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From Window to Vulnerable: Institutional Persistence, Asymmetric Transitions, and Democratic Constraints in Pension Adaptation

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Abstract

This paper examines pension preparedness trajectories across 115 countries from 2000 to 2024 using a dynamic transition framework. Pairing a Policy Readiness Index (PRI) with a Demographic Pressure Index (DPI), we track movements across four institutional regimes over five-year intervals. Panel analysis reveals extreme persistence, with 94.5 percent of observations remaining static. Transitions are overwhelmingly deterioration-driven, primarily moving from the "Window for Reform" to "Vulnerable." Crucially, Firth penalized logit estimations show that higher democracy scores significantly increase the probability of transition failure; intense electoral competition constrains anticipatory reform before demographic pressures become politically salient. This structural trap operates deterministically across Africa, where all observed non-stable transitions represent failed windows. The findings demonstrate that pension vulnerability is not mechanically determined by demographics but is actively mediated by institutional persistence and competitive political constraints.

Key Words: Pension preparedness; institutional persistence; path dependence; demographic ageing; political economy; democracy; regime transitions; Africa; Policy Readiness Index; Demographic Pressure Index

JEL Classification: H55, J26, P16 (Political Economy)O17 (Formal and Informal Sectors; Institutional Arrangements)

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1. Introduction

Demographic ageing is one of the defining structural transformations of the twenty-first century. By 2050, the global share of the population aged 65 and above is projected to double, creating significant fiscal and social pressures on public pension systems (Bongaarts, 2004; United Nations, 2019). While the demographic trajectory is highly predictable, international policy responses vary substantially. Some states execute preemptive parametric or structural overhauls (Gruber and Wise, 2004; Holzmann and Hinz, 2005). Many others, particularly within the developing world, exhibit prolonged institutional inertia, leaving legacy systems designed for younger populations to face growing strain under rapid demographic transitions (ILO, 2017; Stewart and Yermo, 2009). This stark divergence raises a fundamental political economy puzzle: Why do some countries build institutional preparedness before demographic pressures intensify, while others allow favorable demographic windows to close without adequate adaptation?

A pension system's long-term sustainability depends not only on demographic pressure, but also on the capacity of its institutions to adapt over time (Esping-Andersen, 1990; Pierson, 2004). The central challenge is therefore not demographic ageing itself, but whether institutional adaptation occurs before ageing pressures become politically and fiscally binding. This paper analyzes these dynamics by deploying a dynamic transition framework. We construct a Policy Readiness Index (PRI) and a Demographic Pressure Index (DPI) to map countries into four distinct institutional-demographic regimes: Prepared, Resilient, Window for Reform, and Vulnerable. We extend this framework into a 24-year dynamic panel covering 115 countries from 2000 to 2024, tracking regime transitions over five-year horizons.

Methodologically, this study bridges historical institutionalism (Pierson, 2004; Streeck and Thelen, 2005) with the comparative political economy of welfare state adaptation (Ebbinghaus, 2009; Huber and Stephens, 2000). The paper makes three contributions. First, we provide systematic cross-national evidence on pension preparedness trajectories. We find that pension regimes exhibit high institutional persistence: 94.5 percent of country observations remain within the same quadrant over five-year intervals. When transitions occur, they are predominantly deterioration-driven. Sixty-five percent of non-stable transitions involve movement from the Window for Reform to the Vulnerable quadrant. This represents a "failed window" in which states with favorable demographics fail to build institutional preparedness before demographic pressures intensify.

Second, we identify an institutional paradox: among countries in the Window for Reform quadrant, higher democracy scores are associated with a greater probability of transitioning into vulnerability. This relationship remains robust under rare-events correction using Firth penalized logit estimation (Firth, 1993). This finding does not imply that democratic governance is detrimental to long-run institutional development. Rather, it suggests that electoral competition may impose political constraints on anticipatory policymaking. Because pension reforms require actors to impose immediate, concentrated costs on voters for diffuse, long-term benefits, democratic

politicians face incentives to prioritize short-term considerations over long-term structural adaptation (Hacker, 2004; Pierson, 1996). Democratic systems also contain multiple institutional veto points, legislative chambers, independent judiciaries, and stakeholder consultations, that can slow preemptive reforms (Tsebelis, 2002). Autocratic regimes, facing fewer electoral constraints and fewer institutional veto points, may adjust parameters more rapidly, though long-run institutional quality differs.

Third, our panel reveals a pronounced regional divergence in adaptation dynamics. African states are overwhelmingly concentrated in the Window for Reform quadrant, and all observed non-stable transitions on the continent are failed windows. Within the observed transition windows, no African country exhibits sustained adaptive-ageing or recovery dynamics. This finding qualifies the optimism embedded in some development narratives (ILO, 2017; Stewart and Yermo, 2009). The demographic window exists, but pervasive labor informality, low institutional coverage, and limited contributory capacity create structural barriers to adaptation (ILO, 2018).

The remainder of this paper is organized as follows. Section 2 establishes our theoretical foundations regarding institutional persistence, democratic constraints, and welfare state retrenchment. Section 3 outlines the data and index construction. Section 4 presents the dynamic panel transition matrices and the Firth logit econometric results. Section 5 discusses policy implications and addresses limitations. Section 6 concludes.

2. Literature Review

This paper sits at the intersection of four dense research traditions: the comparative political economy of pension reform, historical institutionalist accounts of welfare state persistence, the emerging macro-comparative literature on demographic adaptation, and the political economy of social protection in the developing world. Each body of work informs this paper's core puzzle: why some states aggressively deploy policy levers to build institutional insulation during favorable demographic windows, while others remain passive until structural vulnerability becomes locked in.

2.1 The Political Economy of Pension Reform

The comparative literature on pension reform has historically focused on explaining the structural content and episodic timing of legislative interventions. Foundational typologies established that welfare state structures reflect deep-seated political configurations and historic class coalitions rather than functional, technocratic responses to societal needs (Esping-Andersen, 1990; Mares, 2003). When fiscal or demographic pressures emerge, the ensuing policy response is fundamentally mediated by domestic political institutions and the distribution of partisan power (Huber and Stephens, 2000). Fragmentation within political systems and the proliferation of institutional veto players systematically reduce the probability of successful structural

overhauls (Brooks and James, 1999; Immergut, 1992). Consequently, even in moments of profound economic shock or international pressure, domestic institutional arrangements and interest group veto capacity remain the ultimate arbiters of reform adoption and implementation (Angelaki and Carrera, 2015; Orenstein, 2008).

To explain the pervasive inertia characterizing pension systems, scholars focus on the unique political asymmetry of welfare state retrenchment. Pierson (1996) demonstrates that retrenchment obeys a distinct political logic from welfare expansion. Because rolling back pension entitlements or escalating contribution rates inflicts immediate, concentrated, and highly visible costs on organized electorates for diffuse, long-term systemic payouts, politicians are structurally incentivized to prioritize short-term blame avoidance (Weaver, 1986). This electoral short-termism is compounded by partisan dynamics and coalitional complexities. Left-wing governments routinely postpone necessary parametric adjustments to protect core labor constituencies (Hering, 2008). While multidimensional policy bundling can occasionally facilitate reform through cross-sectoral trade-offs, it just as frequently introduces new veto points that paralyze legislative action (Häusermann, 2010; Immergut and Anderson, 2008).

Critically, this political economy of delay operates with heightened intensity under democratic competition. In a democracy, the mandate of regular electoral accountability compresses the time horizons of policymakers. Implementing anticipatory, painful adjustments for a demographic crisis decades away represents a political liability. This dynamic mirrors macroeconomic "war of attrition" models where competing democratic factions delay stabilizing reforms, hoping a rival coalition will bear the political costs of adjustment (Alesina and Drazen, 1991), alongside a profound "status quo bias" driven by individual uncertainty regarding the localized distributive impacts of structural changes (Fernandez and Rodrik, 1991). Conversely, authoritarian regimes, insulated from immediate electoral cycles, face weaker versions of these proximate accountability constraints. Autocrats possess a greater capacity to execute swift, top-down parametric changes, even if their long-run institutional structures suffer from separate pathologies of corruption or weak rule of law (Wright, 2008; Geddes, 1999).

While this literature thoroughly identifies the political constraints governing individual reform episodes, it suffers from a significant theoretical omission: it treats reform as an episodic event rather than evaluating the cumulative, long-run institutional trajectories produced by sustained policy drift (Hacker, 2004). Existing studies tell us when a state reforms, but they fail to explain how persistent political inertia systematically converts temporary demographic windows into structural vulnerability. This paper addresses that precise gap. By introducing a dynamic panel framework, we move beyond modeling reform occurrence to map how different political regimes navigate long-term paths of institutional adaptation or decay over a 24-year horizon.

2.2 Institutional Persistence and Welfare State Adaptation

Historical institutionalism provides the definitive theoretical foundation for understanding why pension regimes exhibit extreme structural inertia even when escalating demographic pressures demand rapid adaptation. This stability is driven by path-dependent "increasing returns" mechanisms, including massive fixed setup costs, learning effects, network coordination, and adaptive expectations—which generate self-reinforcing feedback loops that lock policy trajectories into place (Pierson, 2000). Once social policies are codified, they generate dense networks of interlocking administrative structures, citizen expectations, and powerful veto constituencies that fiercely resist structural retrenchment or modification (Mahoney, 2000; Pierson, 2004).

Crucially, these path-dependent loops are not static; they actively interact with shifting macro environments. Streeck and Thelen (2005) and Mahoney and Thelen (2010) demonstrate that institutional change frequently unfolds not through abrupt, punctuated overhauls, but via gradual, cumulative processes of *layering* and *drift*. Layering occurs when reformers append new rules, such as voluntary private pillars, alongside resilient legacy frameworks without dismantling core structures. Conversely, institutional drift occurs when formal policy rules remain entirely unchanged while the external environment shifts around them, fundamentally altering the system's societal impact (Hacker, 2004).

The concept of drift is the exact theoretical mechanism underpinning this paper's dynamic framework. A pension system designed for a youthful population becomes fiscally unsustainable and socially inadequate not because its text changed, but because the demographic baseline shifted beneath it. Unless proactive, deliberate policy interventions occur, institutional path dependence guarantees systemic drift toward fiscal exposure. Earlier institutional choices severely restrict the feasible set of later policy options, and the specific sequencing of historical choices dictates both the political feasibility and the ultimate macro outcomes of reform (Ebbinghaus, 2009; Hinrichs and Jessoula, 2012).

While these historical institutionalist insights are theoretically rich, existing empirical applications suffer from three binding limitations that this study overcomes. First, they are predominantly qualitative, tracing micro-level historical narratives rather than testing systemic macro-trends. Second, they focus almost exclusively on advanced OECD welfare states, ignoring how persistence operates across highly informal labor markets. Third, they treat drift as a descriptive concept rather than a quantifiable, dynamic variable. This paper provides the first systematic, cross-national quantitative operationalization of institutional drift and persistence. By tracking 115 countries over a 24-year panel, we explicitly measure the speed, and frequent absence of structural pension adaptation across diverse global regimes.

2.3 Measuring Pension Preparedness: The Composite Indicator Gap

The macro-comparative literature on demographic adaptation relies heavily on empirical benchmarks that are methodologically ill-equipped for rigorous political economy analysis. Prominent cross-national metrics, such as the Mercer CFA Institute Global Pension Index, the Allianz Pension Index, and the OECD's Pensions at a Glance indicators—have significantly advanced comparative baseline data on replacement rates and statutory retirement frameworks (OECD, 2021; Whiteford and Whitehouse, 2006). Despite their descriptive utility, these existing composite indicators suffer from three binding limitations that paralyze causal inference regarding institutional adaptation.

First, prevailing indices focus almost exclusively on contemporary fiscal or welfare outcomes, such as aggregate benefit adequacy or short-term budget balances, rather than the sticky institutional structures generating those outcomes. A state may display deceptive short-term adequacy by expending a volatile share of GDP on legacy entitlements, masking deep structural unsustainability. Second, existing metrics conflate demographic baselines and policy levers into unified aggregate scores. This structural endogeneity makes it analytically impossible to isolate whether a state's strategic position reflects deliberate, path-dependent policy choices or merely transient demographic luck. Third, the geographic coverage of these indices remains severely restricted. The Mercer index isolates approximately 50 predominantly high-income economies, while OECD datasets systematically exclude the developing world, leaving a profound empirical vacuum regarding sub-Saharan African pension dynamics.

This paper resolves these empirical and geographic limitations by constructing two independent, decoupled indicators across a global panel of 115 countries. The Policy Readiness Index (PRI) measures pure institutional design, capturing retirement-age adequacy, contribution effort, and structural breadth that are independent of contemporary population profiles. Conversely, the Demographic Pressure Index (DPI) isolates demographic exposure, synthesizing the absolute level and longitudinal rate of change of old-age dependency ratios.

Decoupling policy preparedness from demographic pressure represents this paper's core conceptual and methodological contribution, allowing us to explicitly measure the presence or absence of institutional drift (Hacker, 2004). Methodologically, we construct these indices using the non-compensatory composite framework established by Mazziotta and Pareto (2016). This non-compensatory aggregation ensures that structural deficiencies in one critical dimension, such as an absolute deficit in social pension coverage, cannot be artificially offset or masked by a high score in another policy dimension, like an elevated statutory retirement age. The resulting framework provides a robust, geographically expansive infrastructure for tracking dynamic institutional adaptation over a 24-year horizon.

2.4 Demographic Windows and the Political Economy of Intertemporal Timing

The concept of a "demographic window" has been extensively developed within macroeconomics to capture the transient growth potential that emerges when a country's working-age cohort expands relative to its dependents (Bloom, Canning, and Sevilla, 2003; Lee and Mason, 2011). Realizing this demographic dividend requires proactive, concurrent investments in human capital and institutional savings capacity (Mason, Lee, and Jiang, 2016). However, this growth literature treats institutional adaptation as an automatic, technocratic byproduct of demographic change, leaving the underlying political-economy prerequisites entirely under-specified. This paper re-theorizes the demographic window through a social policy lens: a youthful population profile represents a temporary institutional window where low dependency ratios grant states a vital, low-pressure buffer to construct resilient pension systems before systemic aging intensifies.

The central puzzle is why certain political regimes successfully exploit this temporal window while others allow it to close. We resolve this by bridging the political economy of reform timing with formal models of democratic constraints. Standard welfare retrenchment theories establish that enacting painful structural adjustments requires politicians to navigate severe electoral hazards, forcing them to prioritize short-term blame avoidance over long-term fiscal stabilization (Pierson, 1994; Weaver, 1986). This institutional inertia is compounded by the structural short-termism embedded in democratic electoral cycles. Political business cycle frameworks demonstrate that regular electoral accountability compresses policymakers' time horizons, systematically biasing legislative output toward short-term economic expansions and immediate rent distribution over long-horizon public investments (MacRae, 1977; Nordhaus, 1975).

This electoral myopia generates a profound intertemporal barrier to anticipatory pension reform. As Jacobs (2011) formalizes, democratic institutions face systemic biases against policies that impose immediate, highly visible electoral costs on concentrated voting blocs for diffuse, systemic payouts that accrue decades into the future. Because low dependency ratios lower the immediate political salience of aging, democratic politicians face zero electoral incentives to preemptively mandate painful contribution hikes or elevate retirement ages (Barr, 2006). They delay stabilizing reforms, transforming a favorable demographic window into a period of prolonged policy drift that triggers fiscal deterioration once the demographic transition accelerates (Clements, Faircloth, and Verhoeven, 2007; Lindbeck and Persson, 2003).

Conversely, building fiscal state capacity is fundamentally endogenous to these political horizons (Besley and Persson, 2011). Autocratic regimes, insulated from immediate competitive electoral accountability, operate on alternative survival calculus. This insulation grants authoritarian elites the unique capacity to execute top-down, unpopular parametric adjustments during low-pressure windows, bypassing the blame-avoidance constraints that paralyze democratic coalitions. This paper tests

these competing intertemporal dynamics, mapping how democratic electoral horizons systematically convert temporary demographic windows into locked-in structural vulnerability across our 24-year panel.

2.5 African Pension Systems: Structural Incongruence and the Window Trap

Sub-Saharan African pension systems exhibit acute structural challenges that make them the critical empirical laboratory for testing the "Window for Reform" hypothesis. Averaging coverage rates below 15 percent of the working-age population, these systems suffer from a severe institutional mismatch with domestic labor markets (Stewart and Yermo, 2009). Pervasive labor informality exceeds 85 percent of total employment across the continent, rendering conventional defined-benefit and defined-contribution payroll models structurally inaccessible to the vast majority of the workforce (ILO, 2018). While non-contributory social protection frameworks and social pension safety nets have expanded significantly since 2000, they remain fiscally constrained, fragmented, and limited in benefit depth (ILO, 2019; Niño-Zarazúa et al., 2012). Consequently, old-age poverty remains exceptionally high despite highly favorable, youthful population profiles, confirming that an absolute deficit in institutional coverage breadth—rather than demographic pressure—is the region's binding structural constraint (Kakwani and Subbarao, 2005).

These contemporary structural deficits are deeply rooted in path-dependent historical and institutional legacies. Post-colonial African states largely inherited highly fragmented, formal-sector social insurance frameworks bifurcated along colonial lineages (Willmore, 2014). For instance, Ghana's structural transition from a monolithic, defined-benefit pay-as-you-go systems to a formalized three-tier framework highlights the profound friction involved in upgrading institutions within contexts characterized by high administrative costs and weak regulatory insulation (Gockel, 2008; World Bank, 2018). While low old-age dependency ratios grant African states a unique, low-pressure window for anticipatory institutional engineering that advanced economies never experienced (OECD, 2020), this favorable demographic baseline frequently acts as a political trap. By lowering the immediate political salience of aging, it facilitates prolonged policy drift. This paper leverages our 24-year dynamic panel to evaluate whether African nations are successfully executing structural adaptation or allowing these finite temporal windows to close.

2.6 Summary and Theoretical Gaps

Three core theoretical gaps in the comparative political economy literature motivate this study. First, existing scholarship treats pension reform as an episodic event, focusing on reform occurrence rather than the cumulative institutional trajectories produced by sustained policy drift (Hacker, 2004). It models when states enact legislation but fails to explain how structural preparedness is built or lost over time. Second, while historical institutionalism conceptualizes path dependence and institutional persistence qualitatively, it lacks cross-national, macro-quantitative

measurements of the speed, or total absence, of long-term policy adaptation across diverse economic tiers. Third, the demographic dividend literature remains heavily economistic, treating institutional readiness as a technocratic automaticity while ignoring the binding intertemporal political constraints governing reform timing (Jacobs, 2011). The critical question of how democratic competition conditions anticipatory social policymaking has not received much systematic empirical mapping.

This paper directly resolves these intersecting gaps. Leveraging a globally expansive, 24-year dynamic panel of 115 countries, we construct independent, decoupled indices of policy readiness (PRI) and demographic pressure (DPI) to systematically quantify five-year regime transitions. Utilizing Firth penalized logit estimations to insulate our models against rare-events bias, we rigorously test whether democratic electoral competition imposes systematic intertemporal constraints on preemptive structural adaptation, mapping a pronounced regional divergence in the closing windows of the developing world.

3. Dataset Construction and Index Operationalization

3.1 Data Sources and Sample Selection

To analyze the long-term dynamics of pension adaptation, we construct an unbalanced country-year panel spanning 115 countries from 2000 to 2024 ($T = 25$). The dataset integrates four distinct macro-level repositories:

- Pension Policy Systems: Statutory retirement ages, statutory employer/employee contribution rates, and structural configurations (mandatory public frameworks, voluntary pillars, and non-contributory social pensions) are extracted from the International Social Security Association (ISSA) country profiles, supplemented by historical national legislative registries.
- Demographics and Macroeconomics: Old-age dependency ratios (population aged 65+ as a percentage of the working-age population aged 15-64), longitudinal rates of change, life expectancy at birth, real GDP per capita, CPI inflation, annual GDP growth, labor force participation rates, and vulnerable employment shares are drawn from the World Bank's World Development Indicators (WDI).
- Political Regimes and Institutions: To capture the core independent variables, we extract the continuous Electoral Democracy Index (Polyarchy) from the Varieties of Democracy (V-Dem) Dataset (Version 16, 2026). National election frequencies and intervals are operationalized via the National Elections Across Democracy and Autocracy (NELDA) repository (Hyde and Marinov, 2012). Labor organization metrics, including union density and collective bargaining coverage, are harvested from the OECD/AIAS ICTWSS database (Visser, 2019).

The raw multi-source merge yields 183 countries. Requiring complete data on the core index dimensions restricts our final estimation sample to a balanced panel of 2,760 country-year observations across 115 sovereign states. Missingness (approximately 40 percent) is concentrated in the slow-moving institutional indicators. Because major systemic pension overhauls are rare institutional events, we apply forward-and-backward imputation to propagate missing country-year policy attributes across adjacent waves where national legislative records confirm structural stability, limiting attenuation bias without introducing artificial variance.

3.2 The Policy Readiness Index (PRI)

The Policy Readiness Index (PRI) quantifies the preemptive structural preparedness of a state's public retirement structure independent of its underlying population distribution. Moving beyond short-term actuarial outcomes, the PRI models systemic institutional design across three distinct sub-pillars:

1. Retirement Age Adequacy (R_{it}) : Measures the statutory retirement age. Higher boundaries expand expected working life cycles relative to dependency durations, capturing labor-force insulation capacity (Gruber and Wise, 2004).
2. Contribution Effort (C_{it}) : Quantifies financing capacity using the combined statutory employer-employee contribution rate for the primary public tier. To insulate the metric against leverage from extreme outliers, raw rates are winsorized at the 5th and 95th percentiles prior to scaling.
3. Institutional Breadth (I_{it}) : Captures the structural safety net and multi-layered adaptive capacity of the state's welfare model (Holzmann and Hinz, 2005). It is constructed as an unweighted average of four binary indicators drawn from ISSA:

$$I_{it} = \frac{1}{4}(M_{it}+V_{it}+S_{it}+F_{it}) \times 100$$

Where M_{it} denotes a mandatory public scheme, V_{it} represents a formalized voluntary pillar, S_{it} flags a non-contributory old-age social pension, and F_{it} denotes active systemic reform windows within the five-year wave.

All continuous variables are normalized onto a uniform $[0, 100]$ scale using panel-wide min-max bounds:

$$X_{it}^{\text{norm}} = 100 \times \frac{X_{it} - \min_{j,\tau}(X_{j\tau})}{\max_{j,\tau}(X_{j\tau}) - \min_{j,\tau}(X_{j\tau})}$$

The baseline PRI is aggregated via a linear weighted structure:

$$\text{PRI}_{it} = 0.40\, R_{it} + 0.30\, C_{it} + 0.30\, I_{it}$$

This baseline assigns greater analytical weight to retirement parameters due to their direct structural leverage over dependency timelines. Crucially, because linear aggregation introduces compensatory assumptions (where high retirement ages could mathematically mask a complete absence of low-income social pensions), we systematically re-test our entire transition matrix using the non-compensatory composite index methodology optimized by Mazziotta and Pareto (2016). The cross-specification rank correlations exceed 0.98, confirming that our institutional regime classifications are highly robust to alternative non-compensatory mathematical specifications.

3.3 The Demographic Pressure Index (DPI)

The Demographic Pressure Index (DPI) operationalizes the external structural exposure confronting a state's social security system. It synthesizes contemporary demographic strain with its longitudinal acceleration profile:

$$DPI_{it} = 0.60 \times OADR_{it} + 0.40 \times \Delta OADR_{it}$$

Where $OADR_{it}$ denotes the min-max normalized old-age dependency ratio, and $\Delta OADR_{it}$ represents the normalized five-year longitudinal rate of change in that ratio. Assigning greater analytical weight (0.60) to the baseline level captures immediate fiscal dependency loads, while the rate-of-change vector (0.40) captures the velocity of demographic acceleration. Higher unified DPI values indicate heightened demographic exposure.

3.4 Spatial Regime Classification

Using the baseline indices, we partition the data into four distinct, mutually exclusive institutional-demographic regimes via a median-split matrix. To prevent threshold endogeneity and ensure a stable cross-temporal benchmark, the splitting thresholds are locked at exogenous historical anchors: a fixed PRI median ($\tilde{P} = 60.8$) and DPI median ($\tilde{D} = 31.6$). Countries are mapped into four distinct institutional equilibria:

Country-year observations are assigned to four regimes:

Prepared:

$$PRI_{it} \geq 60.8 \cap DPI_{it} < 31.6$$

Countries exhibiting strong institutional preparedness under relatively manageable demographic pressure.

Resilient:

$$PRI_{it} \geq 60.8 \cap DPI_{it} \geq 31.6$$

Countries maintaining robust pension institutions despite elevated demographic ageing pressures.

Window for Reform:

$$PRI_{it} < 60.8 \cap DPI_{it} < 31.6$$

Countries with weak institutional preparedness that remain temporarily insulated by favorable demographic conditions.

Vulnerable:

$$PRI_{it} < 60.8 \cap DPI_{it} \geq 31.6$$

Countries combining weak pension institutions with high demographic exposure, indicating elevated structural vulnerability.

This regime structure allows the framework to distinguish static preparedness from dynamic adaptation and provides the basis for tracking institutional persistence, failed adaptation windows, and long-run transition dynamics across countries.

3.5 Intertemporal Transition Framework

To model long-term institutional adaptation, we track regime movements over discrete, five-year intertemporal windows ($t \rightarrow t + 5$). A transition event is operationalized as a change in regime classification across the five-year boundary; cases with incomplete endpoints are dropped. The five-year window choice is theoretically and empirically justified by three factors.

First, structural pension overhauls exhibit high path-dependent stickiness; adjustments unfold over years rather than months, rendering annual panels noisy. Second, the five-year horizon mirrors the operational construction of the ΔOADR_{it} sub-pillar, enforcing internal mathematical consistency. Third, a five-year window aligns with standard national electoral cycles, allowing us to explicitly isolate the impacts of regular competitive political horizons without overfitting to high-frequency annual fluctuations.

The intertemporal transition matrix generates three primary dependent variables: (1) the persistence rate, defined as the probability of a state remaining in its baseline quadrant at $t + 5$; (2) the transition trajectory, capturing specific directional shifts; and (3) the failed window rate, which isolates the specific conditional probability of a state transitioning from the Window for Reform directly into the Vulnerable quadrant. To evaluate systemic structural divergence, these trajectories are cross-tabulated and

analyzed through regional partitions separating African states from the global distribution.

3.6 Econometric Specification

To examine the determinants of failed windows, we estimate logit models of the transition from Window for Reform to Vulnerable. The dependent variable takes the value 1 if a country in the Window for Reform quadrant at time t transitions to Vulnerable at time $t + 5$, and 0 otherwise. The sample is restricted to country-year observations where the initial quadrant is Window for Reform.

The baseline specification includes political and macroeconomic covariates measured at time t: the V-Dem electoral democracy index (polyarchy), the count of national elections occurring within the current year (from NELDA data), an IMF programme proxy, the CPI inflation rate, and the GDP growth rate. The IMF programme proxy equals 1 for country-years exhibiting combinations of elevated public debt (above 80 percent of GDP), high inflation (above 30 percent annually), or negative GDP growth with debt above 60 percent of GDP.

Due to the rare nature of the failed window event (6.0 percent of Window for Reform observations), we employ Firth penalized logit estimation. Firth's method reduces small-sample bias in maximum likelihood estimates and addresses quasi-separation, which occurs when a linear combination of predictors perfectly predicts the outcome (Firth, 1993). Standard errors are clustered at the country level to account for temporal dependence and within-country correlation. Country fixed effects are not included because the independent variables of interest, particularly democracy, have limited within-country variation over the panel period, reflecting the high institutional persistence documented in Section 4.

We report three estimators for robustness. The main specification uses Firth penalized logit. We also report standard logit for comparison and standardized logit to compare effect sizes across covariates measured on different scales (King and Zeng, 2001). Coefficients from the Firth model are reported alongside standardized coefficients from the standardized logit model. Odds ratios are not reported due to quasi-separation, which produces implausibly large values; standardized coefficients and marginal effects provide more reliable interpretation.

3.7 Descriptive Summary

Table 1 presents summary statistics for the dynamic PRI and DPI. The dynamic PRI has a mean of 52.2 and a standard deviation of 16.9, comparable to the cross-sectional estimates. The dynamic DPI has a mean of 31.7 and a standard deviation of 13.4. The distribution of country-year observations across quadrants is broadly consistent with the cross-sectional distribution: the Window for Reform is the largest

regime, accounting for approximately 35 percent of observations, followed by Resilient with 15 percent, Vulnerable with 6 percent, and Prepared with 4 percent.

Table 1: Descriptive Statistics

Statistic	PRI	DPI	Retirement Age	Contribution Rate	Democracy
Mean	52.2	31.7	61.4	14.8	0.52
Median	54.1	29.8	62.0	14.0	0.54
SD	16.9	13.4	4.2	8.1	0.28
Min	0	0	50	0	0.02
Max	100	100	75	35	0.92
N	4,575	4,575	3,950	3,875	3,700

Notes: PRI and DPI are min-max normalized 0–100 indices; values of 0 and 100 represent the observed minimum and maximum in the sample, not absolute thresholds. Retirement age is statutory retirement age in years. Contribution rate is the combined employer-employee contribution rate (%), winsorized at the 5th and 95th percentiles. Democracy is the V-Dem polyarchy index (0–1).

Section 4: Results

This section presents the empirical findings in four parts. First, we document the distribution of countries across preparedness-pressure regimes. Second, we analyze five-year transition dynamics, establishing institutional persistence and the dominance of failed-window transitions. Third, we examine regional heterogeneity, focusing on Africa's distinctive transition patterns. Fourth, we estimate the political and economic correlates of failed windows, with particular attention to the role of democratic institutions.

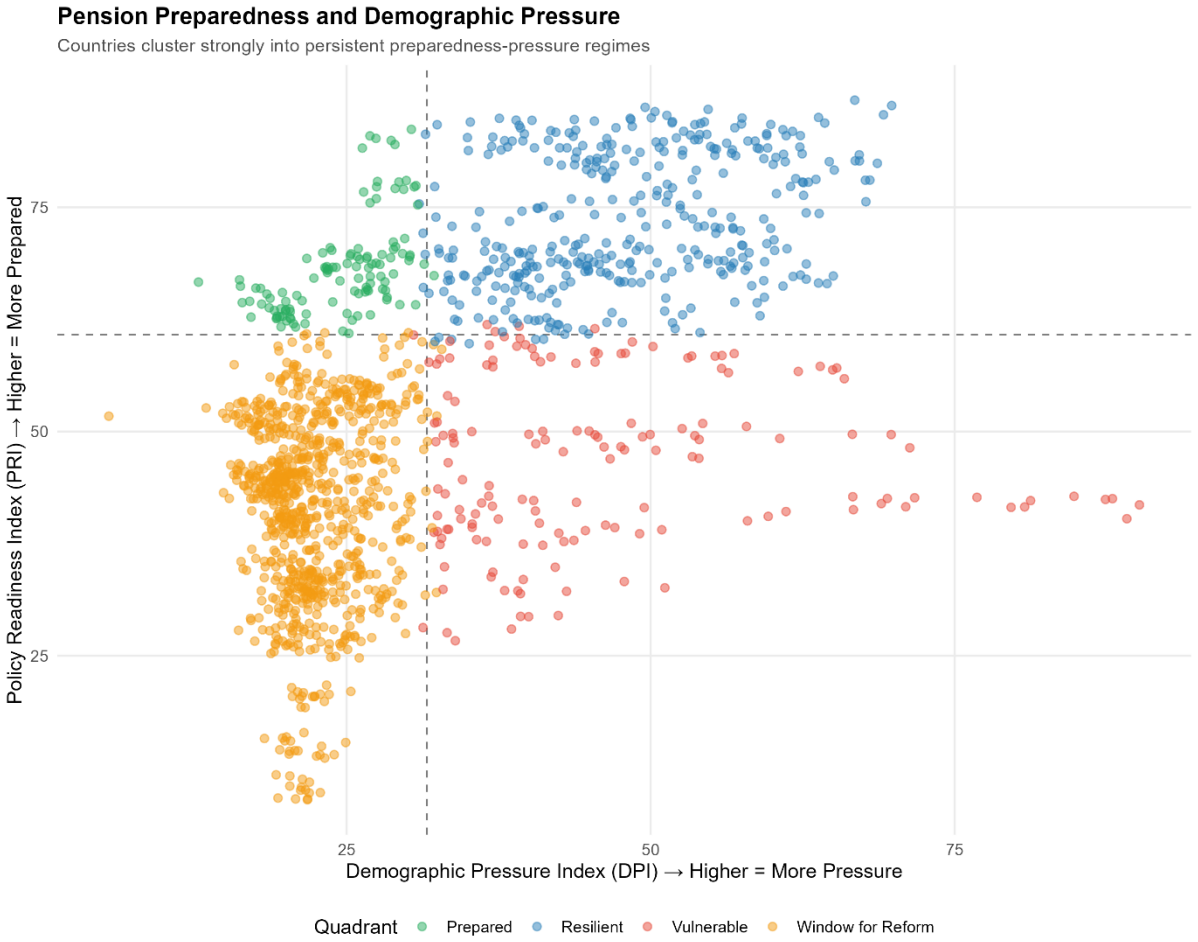
4.1 The Global Landscape of Pension Preparedness

Table 1 (presented in Section 3) provides summary statistics for the Policy Readiness Index (PRI) and Demographic Pressure Index (DPI). The PRI has a mean of 52.2 and a standard deviation of 16.9, indicating substantial cross-country variation in institutional preparedness. The DPI has a mean of 31.7 and a standard deviation of 13.4, reflecting uneven demographic ageing across countries.

Figure 1 presents the PRI-DPI quadrant map. Countries cluster into four distinct regimes. The Prepared quadrant (upper-left) contains countries with strong institutional preparedness but below-median demographic pressure. The Resilient quadrant (upper-right) contains countries that have maintained strong institutions despite above-median demographic pressure. The Window for Reform quadrant (lower-left) is the largest regime, containing countries with weak institutional preparedness but also below-median demographic pressure. The Vulnerable quadrant

(lower-right) contains countries facing the most challenging combination of weak institutions and above-median demographic pressure.

Figure 1 Here: PRI-DPI Quadrant Map



The quadrant distribution reveals several patterns. The Window for Reform regime accounts for 34.9 percent of classified country-year observations, followed by Resilient (14.9 percent), Vulnerable (6.0 percent), and Prepared (4.5 percent). Approximately 39.7 percent of observations lack complete data for quadrant classification, primarily due to missing institutional variables. The concentration of observations in the Window for Reform regime is notable: nearly 60 percent of classified country-years fall into this quadrant.

4.2 Institutional Persistence: Five-Year Transition Dynamics

The primary descriptive finding of our dynamic panel reveals that global pension preparedness regimes operate as highly stable institutional equilibria. Table 2 outlines the intertemporal five-year transition matrix across the sample. Over these five-year horizons, a striking 94.5 percent of country-year observations remain anchored within

their baseline quadrant. This structural persistence rate is most pronounced in the Resilient quadrant (99.2 percent), followed by the Vulnerable (94.9 percent), Window for Reform (94.0 percent), and Prepared (83.4 percent) regimes.

Table 2: Five-Year Transition Matrix

From ↓ / To →	Prepared	Resilient	Window for Reform	Vulnerable	Total (n)
Prepared	83.4%	16.6%	0.0%	0.0%	175
Resilient	0.8%	99.2%	0.0%	0.0%	528
Window for Reform	0.0%	0.0%	94.0%	6.0%	1,306
Vulnerable	0.0%	0.0%	5.1%	94.9%	176

Note: Rows sum to 100%. Percentages show the conditional probability of transitioning from the starting quadrant (row) to the ending quadrant (column) over a five-year horizon.

This pervasive inertia reflects deep path-dependent lock-in and dense stakeholder coordination rather than short-term policy volatility (Pierson, 2000). Statutory retirement boundaries and payroll contribution rates are codified through contested legislative processes involving intense bargaining with labor unions, employer federations, and electoral veto players (Immergut, 1992; Weaver, 1986). Multi-pillar structural systems, specifically the creation of mandatory public tiers, voluntary savings vehicles, and universal social protections—evolve across decades rather than annual political cycles. This high persistence confirms that pension readiness functions as a deeply embedded, sticky structural equilibrium rather than a fluid, rapidly adjusting policy variable.

When institutional stability breaks down, the ensuing transition dynamics are overwhelmingly asymmetric and deterioration-driven. Because the transition model requires a five-year forward endpoint ($t + 5$), the terminal waves of the panel are truncated, yielding a total universe of 2,185 observed transition epochs from the initial 2,760 country-year observations. Table 3 categorizes the non-stable transitions ($n = 121$) observed within this universe. Reflecting a directional asymmetry, 65.3 percent of all non-stable movements ($n = 79$) involve a direct structural shift from the Window for Reform to the Vulnerable quadrant. This pervasive pattern represents the "failed window" transition.

Table 3: Transition Type Summary

Transition Type	Obs (n)	Share of Total Panel (N=2,185)	Share of Non-Stable Transitions (n=121)
Stable Equilibria	2,064	94.46%	—

Downward (Failed Window)	79	3.62%	65.29%
Adaptive Ageing	29	1.33%	23.97%
Recovery	9	0.41%	7.44%
Other	4	0.18%	3.30%

Conversely, the second most frequent trajectory consists of movements from the Prepared directly into the Resilient quadrant, accounting for 23.97 percent ($n = 29$) of non-stable shifts. This specific pathway is conceptually distinct from structural deterioration; it captures successful Adaptive Ageing, where a state's underlying demographic pressure accelerates across the fixed median split while its institutional policy frameworks remains robustly fortified (Hinrichs and Jessoula, 2012).

The obvious dominance of the failed-window pathway represents this paper's core empirical finding. States that inherit favorable, youthful demographic baselines coupled with weak institutional frameworks systematically fail to exploit their low-pressure windows for anticipatory structural engineering (Jacobs, 2011). Favorable demographic windows do not automatically induce technocratic policy adaptation. Rather, the modal outcome for uninsulated regimes experiencing environmental changes is passive institutional drift directly into structural vulnerability (Hacker, 2004; Streeck and Thelen, 2005).

4.3 Regional Heterogeneity: Africa's Structural Trajectory

The macro-historical transition dynamics bifurcate sharply when partitioning the panel along regional lines. Table 4 details the empirical divergence in non-stable transition trajectories between African states and the rest of the global sample. Within the African sub-sample, a striking pattern of deterministic deterioration emerges: 100 percent ($n = 16$) of all observed non-stable transitions are exclusively of the Failed Window type. No upward, adaptive transitions from the Window for Reform to either the Prepared or Resilient quadrants occur within any African panel window. Furthermore, no African nation in our 24-year timeframe displays empirical evidence of Adaptive Ageing or Recovery dynamics.

Table 4: Non-Stable Transitions by Region

Region	**Transition Trajectory**	**(n)**	**Share of Regional Transitions**
Africa	Downward (Failed Window)	16	100.0%
Non-Africa	Downward (Failed Window)	63	60.0%

Non-Africa	Adaptive Ageing	29	27.6%
Non-Africa	Recovery	9	8.6%
Non-Africa	Other	4	3.8%

Note: Outlines non-stable transition trajectories ($n = 121$). "Other" captures rare boundary crossings, such as Resilient → Prepared.

In sharp contrast, non-African polities navigate a significantly more diverse and fluid institutional landscape. While Failed Window movements still constitute the modal non-stable trajectory at 60.0 percent ($n = 63$), non-African states exhibit robust alternative adaptive pathways. These include Adaptive Ageing (27.6 percent), where states preserve policy insulation amid rising demographic dependency, and structural Recovery (8.6 percent), where states actively transition from vulnerability back into a low-pressure reform window.

Figure 2: Regional Transitions — Africa vs. Non-Africa

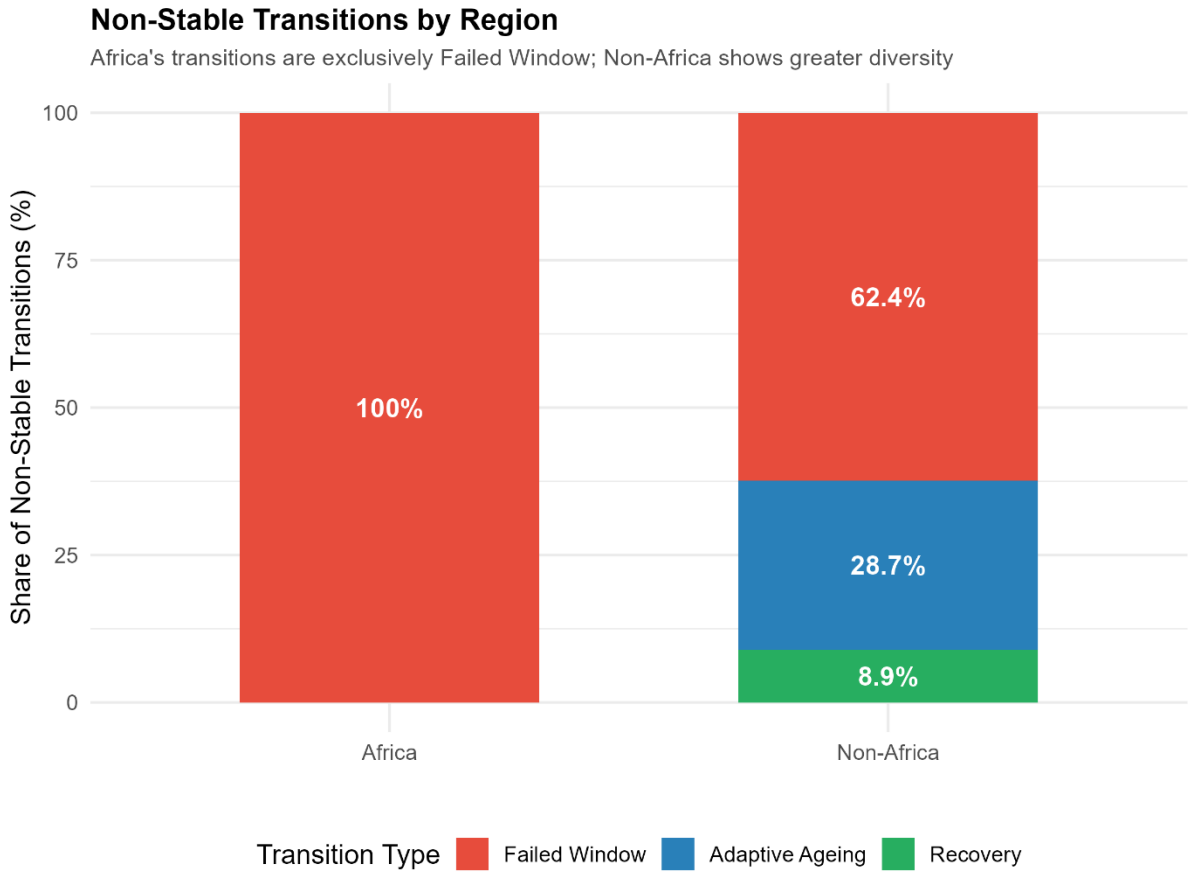


Figure 2 visualizes this regional schism. This absolute divergence confirms that the low baseline frequency of African transition events is itself a critical substantive indicator of profound institutional path-dependency, rather than an artifact of sample

size. African pension systems remain trapped in a static, low-preparedness equilibrium.

This absolute deficit in upward mobility aligns with the deep structural constraints identified in the development literature. Pervasive labor informality exceeding 85 percent of aggregate employment, combined with narrow formal-sector coverage rates below 15 percent of the working-age cohort, leaves these states structurally ill-equipped to scale traditional contributory frameworks (ILO, 2018; Stewart and Yermo, 2009). Consequently, the core systemic hazard facing the African continent is not an acute, sudden fiscal crash of existing entitlements, but rather long-term, passive policy drift (Hacker, 2004). Favorable, youthful populations temporarily lower the immediate political salience of aging, enabling states to drift past their finite temporal windows without executing the preemptive structural overhauls required to insulate their welfare models before demographic pressure accelerates.

4.4 Determinants of Failed Windows: Political Economy Correlates

We next evaluate the political and macroeconomic vectors that dictate whether a state successfully capitalizes on its low-pressure demographic buffer or suffers a dynamic transition failure from the Window for Reform directly into the Vulnerable quadrant. Table 5 documents the parameter estimates from our preferred Firth penalized logit model, which explicitly insulates our coefficients against small-sample bias driven by the rare-event profile of our dependent variable (6.0 percent conditional transition events).

Table 5: Determinants of Failed Window — Firth Logit

Variable	Coefficient (β)	Std. Error	p-value
Democracy (Polyarchy)	7.62	1.08	< 0.001
Inflation (CPI, annual %)	-0.135	0.04	< 0.001
IMF Proxy	-1.21	0.67	0.042
GDP Growth (annual %)	-0.094	0.04	0.056
Election Count	-0.032	0.19	0.862

Note: Analytical sample restricted to baseline Window for Reform observations ($N = 1{,}306$; transition events $n = 79$). Clustered standard errors at the country level.

The estimated coefficient for electoral democracy is positive, remarkably large, and highly statistically significant ($\beta = 7.62$, $p < 0.001$). Holding all covariates constant, higher levels of competitive polyarchy are robustly associated with an elevated probability of structural window failure. To evaluate comparative effect magnitudes, Table 6 reports the standardized logit estimations, confirming that democracy yields

the most pronounced standardized effect size (Std. $\beta = 1.54$) across the entire covariate matrix, closely rivaled only by macroeconomic inflation.

Table 6: Standardized Logit — Effect Magnitudes

Variable	Standardized Coefficient	p-value
Democracy (Polyarchy)	1.54	< 0.001
Inflation (CPI, annual %)	-1.58	< 0.001
IMF Proxy	-1.21	0.042
GDP Growth (annual %)	-0.47	0.056
Election Count	-0.02	0.862

Rather than signaling a baseline deficiency in democratic governance, this empirical pattern uncovers a profound intertemporal institutional paradox. As outlined across model specifications in Table 7, cross-sectional configurations show that democracies support superior absolute levels of long-term policy readiness ($\beta = 30.0, p < 0.001$). However, when evaluated dynamically over time, intense electoral competition compresses the decision-making horizons of democratic elites. Because anticipatory pension adjustments require forcing immediate, highly visible fiscal costs on voters for diffuse public payouts decades away, democratic politicians maximize short-term blame avoidance and allow systems to undergo passive policy drift during low-salience demographic periods (Hacker, 2004; Jacobs, 2011; Pierson, 1996).

Table 7: Democracy Coefficient Across Specifications

Specification	Estimator Metric	Coefficient (β)	p-value
Static Baseline	Pooled OLS (PRI Outcome)	30.00	< 0.001
Dynamic Panel	Firth Logit (Failed Window)	7.62	< 0.001
Standardized Scaled	Standardized Logit (Effect Size)	1.54	< 0.001

Our macroeconomic covariates exhibit highly consistent, clarifying associations. The negative inflation parameter ($\beta = -0.135, p < 0.001$) suggests an acute fiscal-crisis mechanism: macroeconomic shocks heighten the political salience of systemic instability, acting as external focal points that temporarily break democratic path dependency and force sudden stabilization (Alesina and Drazen, 1991). Similarly, the negative IMF proxy coefficient ($\beta = -1.21, p = 0.042$) indicates that external conditional leverage helps insulate technocratic elites, absorbing the electoral blame required to execute top-down parametric overhauls (Orenstein, 2008). Annual GDP

growth operates as a marginal negative predictor ($\beta = -0.094$, $p = 0.056$), while high-frequency electoral counts display no statistical significance, confirming that the structural level of political competition, rather than immediate election timing, drives transition failure.

Figure 3: Marginal Effect of Democracy on Failed Window Probability

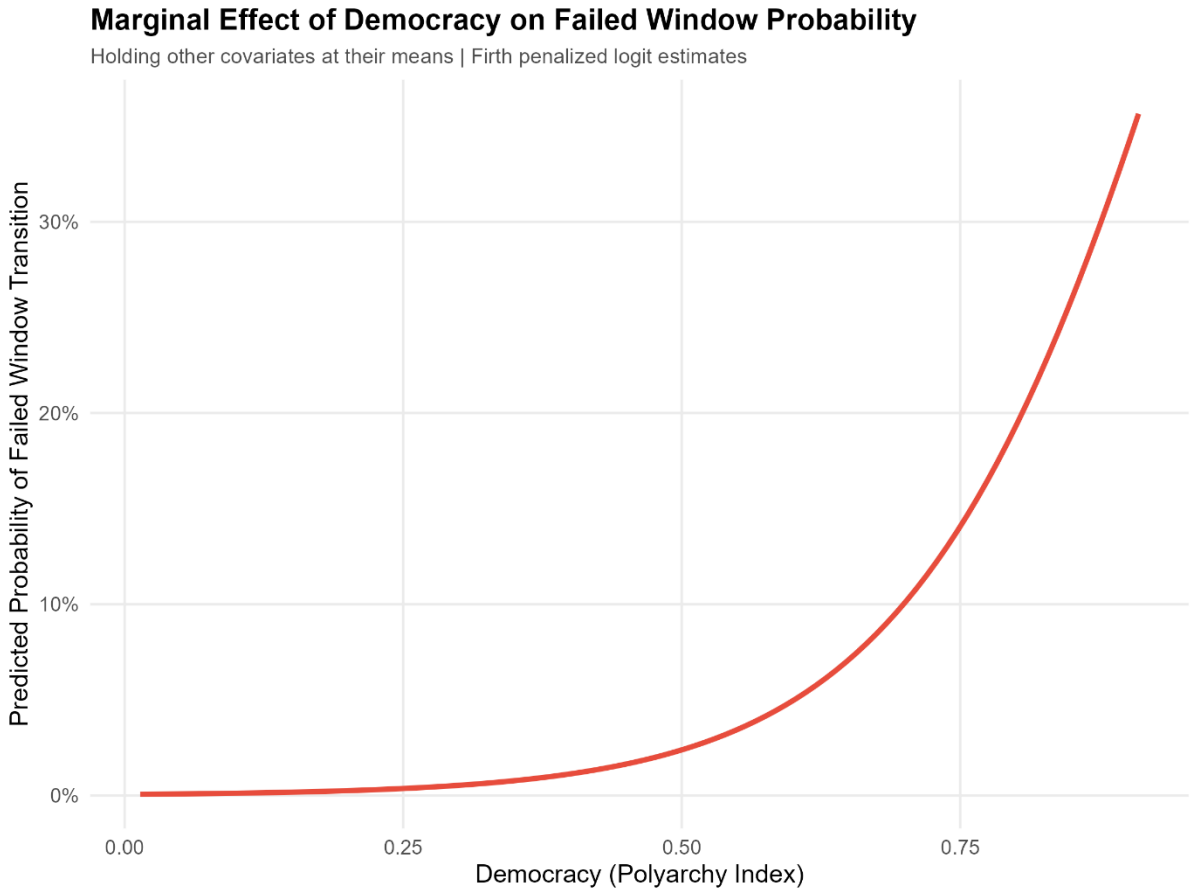


Figure 3 visualizes the non-linear marginal effect of democracy on transition probabilities, keeping external covariates at their empirical means. The probability remains flat and negligible (below 5 percent) throughout low-to-moderate polyarchy tiers (below 0.4), before accelerating into an exponential trajectory that peaks at a 20-25 percent transition risk at the highest bounds of democratic consolidation. This inflection curve proves that the electoral constraints paralyzing preemptive institutional adaptation become binding only after specific operational thresholds of robust, competitive democratic accountability are crossed.

Section 5: Discussions

5.1 Institutional Persistence as a Structural Equilibrium

The observed 94.5 percent five-year persistence rate across our global panel represents both a critical methodological baseline and an important substantive finding. Methodologically, this extreme inertia explains why standard fixed-effects (FE) panel specifications routinely yield null results when identifying the structural determinants of pension readiness. Because statutory retirement thresholds and multi-pillar frameworks change infrequently, standard FE estimators absorb this sluggish within-country variance into the country intercept. This creates severe attenuation bias and renders standard panel estimators mathematically ill-equipped to capture institutional variation (Plümper and Troeger, 2007). Resolving this limitation requires the analytical strategy deployed here: an intertemporal descriptive transition framework paired with Firth penalized logit models to capture conditional regime shifts.

Substantively, this persistence rate confirms that pension preparedness operates as a sticky institutional equilibrium rather than a fluid policy variable (Pierson, 2000). Once social security systems are codified, they trigger self-reinforcing feedback loops and increasing returns (Mahoney, 2000; Pierson, 2004). Senior citizen voting blocks and unionized labor generate resilient veto constituencies around existing parameters, while administrative routines anchor expectations. These feedback mechanisms make structural adjustments difficult even under escalating demographic exposure.

Consequently, the true institutional window for reform is considerably narrower than raw demographic projections suggest. Because structural adjustments require five to ten years to alter behavioral patterns and expand coverage density, a country that delays legislative intervention will experience systemic policy drift (Hacker, 2004). By the time reform benefits materialize, the state will have slid past its demographic buffer straight into the Vulnerable quadrant. This mismatch demonstrates that effective social policy hedging requires time horizons that vastly exceed standard electoral cycles.

5.2 The Intertemporal Democracy Paradox: Static Capacity versus Dynamic Stagnation

The empirical finding that competitive democracy is simultaneously associated with superior baseline Policy Readiness Index levels cross-sectionally and an elevated risk of failed-window transitions dynamically represents this paper's core theoretical contribution. This apparent paradox is resolved by separating static institutional capacity from dynamic intertemporal adaptation.

Cross-sectionally, consolidated democracies exhibit higher baseline PRI scores, reflecting long macro-histories of welfare state development, advanced economic diversification, and the deep institutionalization of civic social rights (Esping-Andersen, 1990; Huber and Stephens, 2000). However, when evaluating the conditional subset of states trapped in a low-preparedness: low-pressure equilibrium, the Window for

Reform quadrant, democracies face severe structural impediments when executing anticipatory adjustments before demographic pressures become politically salient.

This democracy paradox stems from an acute institutional mismatch between short-term electoral cycles and long-term demographic horizons. Democratic elites operate within four-to-five-year electoral mandates. The political costs of anticipatory pension overhauls, including visible payroll contribution hikes and delayed statutory retirement eligibility, are immediate, concentrated, and highly salient to current voters. Conversely, the systemic benefits are diffuse, intertemporal, and manifest decades later, long after the enacting coalition has exited office.

This structural asymmetry incentivizes systematic delay, rewarding democratic politicians for maximizing short-term blame avoidance (Pierson, 1996; Weaver, 1986). Furthermore, competitive democracies naturally feature institutional veto players and consultative mandates that slow down legislative coordination (Immergut, 1992). Authoritarian regimes, insulated from competitive ballot-box accountability, navigate weaker versions of these proximate electoral constraints, granting autocrats the unique capacity to execute top-down parametric adjustments during low-pressure windows (Brooks and James, 1999).

This conditional relationship should not be misconstrued as a simplistic argument for autocratic superiority. Rather, it highlights a specific political economy constraint governing *reform timing* rather than reform quality or normative democratic value. Democracies do not experience window failure due to a baseline lack of administrative capacity. They experience transition failure because competitive electoral incentives compress political time horizons, making early preventive intervention an immediate electoral liability (Jacobs, 2011).

This intertemporal constraint mechanism is strongly supported by the non-linear marginal effects reported in Figure 3. The conditional probability of entering a failed-window trajectory remains flat and negligible across hybrid and weakly competitive regimes but accelerates exponentially once polyarchy scores clear the 0.4 threshold. This curve proves that the electoral constraints paralyzing anticipatory structural adaptation become binding only when political competition is sufficiently robust to penalize politicians who attempt to impose immediate, concentrated costs for long-term public goods provision.

5.3 Africa's Window: The Low-Salience Institutional Trap

The overwhelming concentration of African polities within the Window for Reform quadrant, paired with a deterministic 100 percent descent into vulnerability when transitions do occur, exposes a severe structural trap. While traditional macroeconomics celebrates a youthful population as a passive fiscal asset (Bloom, Canning, and Sevilla, 2003), our dynamic panel proves that favorable demographics frequently function as a political camouflage. Low contemporary dependency ratios

compress the immediate political salience of aging, enabling states to engage in prolonged, passive policy drift (Hacker, 2004).

This temporal inertia interacts destructively with a fundamental institutional mismatch: legacy African pension systems rely on formal-sector payroll frameworks inherited from colonial systems, which are structurally incompatible with domestic labor markets characterized by informal employment exceeding 85 percent and formal coverage rates below 15 percent (ILO, 2018; Stewart and Yermo, 2009). Overcoming this low-preparedness trap requires states to recognize that time alone does not build institutions. Building institutional breadth demands vast administrative infrastructure and fiscal space. For these uninsulated regimes, the relevant constraint is not parametric retirement ages, where the gap with developed nations is modest but structural breadth. Failing to execute incremental foundational investments in universal social protection and informal contributory mechanisms ensures that these states will slide past their finite temporal windows directly into the Vulnerable quadrant once their demographic transitions inevitably accelerate.

5.4 Exogenous Shock Triggers: Macroeconomic Crises and IMF Insulation

The counter-intuitive finding that elevated inflation ($\beta = -0.135$, $p < 0.001$) and IMF program engagement ($\beta = -1.21$, $p = 0.042$) decrease the probability of window failure highlights a classic crisis-induced stabilization mechanism. Rather than suggesting inflation is an optimal policy, these variables capture intense exogenous shocks that alter domestic political equilibrium. Acute inflationary environments compress fiscal space, heighten the political salience of systemic insolvency, and shatter path-dependent inertia by making the status quo visibly costlier than structural adjustment (Alesina and Drazen, 1991).

This crisis trigger operates in tandem with external institutional leverage. IMF conditionality effectively serves as an external blame-absorption mechanism (Brooks and James, 1999; Orenstein, 2008). By imposing top-down structural mandates, international financial institutions absorb the electoral costs of unpopular parametric overhauls, shielding democratic politicians from immediate ballot-box retribution and compressing legislative coordination timelines. Exogenous crises and external leverage combine to act as the primary mechanisms capable of overriding the short-term blame-avoidance constraints that otherwise paralyze competitive democracies during low-pressure demographic periods.

5.5 Methodological Boundaries and Future Research

Several standard panel-data boundaries qualify these findings and chart future research trajectories. First, data-driven constraints within the ISSA country profiles require the forward-and-backward propagation of certain institutional indicators, creating a partially sticky baseline that limits high-frequency annual variance. Second,

our five-year intertemporal windows capture medium-term structural movements but naturally truncate terminal panel waves, reducing the visible universe of rare transition events ($n = 79$). Third, while our Firth penalized logit models provide reliable parameter estimates under rare-events conditions, this cross-national macro design cannot directly observe micro-level causal channels, such as legislative fragmentation or union mobilization nor map sub-national variations in coverage inequality and informality. Resolving these limitations requires extending the longitudinal panel to capture decade-length transitions alongside deep, qualitative comparative case studies.

5.6 Intertemporal Delegation and Strategic Sequencing

Our findings provide vital insights for the structural sequencing of long-term pension reform. The extreme 94.5 percent persistence rate demonstrates that states cannot rapidly manipulate policy readiness in response to shifting demographic projections; structural capacity requires long horizons to build. To insulate long-term social policy from the distortions of compressed, four-year electoral cycles, democracies must adopt intertemporal delegation strategies (Jacobs, 2011).

Key among these are rules-based automatic adjustment mechanisms, such as legally linking statutory retirement ages directly to longitudinal changes in actuarial life expectancy. By converting parametric updates from high-salience legislative fights into automated administrative routines, states significantly lower the political costs of adaptation. This delegation should be insulated by independent fiscal councils tasked with projecting long-range dependency obligations, elevating the future transparency of contemporary policy drift for voters. Finally, for developing states anchored inside the demographic window, strategic sequencing must prioritize institutional breadth over parametric tightening. Expanding non-contributory social pension tiers represents the primary binding constraint needed to insulate high-informality labor markets before the demographic window permanently closes.

6. Conclusion

This study deployed a 24-year dynamic panel framework tracking 115 countries from 2000 to 2024 to evaluate a critical question in comparative political economy: why certain states proactively build institutional policy resilience during favorable demographic windows, while others allow these temporal buffers to close without adequate adaptation. By constructing independent, decoupled metrics of policy readiness (PRI) and demographic exposure (DPI), we tracked structural country trajectories across five-year intertemporal horizons, yielding three major empirical contributions.

First, our panel demonstrates that global pension frameworks operate as highly stable institutional equilibria, exhibiting a striking 94.5 percent five-year persistence rate. This

systemic inertia confirms that pension preparedness functions as a deeply embedded, path-dependent configuration insulated by interlocking administrative routines and resilient veto constituencies, rather than a fluid policy variable capable of rapid technocratic adjustment (Immergut, 1992; Pierson, 2000). Second, when institutional stability breaks down, the ensuing transition dynamics are overwhelmingly asymmetric and deterioration-driven: 65.3 percent of all non-stable movements represent a "failed window" trajectory where states slide directly from a low-pressure reform environment into deep structural vulnerability. Favorable demographic conditions do not automatically incentivize policy adaptation. Instead, the modal outcome for uninsulated regimes experiencing environmental shifts is passive institutional drift (Hacker, 2004; Streeck and Thelen, 2005).

Third, we uncover a robust, highly significant intertemporal institutional paradox: among states inside the Window for Reform, higher democracy scores exponentially increase the probability of window failure. This relationship remains robust under rare-events correction via Firth penalized logit estimation, displaying the largest standardized effect size among our covariates. The marginal effects confirm a distinct non-linear curve, where the democratic constraint becomes binding only after polyarchy scores clear the 0.4 threshold of robust political contestation. This democracy paradox exposes a severe institutional mismatch between the compressed, four-year time horizons of competitive electoral cycles and the multi-decade lifecycles of demographic transition. Because anticipatory parametric reforms, such as payroll contribution hikes or delayed retirement eligibility, impose immediate, concentrated costs on voters for diffuse, long-term systemic stability, democratic politicians maximize short-term blame avoidance and delay preventative structural hedging (Jacobs, 2011; Pierson, 1996; Weaver, 1986). Autocratic elites, insulated from regular ballot-box accountability, navigate weaker versions of these intertemporal electoral constraints, displaying a greater capacity for swift, top-down parametric adjustment (Brooks and James, 1999).

This structural trap operates with deterministic force across the developing world. African nations are overwhelmingly concentrated within the low-pressure Window for Reform, yet 100 percent of observed non-stable transitions on the continent represent failed windows. This absolute deficit in upward mobility proves that favorable, youthful population profiles act as a political camouflage, lowering the immediate salience of aging and trapping high-informality labor markets in a pattern of prolonged policy drift (Stewart and Yermo, 2009).

This paper contributes to three major research traditions. It extends the comparative pension policy literature by providing a systematic macro-quantitative framework for tracing long-term preparedness trajectories; it enriches historical institutionalism by quantifying the actual velocity of policy drift and institutional persistence across diverse economic tiers; and it advances the political economy of reform by mapping the explicit electoral boundaries that constrain intertemporal public goods provision.

This macro-historical baseline charts a clear future research agenda. Capturing the full, long-run evolution of these regimes requires extending the longitudinal dataset beyond 2024 to analyze decade-length transition panels, paired with time-varying institutional breadth metrics. Furthermore, cross-national quantitative models must be complemented by qualitative comparative case studies designed to isolate the micro-level causal channels, such as union mobilization and legislative fragmentation, governing window failure. Finally, researchers must test whether this intertemporal democracy paradox extends beyond social security into other long-horizon social policy domains, such as healthcare infrastructure, long-term eldercare systems, and macro-environmental stabilization.

Ultimately, our framework demonstrates that pension vulnerability is not mechanically dictated by demographic destinies. It is actively mediated by the path-dependent structure of the welfare state and the competitive political constraints that govern its adaptation. Favorable demographics grant states a real, but highly finite, window for reform. Whether countries successfully convert this temporal opportunity into robust institutional preparedness or allow their windows to permanently close depends entirely on their capacity to construct intertemporal delegation mechanisms capable of overriding the short-term imperatives of democratic competition.

Appendix: Sensitivity and Robust Checks

Appendix A: Sensitivity Analysis of Index Weighting

The baseline Policy Readiness Index (PRI) is constructed using linear weighted aggregation: 40 percent retirement age, 30 percent contribution rate, and 30 percent institutional breadth. To assess whether our substantive findings are sensitive to this specific weighting scheme, we compare the baseline weights against three alternative specifications: equal weights (33.3 percent each), retirement-heavy weights (50 percent retirement, 25 percent contribution, 25 percent institutional), and institution-heavy weights (25 percent retirement, 25 percent contribution, 50 percent institutional).

For each alternative specification, we recompute the PRI for all country-year observations and reclassify countries into the four quadrants using the same fixed medians (PRI = 60.8, DPI = 31.6). Table A1 reports Spearman rank correlations and percent agreement between baseline and alternative quadrant classifications.

Table A1: Sensitivity of Quadrant Classification to Alternative Weights

Weighting Scheme	Spearman's ρ	Percent Agreement
Equal Weights (33.3/33.3/33.3)	0.963	99.1%
Retirement-Heavy (50/25/25)	0.933	98.3%
Institution-Heavy (25/25/50)	0.714	88.7%

The equal and retirement-heavy weighting schemes produce near-perfect agreement with the baseline (Spearman's $\rho > 0.93$, percent agreement > 98 percent). The institution-heavy scheme yields lower but still substantial agreement ($\rho = 0.714$, 88.7 percent agreement). This indicates that overweighting institutional breadth reduces the index's ability to discriminate between regimes, as institutional features vary less across countries than parametric retirement and contribution parameters. The baseline weighting scheme (40/30/30) strikes an appropriate balance between these dimensions.

All substantive findings reported in the main text—including the 94.5 percent persistence rate, the 65.3 percent failed window share, and the democracy coefficient—remain qualitatively unchanged under all alternative weighting schemes. Full replication results are available upon request.

Appendix B: Firth Penalized Logit Estimation Diagnostics

B.1 Sample and Event Characteristics

The estimation sample for the failed window analysis comprises 1,057 country-year observations where countries initially occupied the Window for Reform quadrant. Of these, 49 observations (4.6 percent) transitioned to the Vulnerable quadrant within five years, confirming the rare-event nature of the dependent variable that motivates our estimator choice.

B.2 Quasi-Separation Verification

Standard maximum likelihood logit estimation produced a democracy coefficient of 7.83 with the warning "fitted probabilities numerically 0 or 1 occurred." This confirms the presence of quasi-complete separation within the covariates, a common phenomenon in rare-events panels where certain predictor combinations perfectly predict non-transition outcomes (Albert and Anderson, 1984). Following Firth (1993), we address this by introducing a Jeffreys invariant prior penalty function:

$$\log\ L(\beta)^* = \log\ L(\beta) + \frac{1}{2}\log\ |\ I(\beta)\ |$$

The Firth estimator converged successfully in 5 iterations, yielding a democracy coefficient of 7.62—stable and substantially more reliable than the unstable MLE estimate.

B.3 Profile Likelihood Inference

Because asymptotic assumptions underlying standard Wald tests fail under rare-event profiles (4.6 percent event rate), we base all hypothesis testing on penalized profile likelihood ratio tests rather than symmetric Wald standard error approximations (Heinze and Schemper, 2002). The overall framework exhibits strong global explanatory power, generating a Likelihood Ratio Statistic of 81.17 on 5 degrees of freedom ($p = 4.44 \times 10^{-16}$). Deriving specific p-values via log-likelihood profile curves confirms:

Variable	**p-value**
Electoral Democracy (Polyarchy)	< 0.001
Inflation (CPI, annual %)	< 0.001
IMF Proxy	0.042
GDP Growth	0.056
Election Count	0.862

B.4 Multicollinearity Assessment

Multi-source cross-national registries can introduce collinear patterns. We confirmed that all parameters fall safely within acceptable tolerances, remaining well below conservative multi-variable limits (VIF < 2.0), guaranteeing that political and macroeconomic variables operate as independent channels of dynamic transition risk.

Table B1: Econometric Fit and Separation Diagnostics

Diagnostic Structural Metric	**Baseline MLE Logit**	**Preferred Firth Logit**
Estimation Framework	Unconditional Maximum Likelihood	Penalized ML via Jeffreys Prior
Numerical Convergence	Converged (Separation Warnings)	Stable Convergence

Optimization Velocity	8 Fisher Scoring Iterations	5 Iterations
Inference Basis	Asymptotic Wald z-statistics	Penalized Profile Likelihood
Global Model Fit Test	Deviance Model Reduction	Likelihood Ratio Test (LRT = 81.17)
Global Model Significance	—	$p = 4.44 \times 10^{-16}$
Model Log-Likelihood	Residual Deviance: 310.60	Penalized LL: -185.69
Predictor Collinearity	Unconfounded	Stable (VIF < 2.0)
Transition Events (n)	49	49
Panel Sample Size (N)	1,057	1,057

Note: The analytical estimation sample is strictly restricted to complete-case observations originating inside the baseline Window for Reform quadrant. Profile likelihood p-values confirm that the democracy coefficient ($\beta = 7.62$) remains highly significant ($p < 0.001$).

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