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RETURN-BASED STYLE ANALYSIS IN BRAZILIAN PENSION FUNDS

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INTRODUCTION

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Pension Funds

Pension Funds	✓Institutional investors legally required to invest their assets in financial markets. ✓Established as civil associations or foundations. ✓Aim to supplement retirement benefits from the General Social Security System. ✓Market holds approximately BRL 1,283 trillion in total assets (12% of the GDP).

Key Regulations

- **1988** Brazilian Federal Constitution
- **2001** Complementary Law No. 108/2001
- **2001** Complementary Law No. 109/2001

INTRODUCTION

Pension Funds

Primary objective of the paper:

Investigate the investment style adopted by managers of Brazilian pension plans via Sharpe's RBSA analysis (Sharpe, 1988, 1992).

THEORETICAL FRAMEWORK

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Pension Funds

- The pension fund market represents a significant wealth segment of the economy, and its management is especially important (Doyle et al., 2021).
- According to PREVIC (2023), as of December 2023, most pension fund investments were allocated to investment funds (67%), followed by government bonds (19%).
- Types of plans managed by pension funds: defined contribution (DC), variable contribution (VC) and defined benefit (DB).

THEORETICAL FRAMEWORK

Return-based style analysis

- Sharpe (1992):

$$R_i = [b_{i1}F_1 + b_{i2}F_2 + \ldots + b_{in}F_n] + e_i$$

- R_i denotes the return of asset i, F_1 represents the value of factor 1, F_2 the value of factor 2, F_n the value of the *n-th* factor, and e_i the model´s residual.

International studies:

- ✓ Andreu et al. (2009)
- ✓ Doyle et al. (2021)
- ✓ López & Walker (2021)
- ✓ Lee & Park (2021)
- ✓ Mirza et al. (2022)
- ✓ Patel et al. (2023)

Brazilian studies:

- ✓ Azambuja & Campani (2022)
- ✓ Cardoso et al. (2022)
- ✓ Silva et al. (2020)
- ✓ Paula & Iquiapaza (2022)

METHODOLOGY

METHODOLOGY

Data and Empirical Framework

Sample

- Pension plans managed by Brazilian pension funds (2015–2023, monthly data).

Data Sources

- Pension plans: provided by PREVIC (Official Letter Nº 2410/2024).
- Asset classes: ANBIMA, CIQ, INVESTING.COM.

Methods

- Weak style analysis.
- “Dynamic” style analysis (rolling regressions).
- Panel data regression.

METHODOLOGY

Data and Empirical Framework

Sample details (as of Dec 31, 2023):

- Total assets (in millions): BRL 1,267,282.
  - DB: BRL 740,586;
  - DC: BRL 172,791;
  - VC: BRL 353,906.
- Number of plans: 1,086.
  - DB: 287;
  - DC: 484;
  - VC: 315.

Weak style analysis:

- Strong: portfolio and positivity constraints;
- Semi-strong: portfolio constraint;
- Andreu et al. (2009): “non-exhaustive” models.

METHODOLOGY

Data and Empirical Framework

Equations:

(1) Fixed Effects: $R_{i,t} = \alpha + \beta_1 lnibov_{it} + \beta_2 lnifix_{it} + \beta_3 lnidagi_{it} + \beta_4 lnimab5_{it} + \beta_5 lnimab5m_{it} + \beta_6 lnimas_{it} + \beta_7 lnirfm_{it} + \beta_8 lnmsci_{it} + \beta_9 lnihfa_{it} + \beta_{10} Year_{in} + c_i + u_{it}.$

(2) Random Effects: $R_{i,t} = \alpha + \beta_1 ativo_{it} + \beta_2 financ_{it} + \beta_3 Year_{in} + \beta_4 modalidade_k + \beta_5 esi_j + \beta_6 patrocinio_p + \beta_7 indexador_z + u_{it}.$

METHODOLOGY

Data and Empirical Framework

Independent variables:

- IBOV: performance index of the most traded stocks in the Brazilian market;
- IFIX: performance index of real estate investment funds;
- IDAG: debenture index, reflecting the behavior of private debt portfolios;
- IMAB5: index of inflation-linked government securities indexed to IPCA (maturity < 5 years);
- IMAB5+: index of inflation-linked government securities indexed to IPCA (maturity >= 5 years);
- IMA-S: index of post-fixed securities linked to the basic interest rate (Selic);
- IRFM: index composed of prefixed government securities;
- MSCI: performance of large/medium-sized companies with global presence in developed countries (to capture foreign allocation);
- IHFA: benchmark for the hedge fund industry (multi-market funds in Brazil).

ANALYSIS & MAIN RESULTS

ANALYSIS & MAIN RESULTS

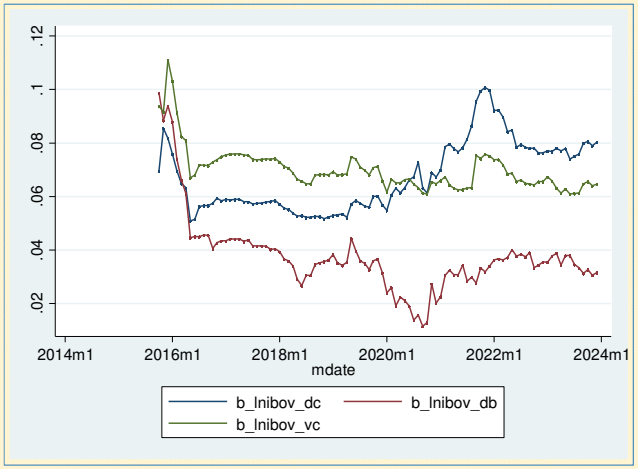
General and By-Type Style Analysis

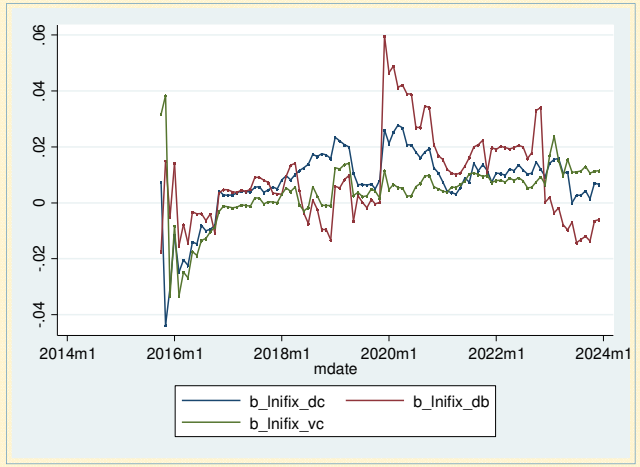
Variables	(1) General	(2) DB	(3) DC	(4) VC
ln(ibov)	0.0613***	0.0376***	0.0704***	0.0707***
	(0.00192)	(0.00441)	(0.00234)	(0.00319)
ln(ifix)	0.00972***	0.01000*	0.0107***	0.00845***
	(0.00184)	(0.00529)	(0.00225)	(0.00204)
ln(idag)	0.0918***	0.00231	0.162***	0.0738***
	(0.00918)	(0.0159)	(0.0141)	(0.0171)
ln(imab5)	0.138***	0.159***	0.138***	0.124***
	(0.00792)	(0.0167)	(0.00915)	(0.0165)
ln(imab5m)	0.0908***	0.112***	0.0684***	0.102***
	(0.00417)	(0.00917)	(0.00587)	(0.00691)
ln(imas)	0.229***	0.133	0.365***	0.144***
	(0.0336)	(0.0974)	(0.0395)	(0.0366)
ln(irfm)	0.000469	-0.0952***	0.0355***	0.0354***
	(0.00879)	(0.0210)	(0.0133)	(0.0106)
ln(msci)	0.0125***	0.00886***	0.0125***	0.0154***
	(0.00132)	(0.00320)	(0.00146)	(0.00247)
ln(ihfa)	0.0787***	0.0490***	0.107***	0.0698***
	(0.00507)	(0.0115)	(0.00712)	(0.00813)
Constant	0.00272***	0.00594***	-5.86e-05	0.00349***
	(0.000381)	(0.00101)	(0.000523)	(0.000464)
Obs.	107,671	30,307	43,149	34,215
R^2	0.311	0.133	0.434	0.417
Plans	1,132	292	507	333
Year FE	Yes	Yes	Yes	Yes

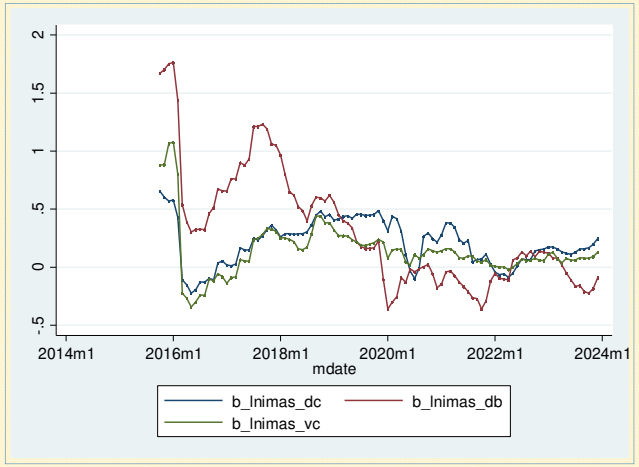
Note: ***/**/* indicate statistical significance at the 1%, 5% e 10%, respectively. Source: own elaboration.

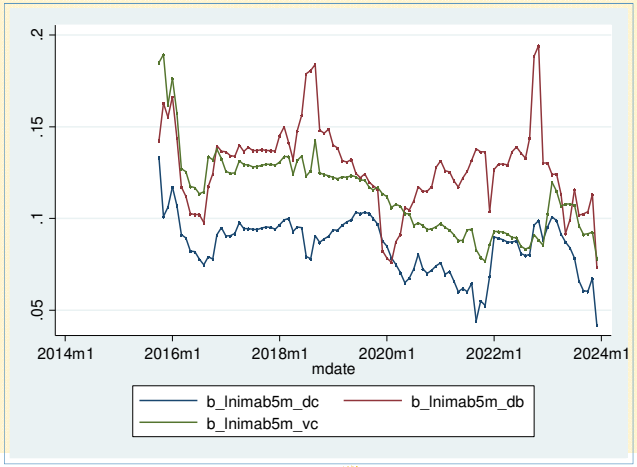
ANALYSIS & MAIN RESULTS

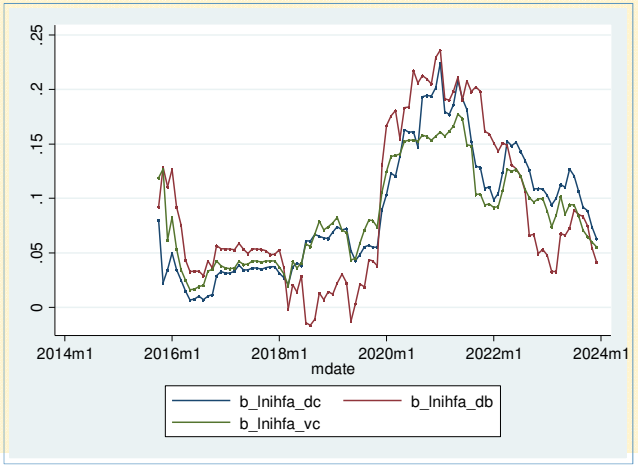
"Dynamic" Style Analysis (*rolling-regressions*)











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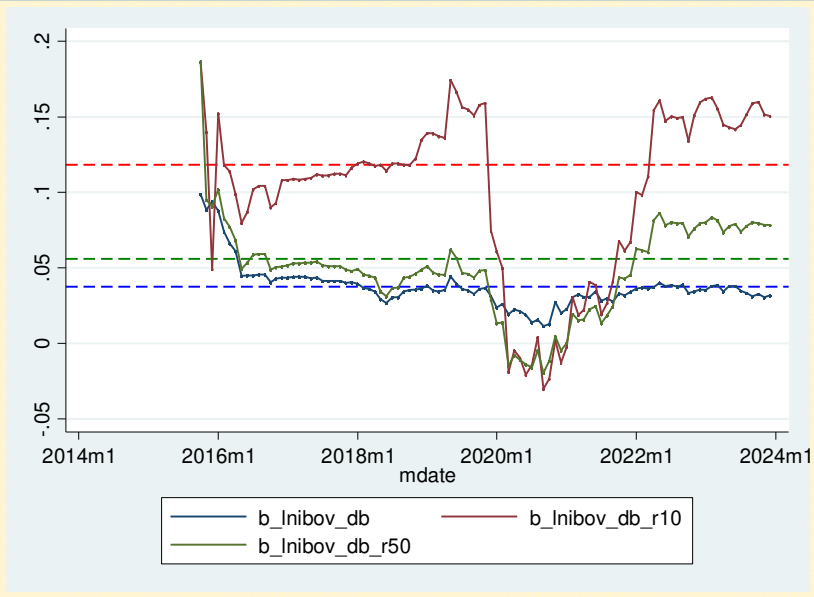

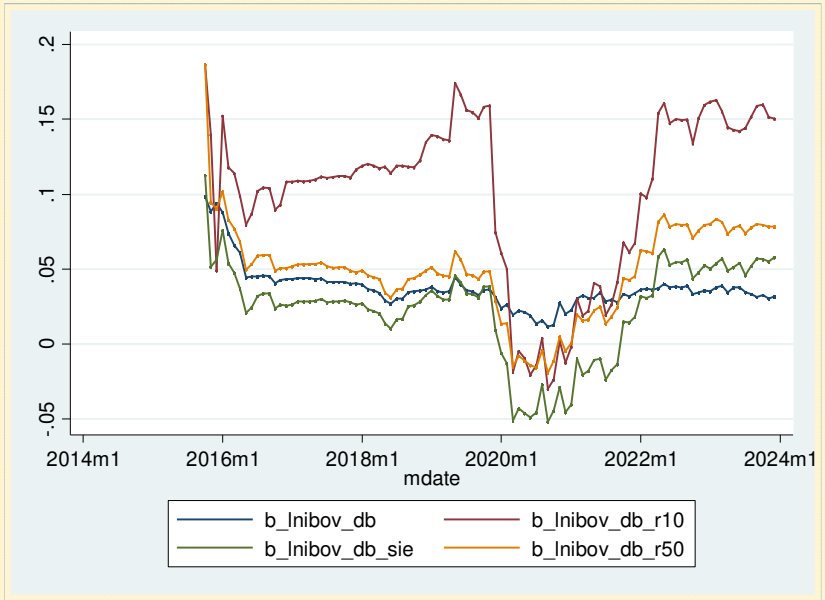

ANALYSIS & MAIN RESULTS

General and By-Type Style Analysis

Variables	(1) General	(2) DB	(3) DC	(4) VC	(5) RE
asset	0.000417**	3.84e-06	0.000614**	0.000310	0.000163***
	(0.000212)	(0.000608)	(0.000253)	(0.000281)	(4.87e-05)
fund	0.124***	0.126***	0.101**	0.158**	0.0658***
	(0.0263)	(0.0279)	(0.0485)	(0.0715)	(0.0114)
DC					-0.000792***
					(0.000183)
VC					-0.000510***
					(0.000157)
Non-SIE					0.000295**
					(0.000150)
Constant	0.000925	0.00905	-0.00199	0.00235	0.00475***
	(0.00382)	(0.0116)	(0.00428)	(0.00525)	(0.00121)
Obs.	100,941	26,912	42,127	31,902	100,941
R^2	0.040	0.014	0.067	0.051	
Plans	1,075	265	497	313	1,075
Year FE	Yes	Yes	Yes	Yes	Yes
Type FE					Yes
SIE FE					Yes
Sponsorship FE					Yes
Indexer FE					Yes

Note: ***/**/* indicate statistical significance at the 1%, 5% e 10%, respectively. Source: own elaboration.

CONCLUSION

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- Different allocation strategies observed among plan types.
- Pension fund investment styles vary over time, especially across certain plan types and asset classes.
- Significant allocation shifts during COVID-19 pandemic.
- Larger pension funds tend to have higher returns.
- Systemically important pension funds yield lower returns.
- DB plans generally show higher profitability than DC and VC plans.

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Thank you! Obrigado!

Questions?

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