

Demographic Ageing in Mexico and the Limits of Long-Range Dependency Projections

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Abstract :

Mexico's age structure is undergoing rapid transformation; however, the magnitude of this change varies depending on the statistical series analyzed. An old-age dependency ratio was calculated using annual United Nations-derived World Bank age shares for 2000–2025, and its 2025 endpoint was compared with data from Mexico's new Intercensal Survey. Calibration using 2000–2019 and a chronological holdout for 2020–2025 produced root mean squared errors of 0.411, 0.526, and 0.662 older persons per 100 individuals aged 15–64 for quadratic, exponential, and linear trend models, respectively. The harmonized series projects a value of 12.65 in 2025, while the official intercensal presentation reports approximately 15. This discrepancy indicates that the two products should not be considered interchangeable. When the three trends are refitted to the full harmonized series, illustrative 2050 ratios of 21.15, 17.99, and 15.90 are obtained. These represent mathematical scenarios rather than demographic forecasts. This study provides a transparent quantitative baseline and highlights the need for additional cohort and fiscal data to assess financial consequences.

Keywords: population ageing; old-age dependency ratio; demographic transition; trend models; pensions; demographic data comparability.

Date of Submission: 08-10-2026

Date of Acceptance: 18-10-2026

I. INTRODUCTION

Population ageing is transforming societies globally, as increased longevity and declining birth rates alter the demographic balance between younger and older generations. The World Health Organization (WHO) projects that by 2030, one in six people worldwide will be aged 60 years or older, with this population reaching approximately 1.4 billion and rising to 2.1 billion by 2050 [1]. These demographic shifts necessitate comprehensive planning across health services, long-term care, employment, and social protection systems. Extended life expectancy also presents opportunities for continued participation in families and communities, contingent upon health status and supportive environments [1].

Amid this global demographic transition, Latin America and the Caribbean are undergoing a particularly rapid shift in age structure. According to the Economic Commission for Latin America and the Caribbean (ECLAC), regional fertility declined from approximately 5.8 children per woman in the 1950s to 1.8 in 2024, while the proportion of the population aged 65 years or older reached 9.9% in 2024 and is projected to approach 18.9% by 2050 [2]. The pace and stage of this demographic transition vary across countries. These changes occur alongside persistent socioeconomic inequalities and gaps in public services, complicating the expansion of long-term care [2]. Consequently, regional research addresses both the pressures on social protection systems and the opportunities related to productivity, employment, and evolving care arrangements [3], [4].

Mexico exemplifies this regional transformation, as demographic changes alter the relative sizes of cohorts entering the workforce and approaching older ages. The 2025 Intercensal Survey (EIC) estimates a population of 130.9 million residents, including 130.4 million individuals in private dwellings, which constitute the main survey population [5]. National results indicate a higher old-age dependency ratio in 2025 compared to 2020 [6]. Earlier censuses provide essential historical context [7]–[9], while the United Nations harmonizes age structures into an annual international series [10], [11]. These complementary statistical sources position Mexico as a pertinent case for examining both populations ageing and the comparability of measurement approaches.

Transitioning from this broad context to quantitative assessment necessitates explicit definitions. The global figures cited above refer to individuals aged 60 years or older, whereas the regional statistics and the old-

age dependency ratio used in this article apply a threshold of 65 years. These age thresholds are not interchangeable.

Furthermore, an age-based ratio does not directly measure financial dependence; factors such as pension financing, labor-market participation, and employment conditions require separate analysis [12]-[15]. Consistent use of age groups, population universes, and reference dates is therefore essential for estimating historical trends or comparing future scenarios.

In this context, the central research question is: How rapidly has Mexico's old-age dependency ratio increased in a consistent annual series, and how sensitive are projections to the mathematical model selected? The analysis also examines whether a separately collected 2025 national estimate can be incorporated into that series without recalibration. To address these questions, linear, exponential, and quadratic trends are compared using a chronological holdout, and their longer-term extrapolations are evaluated. This study provides a transparent quantitative baseline that distinguishes mathematical scenarios from demographic forecasts. The economic discussion focuses on mechanisms and documented policy issues, without attributing specific tax or pension reforms solely to population ageing.

II. THEORETICAL BACKGROUND

Demographic ageing refers to the combination of smaller successive birth cohorts and increased survival to older ages. Let's represent the share of the population within a specified age range at time t . The old-age dependency ratio $D(t)$ quantifies the number of persons aged 65 or older per 100 individuals aged 15-64, while the ageing index $A(t)$ measures the number of persons aged 65 or older per 100 children aged 0-14, as shown in Eqs. (1) and (2) respectively. These ratios reflect age structure rather than actual employment, financial dependence, or pension eligibility. Accurate interpretation requires considering labor-force participation, employment, and pension financing and coverage in Mexico; these cannot be determined solely by examining age distribution. The Organization for Economic Cooperation and Development (OECD) [12]-[14] provides detailed documentation on pension design, public expenditure, and the financial uncertainties linked to recent Mexican reforms. Additionally, its employment country note highlights significant labor-market participation among older adults [15]. The IMF [16] addresses broader macro fiscal conditions. Regional analyses identify both risks and economic opportunities, particularly in relation to productivity, care, and participation [3], [4]. Coverage and care quality are distinct aspects, as documented by the International Labor Organization (ILO) [17] and WHO [18].

$$D(t) = 100 \left(\frac{S_{65+}(t)}{S_{15-64}(t)} \right) \quad (1)$$

$$A(t) = 100 \left(\frac{S_{65+}(t)}{S_{0-14}(t)} \right) \quad (2)$$

III. DEVELOPMENT

Data and comparability. Mexico's annual percentages for the age groups 0-14, 15-64, and 65+ from 2000 to 2025 were obtained from the World Bank's World Development Indicators, which cite the United Nations Population Division as the underlying population source [19]-[21]. This dataset represents an internally consistent modelled series rather than a direct transcription of Mexican census data. The 2000 and 2010 census programs, the 2020 census release, and the 2025 EIC are maintained as distinct sources of national evidence [5]-[9]. For future benchmarking, the 2020-2070 cohort projections of the National Population Council (CONAPO), provide a more suitable basis for subsequent cohort-based extensions [22].

The EIC's estimated population residing in private dwellings and the harmonized annual total-population estimates differ in terms of population universe, reference date, and estimation procedure. The EIC national presentation rounds the old-age dependency ratio to 12 in 2020 and 15 in 2025 [6]. Consequently, the 2025 EIC point is displayed separately, and no regression is calibrated across a mixed-source series.

Models. Let x represent the number of years since 2000. Three trend functions are specified and estimated using least squares. The first 20 observations (2000-2019) constitute the estimation sample, while 2020-2025 is reserved as a holdout set. Mean absolute error and root mean squared error are calculated for the six held-out annual values. Following this comparison, each model is refitted to the full 2000-2025 period for illustrative extrapolation to 2050. The holdout values serve as assessments against later years of the same retrospectively harmonized data product, rather than as an independent prospective forecast test. Eqs. (3)-(5) represent the quadratic, exponential, and linear models proposed for extrapolation.

$$D_{lin}(x) = a_1 + b_1x \quad (3)$$

$$D_{exp}(x) = a_2 e^{b_2x} \quad (4)$$

$$D_{quad}(x) = a_3 + b_3x + c_3x^2 \quad (5)$$

IV. RESULTS

Table 1. Selected observations from the internally consistent annual series

Year	0–14 (%)	15–64 (%)	65+ (%)	D(t)
2000	34.32	60.67	5.01	8.27
2010	29.77	64.13	6.10	9.51
2015	27.98	65.37	6.65	10.17
2020	25.98	66.53	7.49	11.25
2025	24.09	67.39	8.52	12.65

Source: Author's calculations from World Bank [19]–[21].

Table 2. Chronological holdout errors and full-sample 2050 illustrations

Model	Holdout MAE	Holdout RMSE	2050 D(t)
Linear	0.598	0.662	15.90
Exponential	0.466	0.526	17.99
Quadratic	0.354	0.411	21.15

Error units and projections: persons aged 65+ per 100 persons aged 15–64. (The 2050 values are unconstrained mathematical extrapolations, not population projections).

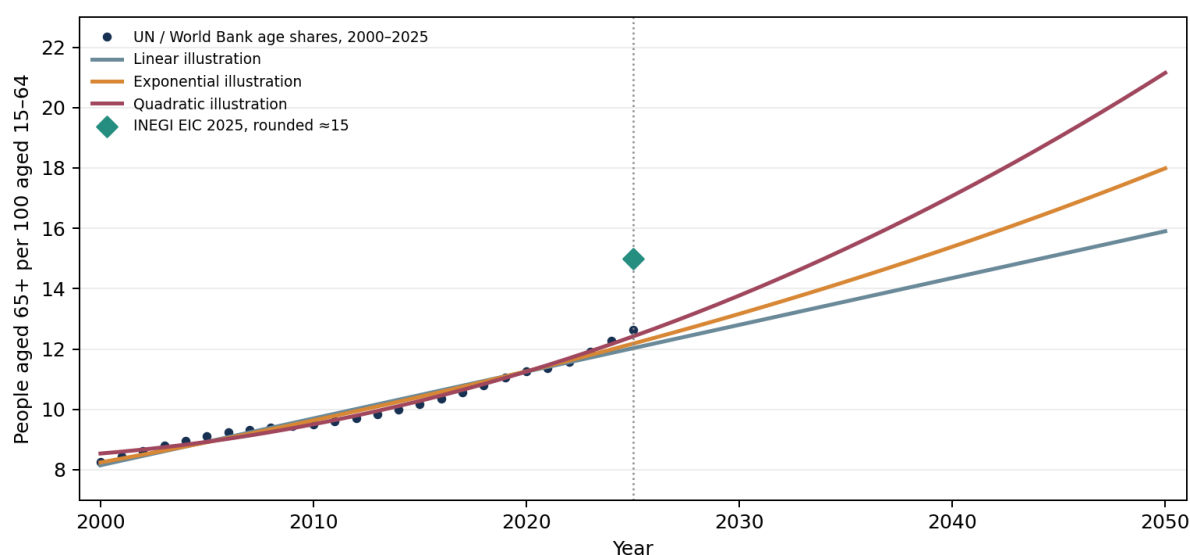


Figure 1. Annual harmonized values and refitted trend scenarios. The separately reported EIC point is shown as a diamond and is excluded from model fitting.

V. FINDINGS AND COMMENTS

Harmonized age shares indicate a decline in the 0–14 population share from 34.32% in 2000 to 24.09% in 2025, accompanied by an increase in the 65+ share from 5.01% to 8.52%. The resulting ratio increases from 8.27 to 12.65, and this measured growth remains robust within the selected data series. The 2025 EIC national presentation, however, rounds the comparable age ratio to approximately 15 and reports an infant dependency ratio of approximately 32 and a total dependency ratio of approximately 47 [6]. The notable discrepancy between the 2025 estimates necessitates a source-level reconciliation before designating a single national historical model based on the National Institute of Statistics and Geography (INEGI).

The quadratic model yields the lowest six-year holdout error; however, this result alone does not confirm that its acceleration will continue for the next 25 years. When refitted to all available years, linear, exponential, and quadratic models project a range of 15.90 to 21.15 in 2050. This range reflects model-form sensitivity rather

than a statistical confidence interval, as it does not account for factors such as fertility, migration, mortality, census revisions, or policy changes. Therefore, CONAPO's cohort-component projection and the United Nations methodology should serve as demographic reference cases before interpreting any 2050 projections [22], [10].

An older population increases demand for pension payments, health services, and care; however, fiscal outcomes depend on coverage and contribution histories, tax structure, and productivity. ECLAC's regional analysis highlights the potential offsetting effects of increased employment among women and older individuals, as well as shifts in the care economy [3]. Mexico-specific studies on pension financing and the older workforce [14], [15] underscore the importance of linking demographic series to observed pension expenditures, contribution coverage, and formal employment prior to estimating budgetary impacts. The current data support demographic association and scenario analysis but do not establish a causal relationship with tax policy.

VI. CONCLUSIONS

Mexico's age structure has shifted substantially; however, published data series should maintain their original source identities. The United Nations derived annual series indicates an old-age dependency ratio of 8.27 in 2000 and 12.65 in 2025, while the new INEGI survey reports an estimated value of approximately 15 for 2025. Trend models demonstrate considerable sensitivity to underlying mathematical assumptions, as plausible fitting choices in this analysis produce markedly different projections for 2050. The subsequent research phase should involve extracting national age-by-sex counts and survey precision estimates directly from INEGI, reconciling population universes, and comparing a cohort-component projection with CONAPO. Only after these steps should pension, health, and fiscal variables be integrated to empirically test socioeconomic mechanisms.

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