E-Journal of Humanities, Arts and Social Sciences (EHASS)
ISSN – Online 2720-7722 | Print 2821-8949
Volume 6 Issue 14 2025 pp 4129 - 4153
Available online at: https://noyam.org/journals/ehass/
DOI: https://doi.org/10.38159/ehass.202561454

Unlocking Green Finance: The Role of Pension fund assets, Investment regulations and Environmental advocacy in SADC

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ABSTRACT

This paper explored the critical role of pension fund assets in driving green finance within the Southern African Development Community (SADC). Utilizing panel data from South Africa, Botswana, Namibia, and Zimbabwe from 2012 to 2022, the study examined the interactive effects of pension fund assets, investment regulations, and environmental advocacy on green finance investments. The findings reveal a significant positive relationship between pension fund assets and green investments, suggesting that larger pension funds are better positioned to contribute to green finance. Conversely, stringent investment regulations were found to have a negative impact, limiting the allocation of funds towards green investments. While environmental advocacy showed a positive correlation with green finance, its effect was statistically insignificant. The study concludes that to enhance the role of pension funds in green finance, there is a need for regulatory reforms that strike a balance between protecting investors and promoting sustainable investments. Additionally, the potential influence of environmental advocacy should be harnessed to foster greater commitment to green finance. The paper provides valuable insights for policymakers and industry stakeholders aiming to optimize the contributions of pension funds to sustainable development in the SADC region.

Keywords: Pension funds; Sustainable finance; Green environment advocacy; Investment regulations; SADC

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Publication History
Received: 12th June, 2025
Accepted: 20th October, 2025
Published online: 30th December, 2025

To Cite this Article:
Tondhlana, Arnold, Nyasha Kaseke, Pablo de Frutos Madrazo & Pedro Martin Cervantes. "Unlocking Green Finance: The role of Pension fund assets, Investment regulations and Environmental advocacy in SADC." *E-Journal of Humanities, Arts and Social Sciences* 6, no. 14 (2025): 4129 - 4153, https://doi.org/10.38159/ehass.202561454.

INTRODUCTION

The historical trajectory of climate action in the last three decades has been marked by significant milestones and challenges, underscoring the need for concerted global efforts to address climate change. Beginning with the Brundtland Commission in 1987, also known as the World Commission on Environment and Development, published the groundbreaking report "Our Common Future" which introduced the concept of sustainable development and emphasized the interconnectedness of economic development, social equity, and environmental protection.[1] In 1992, the United Nations Conference on

[1] Gru Brundtland et al., "Our Common Future," *Journal Medicine and War* 4, no. 1 (1987); Gro Harlem Brundtland, "Our Common Future—Call for Action," *Environmental Conservation* 14, no. 4 (August 24, 1987): 291–94,

Environment and Development (UNCED), publicly regarded as the Earth Summit, was held in Rio de Janeiro, which led to the ratification of Agenda 21, a detailed scheme for global, national, and local action on sustainable development. Additionally, the United Nations Framework Convention on Climate Change (UNFCCC) was set up to address climate change.[2]

Following that, the Kyoto Protocol was endorsed in 1997 and became effective in 2005, establishing legally enforceable targets for reducing emissions in developed nations, marking the first significant step in international efforts to reduce greenhouse gas emissions.[3] After that, the 2015 Paris Agreement, adopted at COP21, represented a pivotal moment in climate action by establishing a detailed international framework to mitigate the adverse effects of climate change by limiting the rise in global warming to significantly below 2°C, with additional effort directed towards keeping it to 1.5°C. The agreement required all countries to set and achieve national climate goals.[4] In the same year, the United Nations adopted the 2030 Agenda for Sustainable Development, which published 17 Sustainable Development Goals (SDGs). Inspiring this paper is Goal 13, which specifically calls for urgent action to combat climate change and its impacts.[5]

In 2016, the adoption of the Kigali Amendment to the Montreal Protocol had as its main objective the reduction of the levels of hydrofluorocarbons (HFCs), which are recognized as highly potent greenhouse gases. It was expected to prevent up to 0.5°C of global warming by the end of the century.[6] Between 2018 and 2019, a worldwide series of climate strikes took place, led by Greta Thunberg and engaged millions of people across the globe. These strikes brought significant public attention to the urgency of climate action.[7] In 2018, the Intergovernmental Panel on Climate Change (IPCC) issued a special communique on the impacts of global warming of 1.5°C above pre-industrial levels. The report highlighted the severe impacts of even 1.5°C of warming and underscored the need for rapid and far-reaching transitions in energy, land, urban, and industrial systems.[8] To scale up movement towards climate resilience, the Glasgow Climate Pact, adopted at COP26 in 2021, reaffirmed the Paris Agreement goals and urged countries to strengthen their national climate targets by phasing down coal power and a phase-out of inefficient fossil fuel subsidies.[9]

More recently, the highlighted in the Financing for Sustainable Development Report highlights that there is a growing "financing divide" between financing requirements and the actual pace of development funding globally. It stressed the need for increased financial resources to achieve the SDGs and address climate change, amidst challenges such as global conflicts in Ukraine and Gaza, surges in food and energy prices, and financial constraints.[10] To achieve the urgent global demands espoused in the Addis Ababa Action Agenda for Sustainable Development financing, the mobilization of financial resources is critical at both the country and multilateral level to steer efforts towards the achievement of the Sustainable Development Goals (SDGs).[11]

Despite progress made so far, financial constraints remain the most significant obstacle. Disparities in sustainable development persist between developed and developing nations, particularly countries in sub-Saharan Africa. Projections indicate the emergence of significant disparities in financial resources, which could potentially perpetuate a lasting "sustainable development divide" if not effectively

https://doi.org/10.1017/S0376892900016805; R. H. Cassen, "Our Common Future: Report of the World Commission on Environment and Development," *International Affairs* 64, no. 1 (1987): 126–126, https://doi.org/10.2307/2621529; David Simon, "Our Common Future: Report of the World Commission on Environment and Development (Book Review)," *Third World Planning Review* 9, no. 3 (August 1987): 285, https://doi.org/10.3828/twpr.9.3.x4k73r2p72w22402.

[2] United Nations, *Agenda 21: The United Nations Plan of Action from Rio* (United Nations, 1992).

[3] UNFCCC, "Kyoto Protocol: Framework Convention on Climate Change," *Kyoto Protocol*, 1997.

[4] UNFCCC, " Paris Agreement : United Nations Framework Convention on Climate Change" (Bonn: Climate Change Secretariat, 2015).

[5] Ergül Halisçelik and Mehmet Ali Soytas, "Sustainable Development from Millennium 2015 to Sustainable Development Goals 2030," *Sustainable Development* 27, no. 4 (July 22, 2019): 545–72, https://doi.org/10.1002/sd.1921.

[6] UNEP, " United Nations Environment Programme : Kigali Amendment to the Montreal Protocol," *United Nations*, 2016.

[7] Fridays for Future, " Global Climate Strikes," 2019, https://fridaysforfuture.org/.

[8] IPCC, "Global Warming of 1.5 ºC. ," 2018, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf.

[9] UNFCCC, "Thee Glasgow Climate Pact," 2021, https://unfccc.int/documents/310475.

[10] Halisçelik and Soytas, "Sustainable Development from Millennium 2015 to Sustainable Development Goals 2030"; United Nations Framework Convention on Climate Change (UNFCCC), "The Paris Agreement," 2015.

[11] Halisçelik and Soytas, "Sustainable Development from Millennium 2015 to Sustainable Development Goals 2030"; Markus Loewe, "Post 2015: How to Reconcile the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs)?" (Briefing paper, 2012); United Nations Framework Convention on Climate Change (UNFCCC), "The Paris Agreement."

addressed.[12] As such, development stakeholders and governments must seek to prioritize long-term strategies for resilient and inclusive development, while also addressing immediate crises, to mitigate worsening financial challenges in the future.[13]

Considering the preceding context, the necessity for the global community to align financial mechanisms with sustainable green development objectives is underscored.[14] To expedite the transition of national economies towards green transition, nations must devise their strategic pathways to attain Sustainable Development Goals (SDGs) through novel sustainability policies, undergirded by integrated and comprehensive national financial frameworks.[15] In this pursuit of global sustainable development and combating climate change, the role of institutional investors, particularly pension funds, has garnered increasing attention.[16]With substantial capital under management and a fiduciary duty to generate long-term returns for beneficiaries, pension funds hold significant potential to drive investments toward environmentally sustainable initiatives in future.[17] Pension funds have long-term commitments and investment timelines, placing them in a distinctive position to support the Sustainable Development Goals (SDGs) by addressing financing gaps in climate change.[18]

However, their involvement remains obscure. UNCTAD (2023) states that over half of the top one hundred public pension and sovereign wealth funds globally do not share information or report on sustainability matters.[19] As such, institutional investors have the potential to further integrate sustainability into their operations.[20] In fact, it is more critical that domestic pension funds in sub-Saharan Africa integrate green investing in their portfolios, in a background where traditional international capital markets have been jittery and very fluid and biased against African borrowers in the face of the Global financial crisis of 2008 and more recently the COVID pandemic (2020-2023) and geopolitical disturbances in Ukraine and Gaza. In such a funding quagmire, it is time for Africa and other emerging markets to explore the potential of domestic pension fund infrastructure (also called Domestic Direct Investment-DDI), to propel and spur their economic growth and development trajectories in line with green and climate change realities of the 21st century.[21]

In recent years, global discourse on sustainable finance has increasingly emphasized the importance of aligning domestic resource mobilization with international green transition financing frameworks. Institutions such as the IMF, OECD, and UNFCCC have highlighted that achieving global climate neutrality requires the participation of both advanced and emerging economies through integrated financial mechanisms. Emerging markets face acute challenges in accessing concessional and blended finance due to perceived risks and credit limitations, which makes domestic institutional capital, particularly pension funds, critical for bridging the climate finance gap. Within this context, the Southern African Development Community (SADC) presents a valuable case for understanding how locally mobilized pension fund assets can complement global initiatives like the Paris Agreement and the Addis

[12] IMF, " Global Financial Stability Report: Financial and Climate Policies for a High-Interest-Rate Era," 2023, https://www.imf.org/en/Publications/GFSR/Issues/2023/10/10/global-financial-stability-report-october-2023; Loewe, "Post 2015: How to Reconcile the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs)?"; J. D. Sachs, *The Age of Sustainable Development* (Columbia University Press, 2015).

[13] UNDP, "SDG's in Action," Sustainable Development Goals, August 24, 2024, https://www.undp.org/sustainable-development-goals.

[14] OECD, "Climate Finance Provided and Mobilised by Developed Countries in 2023," *Organisation for Economic Co-Operation and Development*, 2023.

[15] IPCC, "Sixth Assessment Report: Climate Change and Indigenous Knowledge," *Intergovernmental Panel on Climate Change*, 2023.

[16] R. Della-Croce, "Trends in Large Pension Fund Investment in Infrastructure," December 7, 2012, https://doi.org/10.1787/5k8xd1p1p7r3-en; GEF, " The Global Environment Facility Monitoring Report 2023," 2023, https://www.thegef.org/sites/default/files/documents/2024-01/EN_GEF.C.66.03_The_GEF_Monitoring_Report_2023_0.pdf.

[17] CPI, "Global Landscape of Climate Finance 2023," 2023, https://www.climatepolicyinitiative.org/wp-content/uploads/2023/11/Global-Landscape-of-Climate-Finance-2023.pdf.

[18] R. Della-Croce, Kaminker, C. R., and F. Stewart, "The Role of Pension Funds in Financing Green Growth Initiatives," September 1, 2011, https://doi.org/10.1787/5kg58j1lwdjd-en; IRENA, " Renewable Capacity Statistics 2023," 2023, https://www.irena.org/Publications/2023/Mar/Renewable-capacity-statistics-2023.

[19] UNCTAD, "African Continental Free Trade Area: Advancing Pan-African Integration. Some Considerations," 2023.

[20] Ben Caldecott, "Achieving Alignment in Finance," 2019; Jonathan P. Doh et al., "Does the Market Respond to an Endorsement of Social Responsibility? The Role of Institutions, Information, and Legitimacy," *Journal of Management* 36, no. 6 (November 1, 2010): 1461–85, https://doi.org/10.1177/0149206309337896; Benedictus Mingeli, "Pension Fund Investment and Infrastructure Development in Namibia," 2020; UNEP-FI, " Aligning Finance for the Net-Zero Economy," 2023, https://www.unepfi.org/themes/climate-change/aligning-finance-for-the-net-zero-economy-thought-leadership-papers-5-6/.

[21] Halisçelik and Soytas, "Sustainable Development from Millennium 2015 to Sustainable Development Goals 2030."

Ababa Action Agenda on Financing for Sustainable Development. By exploring the intersection of pension fund growth, investment regulations, and environmental advocacy, this study situates the SADC experience within the broader narrative of climate finance in emerging markets.

This paper, therefore, provides several contributions to the literature on pension funds and green finance in Southern Africa. First, we assess the contributions and feasibility of scaling up the role of domestic pension funds, ex-ante, in closing the financing gaps in green financing, for which understanding is critical for future policy steps. Second, we provide empirical evidence regarding investment contributions of pension funds' assets in the green transition in mitigation and adaptation to climate change risks in SADC. Third, we introduce a novel control variable, green environment advocacy, to examine its impact on pension fund green investment behaviour, alongside other factors such as pension investment regulations and pension asset size relative to GDP. While the absorptive capacity influence of advocacy has been explored in some management disciplines,[22] to the best of our knowledge, it has not been formally investigated in our area, and this contributes to the emerging literature on the role of advocacy in fostering sustainable finance. Finally, we provide scientific evidence through robust econometric modelling to policymakers to design strategic investment frameworks to harness national pension funds' capital to optimize institutional returns while scaling up investments towards green economic growth in SADC.

The structure of this paper is as follows. Section 2 covers the theoretical, conceptual foundations, and green finance landscape with regard to pension funds. Section 3 describes the methods and analytical strategy, Section 4 presents results, Section 5 discusses findings, and Section 6 concludes.

Pension Funds and Green Finance: Concepts and Landscape in Africa

The literature on green finance and pension fund investment reveals a growing recognition of the financial sector's role in accelerating low-carbon transitions. This section consolidates three key themes: the conceptual scope of green finance; the African green finance landscape; and the role of pension funds in mobilizing domestic resources for sustainable growth. Each sub-section highlights theoretical and relevant empirical perspectives.

Conceptual scope of green finance

Green finance, also called sustainable finance, encompasses financial initiatives that drive the shift towards a sustainable, low-carbon economy while addressing global risks like climate change, emerging environmental and sustainability risks.[23] It entails funding projects and initiatives with positive environmental impacts that reduce greenhouse gas emissions and promote the use of renewable energy resources.[24] On a broader scale, it brings together environmental, social, and governance (ESG) factors into investment choices to foster sustainable economic growth, social welfare, and environmental preservation. Essentially, it advocates for positive transition by influencing the allocation of capital towards projects that support sustainability and reduce adverse environmental effects by over-reliance on fossil fuels and other non-renewable energy resources.[25] It acts as a fulcrum for global green transitioning

[22] Dirk W. G. A. Broeders, Kristy A. E. Jansen, and Bas J. M. Werker, "Pension Fund's Illiquid Assets Allocation under Liquidity and Capital Requirements," *Journal of Pension Economics and Finance* 20, no. 1 (January 7, 2021): 102–24, https://doi.org/10.1017/S1474747219000398; Fernando López and Eduardo Walker, "Investment Performance, Regulation and Incentives: The Case of Chilean Pension Funds," *Journal of Pension Economics and Finance* 20, no. 1 (January 6, 2021): 125–50, https://doi.org/10.1017/S1474747219000350.

[23] S. Bhatnagar and D. Sharma, "Evolution of Green Finance and Its Enablers: A Bibliometric Analysis," *Renewable and Sustainable Energy Reviews* 162 (July 2022): 112405, https://doi.org/10.1016/j.rser.2022.112405; Simon Dikau and Ulrich Volz, "Central Banking, Climate Change, and Green Finance," in *Handbook of Green Finance* (Springer, 2019), 81–102.

[24] Ulrich Volz, "Fostering Green Finance for Sustainable Development in Asia," in *Routledge Handbook of Banking and Finance in Asia* (Abingdon, Oxon ; New York, NY : Routledge, 2019.: Routledge, 2018), 488–504, https://doi.org/10.4324/9781315543222-27; Simon Zadek and Cassie Flynn, "South-Originating Green Finance: Exploring the Potential," 2014.

[25] Aaron Ezroj, *Carbon Risk and Green Finance* (Abingdon, Oxon ; New York, NY : Routledge, 2021. | Series: Banking, money and international finance: Routledge, 2020), https://doi.org/10.4324/9781003095996; The Chartered Banker, " What Is Green and Sustainable Finance? ," 2023, https://www.charteredbanker.com/resource_listing/knowledge-hub-listing/what-is-green-and-sustainable-finance.html.

through the allocation of investments towards environmentally friendly projects by incentivizing investments in renewable energy, energy efficiency, and other sustainable ventures.[26]

Batsukh et al., characterize green finance as a framework that streamlines and finances ventures related to renewable or clean energy, resource efficiency, clean production, emission reduction, enhanced waste management and other projects that contribute to the growth and development of a green economy.[27] Green financing supports the establishment of a green economy, which represents an alternative perspective to development: one that can uplift standards of living to align with the principles of sustainable development. Dikau and Volz add that green finance advocates for a triple bottom line by advancing economic, environmental, and social well-being.[28] Furthermore, a green economy ensures the "long-term enhancement of human well-being and the reduction of inequality, enabling future generations to avert substantial environmental hazards."[29]

Green investment allocation pension funds include different types of environmentally sustainable assets and projects whose impacts address climate change, enhance resource efficiency and promote sustainable development.[30] Such may include renewable energy projects, energy efficiency initiatives, clean transportation, sustainable infrastructure, green bonds, natural resource conservation, clean technology and innovation, socially responsible investments (SRI), carbon offsetting projects and water and waste management.[31] These present an array of potential green economy investment options to guide the study on the definition scope. It may not be exhaustive due to updates resulting from new findings in climate change research, and as such, it provides a range of investment possibilities which may guide pension funds interested in aligning their portfolios with environmental sustainability or increasing their contributions to the green economy transition.

Green finance landscape in Africa

The context of green economy investment financing in Africa is driven by a convergence of environmental, economic, social, and developmental factors. The African continent is endowed with abundant natural resources and possesses huge potential in renewable energy, ranging from geothermal, wind and solar. Notwithstanding such potential, the continent continues to face major environmental issues, which include climate change, deforestation, biodiversity loss, and pollution.[32] Consequently, it requires an urgent need to shift towards a green economy paradigm that supports sustainable development, advocates for environmental stewardship, and tackles the interrelated issues of poverty reduction, social justice, and climate resilience is being increasingly acknowledged as pivotal in response to these challenges.[33] However, for Africa's transition, the task needs huge green financial flows to mitigate the

[26] Nannette Lindenberg, "Definition of Green Finance," 2014; Dayong Zhang, Zhiwei Zhang, and Shunsuke Managi, "A Bibliometric Analysis on Green Finance: Current Status, Development, and Future Directions," *Finance Research Letters* 29 (June 2019): 425–30, https://doi.org/10.1016/j.frl.2019.02.003.

[27] Egshiglent Batsukh et al., "Green Financing in Developing Countries: Experiences from Mongolia, Kenya and Nigeria," *Emerging Issues on Trade and Sustainability* 37 (2019).

[28] Dikau and Volz, "Central Banking, Climate Change, and Green Finance"; Volz, "Fostering Green Finance for Sustainable Development in Asia."

[29] Elena Tarkhanova, Anhelica Fricler, and Natalia Baburina, "Green Economy in Russia: Leadership and Financial Aspects," in *5th International Conference on Social, Economic, and Academic Leadership (ICSEALV 2019)* (Atlantis Press, 2020), 197–203; UNEP, " UNEP Medium Term Strategy 2022-2025," 2024, https://www.unep.org/resources/people-and-planet-unep-strategy-2022-2025; Zadek and Flynn, "South-Originating Green Finance: Exploring the Potential."

[30] Bhatnagar and Sharma, "Evolution of Green Finance and Its Enablers: A Bibliometric Analysis"; L.L.B. Lazaro et al., "What Is Green Finance, after All? – Exploring Definitions and Their Implications under the Brazilian Biofuel Policy (RenovaBio)," *Journal of Climate Finance* 2 (March 2023): 100009, https://doi.org/10.1016/j.jclimf.2023.100009; Zadek and Flynn, "South-Originating Green Finance: Exploring the Potential."

[31] Bhatnagar and Sharma, "Evolution of Green Finance and Its Enablers: A Bibliometric Analysis"; Lazaro et al., "What Is Green Finance, after All? – Exploring Definitions and Their Implications under the Brazilian Biofuel Policy (RenovaBio)"; Suwan Long et al., "Climate Finance: What We Know and What We Should Know?," *Journal of Climate Finance* 1 (December 2022): 100005, https://doi.org/10.1016/j.jclimf.2023.100005.

[32] Goshu Desalegn and Anita Tangl, "Enhancing Green Finance for Inclusive Green Growth: A Systematic Approach," *Sustainability* 14, no. 12 (June 17, 2022): 7416, https://doi.org/10.3390/su14127416; Peterson K. Ozili, "Green Finance Research around the World: A Review of Literature," *International Journal of Green Economics* 16, no. 1 (2022): 56, https://doi.org/10.1504/IJGE.2022.125554.

[33] Desalegn and Tangl, "Enhancing Green Finance for Inclusive Green Growth: A Systematic Approach"; G. Marbuah, "Scoping the Sustainable Finance Landscape in Africa: The Case of Green Bonds," 2020, https://policycommons.net/artifacts/1424160/scoping-the-sustainable-finance-landscape-in-africa/.

effects and adapt to climate change risks, and meaningfully contribute to the reduction of greenhouse gas (GHG) emissions.[34]

Research has shown that Africa requires USD 2.8 trillion to execute its Nationally Determined Contributions (NDCs) as per the Paris Agreement between 2020 and 2030.[35] This funding is anticipated to help the continent in containing global warming to 1.5°C while dealing with the major shocks of climate change. African national governments have pledged to provide USD 264 billion (approximately 10%) of this amount, leaving USD 2.5 trillion as unmet climate finance needs. Hence, alternative mechanisms must be explored to bridge this gap, given that national budgets are already strained, catering to other societal requirements.[36]

A collaborative approach involving all stakeholders is therefore critical for Africa to achieve its climate objectives.[37] Public and private institutions must intensify their efforts to fulfil Africa's climate finance requirements.[38] The continent's shortfall requires an annual provision of USD 277 billion to implement its NDCs and attain the climate targets by 2030. Presently, the annual climate finance inflows in Africa amount to merely USD 29.5 billion, constituting only 11% of the USD 277 billion annual necessity for implementing NDCs towards meeting the 2030 climate objectives.[39] This gap is likely to be wider due to countries underestimating their financial needs, particularly concerning adaptation, owing to challenges in data and methodologies for costing their NDCs.[40] This state of climate finance resource constraints indicates an urgency and delay in taking measures, which could result in higher costs for the continent in the future.[41]

In Africa, while climate finance investment requirements vary by sub-regions, all received significantly inadequate official climate finance support for addressing their climate-related challenges. The Southern African region exhibits the most significant deficit in financing when compared to other regions on the African continent.[42] The substantial climate finance requirements in South Africa alone, totalling USD 107 billion annually, primarily contribute to the disparity, along with one of the least significant levels of climate investment at the regional level. The nations in Central and East Africa face notable discrepancies in climate investment as a percentage proportion of their Gross Domestic Product, averaging 26% and 23%, respectively. In contrast, North African countries exhibit the smallest climate investment gaps, representing 3% of their GDP. Nevertheless, the actual climate finance needs in these nations exceed current funding by a factor of three to six times.[43]

It is a fact that Africa faces a significant challenge in mobilizing additional funding beyond the multilateral assistance flows, and an urgent need to leverage private financing lingers. Optionally, through domestic resource channels, to address the growing gap in climate finance. Globally, private investment

[34] Desalegn and Tangl, "Enhancing Green Finance for Inclusive Green Growth: A Systematic Approach"; Marbuah, "Scoping the Sustainable Finance Landscape in Africa: The Case of Green Bonds."

[35] Sandra Guzmán et al., "The State of Climate Finance in Africa: Climate Finance Needs of African Countries," *Climate Policy Initiative*, 2022; United Nations Framework Convention on Climate Change (UNFCCC), "The Paris Agreement."

[36] Della-Croce, "Trends in Large Pension Fund Investment in Infrastructure"; Della-Croce, R., and Stewart, "The Role of Pension Funds in Financing Green Growth Initiatives."

[37] Jiahui Xu et al., "Research Landscape of Energy Transition and Green Finance: A Bibliometric Analysis," *Heliyon* 10, no. 3 (February 2024): e24783, https://doi.org/10.1016/j.heliyon.2024.e24783.

[38] IPCC, "Sixth Assessment Report: Climate Change and Indigenous Knowledge"; Phemelo Tamasiga et al., "Is Africa Left behind in the Global Climate Finance Architecture: Redefining Climate Vulnerability and Revamping the Climate Finance Landscape—A Comprehensive Review," *Sustainability* 15, no. 17 (August 29, 2023): 13036, https://doi.org/10.3390/su151713036.

[39] Guzmán et al., "The State of Climate Finance in Africa: Climate Finance Needs of African Countries"; IEA, "Financing Clean Energy in Africa," 2023, https://iea.blob.core.windows.net/assets/f76594a5-8a9f-4820-ba3e-2908e03b02a9/FinancingCleanEnergyinAfrica.pdf.

[40] Kalkidan A. Mulatu et al., "Nationally Determined Contributions to the 2015 Paris Agreement Goals: Transparency in Communications from Developing Country Parties," *Climate Policy* 24, no. 2 (February 7, 2024): 211–27, https://doi.org/10.1080/14693062.2023.2285519; UNFCCC., " Determining the Needs of Developing Countries to Implement the Paris Agreement and the Convention," Report of the Standing Committee on Finance, Issue. https://unfccc.int/sites/default/files/resource/cp2021_10a02_cma2021_07a02.pdf, 2022, https://unfccc.int/sites/default/files/resource/cp2021_10a02_cma2021_07a02.pdf.

[41] Tamasiga et al., "Is Africa Left behind in the Global Climate Finance Architecture: Redefining Climate Vulnerability and Revamping the Climate Finance Landscape—A Comprehensive Review."

[42] Rabah Arezki, "Climate Finance for Africa Requires Overcoming Bottlenecks in Domestic Capacity," *Nature Climate Change* 11, no. 11 (November 11, 2021): 888–888, https://doi.org/10.1038/s41558-021-01191-7.

[43] Arezki, "Climate Finance for Africa Requires Overcoming Bottlenecks in Domestic Capacity"; Guzmán et al., "The State of Climate Finance in Africa: Climate Finance Needs of African Countries"; Tamasiga et al., "Is Africa Left behind in the Global Climate Finance Architecture: Redefining Climate Vulnerability and Revamping the Climate Finance Landscape—A Comprehensive Review."

in climate initiatives accounts for half of total climate finance,[44] yet its impact remains unclear. In Africa, this proportion accounts for 14%, an anomaly that may be attributed to actual risks, perceived risks, and investment sizes in green finance projects that discourage private investors. Efforts must therefore be intensified in this area to make private funding more conducive to expanding contributions to the climate change agenda.[45]

In 2020, Multilateral Development Financial Institutions (mDFIs) and other Climate Financing funds constituted the biggest portion of public climate finance (49%), followed by Bilateral Development Institutions (bDFIs) (22%), international governments (16%), and climate funds (4%).[46] However, in Africa, CPI reports that private climate financing only accounted for 14% (USD 4.2 billion) of total climate finance in Africa.[47] This is significantly lower than other regions such as South Asia (37%), East Asia and Pacific (39%) and Latin America & Caribbean (49%). This pattern highlights the necessity for the private sector in Africa to scale up its role in financing climate change and sustainability, and may require supportive public interventions, advancement in renewable energy technologies and improved funding models for renewable energy projects as opposed to adaptation-based projects.[48]

What factors contribute to this phenomenon in Africa regarding the expansion of private-sector green economy investments? Notably, policy challenges must tackle the limited capital availability, high transaction costs and perceived investment risks hindering private sector involvement in green initiatives.[49] Despite the utilization of innovative financial tools like green bonds, climate funds, impact investing and public-private partnerships to mobilize resources, aimed at bridging green financing gaps, their impact remains significantly minimal.[50] Eventually, Development Finance Institutions (DFIs), Multilateral Development Banks (MDBs), and international donor agencies still dominate the climate financing landscape, offering concessional financing, technical support, and capacity building to boost green investments in Africa.

From the insights above, the state of green investment funding in Africa underscores a need for coordinated actions, creative solutions, and transformative investments to tackle environmental issues, foster sustainable development, and unlock the continent's considerable potential for green development.[51] Collaborative efforts involving governments, businesses, civil society, and international partners are critical to a resilient, inclusive, and environmentally sustainable future in Africa.

Pension funds and resource mobilization

Pension funds are significant long-term investors and key stakeholders in the mobilization of long-term funds to support infrastructure development.[52] To address the perennial problem of low levels of development, which is compounded by the lack of and poor-quality infrastructure in Sub-Saharan African (SSA) economies, it needs to mobilise resources for financing development initiatives that translate into

[44] CPI, " The State of Climate Finance in Africa: Climate Finance Needs of African," 2022, https://www.climatepolicyinitiative.org/wp-content/uploads/2022/06/Climate-Finance-Needs-of-African-Countries-1.pdf; Tamasiga et al., "Is Africa Left behind in the Global Climate Finance Architecture: Redefining Climate Vulnerability and Revamping the Climate Finance Landscape—A Comprehensive Review."

[45] Arezki, "Climate Finance for Africa Requires Overcoming Bottlenecks in Domestic Capacity."

[46] CPI, " Global Landscape of Climate Finance 2021," 2021, https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/.

[47] CPI, " The State of Climate Finance in Africa: Climate Finance Needs of African."

[48] Arezki, "Climate Finance for Africa Requires Overcoming Bottlenecks in Domestic Capacity"; Seoni Han, "Innovative Climate Financing for a Just Transition in Africa," *SSRN Electronic Journal*, 2023, https://doi.org/10.2139/ssrn.4549111.

[49] Arezki, "Climate Finance for Africa Requires Overcoming Bottlenecks in Domestic Capacity"; Isaac Doku, Ronney Ncwadi, and Andrew Phiri, "Determinants of Climate Finance: Analysis of Recipient Characteristics in Sub-Sahara Africa," *Cogent Economics & Finance* 9, no. 1 (January 1, 2021), https://doi.org/10.1080/23322039.2021.1964212.

[50] Doku, Ncwadi, and Phiri, "Determinants of Climate Finance: Analysis of Recipient Characteristics in Sub-Sahara Africa"; Edward M. Mungai, S. Wagura Ndiritu, and Izael Da Silva, "Unlocking Climate Finance Potential and Policy Barriers—A Case of Renewable Energy and Energy Efficiency in Sub-Saharan Africa," *Resources, Environment and Sustainability* 7 (March 2022): 100043, https://doi.org/10.1016/j.resenv.2021.100043.

[51] Mungai, Ndiritu, and Da Silva, "Unlocking Climate Finance Potential and Policy Barriers—A Case of Renewable Energy and Energy Efficiency in Sub-Saharan Africa."

[52] Cyprian Amutabi, "Domestic Resource Mobilization for Economic Development in Africa: Challenges, Policy Options, and Prospects in the New Horizon," 2023; F. Stewart and J. Yermo, "Coverage of Funded Pension Plans," July 1, 2008, https://doi.org/10.1787/241142156207; A. N. R. Sy, "Leveraging African Pension Funds for Financing Infrastructure Development," 2017, https://policycommons.net/artifacts/1447336/leveraging-african-pension-funds-for-financing-infrastructure-development/.

improving productive capacities and potential and uplift living standards. The impact of infrastructure on productivity and output has a direct forward linkage and serves as a critical input to the production potential of economies.[53] While infrastructure development requires a multi-stakeholder approach, national governments need to take the lead in addressing infrastructure gaps by directing domestic and external financial resources towards this cause. Estimates suggest that the infrastructure funding deficit in Africa ranged from US$68 billion to US$108 billion annually, and projections indicated a persistent increase over the medium-term horizon in Africa.[54]

Baker McKenzie sheds light on the fact that infrastructure financing dynamics in Africa have indicated a widening financing gap during the COVID-19 pandemic due to falling international banks' lending capacity, coupled with declines in multilateral and bilateral lending.[55]

As it stands, African countries encounter significant capacity constraints concerning lending for infrastructure projects. Consequently, they face challenges in resource mobilization to bridge the infrastructure gap.[56] Followed closely, this presents an opportunity for pension funds, which remain underutilized in SSA, to fill the gap. Pension funds, alongside other institutional investors like insurance companies and sovereign wealth funds, possess the potential to serve as conduits for long-term investment resources owing to their extended investment horizons.[57]

Arezki and Sy, and Inderst offer support that institutional investments, such as pension funds, can leverage on the increasing availability of financial instruments to address the gaps left by traditional investors reaping good returns on their investments in emerging green transition markets.[58] Nonetheless, this has its fair share of impediments in the form of governance challenges, regulatory hurdles, and a dearth of suitable financial instruments restricting the allocation of pension funds to infrastructure projects.[59] However, for pension funds, investing in infrastructure presents a prudent avenue for diversification, which shields institutional investors from the impacts of inflation and fluctuating interest rates.[60] Besides their impacts on capital infrastructure investments, pension funds play an additional important role in fostering the growth of capital markets and enhancing liquidity in numerous economies.[61]

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[53] AfDB, "Africa's Infrastructure: Great Potential but Little Impact on Inclusive Growth ," African Economic Outlook 2018, Issue, 2018, https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2018AEO/African_Economic_Outlook_2018_-_EN_Chapter3.pdf; Amutabi, "Domestic Resource Mobilization for Economic Development in Africa: Challenges, Policy Options, and Prospects in the New Horizon."

[54] AfDB, "Africa's Infrastructure: Great Potential but Little Impact on Inclusive Growth "; K. Juvonen et al., "Unleashing the Potential of Institutional Investors in Africa ," Working Paper No 325, 2019, https://www.afdb.org/sites/default/files/documents/publications/wps_no_325_unleashing_the_potential_of_institutional_investors_in_africa_c_rv1.pdf; Sy, "Leveraging African Pension Funds for Financing Infrastructure Development."

[55] Baker Mckenzie, "New Dynamics Shifting Patterns in Africa's Infrastructure Funding," 2021, https://www.bakermckenzie.com/-/media/files/insight/publications/2021/04/new-dynamics_africa_report_update.pdf?la=en.

[56] Amutabi, "Domestic Resource Mobilization for Economic Development in Africa: Challenges, Policy Options, and Prospects in the New Horizon"; Juvonen et al., "Unleashing the Potential of Institutional Investors in Africa "; A B Kamara, L Kasekende, and L Ndikumana, "Mitigating the Impacts of the Financial and Economic Crisis in Africa," 2009; Sy, "Leveraging African Pension Funds for Financing Infrastructure Development."

[57] Kamara, Kasekende, and Ndikumana, "Mitigating the Impacts of the Financial and Economic Crisis in Africa"; UN-ITFFD, *Financing for Sustainable Development Report 2021* (United Nations, Inter-agency Task Force on Financing for Development, 2021), https://www.un.org/sustainabledevelopment/wp-content/uploads/2022/03/2021-Report.pdf.

[58] Rabah Arezki and Amadou Sy, "Financing Africa's Infrastructure Deficit: From Development Banking to Long-Term Investing," *Journal of African Economies* 25, no. suppl 2 (September 2016): ii59–73, https://doi.org/10.1093/jae/ejw017; Georg Inderst, "Financing Development: Private Capital Mobilization and Institutional Investors," *SSRN Electronic Journal*, 2021, https://doi.org/10.2139/ssrn.3806742.

[59] Amutabi, "Domestic Resource Mobilization for Economic Development in Africa: Challenges, Policy Options, and Prospects in the New Horizon"; ICA, "Infrastructure Financing Trends in Africa - 2018," 2018, https://www.icafrica.org/fileadmin/documents/IFT_2018/ICA_Infrastructure_Financing_in_Africa_Report_2018_En.pdf.

[60] Inderst, "Financing Development: Private Capital Mobilization and Institutional Investors"; Tomoko Suzuki, Keita Miyaki, and Jordan Townswick Pace, *Infrastructure Financing Trends: What Are the Current Trends in Emerging Market Infrastructure Spending?* (International Finance Corporation, Washington, DC, 2016), https://doi.org/10.1596/30333.

[61] Amutabi, "Domestic Resource Mobilization for Economic Development in Africa: Challenges, Policy Options, and Prospects in the New Horizon"; Cosmin Enache, Laura Raisa Miloş, and Marius Cristian Miloş, "Pension Reform and Capital Market Development in Central and Eastern European Countries," *Economic Research-Ekonomska Istraživanja* 28, no. 1 (January 11, 2015): 75–84, https://doi.org/10.1080/1331677X.2015.1022388; United Nations, " United Nations Sustainable Development Cooperation Framework: Internal Guidance (Final June 2019)," New York: United Nations, 2019, https://unsdg.un.org/sites/default/files/2019-10/UN-Cooperation-FrameworkInternal-Guidance-Final-June-2019_1.pdf.

The role of pension funds in Green Finance investing.

The urgency to address climate change and promote environmental sustainability by accelerating green investing has become ever more pressing. This transition, however, requires significant financial investments in renewable energy, clean technologies, sustainable infrastructure, and environmental conservation initiatives, which are scarce as highlighted in previous sections.

Della- Croce et.al. in their paper on studying the potential to decarbonize the global energy system, highlight a need to accelerate current investment levels to around USD 2 trillion annually or 2% of global GDP, an amount which governments (both in developed and developing) are not able to provide from public budgets and hence the need to resort to private capital.[62] Institutional investors could potentially play a catalytic role in covering the clean energy financing deficit by investing in clean energy projects, a real asset class that can deliver steady inflation-linked income streams with low correlations to the returns of other investments.[63] They also find that beyond major pension funds and insurance companies, institutional investor commitments to clean energy initiatives remain limited, particularly in terms of direct investments that could help bridge the financing gap.[64]

Ridzak and Žigman reiterate the importance of pension funds in sustainable finance by exploring the possibility of redirecting capital towards building a more sustainable economy by making it more attractive for financial intermediaries to develop and offer a wider range of sustainable investment products. They argue that the success of the EU sustainable finance plan hinged on the integration of pension plans as the fundamental investors in EU member states to increase overall plan impact. They further establish that country-level regulations about non-financial (sustainability) data for listed companies must be improved and harmonised for effective green transition policy.[65]

While on the same issue, the fact that pension funds are investors with a long-term outlook makes them inherently exposed to ESG risks, particularly those related to climate change, and therefore should have strategies in place to manage them.[66] More so, retirement funds hold substantial amounts of capital, which positions them as influential stakeholders in economic and strategic policymaking in many countries, beyond just the financial impact on their members and capital markets.[67] Their stewardship in sustainable financing is substantial because they have the power to influence policymakers and the companies they invest in. In their investment policies, pension funds have the choice to exclude companies that do not meet their rating standards.[68] Therefore, as they carry out their investment activities in a wide range of industries, it is crucial for them to engage with companies to promote climate-sensitive practices to accelerate the green transition.

It has also been argued that pension funds are cautious about investing in long-term infrastructure projects. However, it has been proven that with the proper governance, regulation, and risk mitigation measures in place, pension funds can indeed be used for infrastructure investments.[69] Pension funds are

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[62] Della-Croce, R., and Stewart, "The Role of Pension Funds in Financing Green Growth Initiatives."

[63] Havard Halland et al., "Governing Blended Finance: An Institutional Investor Perspective," *SSRN Electronic Journal*, 2018, https://doi.org/10.2139/ssrn.3264922; C. Kaminker et al., "Institutional Investors and Green Infrastructure Investments," October 23, 2013, https://doi.org/10.1787/5k3xr8k6jb0n-en; C. Kaminker and F. Stewart, "The Role of Institutional Investors in Financing Clean Energy," September 24, 2012, https://doi.org/10.1787/5k9312v21l6f-en.

[64] Halland et al., "Governing Blended Finance: An Institutional Investor Perspective"; Kaminker et al., "Institutional Investors and Green Infrastructure Investments"; Kaminker and Stewart, "The Role of Institutional Investors in Financing Clean Energy."

[65] Aled W. Jones, "Perceived Barriers and Policy Solutions in Clean Energy Infrastructure Investment," *Journal of Cleaner Production* 104 (October 2015): 297–304, https://doi.org/10.1016/j.jclepro.2015.05.072; Tomislav Ridzak and Ante Žigman, "GREEN FINANCE FOR SUSTAINABLE GROWTH, THE CASE OF CROATIA," *InterEULawEast: Journal for the International and European Law, Economics and Market Integrations* 7, no. 2 (December 2020): 131–50, https://doi.org/10.22598/iele.2020.7.2.5.

[66] Halland et al., "Governing Blended Finance: An Institutional Investor Perspective"; Sanlam., " Sanlam Benchmark 2023 Insights Report," 2023, https://www.sanlam.co.za/corporate/retirement/benchmarksurvey/Documents/Benchmark 2023_Insights.pdf.

[67] Fisnik Morina and Simon Grima, "The Performance of Pension Funds and Their Impact on Economic Growth in OECD Countries," in *New Challenges for Future Sustainability and Wellbeing* (Emerald Publishing Limited, 2021), 17–47, https://doi.org/10.1108/978-1-80043-968-920211003; Fisnik Morina and Simon Grima, "The Impact of Pension Fund Assets on Economic Growth in Transition Countries, Emerging Economies, and Developed Countries," *Quantitative Finance and Economics* 6, no. 3 (2022): 459–504, https://doi.org/10.3934/QFE.2022020.

[68] Vassilios Babalos and Stavros Stavroyiannis, "Pension Funds and Stock Market Development in OECD Countries: Novel Evidence from a Panel VAR," *Finance Research Letters* 34 (May 2020): 101247, https://doi.org/10.1016/j.frl.2019.07.020; Yuwei Hu, "Growth of Asian Pension Assets: Implications for Financial and Capital Markets," *SSRN Electronic Journal*, 2012, https://doi.org/10.2139/ssrn.2071134.

[69] Sarah Hafner et al., "Closing the Green Finance Gap – A Systems Perspective," *Environmental Innovation and Societal Transitions* 34 (March 2020): 26–60, https://doi.org/10.1016/j.eist.2019.11.007; Alma Harris and Michelle Jones, "Transforming Education Systems:

considered suitable for infrastructure investments due to their long-term nature, stable cash flows, consistent returns, and diversified portfolios. Some scholars agree that pension funds play a critical role in closing the gap for infrastructure development that can spur economic growth.[70] Ngozi et.al., further submit that pension fund investment in infrastructure can be the only way to boost economic activity, given the tight fiscal allocations towards infrastructure by governments and compounded by inability to attract foreign capital to fill the gaps vital for economic expansion.[71]

A general consensus among scholars exists that public pension funds have no choice but to become symbiotic partners in sustainable finance trends. Some scholars share the view that pension funds experience exceptional expectations and demands from national governments, international conventions, and international multilateral institutions to consider national political goals and environmental sustainability in their financing ecosystems and frameworks that focus solely on maximising economic returns.[72] With their huge capital endowments, they should increasingly play a more significant role by scaling up pension asset investments in the economic growth biased towards the green transition of their countries' economies.[73]

In Southern Africa, like in many other nations, retirement fund assets are the largest and primary source of invested assets in economies by a significant margin. In a report by the Brookings Institution, some African countries have significantly large pension funds compared to their gross domestic product ratios.[74] For example, in 2021, South Africa, Namibia, and Botswana (52.01 percent, 103.33 percent and 57.73 percent, respectively) are among the top four countries with the highest percentages of African emerging economies.[75] This uniquely positions them to lead the green transition through impactful investing, but is this so?

CONCEPTUAL FRAMEWORK

The study is guided by a conceptual framework illustrating the dynamic interaction between pension fund assets, investment regulations, and environmental advocacy in influencing green finance investments (Figure 1). Pension fund assets determine the investment capacity and long-term horizon of institutional investors. Investment regulations shape permissible asset allocations and thus mediate the extent of green exposure. Environmental advocacy functions as an external driver that enhances awareness, stakeholder

Comparative and Critical Perspectives on School Leadership," *Asia Pacific Journal of Education* 35, no. 3 (July 3, 2015): 311–18, https://doi.org/10.1080/02188791.2015.1056590; Jung Wan Lee, "Green Finance and Sustainable Development Goals: The Case of China," *The Journal of Asian Finance, Economics and Business* 7, no. 7 (July 31, 2020): 577–86, https://doi.org/10.13106/jafeb.2020.vol7.no7.577; Claire Woods and Roger Urwin, "Putting Sustainable Investing into Practice: A Governance Framework for Pension Funds," *Journal of Business Ethics* 92, no. S1 (April 26, 2010): 1–19, https://doi.org/10.1007/s10551-010-0631-x.

[70] Javier Alonso et al., "A Balance of Pension Fund Infrastructure Investments: The Experience in Latin America," 2010, https://www.bbvaresearch.com/wp-content/uploads/migrados/WP_1003_tcm348-215241.pdf; Arezki and Sy, "Financing Africa's Infrastructure Deficit: From Development Banking to Long-Term Investing"; Sy, "Leveraging African Pension Funds for Financing Infrastructure Development."

[71] Ngozi Eunice Egbuna et al., "Infrastructural Financing Using Pension Funds of the West African Monetary Zone's Member States" (WAMI Occasional Paper Series, 2018).

[72] Monika Berg and Jan Olsson, "Managing Public Value Conflicts – Institutional Strategies and the Greening of Public Pension Funds," *Scandinavian Journal of Management* 39, no. 4 (December 2023): 101301, https://doi.org/10.1016/j.scaman.2023.101301; Franziska Schütze et al., "EU Taxonomy Increasing Transparency of Sustainable Investments," *DIW Weekly Report* 10, no. 51 (2020): 485–92; Riikka Sievänen, Hannu Rita, and Bert Scholtens, "European Pension Funds and Sustainable Development: Trade-Offs between Finance and Responsibility," *Business Strategy and the Environment* 26, no. 7 (November 28, 2017): 912–26, https://doi.org/10.1002/bse.1954; Benjamin J. Richardson, "Keeping Ethical Investment Ethical: Regulatory Issues for Investing for Sustainability," *Journal of Business Ethics* 87, no. 4 (July 7, 2009): 555–72, https://doi.org/10.1007/s10551-008-9958-y; S. Prakash Sethi, "Investing in Socially Responsible Companies Is a Must for Public Pension Funds ? Because There Is No Better Alternative," *Journal of Business Ethics* 56, no. 2 (January 2005): 99–129, https://doi.org/10.1007/s10551-004-5455-0.

[73] Javier Alonso, Alfonso Arellano, and David Tuesta, "Pension Fund Investment in Infrastructure and Global Financial Regulation," in *Retirement System Risk Management* (Oxford University Press, 2016), 186–212, https://doi.org/10.1093/acprof:oso/9780198787372.003.0010; Berg and Olsson, "Managing Public Value Conflicts – Institutional Strategies and the Greening of Public Pension Funds"; Lee, "Green Finance and Sustainable Development Goals: The Case of China"; Morina and Grima, "The Impact of Pension Fund Assets on Economic Growth in Transition Countries, Emerging Economies, and Developed Countries."

[74] Owen Nyang'oro and Githinji Njenga, *Pension Funds in Sub-Saharan Africa* (WIDER Working Paper, 2022).

[75] World Bank, " World Development Indicators," World Bank Databank, 2024, https://databank.worldbank.org/source/world-development-indicators.

engagement, and policy responsiveness. The intersection of these three components determines the overall level of pension fund participation in green finance across the SADC region.

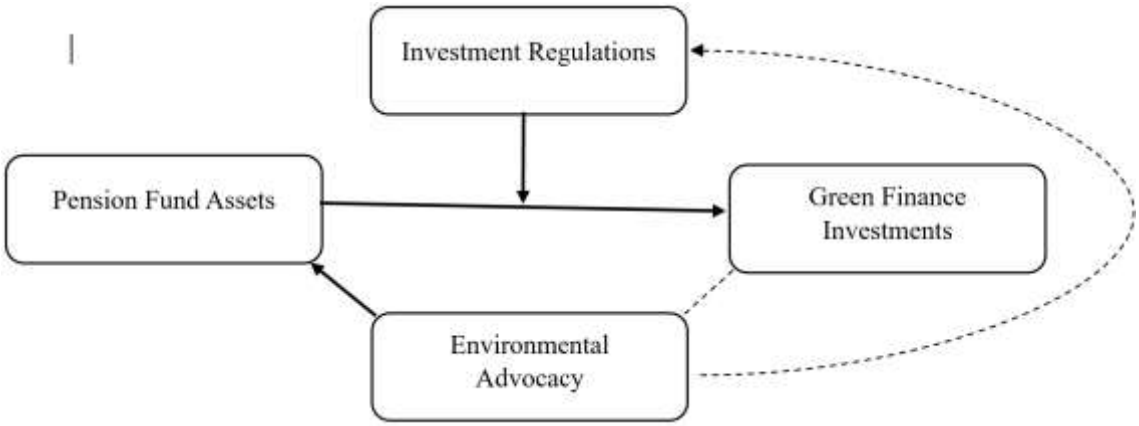

Figure 1: Conceptual framework showing interactions among pension fund assets, investment regulations, environmental advocacy, and green finance outcomes.

The framework supports the works' empirical model by hypothesizing that pension fund assets have a positive effect on green finance, stringent regulations exert a constraining effect, and environmental advocacy exerts a supportive, though potentially indirect, influence.

In the midst of all the foregoing surrounding uncertainties as discussed, this paper therefore evaluates a theoretically and scientifically justified hypothesis, that pension fund investment assets, investment regulations and environmental advocacy have a significant impact on green finance economy infrastructure in SADC countries, against the null of no effect. To analyse the impacts of these on the volatility of the green economy investment economy, the paper employs a fixed effects econometric method, which is widely used in economic scientific research for forecasting macroeconomic phenomena.

METHODOLOGY

The present study used panel data analysis on data from four Southern African countries: Zimbabwe, South Africa, Botswana, and Namibia, spanning 11 years from 2012 to 2022. Our dataset is formed by a strongly balanced panel set comprising forty-four valid observations for the variables Pension Fund Green Finance Assets (*PFGFA),* Pension Fund Assets (*PFA),* Pension Fund Investment Regulations *(PFIR)* and Green Environmental Advocacy (*GENVA*) and no missing values. Choice for cross-sectional inclusion was influenced by data availability. Secondary data about the study countries was obtained from the World Bank database, Organisation for Economic Co-operation and Development (OECD) database, African Development Bank database (AfDB), Country reports and Pension regulator reports.[76] Table 1 presents descriptive statistics, which include the mean, standard deviation, minimum, maximum, variance, and range for variables.

Table 1. Descriptive statistics

	Mean	**Std. Dev.**	**Min**	**Max**	**Variance**	**Skewness**	**Range**
PFGFA	0.5102	0.6659	0.0025	2.7604	5.3594	1.7123	5.0822
PFA	46.6817	29.3647	2.2960	103.3300	2.0705	-0.0926	10.5450
PFIR	0.7273	0.4505	0	1	2.0417	-1.0206	10.7083
GENVA	0.4091	0.4974	0	1	1.1368	0.3698	5.4561

[76] FSCA., "Pension Annual Reports. Financial Sector Conduct Authority (FSCA)," 2024, https://www.fsca.co.za/Pages/Default.aspx; IPEC, " Pension Annual Reports," Insurance and Pension Commission (IPEC), 2024, Insurance and Pension Commission (IPEC); NAMFISA, " Namibia Pension Annual Reports," Namibia Financial Institutions Supervisory Authority (NAMFISA), 2024, https://www.namfisa.com.na/publications/; NBFIRA, " Botswana Annual Reports," Non-bank Financial Institutions Regulatory Authority (NBFIRA), 2024, https://www.nbfira.org.bw/documents-library?title=&field_document_type_tid=17.

Table 1 reveals important insights into how pension funds approach green finance investments. Firstly, there is high substantial variability in Pension Fund Green Finance Assets (*PFGFA*), which suggests the presence of diverse investment strategies among pension funds. While some funds are highly committed to green finance, others invest minimally. Secondly, the influence of Pension Fund Assets (*PFA*) has a broad distribution, indicating that larger funds may have more resources to allocate towards green investments. However, the symmetric distribution implies that both large and small funds are investing in green finance. Thirdly, the negative skewness in Pension Fund Investment Regulations (*PFIR*) suggests that stricter investment regulations are cross-sectionally common, potentially restricting funds from investing in green finance. Lastly, the variability in Green Environmental Advocacy (*GENVA*) points to differing levels of commitment to environmental causes among countries. Advocacy can influence investment decisions, with funds more inclined towards green finance likely to be more receptive to stronger advocacy efforts.

In addition to standard descriptive statistics (Table 1), the study's econometric methodology involved various model diagnostic tests to establish the relationships between study variables. The conducted tests include stationarity tests using the Levin-Lin-Chu (LLC) test[77] and Im, Pesaran, Shin test[78] (Table 3), multicollinearity tests using the matrix of correlations (Table 4) and value inflation factor (VIF) tests (Table 4). After determining the stability of the dataset, we conducted the F-Limer test to decide between a Pooled OLS model and a Fixed Effects model. The F-test suggested a Fixed Effects model was more appropriate; a Hausman test was carried out to decide between FE and RE within the fixed effects framework (Table 4). The Hausman diagnosed the FE as being more appropriate. Subsequent tests of autocorrelation were carried out using the Durbin-Watson[79] and Baltagi-Wu LBI (Locally Best Invariant) test[80] (Table 4). Final estimation included a barrel estimation of models whose robustness of results was evaluated, presented in Table 5. The models used include the original Fixed Effects regression model, Fixed Effects with Cluster standard errors model (vce) to account for intra-group correlation and heteroskedasticity, Linear Fixed Effects regression models with AR(1) disturbances that correct for panel serial correlation and finally the Prais-Winsten transformation for correction of serial correlation of panel data. Regression results were then reported using the model with the most efficient and robust estimates, accounting for autocorrelation.

The economic modelling approach used in this paper has some similarities with other studies that have evaluated the impacts of pension assets on economic growth, using panel data methodology and using major economic indicators (including Gross Domestic Product(GDP), Pension Assets, Pension Assets as percentage of GDP, Inflation, Population etc), in different countries and regions.[81] This study extends knowledge by using a new control variable, green environment advocacy, in addition to pension investment regulations and pension asset size relative to GDP, in a panel analysis framework, to explain pension funds' propensity to invest in green finance. This variable has been used in other areas to infer the

[77] Andrew Levin, Chien-Fu Lin, and Chia-Shang James Chu, "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties," *Journal of Econometrics* 108, no. 1 (May 2002): 1–24, https://doi.org/10.1016/S0304-4076(01)00098-7.

[78] Kyung So Im, M.Hashem Pesaran, and Yongcheol Shin, "Testing for Unit Roots in Heterogeneous Panels," *Journal of Econometrics* 115, no. 1 (July 2003): 53–74, https://doi.org/10.1016/S0304-4076(03)00092-7.

[79] J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least Squares Regression: I," *Biometrika* 37, no. 3/4 (December 1950): 409, https://doi.org/10.2307/2332391.

[80] Badi H. Baltagi and Ping X. Wu, "UNEQUALLY SPACED PANEL DATA REGRESSIONS WITH AR(1) DISTURBANCES," *Econometric Theory* 15, no. 6 (December 1, 1999): 814–23, https://doi.org/10.1017/S0266466699156020.

[81] Morina and Grima, "The Performance of Pension Funds and Their Impact on Economic Growth in OECD Countries"; Morina and Grima, "The Impact of Pension Fund Assets on Economic Growth in Transition Countries, Emerging Economies, and Developed Countries"; Cristina I. Fernandes et al., "Green Growth versus Economic Growth: Do Sustainable Technology Transfer and Innovations Lead to an Imperfect Choice?," *Business Strategy and the Environment* 30, no. 4 (May 23, 2021): 2021–37, https://doi.org/10.1002/bse.2730; Kazeem Abimbola Sanusi and Forget Mingiri Kapingura, "Pension Funds as Fuel for Overall Investment Level and Economic Growth: An Empirical Insight from South African Economy," *Cogent Business & Management* 8, no. 1 (January 21, 2021), https://doi.org/10.1080/23311975.2021.1935661; N. Altiparmakov and M. Nedeljković, "Does Pension Privatization Increase Economic Growth? Evidence from Latin America and Eastern Europe," *Journal of Pension Economics and Finance* 17, no. 1 (January 3, 2018): 46–84, https://doi.org/10.1017/S1474747216000160; Adesoji Oladapo Farayibi, "The Funded Pension Scheme and Economic Growth in Nigeria," *SSRN Electronic Journal*, 2016, https://doi.org/10.2139/ssrn.2836965; R Acuña, L Villar, and A Villagómez, "The Private Pension System's Contribution to Latin American Economic Development" (FIAP, 2014), https://www.fiapinternacional.org/wp-content/uploads/2016/01/libro_sura_2013_eng.pdf; Alonso et al., "A Balance of Pension Fund Infrastructure Investments: The Experience in Latin America."

catalytic influence of advocacy on absorptive capacity in management decision making,[82] but has not been explicitly used in this area of study (to the best of the researchers' knowledge), and this presents an important addition to the discourse of pension funds and green investments.

This section looks at the variable's definitions, origin, their measurement in Table 2, and thereafter, the analytical empirical specification.

Table 2: Variables

Variable code	Variable type	Measurement	Source
Pension Fund Green Finance Assets – *PFGFA*	Dependent	Percentage of Green investments to Total Assets under management in a country	AfDB,Country & Regulator reports (2012-2022)
Pension Fund Assets as percent of GDP - *PFA*	independent	Percentage of Total Assets under management to Gross Domestic Product of a country	OECD and World Bank (2012-2022)
Pension Fund Investment Regulation - *PFIR*	Independent	Takes value of 1 if probability >50% that pension investment regulations constrain or offer no guidance on green investing, otherwise 0	Country & Regulator reports (2012-2022)
Green Environment Advocacy - *GENVA*	Independent	Takes value of 1 if strong civic, industrial, public lobbying about sustainability green economy impacts exist >50% of times on major investments, otherwise 0	Country & Regulator reports (2012-2022)

Sources: World bank databank, Organisation for Economic Co-operation and Development (OECD) database, African Development Bank (AfDB), Country reports and Pension regulator reports.[83]

Given the variables, the panel regression formulation is therefore stated as:

$$\ln (PFGFA)_{it} = \beta_0 + \beta_1 \ln (PFA)_{it} + \beta_2 PFIR_{it} + \beta_3 GENVA_{it} + \gamma_{it} \quad (1)$$

Where α is a constant; $\beta_1 - \beta_3$, are predictor variables regression coefficients; γ is the stochastic error term; *i*- country interaction with a predictor variable, and *t* is time in years from 2012-2022. With reference to Table 2 and equation 1, we investigate the impact of Pension Fund Assets (*PFA*), Pension Fund Investment Regulations (*PFIR*) and Green Environmental Advocacy (*GENVA*) on the investment propensity of pension funds towards green finance investments (*PFGFA*). The next section briefly describes the research variables introduced earlier.

Pension Fund Green Finance Assets (*PFGFA*) is the dependent variable of the study, which constitutes the value of assets in US$ invested by pension funds in the framework of green finance as a proportion of pension assets under management (*PFA*). A priori, a positive correlation between pension assets and infrastructure investment, whether it is green or brown, is expected.[84]

On independent variables, Pension Fund Assets (*PFA*) forms the main explanatory variable, measured by the total assets under management of a country in US$ as a percentage of GDP, while as Pension Fund Investment Regulations (*PFIR*) takes the value of 1 if the probability >50% that investment

[82] Broeders, Jansen, and Werker, "Pension Fund's Illiquid Assets Allocation under Liquidity and Capital Requirements"; López and Walker, "Investment Performance, Regulation and Incentives: The Case of Chilean Pension Funds."

[83] World Bank, " World Development Indicators"; Morina and Grima, "The Impact of Pension Fund Assets on Economic Growth in Transition Countries, Emerging Economies, and Developed Countries"; AfDB, " AfDB Data Finder Repository. African Development Bank," 2024, https://dataportal.opendataforafrica.org/ydixvvd; Namibia Statistics Agency, " Namibia Statistics," Namibia Statistics Agency, 2024, https://nsa.nsa.org.na/; Statistics Botswana, "Botswana Statistics," Statistics Botswana, 2024, https://www.statsbots.org.bw/; FSCA., "Pension Annual Reports. Financial Sector Conduct Authority (FSCA)"; IPEC, " Pension Annual Reports"; NAMFISA, " Namibia Pension Annual Reports"; NBFIRA, " Botswana Annual Reports."

[84] Zahia Marzouk et al., "What If Learning Analytics Were Based on Learning Science?," *Australasian Journal of Educational Technology* 32, no. 6 (2016); Sy, "Leveraging African Pension Funds for Financing Infrastructure Development."

regulations constrain or offer no guidance on green investing, otherwise 0 and Green Environment Advocacy (*GENVA*) variable takes the value of 1 if strong civic, industrial, public lobbying about green transition exist to align private economic return interests to climate and sustainability concerns >50% times on major investments, otherwise 0. Theoretically, and respectively, we expect an inverse relationship between pension funds' green financing assets and the regulatory framework,[85] while a probable positive correlation holds between environmental advocacy and pension fund green finance assets.[86] The next section presents the results from the analysis of data.

PRESENTATION OF FINDINGS

A series of diagnostic tests was carried out to ensure the appropriateness of econometric estimations. In Table 3, stationarity tests indicate that all the variables are stationary at the first level using the Levin-Lin-Chu(LLC) test and Im, Pesaran, Shin (IPS) test. Estimation of the final model is done at this level of stationarity.

Table 3: Unit root tests

Variable	Levin-Lin-Chu unit root				Im, Pesaran, Shin			
	At Level, I (0)		1st difference I (1)		At Level, I (0)		1st, difference I (1)	
	statistic	***p*-value**	**statistic**	***p*-value**	**statistic**	***p*-value**	**statistic**	***p*-value**
ln*PFGFA*	1.1702	0.879	-5.5187***	0.0000	1.6252	0.948	-3.7478**	0.0001
ln*PFA*	0.658	0.745	-4.251**	0.0000	0.917	0.82	-0.853**	0.002
GENVA	Category	Category	Category	Category	Category	Category	Category	Category
PFIR	Category	Category	Category	Category	Category	Category	Category	Category
***, **, * shows significance level at 1%,5% and 10% respectively								

The researchers also performed a correlation analysis, which indicated that the pairwise correlation coefficients between four variables: *PFGFA*, *PFA*, *PFIR*, and *GENVA* do not exhibit the presence of collinearity. The absolute values of the correlation coefficients were within the absolute coefficient of 0.8 or higher, commonly used as the maximum threshold for the detection of multicollinearity.[87] Additionally, a Variance Inflation Factor (VIF) analysis to quantify the extent of multicollinearity was done. VIF values above 10 may indicate problematic collinearity that needs addressing,[88] and, in this case, the VIF test results (Table 4) show no presence of multicollinearity among study variables.

Table 4: Diagnostic tests

a. F-Limer test and Hausman test			
Test type	Statistic	*p*-value	Decision
F-Limer	52.52	0.0043	Fixed Effects
Hausman	3.82	0.0198	Fixed Effects
b. Autocorrelation tests			

[85] Broeders, Jansen, and Werker, "Pension Fund's Illiquid Assets Allocation under Liquidity and Capital Requirements"; López and Walker, "Investment Performance, Regulation and Incentives: The Case of Chilean Pension Funds."

[86] Syed Haider Ali Shah et al., "Perceived Corporate Social Responsibility and Pro-environmental Behaviors: The Role of Organizational Identification and Coworker Pro-environmental Advocacy," *Corporate Social Responsibility and Environmental Management* 28, no. 1 (January 22, 2021): 366–77, https://doi.org/10.1002/csr.2054; Moxi Song et al., "Green Knowledge Sharing, Stakeholder Pressure, Absorptive Capacity, and Green Innovation: Evidence from Chinese Manufacturing Firms," *Business Strategy and the Environment* 29, no. 3 (March 5, 2020): 1517–31, https://doi.org/10.1002/bse.2450.

[87] Jamal I. Daoud, "Multicollinearity and Regression Analysis," *Journal of Physics: Conference Series* 949 (December 2017): 012009, https://doi.org/10.1088/1742-6596/949/1/012009.

[88] Daoud, "Multicollinearity and Regression Analysis."

Test type	Statistic	Decision	
Durbin-Watson (DW)	2.299741	Weak autocorrelation	
Baltagi-Wu LBI	2.406768	Weak autocorrelation	
c. Variance inflation factor (VIF)			
	VIF	1/VIF	
PFIR	2.1893	0.4568	
GENVA	2.1873	0.4572	
PFA	1.0223	0.9782	
Mean VIF	1.7996		

The F-Limer test results indicated a significant F-statistic, suggesting the FE model is a good fit. This aligns with the Hausman test results, which point towards potential issues with the RE model. Favor of the RE model (see Table 4 for results of the F-Limer and Hausman test).

Autocorrelation test using the Durbin-Watson (DW) test and the Baltagi-Wu LBI (Locally Best Invariant) test corroborate a weak negative AR1 autocorrelation in the residuals (Table 4). For interpreting the Durbin-Watson (DW) and Baltagi-Wu LBI tests, their statistics range between to 4. A value of 2 indicates no autocorrelation, whereas values less than 2 suggest positive autocorrelation and values greater than 2 suggest negative autocorrelation. The detected weak negative autocorrelation is corrected by estimation utilizing a barrel of models that correct for autocorrelation within fixed effects and afterwards comparing the robustness of their outcomes in final model selection, to ensure estimates are reliable and efficient.

The study finally presents model estimates for the original Fixed Effects, Fixed Effects with Cluster Standard Errors (vce), accounting for intra-group correlation and heteroskedasticity, Linear Fixed Effects regression with AR (1) disturbances correcting for panel serial correlation and the Prais-Winsten transformation model, which corrects for serial correlation in panel data, in Table 5. The characteristic lower standard errors, signifying efficiency and an associated higher R-squared, affording a higher explanatory power of variance of the dependent by independent variables, locate the Prais-Winsten Transformation model (Model 4) as the more robust estimation method for the analysis. The Prais-Winsten Transformation adjusts for AR (1) serial correlation while providing relatively higher R-squared values, indicating a better model fit. However, standard errors are negligibly larger than in the FE-Original model but still reasonable and better than the FE with AR1 disturbance models.

Table 5: Regression results

	(Model 1)	**(Model 2)**	**(Model 3)**	**(Model 4)**
	FE-Original	**FE-Clustered Standard Error**	**FE-with AR (1) disturbance**	**Prais-Winsten-Transform**
Ln (PFA)	1.171***	1.171*	1.202***	1.194***
	(0.267)	(0.484)	(0.289)	(0.281)
PFIR	-0.410*	-0.410**	-0.424*	-0.364**
	(0.226)	(0.119)	(0.223)	(0.216)
GENVA	0.294*	0.294*	0.368*	0.212*
	(0.227)	(0.199)	(0.279)	(0.229)
A	0.596**	0.596***	0.661**	0.529*
	(0.254)	(0.099)	(0.284)	(0.253)
Observations	40	40	36	40
R-squared	0.412	0.412	0.409	0.432
Adj R^2	0.305	0.363	0.312	0.372
F-stat	7.709**	60.552**	7.234**	8.412**
Standard errors are in parentheses				
**** p<.01, ** p<.05, * p<.1*				

Model 4 is chosen (lower standard errors and higher R-squared value confer more efficiency, robustness and reliability for coefficient estimation).

As shown in Table 5, there exists a very strong positive and significant relationship between Pension Fund Green Finance Assets (*PFGFA*) and the Pension Fund Assets (*PFA*), though with a small magnitude response coefficient (coef. -1.194). A negative and significant association was obtained between the control variable Pension Fund Investment Regulations (*PFIR)* and *PFGFA*, with a coefficient (coef. -0.364). Furthermore, a positive relationship between Green Environment Advocacy (*GENVA*) and *PFGFA* (coef. 0.212) was found, although this relationship was non-significant.

DISCUSSION

Results showed a very strong positive and significant relationship between Pension Fund Green Finance Assets (PFGFA) and Pension Fund Assets under management (PFA), albeit with a modest scalar factor. This finding indicates that as the Pension Fund Assets under management increase, there is a proportional increase in the Pension Fund Green Finance Assets. In other words, for every unit increase in pension fund assets, green finance assets will increase by slightly more than one unit, implying that proportional increases in green investments might not be as dramatic as the overall pension asset growth. The high level of significance suggests that this relationship is robust and not due to random chance, and therefore presents a good policy target for Southern African countries seeking to accelerate their green transition trajectory. Moreso, it underscores the importance of integrating green finance assets into pension fund management strategies, as they appear to be closely linked to the overall assets under management.

These results corroborate findings by Alonso et.al. and Sy, who found a positive correlation between pension assets and infrastructure investment, though the study was not primarily focused on green finance.[89] In other studies, green finance investing increases with pension fund assets under management, and larger pension fund size correlates with higher green finance investments.[90] The United Nations and Lee submit that initiatives aimed at attracting increased pension fund institutional investment into infrastructure (green or brown) require regulators to incentivize asset managers with long-term liabilities to engage in infrastructure investments over extended time horizons.[91] Della-Croce et al. and Doku et.al. opine that while pension funds' investment in green finance is important, policy frameworks will need to make it attractive by exploring the possibility for financial markets to develop and offer a wider range of sustainable investment products.[92] Ridzak and Žigman insinuate that pension funds actively seek the inclusion of ESG issues into investment decisions by aligning their portfolios with green and sustainable goals to manage risk and improve long-term returns.[93] Green investments encompass a variety of environmentally friendly assets and initiatives capable of creating financial value alongside positive environmental and social outcomes for funds.[94]

By implication, the drive to mobilise resources from retirement funds into green financial assets is not exponential, as study results reveal, but incremental if industry and policymakers proactively engage in a win-win engagement. Consequently, the pursuit of social protection should strike a delicate balance with long-term interests towards fiduciary responsibility, fund growth and green transition, especially in developing countries where there is a dearth of investment capital so that pension funds bankroll green investment expansion. Moreover, local level mobilization of pension funds, through strategic investment

[89] Alonso, Arellano, and Tuesta, "Pension Fund Investment in Infrastructure and Global Financial Regulation"; Sy, "Leveraging African Pension Funds for Financing Infrastructure Development."

[90] M. Beneva, "Private Pension Funds Portfolio Optimization with UPM/LPM Algorithm," *Economic and Social Alternatives* 29, no. 1 (March 30, 2023): 90–106, https://doi.org/10.37075/ISA.2023.1.07; Monika Berg, "Value Judgments at the Heart of Green Transformation: The Leverage of Pension Fund Investors," *Global Environmental Politics*, July 7, 2021, 1–20, https://doi.org/10.1162/glep_a_00613; Della-Croce, R., and Stewart, "The Role of Pension Funds in Financing Green Growth Initiatives."

[91] United Nations Economic and Social Council, " Secretary-General's Report on Progress towards the Sustainable Development Goals," 2019; Lee, "Green Finance and Sustainable Development Goals: The Case of China."

[92] Della-Croce, R., and Stewart, "The Role of Pension Funds in Financing Green Growth Initiatives"; Doku, Ncwadi, and Phiri, "Determinants of Climate Finance: Analysis of Recipient Characteristics in Sub-Sahara Africa."

[93] Ridzak and Žigman, "Green Finance For Sustainable Growth, The Case Of Croatia."

[94] Hafner et al., "Closing the Green Finance Gap – A Systems Perspective."

funds and green banks, has shown more success in attracting institutional investor capital, largely attributable to their local knowledge, networks, and ability to assess and mitigate risks effectively.[95] s

In contrast, a negative and significant association was observed between Pension Fund Investment Regulations (*PFIR)* and Pension Fund Green Finance Assets (*PFGFA*). This implies that stricter investment regulations within pension fund ecosystems are associated with lower levels of green finance assets. While this negative relationship may seem counterintuitive at first, it suggests that stringent investment regulations may be limiting allocation of funds towards green finance assets. Franzen corroborates the present study's inverse relationship between pension funds' green financing assets and the regulatory framework.[96] The author posits that a constraining matrix of regulatory and accounting requirements placed on pension funds impedes their risk tolerance capacity towards green assets capital allocation. Therefore, a need for redesigning pension risk distribution and regulation is an essential component for building pension fund structures that are more aligned and integrated with social policy objectives dictated by evolving demographic, economic and societal factors. In a comparative analysis of Europe and America, reiterate that pension fund investment regulations play a crucial role in shaping pension fund green finance investing by shaping their decision frameworks towards environmentally friendly and socially responsible investments. Regulations should be designed not to stifle investment but rather influence pension funds to align their investment strategies with green finance principles.[97] As such, policymakers and fund managers may need to make a trade-off between regulatory compliance and promoting sustainable investments within pension funds in the long term.

Furthermore, a weak positive relationship was identified between Green Environment Advocacy (*GENVA*) and Pension Fund Green Finance Assets *(PFGFA*), although the relationship was found to be non-significant. This suggests that there is a greater probability that high levels of green environment advocacy are associated with increases in green finance asset holdings by pension funds, even though this relationship did not reach statistical significance. While the lack of significance may limit the generalizability of this finding, it suggests that advocacy efforts for environmental sustainability could potentially influence the allocation of funds towards green finance assets in pension fund portfolios. This positive correlation between environmental advocacy and pension fund green finance assets, though insignificant, aligns with Shah et al., who discovered evidence that supports the role of environmental consciousness and environmental commitment as a mediating mechanism between perceived corporate social responsibility and pro-environmental behaviours.[98] Strong environmental consciousness, as a result of green advocacy, has the capacity to foster environmental commitment and facilitate an increase in green finance commitments by pension funds. Song et.al. corroborate the favourable influence of advocacy by suggesting that absorptive capacity acts as a complete mediator in the relationship between green knowledge sharing and green innovation, with the mediation effect being significantly influenced by stakeholder pressure (advocacy).[99] The findings suggest that organizations enhance their absorptive capacities by keenly monitoring stakeholder pressure in order to realize the environmental innovation advantages of green knowledge. Singh et al. also suggest that pressure mounted by stakeholders has an impact on green dynamic capability, which in turn affects green innovation and has an impact on firm performance.[100] This area on behavioral impacts of green advocacy on pension portfolios has not received much scientific investigation and is a suggestion for future research.

The findings underscore that pension fund growth alone is not sufficient to guarantee an expansion of green investments; enabling regulation and governance frameworks play a decisive role. Policymakers

[95] Halland et al., "Governing Blended Finance: An Institutional Investor Perspective"; Han, "Innovative Climate Financing for a Just Transition in Africa."

[96] D. S. Franzen, " The Impact of Regulation on the Asset Investment of Defined Benefit Pension Funds," 2013, https://ora.ox.ac.uk/objects/uuid:8d721d9a-0aeb-490e-8eee-bb4559de58f3/files/mcb899848e05a3d5f7e82fff403dc2470.

[97] Pasquale Marcello Falcone, "Environmental Regulation and Green Investments: The Role of Green Finance," *International Journal of Green Economics* 14, no. 2 (2020): 159, https://doi.org/10.1504/IJGE.2020.109735.

[98] Shah et al., "Perceived Corporate Social Responsibility and Pro-environmental Behaviors: The Role of Organizational Identification and Coworker Pro-environmental Advocacy."

[99] Song et al., "Green Knowledge Sharing, Stakeholder Pressure, Absorptive Capacity, and Green Innovation: Evidence from Chinese Manufacturing Firms."

[100] Sanjay Kumar Singh et al., "Stakeholder Pressure, Green Innovation, and Performance in Small and Medium-sized Enterprises: The Role of Green Dynamic Capabilities," *Business Strategy and the Environment* 31, no. 1 (January 30, 2022): 500–514, https://doi.org/10.1002/bse.2906.

across SADC, through institutions such as IPEC (Zimbabwe), NAMFISA (Namibia), FSCA (South Africa), and NBFIRA (Botswana), should adopt adaptive investment frameworks that align fiduciary objectives with sustainable development goals. This may involve introducing green bond guidelines for retirement funds, ESG disclosure requirements, and risk-adjusted incentives for long-term green infrastructure. Regional harmonization under the SADC Protocol on Finance and Investment could further strengthen transparency and cross-border collaboration on sustainable finance standards. By coordinating these measures, pension governance structures can balance prudential oversight with sustainability objectives, enhancing both fund performance and developmental impact.

RECOMMENDATIONS

These findings have a bearing on policymakers in Southern African countries. Firstly, they should leverage the positive link between overall pension fund growth and green finance investments by formulating strategies to enhance the scale of pension fund asset growth as a means for them to scale their support for green finance initiatives. Frameworks to widen green investment products may also yield positive results, within the context of shallow financial markets that exist in some of the studied markets. This would enhance risk management frameworks requisite to preserve fiduciary capital under their management. Secondly, regulatory frameworks guiding pension fund investments should be designed to encourage green investments without hindering overall investment activity by pension funds. Policymakers are encouraged to redesign regulatory structures to support green finance by incentivising rather than restricting pension funds' investment in sustainable projects. Regulatory compromise is imperative to widen asset classes that pension funds can hold to include alternative assets in green infrastructure through direct or indirect investments. Thirdly, policy should also be directed to supporting green environment advocacy efforts. Despite its uncertain importance, its potential impact of advocacy suggests that ongoing efforts to promote environmental consciousness could eventually lead to greater integration of green finance into pension portfolios.

CONCLUSION

The paper investigated the factors influencing Pension Fund Green Finance Assets (*PFGFA*) in Southern African countries. The findings reveal a positive and significant relationship with pension fund assets: There is a strong positive correlation between overall pension fund assets and green finance assets in the studied countries. As pension funds grow, their green investments also increase, though proportionally less than the overall growth in total assets under management. This suggests green investments may not grow as exponentially, but can be steadily increased over time. A negative and significant impact of pension fund investment regulations was observed. Stricter pension fund investment regulations on asset allocation are associated with lower levels of green finance assets. Stringent regulations may limit the allocation of funds towards green investments. Policymakers need to design regulations that encourage, not hinder, green investments. Moreover, while not statistically significant, a positive association between green environment advocacy and green finance assets was noted. Increased stakeholder advocacy efforts for environmental sustainability potentially influence pension funds to allocate more towards green investments in Southern Africa.

Overall, the study highlights the importance of considering both asset growth and regulatory frameworks to promote green finance investments in Southern Africa. It also suggests the potential role of green advocacy in influencing pension fund allocation decisions. Further research directions are recommended to explore the behavioural impacts of green advocacy on pension fund portfolios. Focus to be directed towards the mechanisms through which advocacy influences investment decisions and to identify ways to amplify its impact in green transition efforts.

Declarations

Funding

The authors declare that no specific grant or funding was received for this research from any public, commercial, or not-for-profit sectors.

Conflicts of interest

The authors declare no conflicts of interest or competing interests in relation to the publication of the submitted manuscript. All authors have approved the final version of the manuscript and agree with its submission.

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