



# On intergenerational risk sharing within social security schemes

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## Abstract

Pay-as-you-go (PAYG) schemes entail beneficial risk sharing and diversification features in multi-pillar pension systems. Depending on the pension formula these features vary, however, significantly for different types of PAYG schemes. We derive individually most-preferred PAYG rules, represented by a risk-sharing parameter, for young and old members of a society. Preferences depend on the correlation between the risks of the PAYG scheme and the return risk of a funded scheme and on expectations about the durability of the pension rule. We find that the generations' interests with respect to the optimal PAYG rule typically do not fully clash, in particular if future economic conditions are expected to be similar to today's. We discuss the implications of these findings for the political economy of pension systems, offering an explanation why one typically observes "mixed" PAYG rules in reality.

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## 1. Introduction

It is now widely acknowledged that pay-as-you-go (PAYG) social security schemes may exhibit beneficial effects in reallocating risks inter- and intragenerationally. Such effects include risk sharing (see [Merton, 1983](#); [Enders and Lapan, 1993](#); [Richter, 1993](#)) and diversification features (cf. [Hauenschild, 1999](#); [Dutta et al., 2000](#)). Both types of effects may provide a rationale for including PAYG schemes into the pension mix although

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such schemes yield lower expected rates of return than funded forms of old-age provisions (Gale, 1991). It is also well-known that various forms of PAYG schemes differ considerably in their risk allocation features; the “pension formula” is of crucial importance here (Bohn, 1999; Lindbeck, 2002; Thøgersen, 1998). This feature is most easily visible from the defining property of a PAYG scheme that, in every period, current pension payments are financed out of current contributions. Assuming that the economy and its pension scheme are subject to stochastic shocks there are, in principle, two ways to keep the budget balance of the PAYG scheme intact: by adjusting benefits or by adjusting contributions.

- If it is the policy of the PAYG scheme to keep the contribution rate constant (fixed contribution [FC] scheme), then pensions will depend on the future development of the economy. Future economic risks thus have to a considerable extent to be borne by pensioners. Investing in the “PAYG asset” is a risky activity as the relationship between contributions (during the working period) and pension benefits (during retirement) is stochastic. An FC scheme may contribute to a diversification in the risks of old-age consumption as a whole (when other stochastic sources of old-age income are available).
- On the other extreme, a fixed-replacement [FR] scheme follows the policy to keep benefits constant, measured by the ratio between pensions and pre-retirement income (both calculated in real terms). Contributions to an FR scheme create a risk-free entitlement to a pension of a certain size, implying a deterministic nexus between contributions and pensions. The non-stochastic FR pension might provide insurance against other old-age consumption risks but means, on the other hand, that the risks of adverse changes in the economic environment stay with the contributors (i.e., the younger generation).

Pure FC and FR schemes have been discussed by Thøgersen (1998) and Wagener (2002) and, in a more policy-oriented way, by Lindbeck (2002). In this paper, we extend the analysis to allow for convex combinations of FR and FC schemes. We will represent such mixtures by a policy parameter  $\alpha \in [0,1]$ , which measures the degree of intergenerational risk sharing inherent in the PAYG pension policy. As one could expect from previous analyses of “pure” schemes ( $\alpha \in \{0,1\}$ ), “intermediate” policies  $0 < \alpha < 1$  assemble a rather complex mix of risk sharing and diversification features. Our motivation to investigate a continuum of mixed PAYG pension policies is threefold:

- First, mixed schemes are the empirically dominant form of pension schemes. Pure FC or FR PAYG schemes do not exist in reality where pension formulae and policies typically combine elements of both schemes, often in a way difficult to disentangle. A piece of evidence is given in Fig. 1, which depicts contribution and replacement rates<sup>1</sup> for the

<sup>1</sup> Strictly speaking, the GRV statistics do not know an indicator called replacement ratio. The three upper curves in Fig. 1 depict annual data for the pension level of a retiree who previously had average earnings, calculated as a percentage of average earnings of the currently working. *Cum grano salis*, this may be interpreted as the replacement rate for an average earner at the entry into retirement. Since GRV pensions are adjusted annually, the replacement ratio of retirees (i.e., their pension relative to their own previous earnings) varies annually too. The stylized OLG framework of this paper abstracts from this complexity.

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