

IMBALANCE, INEQUALITY, EQUITY, AND ADJUSTMENT IN PAY-AS-YOU-GO PENSION SYSTEMS IN DEVELOPING COUNTRIES: AN EMPIRICAL ANALYSIS WITH DATA FROM BRAZIL

Ajax Moreira

Researcher at the Institute for Applied Economic Research (Ipea). E-mail: <ajax.moreira@ipea.gov.br>.

Miguel Nathan Foguel

Researcher at Ipea. E-mail: <miguel.foguel@ipea.gov.br>.

Sergio Guimarães Ferreira

Research director at the Institute for Mobility and Social Development (IMDS).
E-mail: <sergio.guimaraes@imdsbrasil.org>.

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In Pay-As-You-Go (PAYG) pension systems the financial balance depends on the proportions of active and inactive people in the population. According to the projections of the United Nations (UN, 2019), the median dependency ratio of people over 65 years old per 100 people between 20 and 64 years of age will double in the next thirty years and more than triple at the end of the century in middle income countries. This process of demographic transformation places increasing pressures on the sustainability of PAYG systems in these countries, making the introduction of extensive reforms inevitable.

In general, structural reforms of these systems impact a wide range of economic dimensions. In addition to affecting labor supply, aggregate savings, and economic growth, reforms in PAYG systems change the income distribution across generations, impacting differently permanent income and rates of return for agents born in different cohorts and, in developing countries, where heterogeneity among workers is high, impacting also among different groups of agents in the same cohort. Quantifying changes in permanent income inequality and equity in rates of return is thus an important exercise when there is concern as to the effects of different PAYG systems on vertical (between groups of agents) and horizontal (between generations) inequality.

The most adopted type of PAYG system is that of a defined benefit (DB) structure. Typically, the DB system offers high benefits relative to the taxation levels and operating rules of this system, which generates growing deficits over time, especially in a context of

accelerated demographic transformation. Furthermore, with the aim of compensating agents with lower contributory densities (e.g., women and informal workers), DB replacement rates commonly include a component that is independent of the number of contributions. Despite playing a redistributive role, this component tends to increase fiscal imbalances and generates heterogeneity in rates of return between groups of agents in the same cohort and, due to economic trends and shocks, also between different cohorts.

To deal with the financial unsustainability of the DB system, some countries (e.g., Sweden, Italy, and Poland) reformed their PAYG systems by adopting a defined contribution (DC) structure. Basically, in this system, agents contribute to an individual non-financial (or notional) account that receives remuneration based on some economic indicator and receives a lifetime annuity whose value depends on the total amount accumulated in the notional individual fund at the time of retirement and the life expectancy of the agent's birth cohort. By construction, a DC system of this type does not affect permanent income inequality and inequity of returns between agents. In this sense, the DC system is neutral from both an intra- and inter-generational perspective. However, unlike the DB system, the DC system tends to generate low-value benefits for agents who have low contributory densities or low wages (or both), which makes it an unsuitable system for developing countries. In this article, we propose a new mixed system (DM) that combines features of DB and DC systems. More specifically, we defined a formula for calculating

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retirement benefits that combines the component that does not depend on the number of contributions of the DB system with the individual fund component of the notional DC system. This combination of components makes it possible to mix the redistributive role of the DB system with the neutrality of the DC system.

The theoretical and empirical literature that assesses the economic effects of public pension systems is quite extensive. More related to our study, Auerbach and Lee (2011) analyze how various stylized PAYG programs distribute the risks of demographic and economic shocks across generations. Auerbach et al. (2018) and Ludwig and Reiter (2010), use a model of overlapping generations with balanced government budget to compare the performance of several stylized PAYG systems in the distribution of intergenerational risks arising from specific shocks in productivity, fertility, mortality, and migration. The analysis of these studies is carried out for the representative agent of each generation – that is, there is no intragenerational heterogeneity –, which makes their frameworks and results more appropriate for developed countries. Unlike these studies, our analysis evaluates the performance of different types and designs of stylized PAYG systems for developing countries, where agents are more heterogeneous, inserted in a labor market with informal employment (i.e., where agents do not always contribute to social security), and in which large portions of the population reach the elderly stage in poverty. To take these characteristics into account, our framework incorporates several relevant dimensions. First, recognizing the differences in labor market insertion between men and women, the analysis is carried out separately for the genders. Second, we model both formal and informal labor income, as well as pension contribution patterns and the educational distribution of agents. Third, we control for the effects of the business cycle on these variables and allow them to evolve differently by age and birth cohort of agents. Fourth, we incorporated the existence of a floor for retirement benefits and a pillar that guarantees a minimum income for the elderly poor. Finally, we considered different designs of the DB and the notional DC schemes, in addition to the aforementioned system that combines elements of these two structures. Naturally, the inclusion of all these dimensions makes our framework more complex but allows us to obtain a wealth of results for different types of agents, both within the same cohort and for different cohorts.

Methodologically, we use an empirical age-period-cohort model whose estimates are used, together with some hypotheses about the age profile and trends by cohort, to project the future trajectories of labor income, the probability of contributing, and the educational distribution of observed and unborn cohorts for each type of agent. These trajectories make it possible to simulate the outcome variables of interest for different types and designs of PAYG systems, namely: measures of the financial imbalance over time, permanent income inequality, and rates of return of social security assets between types of agents and between cohorts. This analysis is carried out for two different contexts in relation to the financial stability of the systems. In the first one, we analyze PAYG structures in which system rules are pre-defined, and the financial imbalance is endogenous. In the second, contributions of active and inactive generations are endogenously adjusted over time so that the systems do not present imbalances. In this last context, we consider two adjustment rules: i) the one proposed by Auerbach et al. (2018) in which there is a proportional sharing mechanism between active and inactive groups to cancel the financial imbalance; and ii) an adjustment inspired in the present German pension system, in which inactive groups share with the active ones the risks of imbalance and productivity gains after retirement.

We used data from Brazil, a country that, like other middle-income countries – especially in Latin America –, is experiencing an accelerated population aging process, has significant skill heterogeneity in the workforce, and a large informal sector. The database is the Pesquisa Nacional por Amostra de Domicílios – PNAD (National Household Sample Survey) available between 1992 and 2015. PNAD is an annual cross-section sample representative of the country's population and collects demographic and socioeconomic information, including labor income and formal-informal insertion in the labor market. Our simulations start in 2016 and cover the time horizon up to 2140 using available projections – IBGE (2019) until the year 2030 and UN (2019) from there until 2100 – making it possible to assess long-term effects of trends on the simulated systems.

The results of the simulations without imposition of balance show that, in general, the DB system presents a greater reduction in permanent income inequality and greater returns for the representative agent and for women and for less educated groups. However, this

generosity of the DB system has the counterpart of generating larger deficits over time. The results for the DC system have very different characteristics, as it tends to reduce inequality less, has lower rates of return and smaller deficits. The DM system presents intermediate results between the previous two systems for all variables of interest. In this sense, it corresponds to a PAYG structure that combines the redistributive capacity of the DB system with the neutrality and greater financial stability of the DC system.

Consistent with larger deficits of the DB system, the results for the two classes of balancing rules show that this system requires tax rates from both the active and inactive groups that are higher than those of the DM system. The rates, however, are sensitive to the cut-off point in the distribution of wages above which agents are charged, being substantially reduced with the inclusion of lower-wage groups to help “pay the bill” for the sustainability of the system. Although subject to the parameterization used, another result to be highlighted is that, even in a situation of population aging, charging inactive individuals in the first class of rules does not seem to have significant effects on the rates of contribution of the active workers, which is due to the lower total amount of benefits relative to the total amount of wages.

Other important results emerge in the context of balanced systems. The first is that the class of rules that modulate benefits based on the evolution of demographics and wages can alleviate the additional taxation that falls on active generations. Furthermore, the rate of return of this class of rules tends to be higher than that based on the proportional distribution of the burden between active and inactive groups. Finally, the results show that the former class of rules combined with the mixed DM system presents the smallest intergenerational dispersion of returns, while the latter class presents the largest dispersion.

From the point of view of the discussion on structural reforms of PAYG systems in developing countries, our results suggest at least two points that deserve to be highlighted. The first is that the new mixed system that combines redistributive elements of the DB system with the neutrality features of the notional DC system generates intermediate results between these two systems in terms of deficit, reduction of inequality and aggregate return for the representative agent and

between educational groups by gender. In this sense, if well designed, it can represent a compromise between the financial imbalances that the country is able to support from its PAYG system and the distributive/equitable role that society wants this system to have. The second point is that, if the social choice is to keep the PAYG system internally balanced, the new mixed system in which benefits are subject to the burdens of demographic transition and the bonuses of productivity growth tends to generate lower contribution rates for active and inactive generations and, from the point of view of horizontal equity, it presents the smallest dispersion of intergenerational returns.

Naturally, our results are conditional on the long-term scenarios that base our projections, the designs of the system types (DB, DC and mixed) and the adjustment rules to balance the systems. However, the algorithm used can be modified to consider other long-term scenarios – including introducing randomness on them – and parameters that make up the systems and rules. The exploration of these exercises is left for future research.

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