whether enhanced prudential supervision of systemically important Brazilian closed pension funds generated persistent structural changes in financial and demographic outcomes. Using annual data from 2014 to 2023, we compare EFPC classified as ESI (treatment group) with comparable non-ESI funds (control group). Our empirical strategy combines structural break tests and interaction-based regressions to distinguish between transitory adjustments and lasting changes in key indicators such as total assets, performance, solvency, population, and sustainability.

By focusing on the economic consequences of differentiated regulation rather than its legal design, this study contributes to the applied literature on regulatory economics and pension fund governance. In line with recent empirical work on institutional shocks and economic performance (Andreoli, 2023; Smolski et al., 2024), the paper provides evidence on whether intensified prudential supervision enhances financial stability or primarily reinforces existing trajectories at the cost of increased regulatory burden. The findings are directly relevant for policymakers and regulators seeking to balance financial stability, governance quality, and regulatory efficiency in the supervision of large institutional investors.

2. Data and Empirical Strategy

2.1 Data and sample construction

The empirical analysis is based on annual data for Brazilian closed pension funds (Entidades Fechadas de Previdência Complementar – EFPC), obtained from official regulatory and supervisory records compiled by the Superintendência Nacional de Previdência Complementar (Previc). The dataset covers the period from **2014 to 2023**, allowing the comparison of pre- and post-regulatory intensification dynamics.

The treatment group consists of **systemically important pension funds (EFPC-ESI)**, as formally classified by the supervisory authority according to size, relevance, and systemic risk criteria. These entities became subject to enhanced prudential supervision, stricter governance requirements, and additional reporting obligations. The control group comprises **non-ESI pension funds with total assets above R\$ 2 billion**, ensuring comparability in terms of scale and institutional characteristics while excluding entities directly affected by the intensified regulatory framework.

The final sample includes **17 EFPC-ESI** in the treatment group and **52 non-ESI funds** in the control group. All variables are constructed consistently across entities and years, following regulatory definitions. The main outcome variables analyzed are:

- (i) population size (number of participants),
- (ii) total assets,

- (iii) applied expenditure,
- (iv) consolidated performance,
- (v) sustainability index, and
- (vi) absolute deviation measures associated with volatility and stability.

To mitigate scale effects and improve comparability across funds, variables expressed in monetary terms are analyzed in levels and growth-adjusted form, as reported in the original regulatory datasets.

Variable Definitions and Measurement. The key outcome variables analyzed in this study are defined as follows:

Population: Number of active participants in the pension fund.

Total Assets: Book value of total assets in Brazilian Reais (R\$), reported at year-end.

Applied Expenditure: Total expenses applied to pension operations, in R\$.

Absolute Deviation of Assets: A volatility measure calculated as the absolute deviation of annual asset growth from its trend, capturing short-term instability (Adrian and Shin, 2010).

Consolidated Performance: Annual financial performance measured as the net result of pension operations, in R\$.

Sustainability Index: A composite indicator ranging from 0 to 2, where values above 1 indicate that the fund's technical provisions are fully covered by its assets (Impavido et al., 2010).

2.2 Identification strategy and regulatory shock

The empirical identification exploits an asymmetric regulatory shock associated with the consolidation of prudential regulatory intensification in 2019. While all pension funds operate under the same macroeconomic environment and general regulatory framework, only EFPC classified as systemically important were subject to enhanced supervision and governance requirements.

This setting creates a quasi-experimental environment analogous to a difference-in-differences (DiD) design embedded in a time-series framework, where EFPC-ESI constitute the treated group and comparable non-ESI funds serve as the control group. The year 2019 is defined as the intervention point, consistent with the effective enforcement and operational consolidation of the intensified supervisory regime documented in the regulatory records.

2.3 Structural break analysis

To assess whether the regulatory shock is associated with persistent changes in the underlying data-generating process, the analysis first applies structural break tests. Specifically, Chow tests are employed to evaluate parameter stability before and after 2019 for each outcome variable and group.

The Chow test compares the fit of a pooled regression model with that of two sub-period regressions (pre- and post-2019), testing the null hypothesis of parameter stability. Rejection of the null indicates a structural break consistent with a regime change. This approach allows distinguishing between temporary fluctuations and lasting structural shifts associated with regulatory intensification.

2.4 Interaction-based regression models

To estimate the differential impact of regulatory intensification on EFPC-ESI, the study employs regression models with **time trends and interaction terms**, consistent with the econometric structure presented in the results files.

The baseline specification is given by:

$$Y_{it} = \alpha + \beta_1 ESI_i + \beta_2 Post_t + \beta_3 (ESI_i \cdot Post_t) + \gamma_t + \varepsilon_{it} \quad (1)$$

where Y_{it} represents the outcome variable for fund i in year t , ESI_i is a binary indicator for systemically important funds, $Post_t$ denotes the post-2019 period, $ESI_i \times Post_t$ captures the differential regulatory effect, and t is a linear time trend, and γ_t denotes a linear time trend. This specification follows the standard difference-in-differences design adapted to a panel setting.

The coefficient β_3 is the parameter of interest, representing the causal effect of intensified prudential supervision on treated funds relative to the control group. Robust standard errors are used to account for heteroskedasticity.

2.5 Time-series intervention and robustness checks

In addition to the regression framework, the analysis incorporates time-series intervention techniques to evaluate dynamic responses to the regulatory shock. For selected variables, ARIMA models with intervention components are estimated separately for treatment and control groups. These models capture autoregressive dependence and allow assessing whether post-2019 deviations are statistically distinguishable from historical dynamics.

3. Results

This section presents the econometric evidence on the effects of prudential regulatory intensification applied to systemically important Brazilian closed pension funds (EFPC-ESI). The analysis focuses on identifying whether the regulatory shock consolidated in 2019 generated persistent structural changes and differential post-event dynamics relative to comparable non-ESI funds.

Table 1 presents descriptive statistics for the main variables, separately for ESI and non-ESI funds. On average, ESI funds are substantially larger, with mean total assets of R\$ 34.3 billion compared to R\$ 4.3 billion for non-ESI funds. ESI funds also have higher applied expenditure, greater asset volatility, and a slightly lower sustainability index. The two groups exhibit similar patterns in population growth and consolidated performance. The full set of descriptive statistics is available in the online appendix.

Table 2 reports the results of structural break tests around 2019. Statistically significant breaks are detected for most capital-related indicators in both groups, particularly total assets and consolidated performance. These results indicate a change in the underlying data-generating process coinciding with the period in which enhanced supervisory requirements became fully operational. In contrast, demographic and sustainability-related indicators display weaker or mixed evidence of structural change, suggesting that the regulatory shock did not uniformly affect all dimensions of pension fund activity.

Table 3 summarizes the results from interaction-based regressions designed to capture the causal effect of regulatory intensification on EFPC-ESI after 2019. The baseline treatment coefficient (ESI) is positive and statistically significant for most financial variables, reflecting structural differences between systemically important and non-ESI funds. However, the interaction term identifying the differential post-2019 regulatory effect (Regulation \times ESI) is statistically significant only for total assets and volatility-related measures. This indicates that regulatory intensification primarily amplified existing capital accumulation trajectories and improved stability, rather than generating broad performance gains.

Table 4 reports the complete regression results for the difference-in-differences specification. Each column corresponds to a separate regression. The interaction coefficient captures the causal effect of the regulatory intensification on treated funds relative to the control group.

The results indicate that the regulatory shock had a statistically significant differential effect on total assets ($b_3 = 10.1$, billion, $p = 0.034$) and on asset volatility ($b_3 = -0.0116$), $p = 0.0003$). For the other outcomes—population, applied expenditure, consolidated performance, and sustainability index—the interaction terms are not statistically distinguishable from zero at conventional levels. This pattern suggests that the intensified supervision primarily amplified existing trajectories in balance-sheet size and stability, without generating broad-based improvements in demographic or sustainability indicators.

Taken together, the results suggest that prudential regulatory intensification in Brazil produced selective and economically meaningful effects, concentrated in balance-sheet size and stability. Other outcomes, such as population dynamics and sustainability indicators, exhibit limited responsiveness, consistent with transitory adjustments rather than persistent structural transformation.

Table 1: Descriptive Statistics by Group (2014–2023)

Variable	Group	N	Mean	SD	Median	Min	Max	Miss
Population	Non-ESI	468	2.37e4	2.59e4	1.67e4	2.03e3	2.12e5	0
Population	ESI	153	6.39e4	6.00e4	2.87e4	1.40e3	1.98e5	0
Total Assets	Non-ESI	468	4.29e9	2.11e9	3.63e9	8.71e8	1.22e10	0
Total Assets	ESI	153	3.43e10	5.11e10	1.62e10	2.89e7	2.69e11	0

Expenditure	Non-ESI	468	1.72e7	1.14e7	1.50e7	1.91e6	8.53e7	0
Expenditure	ESI	153	8.43e7	8.31e7	5.33e7	138	3.54e8	0
Abs. Dev.	Non-ESI	468	0.004	0.002	0.004	7.56e-4	0.027	0
Abs. Dev.	ESI	153	0.012	0.035	0.003	9.75e-7	0.308	0
Performance	Non-ESI	468	1.67e3	2.79e3	1.10e3	45.1	2.20e4	0
Performance	ESI	153	2.43e3	4.07e3	1.35e3	0.017	2.12e4	0
Sust. Index	Non-ESI	468	1.02	0.117	1.00	0.323	1.68	0
Sust. Index	ESI	153	0.974	0.142	1.00	0.301	1.32	0

Table 2: Structural break tests around the 2019 prudential regulatory intensification

Variable	Group	Break year	F-statistic	p-value
Population	Non-ESI	2019	2.085	0.0007
Population	ESI	2019	2.749	<0.0001
Total assets	Non-ESI	2019	2.847	<0.0001
Total assets	ESI	2019	2.003	0.0013
Applied expenditure	Non-ESI	2019	2.682	<0.0001
Applied expenditure	ESI	2019	2.387	<0.0001
Consolidated performance	Non-ESI	2019	3.219	<0.0001
Consolidated performance	ESI	2019	2.641	<0.0001
Sustainability index	Non-ESI	2019	1.710	0.011
Sustainability index	ESI	2019	1.985	0.0015

Table 3. Summary of regulatory and treatment effects

Variable	ESI effect	2019 regulation	Regulation × ESI	Interpretation
Population	+	n.s.	n.s.	Structural size effect
Total assets	+	n.s.	+	Regulatory amplification
Applied expenditure	+	n.s.	n.s.	Persistent cost differences
Absolute deviation	+	n.s.	-	Reduced volatility
Consolidated performance	+	n.s.	n.s.	Performance gains unrelated to regulation
Sustainability index	-	n.s.	n.s.	Trade-off effect

The ESI coefficient captures baseline differences between treated and control funds, the regulation coefficient reflects common time effects, and the interaction term (Regulation × ESI) identifies the differential impact of regulatory intensification after 2019. Reported signs refer to statistically significant effects at conventional levels (<0.05).

Table 4: Complete Regression Results

Dependent Variable	Estimate (-3)	Std. Error	Statistic	P-Value	Significant
Population	3,898.43	6,980.24	0.558	0.5767	No
Total Assets	1.01e+10	4.79e+09	2.119	0.0345	Yes
Absolute Deviation	-0.0116	0.0031	-3.664	0.0003	Yes
Sustainability Index	0.0163	0.0232	0.704	0.4815	No
Applied Expenditure	4,837,477	7,936,033	0.609	0.5423	No

4. Discussion

The results of this study indicate that prudential regulatory intensification targeted at systemically important Brazilian closed pension funds (EFPC-ESI) generated selective and asymmetric economic effects. Structural changes and differential post-2019 impacts are concentrated in capital-related indicators—particularly total assets and volatility measures—while demographic and sustainability outcomes exhibit limited or non-persistent responses. This pattern is consistent with a growing body of international evidence suggesting that intensified supervision primarily affects risk management, balance sheet size, and stability, rather than producing broad performance improvements.

The finding that regulatory intensification amplifies existing capital accumulation trajectories aligns with the literature on institutional investors and scale effects. Andonov, Bauer, and Cremers (2017) show that larger pension funds benefit from scale economies in investment management, governance, and access to sophisticated asset classes, which may be reinforced under stricter supervisory regimes. In this context, enhanced regulation may act less as a constraint and more as a coordinating mechanism that stabilizes and legitimizes growth paths already available to large funds.

At the same time, the absence of strong differential effects on population and sustainability indicators echoes prior evidence that regulatory tightening does not automatically translate into improved participant outcomes or broader welfare metrics. Rauh (2010) and Poterba, Rauh, Venti, and Wise (2007) document that pension fund regulatory and accounting reforms often affect funding behavior and asset allocation without materially altering participation dynamics or long-run benefit adequacy. The Brazilian evidence presented here is consistent with these findings, suggesting that intensified supervision primarily reshapes internal financial dynamics rather than external demographic engagement.

The reduction in volatility-related measures for EFPC-ESI after 2019 is particularly noteworthy. This result supports the interpretation that prudential supervision enhances risk discipline and reporting quality, consistent with international regulatory objectives. Similar effects are documented in studies analyzing the impact of tighter oversight on institutional investors and financial intermediaries (IMF, 2019; BIS, 2021). These studies emphasize that regulatory scrutiny can reduce excessive risk-taking and smooth balance sheet fluctuations, even when effects on average returns are modest.

From a regulatory economics perspective, the results also resonate with the theory of regulatory intensity and cost-benefit trade-offs. Baldwin, Cave, and Lodge (2012) argue that heightened regulation may improve governance outcomes while simultaneously imposing non-trivial compliance costs, potentially leading to diminishing marginal returns. Evidence from pension systems in OECD countries suggests that overly prescriptive supervision may crowd out managerial discretion without delivering proportional performance gains (OECD, 2016; OECD, 2023). The lack of strong post-2019 differential effects on performance and sustainability indicators in this study is consistent with this concern.

Importantly, the Brazilian case contributes to the literature by providing evidence from an emerging economy, where institutional capacity, enforcement credibility, and market depth differ from those of advanced economies. Studies focusing on Latin American pension systems highlight that regulatory reforms often interact with structural characteristics such as fund size concentration and governance heterogeneity, producing uneven outcomes across entities (Impavido, Lasagabaster, and García-Huitrón, 2010). The asymmetric effects observed between EFPC-ESI and non-ESI funds reinforce the relevance of proportionality in supervisory design.

To assess the practical relevance of the estimated effects, we compute the average percentage change in key variables from the pre- to post-period for each group. ESI funds grew by 39.2% in total assets after the regulatory intervention, compared to 37.3% for non-ESI funds. The similar growth rates underscore that the regulatory shock did not alter the relative growth trajectory of treated funds in a dramatic way, but rather reinforced pre-existing differences. The reduction in asset volatility for ESI funds corresponds to a decrease of about 0.012 in the absolute-deviation metric, which represents a meaningful improvement in stability given the sample mean.

Our analysis relies on a panel of 74 unique pension funds (18 ESI, 56 non-ESI) observed over ten years (2014–2023), yielding 621 fund-year observations. While this sample is representative of the Brazilian closed pension fund sector and provides sufficient statistical power to detect moderate to large effects, it may be underpowered to identify very small effect sizes. We therefore interpret non-significant results as indicative of effects that are either absent or too modest to be reliably detected with the available data. Future research with longer time series or more granular data could help clarify whether the regulatory intensification had subtler impacts on dimensions such as sustainability or governance quality.

Overall, the findings suggest that prudential regulatory intensification should be interpreted primarily as a risk-stabilization and scale-amplification mechanism, rather than a universal tool for improving all dimensions of pension fund performance. While enhanced supervision appears effective in shaping capital accumulation and reducing volatility among systemically important funds, its ability to deliver broader socioeconomic or sustainability gains remains limited. This reinforces recent calls in the literature for complementary policy instruments that address participant engagement, long-term adequacy, and cost efficiency alongside prudential oversight.

5. Conclusion

This paper examined the economic effects of prudential regulatory intensification applied to systemically important Brazilian closed pension funds (EFPC-ESI). Exploiting the asymmetric regulatory shock consolidated in 2019, we compared treated and non-treated funds within the same institutional environment to assess whether enhanced supervision generated persistent structural changes or merely transitory adjustments.

The results indicate that intensified prudential regulation produced selective and economically meaningful effects. Structural breaks and differential post-2019 dynamics are concentrated in capital-related indicators, particularly total assets and measures of volatility, suggesting that enhanced supervision strengthened balance-sheet stability and reinforced existing accumulation trajectories. In contrast, demographic outcomes and sustainability indicators exhibit limited or non-persistent responses, indicating that regulatory intensification did not translate into broad-based improvements across all dimensions of pension fund activity.

These findings contribute to the applied econometric literature by providing evidence that differentiated prudential supervision functions primarily as a risk-stabilization and scale-amplification mechanism, rather than as a universal driver of performance enhancement. While heightened oversight appears effective in reducing instability and supporting large funds' operational scale, its marginal impact on participation and sustainability outcomes remains limited.

Since the implementation of the ESI framework in 2019, Previc has continued to refine its supervisory approach, introducing additional governance guidelines and risk-based monitoring tools. These subsequent changes, however, fall outside the observation window of the present study and do not affect the identification of the initial regulatory shock. Future work could examine whether the cumulative effect of successive regulatory adjustments leads to different long-run outcomes.

From a policy perspective, the results underscore the importance of regulatory proportionality. Prudential intensification targeted at systemically important institutions may improve financial stability, but it should be complemented by additional policy instruments if broader objectives—such as long-term sustainability, participant engagement, or cost efficiency—are to be achieved. Future research may extend this analysis by incorporating fund-level risk measures, investment allocation channels, and longer post-regulation horizons to further assess the long-term welfare implications of differentiated pension fund supervision.

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