

NATIONAL PENSIONS REGULATORY AUTHORITY

Prepared or Pressured? Pension Policy Readiness and Demographic Ageing in 154 Countries

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Abstract

This paper develops a comparative framework for assessing whether pension systems are institutionally prepared for demographic ageing. It constructs a Policy Readiness Index (PRI) capturing retirement age, contribution effort, and institutional breadth, alongside a Demographic Pressure Index (DPI) measuring ageing exposure. Using data for 154 countries, the paper reveals four findings. First, policy readiness is shaped primarily by institutional design rather than demographic conditions. Once pension policy characteristics are accounted for, old-age dependency ratios and life expectancy do not independently predict readiness. Second, countries cluster into four preparedness-pressure regimes: Prepared, Resilient, Window for Reform, and Vulnerable, reflecting different combinations of institutional capacity and demographic exposure. Third, 89 percent of African countries fall within the Window for Reform regime, characterized by low demographic pressure but weak institutional preparedness. The principal constraint is institutional breadth, particularly limited social pension coverage and weak contribution structures, rather than retirement age itself. Fourth, the framework is robust to alternative weighting schemes, with rank correlations exceeding 0.98 across specifications. The findings suggest that demographic ageing does not mechanically determine pension vulnerability. Institutional preparedness mediates demographic exposure, and countries with favorable demographics but weak pension institutions face a narrowing window to build systems before ageing pressures intensify.

Key words: Pension reform, political economy, reform determinants, state dependence, Africa, Ghana

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1. INTRODUCTION

Population ageing is reshaping the fiscal and social landscape of countries worldwide. By 2050, the global share of the population aged 65 and above is projected to double, placing unprecedented pressure on pension systems. The policy response to this demographic transition has varied enormously. Some countries have undertaken parametric reforms, raising retirement ages and adjusting contribution rates. Others have pursued structural overhauls, introducing multi pillar systems or defined contribution schemes. Many, particularly in the developing world, have made limited adjustments, leaving pension systems designed for younger populations to face rapidly ageing societies.

This variation raises a fundamental question. How effectively are pension systems equipped, through their policy structures, to handle demographic ageing. The question is not merely whether populations are ageing, they are, but whether countries have built the institutional framework to manage the consequences. A country with a high old age dependency ratio but strong pension institutions may be better positioned than a country with favorable demographics but weak policy frameworks.

This paper develops a comparative framework to answer that question. It constructs two complementary indices. The Policy Readiness Index (PRI) measures how well a country's pension system is designed to handle demographic ageing, capturing three dimensions, retirement age adequacy, contribution effort, and institutional breadth. The Demographic Pressure Index (DPI) measures the ageing challenge a country faces, combining the current old age dependency ratio with its rate of change. The distinction between the two is central to the paper's contribution. Preparedness and pressure are conceptually distinct. A country can have strong policies and high pressure, weak policies and low pressure, or any combination thereof. Conflating them obscures the policy choices that countries face.

Using data from the International Social Security Association (ISSA) country profiles and the World Development Indicators for 154 countries, the paper maps countries onto a preparedness pressure typology. Four regimes emerge. Prepared countries combine strong policies with manageable pressure. Resilient countries maintain strong policies despite significant ageing challenges. Countries in the Window for Reform have weak policies but also low pressure, a favorable demographic moment that will not last. Vulnerable countries face both weak policies and high pressure, the most challenging combination.

The analysis yields four main findings. First, pension policy readiness is driven by institutional design, not demographic conditions. Validation regressions confirm that retirement age, contribution rates, and institutional breadth, particularly the presence of social pensions and voluntary pillars, are strongly associated with readiness, while old age dependency ratios and life expectancy are not independently significant once policy variables are accounted for. Second, the preparedness pressure typology reveals a stark global divergence. Advanced economies predominantly occupy the

Resilient quadrant, with strong policies but high pressure. Developing economies, particularly in Africa, cluster in the Window for Reform, with weak policies but low pressure. This is both an opportunity and a warning. The window provides time to build institutions, but it will close as demographics shift.

Third, Africa's principal institutional gap is not parametric but structural. The gap in retirement age between Africa and Prepared countries is modest, approximately three years. The gap in contribution rates and social pension coverage is far larger. This suggests that the conventional focus on retirement age adjustments in pension reform debates may be misplaced for countries at early stages of demographic transition. Institutional breadth, expanding coverage, building contributory capacity, and establishing social pensions, is the binding constraint. Fourth, the framework is robust. Country rankings and regime classifications are insensitive to reasonable alternative weighting schemes, with rank correlations exceeding 0.98.

The paper contributes to the literature on comparative pension policy in three ways. First, it provides a structured, replicable framework for assessing pension preparedness that separates policy design from demographic exposure. Second, it introduces a typology of preparedness pressure regimes that allows for comparative institutional analysis across countries at different stages of demographic transition. Third, it offers an empirical foundation for understanding where institutional gaps are largest and what dimensions of pension design most distinguish prepared systems from unprepared ones. The remainder of the paper is organized as follows. Section 2 presents the conceptual framework. Section 3 describes the data and index construction. Section 4 maps the global landscape. Section 5 presents the validation analysis. Section 6 examines institutional profiles and gaps. Section 7 focuses on Africa's window for reform. Section 8 concludes with policy implications.

2. CONCEPTUAL FRAMEWORK AND LITERATURE

This section develops the conceptual foundation for the Policy Readiness Index (PRI) and Demographic Pressure Index (DPI). It proceeds in three parts. First, it situates the paper within the literature on demographic ageing and pension system pressure. Second, it reviews the institutional and comparative literature on pension reform and welfare state adaptation. Third, it identifies the measurement gap that the PRI/DPI framework is designed to fill.

2.1 Demographic Ageing and Pension System Pressure

Population ageing is one of the defining structural shifts of the twenty first century. Bongaarts (2004) documents the global demographic transition, showing that declining fertility and rising longevity are producing unprecedented increases in old age dependency ratios across both advanced and developing economies. The fiscal implications are well established. As the ratio of retirees to workers rises, pay as you go systems face growing imbalances between contribution revenue and benefit obligations. Gruber and Wise (2004) demonstrate that the implicit tax on continued

work embedded in many pension systems creates powerful incentives for early retirement, compounding the fiscal pressure from demographic change alone.

The policy challenge, however, is not uniform. The speed and timing of demographic transition vary substantially across countries. Advanced economies, particularly in Europe and East Asia, are already experiencing high and rising old age dependency ratios. Many developing economies, particularly in sub-Saharan Africa, remain at an early stage of demographic transition, with relatively young populations and low dependency ratios. This asymmetry creates a policy window for developing countries that advanced economies did not have. The International Labour Organization (2017, 2018) documents that informal employment accounts for more than 60 percent of total employment globally, with rates exceeding 85 percent in sub-Saharan Africa, and that pension coverage in the region remains below 15 percent of the working age population. Stewart and Yermo (2009) identify the structural barriers that traditional pension designs impose on African labour markets, where fixed contribution rates and formal employer-employee relationships systematically exclude the majority of the workforce. The question is whether countries will use this demographic window to build institutional preparedness before ageing pressures intensify.

The literature on demographic pressure and pension sustainability has focused primarily on fiscal outcomes, contribution imbalances, and benefit adequacy (Holzmann and Hinz, 2005; Whiteford & Whitehouse, 2006). These studies establish that demographic ageing creates structural fiscal challenges for pension systems. But they do not directly address the prior question of whether pension systems are institutionally designed to handle the pressures they face. A country may have favorable demographics but weak pension institutions. Another may face severe demographic pressure but have built strong adaptive mechanisms. The fiscal outcome alone does not distinguish between these cases. This paper addresses that gap by constructing separate measures of policy readiness and demographic pressure, allowing for a clearer assessment of whether countries are institutionally prepared for the demographic conditions they face.

2.2 Pension Reform and Institutional Adaptation

The comparative literature on pension reform has developed along two main lines. The first examines the content of reform, distinguishing parametric adjustments, such as changes to retirement age or contribution rates, from structural reforms, such as the introduction of multi pillar systems or defined contribution schemes. The World Bank's multi pillar framework (Holzmann & Hinz, 2005) provides the most influential typology, identifying five pillars ranging from a non-contributory social pension to voluntary private savings. This framework has shaped pension reform debates globally, particularly in developing economies where international financial institutions have promoted multi-pillar models as a response to the fiscal unsustainability of single pillar pay as you go systems.

The second line of inquiry examines the political economy of reform. Esping Andersen's (1990) foundational typology of welfare state regimes, distinguishing liberal, conservative corporatist, and social democratic models, established that welfare state structures are not merely functional responses to social needs but reflect deeper political and institutional configurations. Subsequent work has extended this framework to pension systems specifically. Huber and Stephens (2000) showed that the type of pension reform undertaken in Latin America varied systematically with regime type and the balance of political power. Brooks and James (1999) demonstrated that political fragmentation reduced the probability of structural reform. Angelaki and Carrera (2015) extend this analysis to the post crisis period, showing that radical pension reforms in Argentina and Greece were shaped by the depth of economic crisis and the capacity of organized interests to resist or accelerate change. These studies establish that pension institutions are path dependent. Once established, they create constituencies, administrative structures, and expectations that make fundamental change difficult (Ebbinghaus, 2009; Pierson, 2004).

The institutional adaptation literature provides a further lens. Streeck and Thelen (2005) argue that institutions change not only through abrupt reform but through gradual transformation, layering, conversion, and drift. This insight is directly relevant to pension systems. A pension system that was adequate for the demographic conditions of 1980 may become inadequate not because policies changed but because the demographic context shifted around it. The system drifts toward unsustainability unless institutional adaptation occurs. Hinrichs and Jessoula (2012) apply this framework to pension reform in Europe, showing that the sequencing of reforms across policy domains shapes both feasibility and outcomes. Hadad et al. (2022) provide a contemporary illustration, examining the development of capital pension funds in the Czech Republic and Bulgaria and assessing institutional readiness for the Pan European Personal Pension Product, demonstrating that even within a common regulatory framework, national institutional capacity varies substantially.

These literatures provide a rich theoretical foundation for understanding pension reform. But they are predominantly qualitative and focused on explaining reform occurrence rather than measuring institutional preparedness across countries. This paper builds on these foundations by constructing a systematic, cross country measure of pension policy readiness that captures the key dimensions identified in the reform literature: retirement age adequacy, contribution effort, and institutional breadth.

2.3 Measuring Pension Preparedness: The Composite Indicator Gap

Several existing efforts measure aspects of pension system performance. The Melbourne Mercer Global Pension Index rates pension systems on adequacy, sustainability, and integrity. The Allianz Pension Index focuses on demographic and

fiscal sustainability. The OECD's Pensions at a Glance indicator provide detailed comparative data on replacement rates, pension wealth, and retirement ages for member countries. These efforts have advanced the comparative study of pension systems considerably.

However, three limitations are evident. First, most existing indices focus on outcomes, such as benefit adequacy or fiscal sustainability, rather than on the institutional framework that produces those outcomes. A country may score well on adequacy because it spends a large share of GDP on pensions, but that spending may be unsustainable given its demographic trajectory. Second, existing indices often combine demographic and policy elements into a single score, making it difficult to distinguish whether a country's position reflects its policy choices or its demographic circumstances. Third, the coverage of existing indices is limited. The Melbourne Mercer index covers approximately 50 countries. The OECD indicators cover member and partner countries, largely excluding low income and many African economies.

This paper addresses these limitations by constructing two separate indices. The Policy Readiness Index (PRI) measures institutional preparedness: how well a country's pension system is designed to handle demographic ageing, irrespective of the demographic pressure it currently faces. The Demographic Pressure Index (DPI) measures exposure: the level and rate of change of demographic ageing. Methodologically, the paper draws on the composite indicator literature, particularly Mazziotta and Pareto (2016), who provide a systematic framework for constructing non compensatory composite indices and for assessing their sensitivity to alternative normalization and weighting choices. The present analysis follows their recommended practice of testing robustness across multiple aggregation schemes.

The separation of preparedness from pressure is the paper's central conceptual contribution. It allows for a direct assessment of whether countries are institutionally prepared for the demographic conditions they face, rather than conflating strong outcomes with favorable demographics. The construction of the PRI draws on the institutional dimensions identified in the reform literature. Retirement age adequacy captures the labour force sustainability dimension emphasized by Gruber and Wise (2004). Contribution effort captures the financing capacity dimension central to the multi pillar framework. Institutional breadth, measured through the presence of mandatory public schemes, voluntary pillars, social pensions, and recent reform activity, captures the adaptive capacity dimension identified by the institutional adaptation literature. The DPI captures the demographic pressure dimension through the current old age dependency ratio and its rate of change, reflecting both the level of current ageing pressure and the speed at which it is intensifying.

The following section describes the data and the construction of these indices in detail.

3. DATA AND INDEX CONSTRUCTION

This section describes the data sources, country coverage, and the construction of the Policy Readiness Index (PRI) and Demographic Pressure Index (DPI).

3.1 Data Sources

The analysis draws on two primary data sources. Pension policy variables are obtained from the International Social Security Association (ISSA) country profiles. These profiles provide structured country-specific information on pension system design, including statutory retirement ages, contribution systems, and institutional features such as the presence of mandatory public schemes, voluntary pension pillars, and social pension arrangements. Using the most recent available observations, a cross-sectional pension policy dataset was constructed for 154 countries.

Demographic and macroeconomic variables are drawn from the World Bank's World Development Indicators (WDI). These include the old-age dependency ratio, its rate of change, life expectancy at birth, GDP per capita, labour force participation, and the vulnerable employment share. The demographic variables form the basis of the Demographic Pressure Index (DPI), while the macroeconomic variables are used in the validation analysis. The dataset is assembled as a country-level cross section using the most recent comparable observation for each variable. This approach is appropriate because the objective is to compare broad institutional preparedness across countries rather than short-run annual fluctuations in pension or demographic outcomes.

3.2 The Policy Readiness Index (PRI)

The Policy Readiness Index (PRI) is designed to measure how well a country's pension system is institutionally prepared for demographic ageing. The PRI captures three complementary dimensions of preparedness identified in the pension reform literature:

1. retirement-age adequacy,
2. contribution effort, and
3. institutional breadth.

All continuous variables are normalized onto a common 0–100 scale using min-max normalization:

$$X_i^{norm} = 100 \times \frac{X_i - \min(X)}{\max(X) - \min(X)}$$

where X_i^{norm} denotes the normalized value for country i , bounded between 0 and 100.

Retirement Age Pillar

The retirement-age pillar captures the labour-force sustainability dimension of preparedness. It is measured using the statutory retirement age. Higher statutory retirement ages imply longer expected working lives and shorter expected periods of retirement dependency, other things equal. The statutory rather than effective retirement age is used because the PRI aims to capture policy design rather than behavioural outcomes.

Contribution Effort Pillar

The contribution pillar captures the financing capacity of the pension system. It is measured using the combined statutory employer and employee contribution rate for the primary public pension scheme. To reduce the influence of extreme observations, contribution rates are winsorised at the 5th and 95th percentiles prior to normalization.

Institutional Breadth Pillar

The institutional pillar captures the breadth and adaptability of pension system landscape. It is constructed from four binary indicators:

- The presence of a mandatory public pension scheme,
- The existence of a voluntary pension pillar,
- The availability of a social pension or non-contributory old-age support arrangement,
- And evidence of recent pension reform activity.

The institutional breadth score is defined as:

$$I_i = \frac{1}{4} (M_i + V_i + S_i + F_i) \times 100$$

where:

- M_i indicates a mandatory public pension scheme,
- V_i indicates a voluntary pension pillar,
- S_i indicates a social pension arrangement,
- and F_i indicates recent reform activity.

Each institutional component contributes equally to the institutional breadth score.

PRI Aggregation

The overall PRI is constructed as a weighted average of the three pillars:

$$PRI_i = 0.40 R_i + 0.30 C_i + 0.30 I_i$$

where:

- R_i is the normalized retirement-age pillar,
- C_i is the normalized contribution pillar,
- and I_i is the institutional breadth pillar.

The baseline weighting scheme assigns greater importance to retirement-age adequacy because it directly influences the balance between working years and retirement duration. Contribution effort and institutional breadth are treated as complementary dimensions of preparedness. Sensitivity to alternative weighting structures is examined in Section 5.

A key design principle is that demographic variables are intentionally excluded from the PRI. This reflects the paper's central conceptual distinction between institutional preparedness and demographic exposure. Including demographic variables within the PRI would conflate policy design with demographic circumstances, making it impossible to assess whether preparedness is adequate relative to the pressure a country faces.

3.3 The Demographic Pressure Index (DPI)

The Demographic Pressure Index (DPI) measures the degree of ageing pressure confronting a country. It combines:

1. the current old-age dependency ratio, and
2. the recent rate of change in the old-age dependency ratio.

The DPI is defined as:

$$DPI_i = 0.60 OADR_i + 0.40 \Delta OADR_i$$

where:

- $OADR_i$ denotes the normalized old-age dependency ratio,
- and $\Delta OADR_i$ denotes the normalized rate of change in the dependency ratio.

The level component receives a larger weight because current demographic pressure has more immediate implications for pension sustainability, while the rate-of-change component captures the speed at which ageing pressure is intensifying. Both components are normalized to a 0–100 scale using the same min-max procedure described above. Higher DPI values therefore indicate greater demographic pressure. The DPI remains analytically separate from the PRI throughout the analysis. This separation permits direct comparison between demographic exposure and institutional preparedness and allows countries to be classified into preparedness-pressure regimes.

To summarize the balance between preparedness and exposure, the paper additionally defines a pressure-adjusted readiness measure:

$$PAR_i = PRI_i - DPI_i$$

Positive values indicate that institutional preparedness exceeds demographic pressure, while negative values indicate that demographic exposure outpaces institutional readiness.

3.4 Methodological Choices and Robustness

Several methodological choices warrant discussion. First, equal weighting within the institutional breadth pillar reflects the absence of a strong theoretical basis for assigning different weights to mandatory schemes, voluntary pillars, social pensions, and reform activity. Each contributes to preparedness through a distinct but complementary institutional channel. Second, min-max normalization is adopted because it provides transparency and interpretability while preserving the relative ordering of countries. Alternative normalization procedures, including z-score standardization, yield highly correlated results. Third, the baseline PRI weighting structure reflects the judgment that retirement-age adequacy is the most critical single dimension of pension preparedness because it directly determines the relationship between contribution years and retirement years. However, robustness tests using equal weights, retirement-heavy weights, and institution-heavy weights produce highly stable rankings and regime classifications. Rank correlations between the baseline PRI and alternative specifications exceed 0.98. Finally, the PRI intentionally measures policy design rather than realized behavioural outcomes. Statutory retirement ages and contribution parameters are therefore preferred to effective retirement ages or realized contribution collections, which reflect a combination of policy, enforcement, labour-market informality, and behavioural responses. The validation exercises presented in Section 5 confirm that the PRI behaves consistently with its underlying institutional dimensions.

4. THE GLOBAL LANDSCAPE

This section maps the global distribution of pension policy preparedness and demographic ageing pressure across 154 countries. It introduces the preparedness-pressure typology, documents regional patterns, and examines how institutional readiness and demographic exposure vary across income groups.

4.1 Descriptive Overview

Table 1 presents summary statistics for the Policy Readiness Index (PRI), the Demographic Pressure Index (DPI), and their underlying components. The PRI has a mean value of 61.3 and a standard deviation of 15.7, ranging from 28.9 to 92.5. The wide dispersion indicates substantial cross-country variation in institutional pension preparedness. The DPI has a mean of 39.0 and an even larger standard deviation of

25.7, ranging from 4.1 to 95.9, reflecting the highly uneven pace and intensity of demographic ageing across countries.

The pressure-adjusted readiness measure, defined as the signed difference between PRI and DPI, averages 22.3 points. For most countries, institutional preparedness currently exceeds demographic pressure. However, the range is wide, from negative 30.1 to positive 68.7, indicating that some countries already face demographic exposure that substantially exceeds their level of institutional preparedness. Among the PRI components, the institutional breadth pillar has the highest average score at 77.8, followed by the retirement-age pillar at 57.4 and the contribution pillar at 50.2. The contribution dimension also exhibits the greatest dispersion, suggesting substantial variation across countries in contributory effort and pension financing capacity.

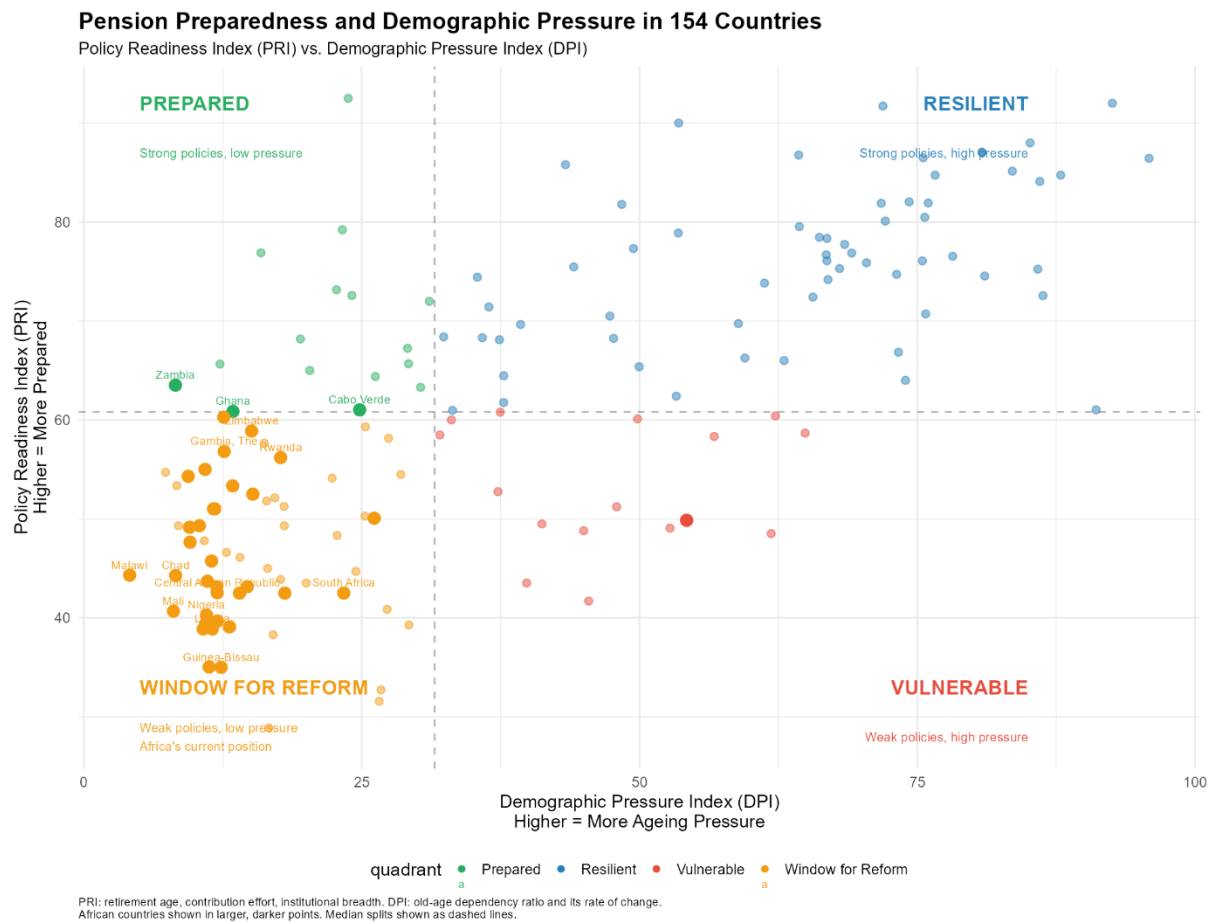
Table 1: Descriptive Statistics

variable	n	mean	sd	min	p25	median	p75	max
pri	154	61.33	15.69	28.88	48.87	60.82	74.67	92.50
dpi	154	39.03	25.74	4.12	15.39	31.56	64.00	95.86
papr	154	53.03	18.06	0.00	38.31	56.52	66.74	100.00
signed_gap	154	22.31	17.84	-30.08	7.76	25.75	35.86	68.71
retirement_score	154	57.38	18.23	0.00	45.00	53.75	75.00	100.00
contribution_score	154	50.18	28.24	0.00	28.38	47.69	73.61	100.00
institution_score	154	77.76	21.11	25.00	50.00	75.00	100.00	100.00
retirement_age	154	61.48	3.65	50.00	59.00	60.75	65.00	70.00
contribution_rate	154	15.71	7.94	0.00	10.00	15.00	21.71	37.00
oadr	154	16.29	10.82	2.01	6.54	12.28	25.74	39.14
oadr_change	154	4.16	3.82	-2.61	0.90	3.19	7.23	14.37
life_expectancy	154	74.09	6.96	54.64	69.02	75.43	78.97	84.58
log_gdp_pc	154	9.04	1.44	5.39	7.97	9.02	10.18	11.87
vulnerable_employment	148	33.86	25.21	0.46	11.63	26.61	52.58	90.22
lfpr	148	61.31	9.83	36.90	55.64	61.81	66.57	87.01

4.2 The Preparedness-Pressure Typology

The central contribution of the framework is the ability to evaluate countries simultaneously along two analytically distinct dimensions: institutional preparedness and demographic exposure. Figure 1 presents the flagship PRI-DPI scatter plot. Using median splits on both dimensions, four preparedness-pressure regimes emerge.

[Figure 1: Pension Preparedness and Demographic Pressure]



Prepared countries, located in the upper-left quadrant, combine relatively high policy readiness with comparatively low demographic pressure. These countries have built institutional pension capacity ahead of demographic transition, creating an institutional buffer before ageing pressures intensify. Their average PRI is 69.4 compared to a DPI of 22.1. Resilient countries, in the upper-right quadrant, combine strong pension institutions with high demographic pressure. These countries have already undergone substantial demographic transition but have developed relatively robust institutional arrangements in response. The group is dominated by advanced economies and has the highest average PRI score, at 76.1, alongside a mean DPI of 64.6.

The Window for Reform regime, located in the lower-left quadrant, combines weak institutional preparedness with low demographic pressure. This is the largest regime in the sample, comprising 61 countries with an average PRI of 46.5 and a DPI of only 15.6. These countries face relatively limited demographic pressure today but have not yet developed strong pension institutions. The regime therefore reflects a temporary institutional opportunity: demographic pressure remains manageable, but the policy framework required to address future ageing has not yet fully emerged. Vulnerable countries, in the lower-right quadrant, combine weak institutional preparedness with relatively high demographic pressure. These countries face the most difficult institutional-demographic configuration because demographic ageing has accelerated

more rapidly than institutional adaptation. The quadrant contains 16 countries with an average PRI of 53.2 and a DPI of 47.6.

Table 2 summarizes the average characteristics of each preparedness-pressure regime.

Table 2: Preparedness-Pressure Regimes

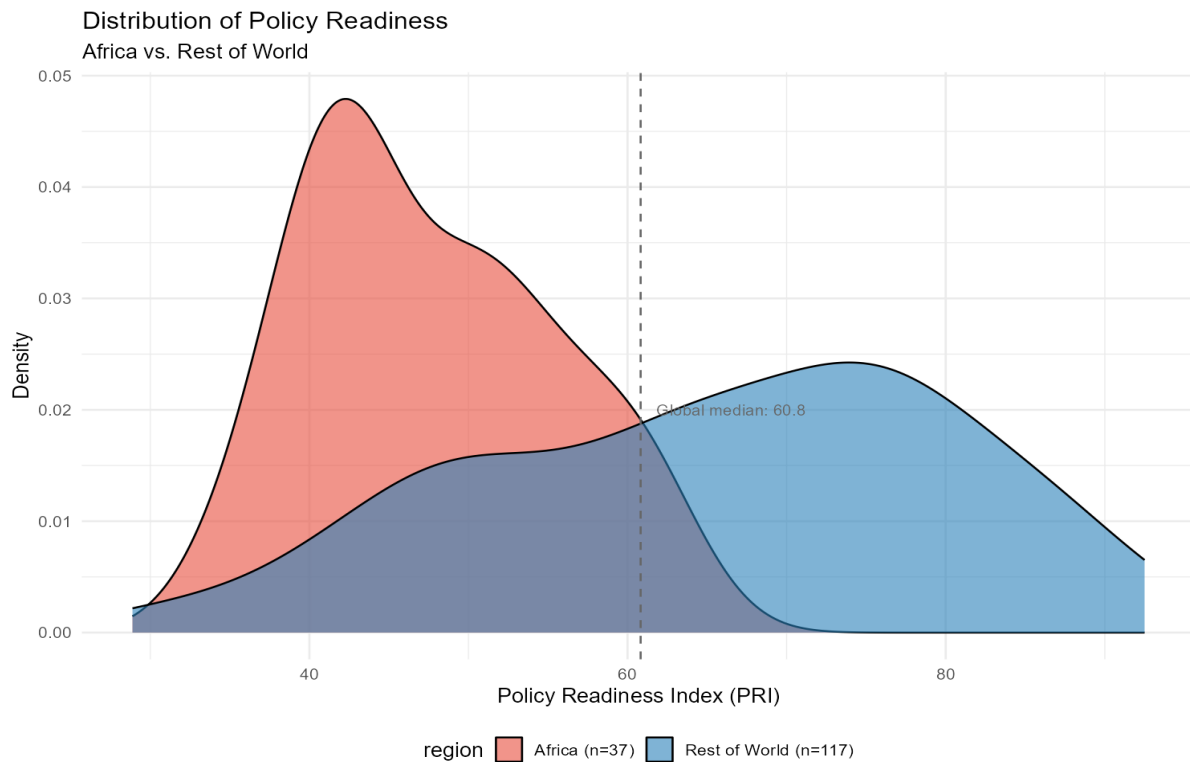
quadrant	n	Africa	mean PRI	mean DPI	mean PAPER	mean Retirement	mean Contribution	Social Pension
Prepared	16	18.8	69.4	22.1	78.3	62.4	19.6	68.8
Resilient	11	0	76.1	64.6	42.1	64	20.8	88.5
Vulnerable Window for Reform	6	6.2	53.2	47.6	36.1	61.1	11.3	62.5
	1	54.1	46.5	15.6	61.8	58.8	10.8	24.6

Importantly, countries are not fixed permanently within these regimes. As demographic transition progresses, countries may move across quadrants depending on whether institutional adaptation keeps pace with rising demographic pressure. The framework therefore captures not only current institutional positioning but also the sequencing relationship between demographic change and pension system development.

4.3 Regional Patterns

The regional distribution of preparedness and pressure reveals substantial divergence between Africa and the rest of the world. Figure 2 presents the density distribution of PRI scores for African countries and all other countries in the sample.

Figure 2: Distribution of Policy Readiness

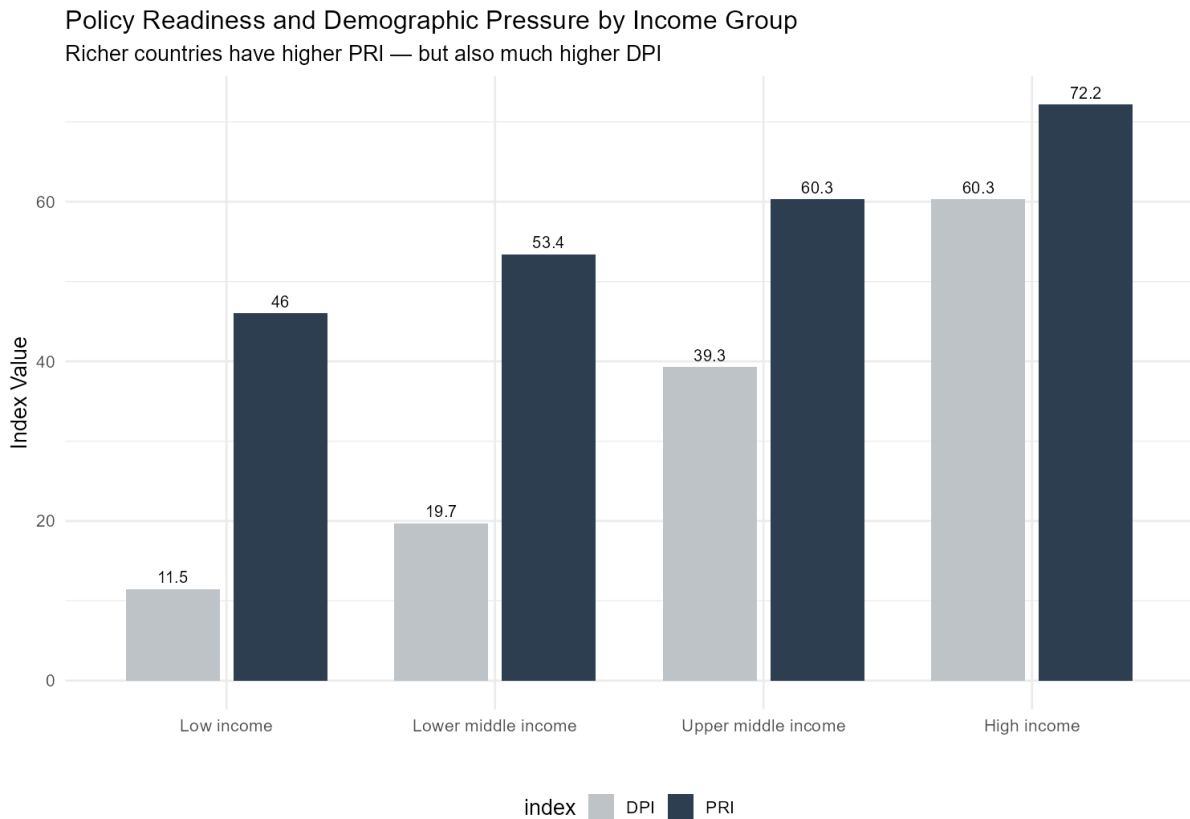


African countries have a mean PRI of 47.6, compared to 65.7 for the rest of the world. The median African PRI is 45.7, substantially below the global median of 60.8. The African distribution is concentrated below a PRI score of 55, while the distribution for the rest of the world is bimodal, with clusters around both moderate and high levels of preparedness. However, lower institutional preparedness in Africa is accompanied by substantially lower demographic pressure. The mean DPI for African countries is 14.0, compared to 47.0 for the rest of the world. Similarly, the average old-age dependency ratio in Africa is only 6.2 percent, against a global average exceeding 16 percent. The demographic pressure gap is therefore substantially larger than the preparedness gap.

This asymmetry forms the empirical basis for the Window for Reform characterization. African countries generally remain at relatively early stages of demographic transition. Institutional preparedness is comparatively weak, but demographic pressure is also limited. The framework, therefore, identifies a temporary institutional window during which pension systems can still expand coverage, strengthen contributory capacity, and broaden social protection structure before ageing pressures intensify more substantially. The quadrant distribution reinforces this interpretation. Of the 37 African countries in the sample, 33 fall within the Window for Reform regime, representing 89.2 percent of the region. Only a small number of African countries currently occupy the Prepared regime, while Mauritius is the only African country classified as Vulnerable due to comparatively elevated demographic pressure relative to the region. No African country appears in the Resilient regime, where strong institutional preparedness coexists with advanced demographic transition.

4.4 The Income Gradient

Figure 3 presents average PRI and DPI scores by income group



A clear positive gradient exists for both institutional preparedness and demographic pressure. High-income countries record an average PRI of 72.2, compared to 46.0 for low-income countries. However, high-income countries also face substantially greater demographic pressure, with a mean DPI of 60.3 compared to only 11.5 among low-income economies. The increase in demographic pressure across income groups is steeper than the increase in policy readiness. This reveals an important development asymmetry. Higher-income countries have generally built stronger pension institutions, but they are also experiencing the most advanced stages of demographic ageing. Lower-income countries possess weaker institutional arrangements, but they continue to benefit from relatively favorable demographic structures.

The pressure-adjusted readiness measure further illustrates this contrast. Low-income countries exhibit the highest average pressure-adjusted readiness because demographic pressure remains low relative to even modest levels of institutional preparedness. By contrast, high-income countries record lower pressure-adjusted readiness because demographic exposure has accelerated more rapidly, despite substantially stronger pension institutions. The framework therefore suggests an important sequencing implication. Countries currently benefiting from low demographic pressure may face narrowing institutional windows as demographic transition accelerates over time. Whether countries ultimately follow a Prepared

pathway or drift toward Vulnerable status depends on whether institutional adaptation occurs before demographic pressure intensifies substantially.

5. WHAT DRIVES PENSION READINESS?

This section examines the institutional correlates of policy readiness. The objective is not to estimate causal effects but to validate that the Policy Readiness Index behaves consistently with its underlying institutional dimensions and to assess whether demographic conditions independently predict readiness once policy variables are accounted for.

5.1 Validation Framework

The validation regressions estimate the cross sectional relationship between the PRI and its constituent policy variables, alongside demographic and macroeconomic controls. Because the PRI is constructed from its component pillars, these regressions are calibration and validation exercises rather than causal models. They serve three purposes. First, they confirm that the PRI reflects the institutional dimensions it is designed to capture. Second, they test whether demographic variables exhibit independent associations with readiness once policy characteristics are controlled for. Third, they provide the empirical basis for the component decomposition presented in Section 6.

The preferred specification includes the full set of policy variables, statutory retirement age, contribution rate, and the four institutional indicators, alongside demographic controls for the old age dependency ratio, its rate of change, and life expectancy, and macroeconomic controls for log GDP per capita, vulnerable employment, and the labour force participation rate. Standard errors are heteroskedasticity robust.

5.2 Results

Table 3 presents the estimates from the preferred specification, which includes the full set of policy variables alongside demographic and macroeconomic controls. Because the PRI is constructed from its component pillars, the regression serves as a calibration and validation exercise. The coefficients confirm that the index behaves consistently with its intended institutional structure. They are not interpreted as independent causal effects.

Table 3: Validation Regression

Term	Estimate	std.error	p.value
Retirement_age	1.971***	0.036	***
Contribution_rate	1.040***	0.014	***
Public_mandatory	8.159***	0.32	***
Voluntary_pillar	7.417***	0.402	***

Social_pension	7.795***	0.253	***
Reform_signal	7.512***	0.256	***
OADR	0.038*	0.022	*
OADR_change	-0.086	0.058	
Life_expectancy	-0.001	0.031	
Log_gdp_pc	-0.330*	0.184	*
Vulnerable_employment	-0.020**	0.008	**
Lfpr	-0.006	0.011	

The policy variables are strongly associated with the PRI, as expected. Each additional year of statutory retirement age is associated with an increase of approximately 2.0 points in the PRI ($p < 0.01$). Each additional percentage point in the headline contribution rate is associated with an increase of approximately 1.0 points ($p < 0.01$). The institutional indicators produce the largest individual associations. The presence of a public mandatory pillar is associated with an 8.2 point increase. A voluntary pillar is associated with a 7.4 point increase. A social pension arrangement is associated with a 7.8 point increase. A recent reform signal is associated with a 7.5 point increase. All four institutional coefficients are statistically significant at the 1 percent level and are similar in magnitude, consistent with the equal weighting adopted within the institutional pillar of the PRI.

Among the demographic controls, the old age dependency ratio has a coefficient of 0.04 and is marginally significant at the 10 percent level ($p = 0.09$). While this suggests a weak positive association, the magnitude is substantively small. A one standard deviation increase in the dependency ratio, approximately 11 percentage points, is associated with a change of less than half a PRI point. By comparison, the presence of a social pension or a reform signal is associated with an increase of approximately 8 points. Life expectancy has a coefficient of essentially zero and is not statistically significant ($p = 0.96$). The rate of change in the old age dependency ratio is also not significant ($p = 0.14$).

Two macroeconomic controls reach statistical significance. Vulnerable employment, a proxy for labour market informality, is negatively associated with the PRI ($p < 0.05$). This is consistent with the interpretation that informality constrains the effective reach of pension policy. Log GDP per capita is marginally significant and negative ($p < 0.10$), likely reflecting a composition effect. Among countries with similar policy configurations, higher income is associated with slightly lower measured readiness, perhaps because the PRI normalizes policy parameters without fully capturing the administrative capacity and enforcement intensity that accompany higher income levels.

The model explains a very high proportion of cross sectional variation in the PRI, with an R squared exceeding 0.99. This is expected for a validation exercise. The PRI is constructed from these policy dimensions, so the high explanatory power confirms that the index behaves consistently with its intended structure, not that the regression has

discovered new independent relationships. The validation value lies in the coefficient patterns rather than in the overall fit. The contrast between policy and demographic variables is the central finding from this exercise. The policy coefficients are large, consistent in sign, and precisely estimated. The demographic coefficients are small, imprecisely estimated, or both. This supports the paper's core analytical distinction. The PRI captures institutional preparedness, which is shaped primarily by policy design choices, not by the demographic conditions that those policies are meant to address.

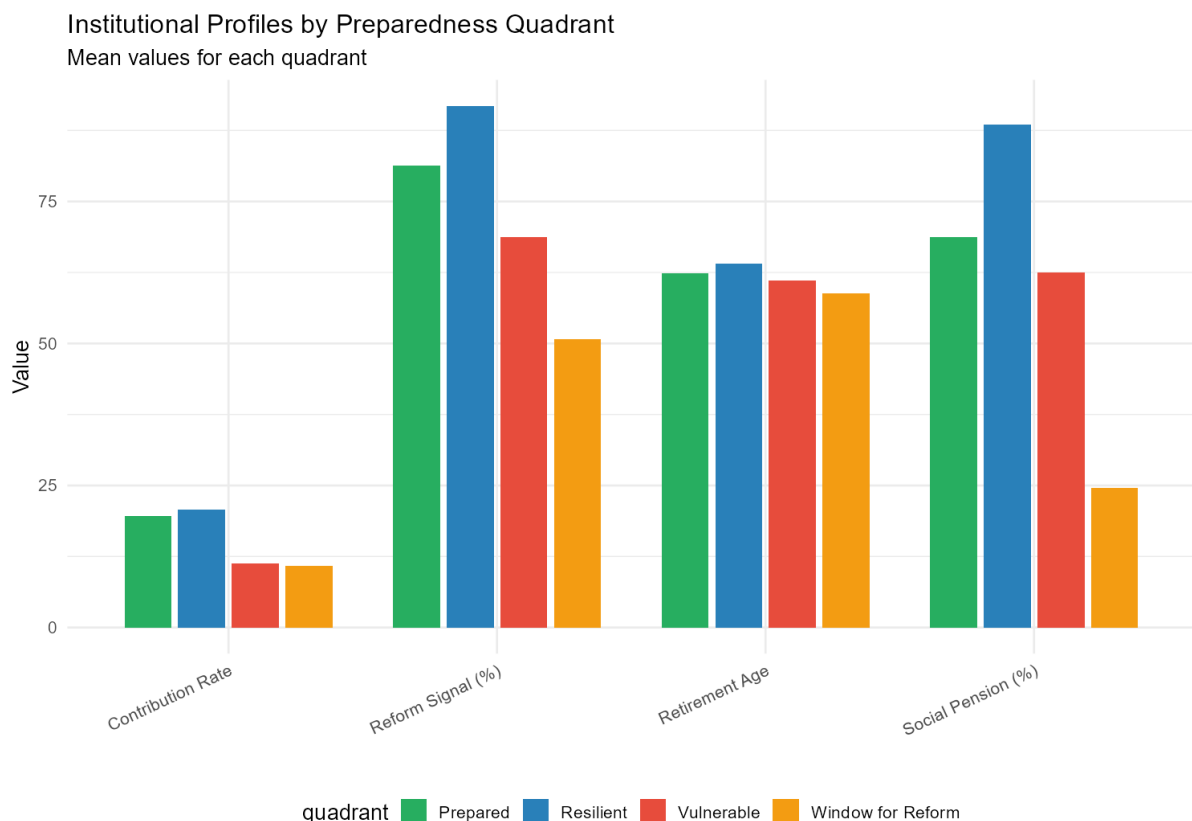
6. INSTITUTIONAL PROFILES AND GAPS

This section moves from aggregate validation to institutional decomposition. It examines how the four preparedness pressure regimes differ in their underlying policy configurations and identifies the specific institutional dimensions that most distinguish prepared systems from unprepared ones. The analysis focuses particularly on Africa, where the Window for Reform regime is concentrated.

6.1 Institutional Profiles by Regime

Table 2, presented in Section 4, provides the aggregate PRI and DPI scores for each regime. Figure 4 decomposes these aggregates into their institutional components.

Figure 4: Institutional Profiles by Preparedness Quadrant



The regimes are distinguished less by retirement age than by contribution effort and institutional breadth. The average retirement age is 64.0 in the Resilient quadrant, 62.4 in the Prepared quadrant, 61.1 in the Vulnerable quadrant, and 58.8 in the Window for Reform quadrant. The gap between the highest and lowest regimes is approximately five years. While meaningful, this difference is modest relative to the gaps in other dimensions. Contribution rates vary far more substantially. The average contribution rate is 20.8 percent in the Resilient quadrant and 19.6 percent in the Prepared quadrant, compared to 11.3 percent in the Vulnerable quadrant and 10.8 percent in the Window for Reform quadrant. The gap between high readiness and low readiness regimes is approximately 9 to 10 percentage points, roughly double the typical contribution rate in the Window for Reform group.

Institutional breadth exhibits similarly large variation. Social pension coverage is near universal in the Resilient quadrant, at 92 percent, compared to only 30 percent in the Window for Reform quadrant. The reform signal indicator, capturing evidence of recent policy activity, is present for 77 percent of Resilient countries, 81 percent of Prepared countries, and 63 to 68 percent of countries in the lower readiness regimes. The pattern is clear. The regimes are differentiated primarily by the financing and institutional breadth dimensions of pension preparedness, not by retirement age alone. Countries in the Window for Reform do not merely have lower retirement ages. They have substantially weaker contribution structures and much narrower institutional framework. The policy implication is that closing the readiness gap requires more than parametric adjustments to retirement age. It requires building contributory capacity and expanding institutional reach.

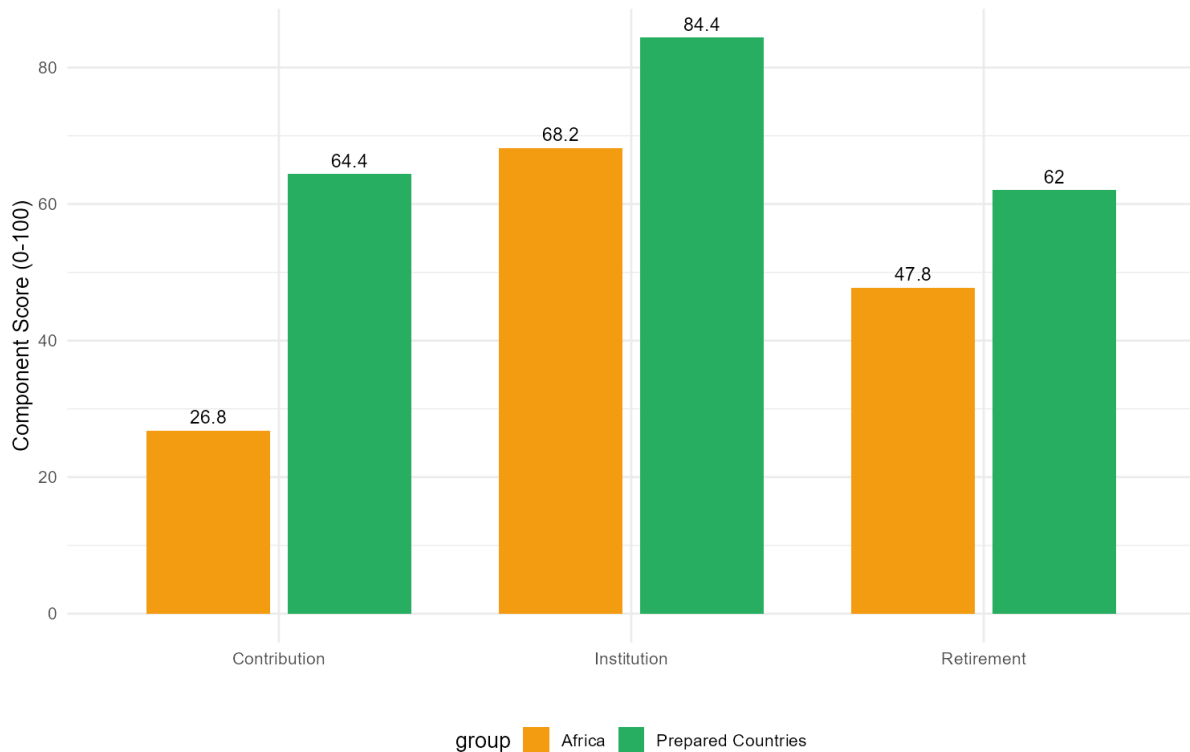
6.2 Africa's Institutional Gap

Figure 5 compares the PRI component scores for Africa against the Prepared group.

Figure 5: Component Scores — Africa vs. Prepared Countries

PRI Component Scores: Africa vs. Prepared Countries

The institutional gap is larger than the parametric gap



The gap is largest in the institutional dimension. Africa's average institutional score is 68.2, compared to 84.4 for the Prepared group, a gap of 16.2 points. The contribution gap is also substantial. Africa's average contribution score is 26.9, compared to 64.4 for the Prepared group. The retirement age gap is the smallest of the three. Africa's average retirement score is 47.8, compared to 62.0 for the Prepared group.

Table 4 quantifies these gaps in natural units.

Table 4: Africa Institutional Gaps

Indicator	Prepared	Africa	Gap
Retirement Age (years)	62.4	59.6	2.8
Contribution Rate (%)	19.6	9.2	10.4
Public Mandatory (%)	87.5	81.1	6.4
Voluntary Pillar (%)	100	94.6	5.4
Social Pension (%)	68.8	29.7	39.1
Reform Signal (%)	81.2	67.6	13.6
Old-Age Dependency Ratio	9.1	6.2	2.9
Life Expectancy (years)	73.5	64.8	8.7
Log GDP per capita	8.3	7.4	0.9

The average retirement age in Africa is 59.6 years, compared to 62.4 in the Prepared group, a gap of 2.8 years. The average contribution rate is 9.2 percent in Africa, compared to 19.6 percent in the Prepared group, a gap of 10.4 percentage points. Social pension coverage stands at 29.7 percent in Africa, compared to 68.8 percent in

the Prepared group, a gap of 39.1 percentage points. The reform signal indicator is present for 67.6 percent of African countries, compared to 81.2 percent of Prepared countries.

The demographic and economic gaps are also informative. Africa's average old age dependency ratio is 6.2 percent, well below the Prepared group average of 9.1 percent. Life expectancy in Africa averages 64.8 years, compared to 73.5 years in the Prepared group. Log GDP per capita averages 7.4 in Africa, compared to 8.3 in the Prepared group. Africa's demographic pressure is lower, but so is its economic capacity to build pension institutions.

6.3 The Primacy of Institutional Breadth

The component decomposition yields a clear substantive finding. Africa's pension preparedness gap is primarily institutional, not parametric. The retirement age gap of 2.8 years is real but modest. The contribution rate gap of 10.4 percentage points and the social pension coverage gap of 39.1 percentage points are far larger. This finding has implications for how pension reform is conceptualized in developing economies. The global pension reform debate has devoted considerable attention to retirement age increases, driven by the fiscal arithmetic of ageing in advanced economies. But for countries at an early stage of demographic transition, where the old age dependency ratio remains low, the binding constraint is not the statutory retirement age. It is whether the pension system reaches a meaningful share of the workforce, whether it commands sufficient contributory resources, and whether it provides basic old age support to those outside the formal sector.

Institutional breadth captures these dimensions. Social pensions extend coverage beyond the formal workforce. Voluntary pillars create space for supplementary savings. Reform activity signals that the system is adapting rather than stagnating. These institutional features are not alternatives to parametric adjustment. They are the foundation on which parametric adjustment becomes meaningful. A higher retirement age matters little if most workers are not covered by the pension system. A higher contribution rate generates limited revenue if enforcement is weak and informality is high. The institutional gap documented here suggests that the policy priority for many African countries is expanding the reach and adaptability of their pension systems. This is a different emphasis from the retirement age focus that dominates pension reform discussions in advanced economies. It reflects the different structural position of countries at early stages of demographic transition.

7. AFRICA'S WINDOW FOR REFORM

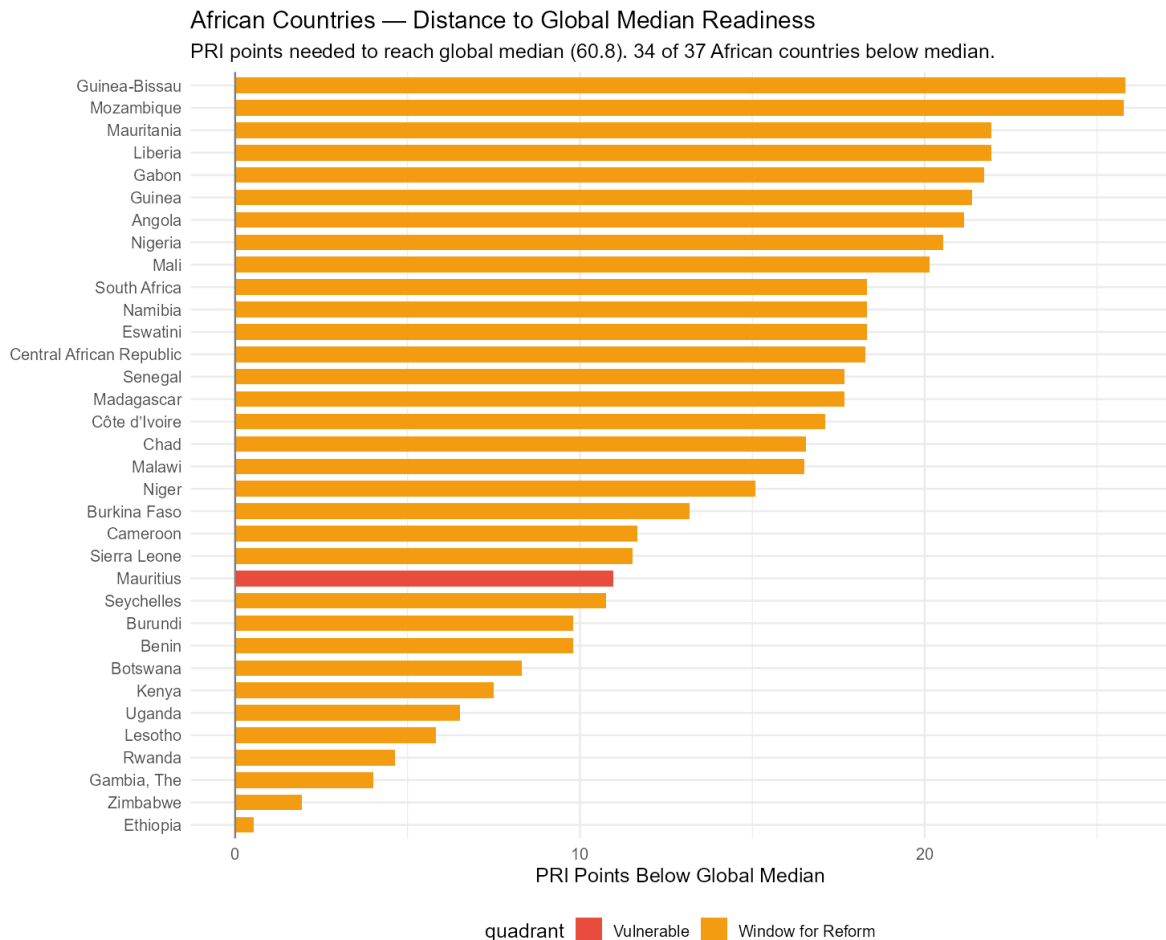
The empirical analysis has established that 89 percent of African countries occupy the Window for Reform quadrant, characterized by low demographic pressure but weak institutional preparedness. This section examines the implications of that positioning. It documents the distance African countries must travel to reach Prepared status,

identifies the binding constraints on institutional development, and assesses the narrowing of the demographic window over time.

7.1 Distance to Preparedness

Figure 6 presents the distance between each African country's current PRI and the global median of 60.8. The figure includes only countries below the median, which is to say nearly all of them.

Figure 6: African Countries — Distance to Global Median Readiness



Of the 37 African countries in the sample, 34 fall below the global median. The distance varies considerably. Guinea Bissau, Mozambique, and Mauritania are 21 to 26 PRI points below the median. At the other end, Ethiopia and Ghana are within one point. Zambia, Cabo Verde, and Ghana are the three African countries that have already reached or exceeded the median, placing them in the Prepared quadrant. The average distance to the median for African countries below it is approximately 13 points. To put this in perspective, Section 5 established that each additional year of retirement age is associated with roughly 2 PRI points, each percentage point of contribution rate with roughly 1 point, and the introduction of a social pension or similar institutional feature with roughly 8 points. Closing the average gap would therefore require a combination

of parametric and institutional reforms whose individual contributions are well understood.

7.2 The Binding Constraint

Section 6 demonstrated that Africa's institutional gap is largest in contribution effort and institutional breadth, not in retirement age. Table 4 quantified these gaps. The retirement age gap between Africa and the Prepared group is 2.8 years. The contribution rate gap is 10.4 percentage points. The social pension coverage gap is 39.1 percentage points. These magnitudes have a clear policy interpretation. The conventional focus of pension reform debates on retirement age increases, while relevant, addresses the dimension on which Africa is already closest to the Prepared benchmark. The dimensions on which Africa lags furthest are contribution capacity and institutional breadth, particularly the extension of social pension coverage to populations outside the formal workforce.

This finding reflects the structural position of African labour markets. High informality means that statutory contribution rates apply to a small fraction of the workforce. Weak enforcement means that even those covered may not contribute consistently. Low contributory capacity means that the resources flowing through the pension system are limited relative to the population it will eventually need to support. Social pensions, which provide non contributory old age support, directly address the coverage gap but require fiscal resources that many African countries currently lack.

The binding constraint is therefore not a single policy parameter that can be adjusted by legislative fiat. It is a configuration of institutional capacity, labour market structure, and fiscal space. Raising the statutory retirement age is administratively straightforward. Building contributory capacity and extending social pension coverage require deeper institutional development.

7.3 The Narrowing Window

Africa's current demographic position is favorable. The average old age dependency ratio of 6.2 percent is less than half the global average. The rate of demographic change, while positive, remains moderate relative to the rapid ageing already underway in East Asia and Europe. This is the empirical basis for the Window for Reform characterization. But the window is narrowing. The forces driving demographic transition, declining fertility and rising longevity, are global. They operate in Africa as they have elsewhere. The question is not whether African populations will age but how quickly and whether institutional development will keep pace. The framework developed in this paper does not forecast the speed of demographic change or predict which countries will successfully transition from the Window for Reform to the Prepared quadrant. It provides a baseline against which progress can be measured. Countries that are 20 points below the median today can track their movement over time as policies change and demographics evolve. The PRI and DPI can be updated

as new data become available, allowing for longitudinal analysis that is beyond the scope of this cross sectional study.

The policy implication is not that African countries should immediately adopt the pension parameters of advanced economies. Their demographic conditions do not warrant it, and their fiscal capacity may not permit it. The implication is that the current period of low demographic pressure provides time to build institutions incrementally, to expand coverage gradually, and to strengthen contributory capacity before demographic pressures intensify. Countries that use this window effectively will move toward the Prepared quadrant as their populations age. Countries that do not will drift toward the Vulnerable quadrant, where weak institutions confront rising pressure.

7.4 Ghana as an Illustrative Case

Ghana occupies a distinctive position within the African distribution. It is one of three African countries already in the Prepared quadrant, with a PRI of 60.9, fractionally above the global median of 60.8. Its DPI of 13.4 is well below the global median of 31.6, giving it a comfortable pressure adjusted position. Ghana's institutional profile reflects its status. The statutory retirement age is 60, the contribution rate is 18.5 percent, and the institutional score is 75 out of 100. It has a mandatory public scheme, a voluntary pillar, and a reform signal. Its social pension coverage, at the time of data collection, was absent, representing the principal institutional gap relative to the Prepared group average.

Ghana's position illustrates both the opportunity and the fragility of the Prepared status at low demographic pressure. The country has built pension institutions ahead of demographic ageing. But its margin above the median is thin, and its institutional gaps, particularly in social pension coverage, mean that its Prepared status could erode if demographic pressure rises without further institutional adaptation. The policy priority for Ghana is not a fundamental redesign of its pension system but the consolidation and extension of its institutional framework, particularly the introduction of a social pension to extend coverage beyond the formal workforce, as demographic transition proceeds.

8. CONCLUSION

This paper has developed a comparative framework for assessing whether pension systems are institutionally prepared for demographic ageing. It constructs a Policy Readiness Index capturing retirement age, contribution effort, and institutional breadth, alongside a separate Demographic Pressure Index measuring ageing exposure. Based on data from 154 countries, the framework provides four conclusions.

First, pension preparedness is a policy choice, not a demographic destiny. Validation regressions confirm that institutional design variables, statutory retirement ages, contribution rates, and the breadth of pension landscape, are strongly associated with readiness. Demographic conditions, the old-age dependency ratio, its rate of change,

and life expectancy are not independently significant once policy characteristics are accounted for. Second, countries fall into four preparedness pressure regimes. Prepared countries combine strong institutions with low pressure. Resilient countries maintain strong institutions despite advanced ageing. Countries in the Window for Reform have weak institutions but also low pressure, a favorable position that will not last. Vulnerable countries face the most challenging combination of weak institutions and high pressure. Third, Africa's position is both concerning and opportune. Eighty nine percent of African countries occupy the Window for Reform. Their demographic pressure is low, but their institutional preparedness is weak. The binding constraint is not retirement age, where the gap with Prepared countries is modest, but institutional breadth, particularly social pension coverage and contribution capacity. Africa has time to build institutions before demographic pressures intensify. The window is open. It is narrowing. Fourth, the framework is robust. Country rankings and regime classifications are insensitive to reasonable alternative weighting schemes, with rank correlations exceeding 0.98 across specifications.

Three policy implications follow. First, pension reform strategy should be informed by a country's position in the preparedness pressure typology. Countries in the Window for Reform should prioritize institutional breadth: expanding coverage, building contributory capacity, and establishing social pensions. Retirement age increases, while relevant, address the dimension on which these countries are already closest to prepared systems. Second, the separation of preparedness from pressure is analytically essential. Conflating the two obscures whether countries are underperforming given their demographic conditions or simply facing demographic conditions that no institutional framework could easily manage. Third, the window for reform is real but finite. Countries that build institutions during the current period of low demographic pressure will be positioned to manage the transition to an older population. Countries that delay will face the narrowing options of the Vulnerable quadrant.

The framework presented here is cross sectional and descriptive. It does not forecast the speed of demographic change or predict which countries will successfully transition between regimes. Extending the framework to allow for longitudinal analysis, incorporating sub-national variation in coverage and informality, and integrating fiscal sustainability metrics are priorities for future work. The contribution of this paper is to establish that such analysis is possible and that the distinction between institutional preparedness and demographic pressure is a necessary starting point. Demographic ageing does not mechanically determine pension vulnerability. Institutions do.

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