



Voluntary versus mandatory public annuity plans: A unified framework to understand their pros and cons



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Abstract

Many countries have adopted the fully-funded retirement financing system, but one disadvantage of this system is that citizens have to bear the longevity risk. In this context, several economies have recently introduced the public annuity plans. We find that a simple model with asymmetric information on survival probability provides a unified framework to understand the pros and cons of voluntary public annuity with ceiling (VPAC) plan versus mandatory public annuity with flexibility (MPAf) plan. Introducing either plan reduces the severity of adverse selection in the public annuity market, but further distorts the private annuity market. These two plans have systematically different effects on the utility of citizens: the healthy (or wealthy) group loses but the intermediate group benefits. The poor health (or low income) group loses under the MPAf plan but benefits from the VPAC plan. These results provide guidance regarding which public annuity plan the government chooses.

Motivation

Background:

Pay-as-you-go pension system: budgetary difficulties in the past decades.
Fully-funded Individual Account system: less likely to have budgetary problems; but citizens have to bear more risks, e.g., longevity risk.
An important policy debate: How to help for retirees to hedge the longevity risk?
Buy private annuity? Annuity puzzle (Benartzi et al., 2011).
Public annuity (PA) plans in recent years: Singapore in 2009 and Hong Kong in 2018;
More plans: e.g., Lithuania in 2020.
One major difference in those plans: Voluntary plan with a ceiling on the purchase amount (e.g., Hong Kong); Mandatory PA plan with some flexibility (e.g., Singapore).

Research questions:

What are the pros and cons of voluntary versus mandatory PA plans? In what ways are the citizens affected by a particular plan? Can we learn something from the recent PA practices? We aim to provide a unified framework to understand different plans and offer some policy guidance.

Related literature:

The idea of government-provided annuity (e.g., Diamond, 2004; Fong et al., 2011; Lau and Zhang, 2020); The annuity demand in the presence of adverse selection: Exclusive contracts specifying both prices and quantities (e.g., Eckstein et al., 1985; Eichenbaum and Peled, 1987). Non-exclusive contract with linear pricing (e.g., Abel, 1986; Brugiavini, 1993; Hosseini, 2015).

A simple model of annuitization

Before a PA plan is introduced:

$$\max_{\hat{v}_\theta} \hat{U}_\theta = u(\hat{c}_{1\theta}) + \frac{\theta}{1+\rho} u(\hat{c}_{2\theta})$$

subject to

$$\hat{c}_{1\theta} = w - \hat{v}_\theta; \hat{c}_{2\theta} = \hat{V} \hat{v}_\theta; \hat{V} = \frac{(1+r) \int_{\theta_0}^{\bar{\theta}} \hat{v}_\theta dF(\theta)}{\int_{\theta_0}^{\bar{\theta}} \theta \hat{v}_\theta dF(\theta)}$$

After the PA plan is introduced:

$$\max_{\gamma_\theta, v_\theta} U_\theta = u(c_{1\theta}) + \frac{\theta}{1+\rho} u(c_{2\theta})$$

subject to

$$c_{1\theta} = w - \gamma_\theta - v_\theta; c_{2\theta} = G\gamma_\theta + Vv_\theta;$$

$$0 \leq f \leq \gamma_\theta \leq m < w;$$

$$G = \frac{(1+r) \int_{\theta_0}^{\bar{\theta}} \gamma_\theta dF(\theta)}{\int_{\theta_0}^{\bar{\theta}} \theta \gamma_\theta dF(\theta)}, \text{ and } V = \frac{(1+r) \int_{\theta_0}^{\bar{\theta}} v_\theta dF(\theta)}{\int_{\theta_0}^{\bar{\theta}} \theta v_\theta dF(\theta)}$$

Various PA plans (in a unified framework):

Pure Voluntary plan: $0 = f = m$.
Pure mandatory plan: $0 < f = m$.
Voluntary plan with restriction: $0 \leq f < m$.
Mandatory plan with flexibility: $0 < f < m$.

Before PA is introduced:

\hat{v}_θ : private annuity choice.
 $\hat{c}_{1\theta}$: Period-1 consumption.
 $\hat{c}_{2\theta}$: Period-2 consumption.
 \hat{V} : private annuity payout.

After PA is introduced:

γ_θ : public annuity choice
 v_θ : private annuity choice.
 $c_{1\theta}$: Period-1 consumption
 $c_{2\theta}$: Period-2 consumption
 G : public annuity payout
 V : private annuity payout
 m : maximum amount of purchase
 f : minimum amount of purchase

Other variables

θ : survival probability
 $F(\theta)$: the distribution of θ
 w : retirement resources
 ρ : subjective discounting rate
 r : interest rate

- Each individual lives for two periods at most: Period 1 (with certainty): early stage of retirement; Period 2 (with uncertainty & longevity risk): senior stage of retirement. Private information about health arrives in period 1 (The problem of adverse selection). Borrowing against annuity contract is not allowed.
- Risk-free bonds (dominated by annuities; Yaari, 1965; Davidoff et al., 2004).
- Insurance companies: offer private annuity in Period 1; distribute annuity payments in Period 2 (to those who are alive); Competitive market (leads to zero-profit condition).
- Public annuity: Similar to private annuity, but supplied solely by the government; No profit and no deficit; Restriction on annuity purchase.

Results

Proposition 1. When either the voluntary public annuity with ceiling or mandatory public annuity with flexibility plan is introduced, the equilibrium payouts of the public and private annuities have the following properties:

$$V^* < G^* < \frac{1+r}{E(\theta)}$$

Proposition 2. Consider the introduction of either the voluntary public annuity with ceiling or mandatory public annuity with flexibility plan in the two-period model. Compared with \hat{V}^* (the equilibrium payout of the private annuity before the introduction of the PA plan), (a) the equilibrium payout of the PA is higher:

$$G > \hat{V}^*$$

and (b) the equilibrium payout of the private annuity is lower:

$$V < \hat{V}^*$$

Proposition 3. Comparing a voluntary public annuity with ceiling (VPAC) plan, a mandatory public annuity with flexibility (MPAf) plan and a pure mandatory public annuity (MPA) plan such that each plan has the same level of m , the equilibrium payouts of the PA and private annuity in the three plans are ranked as follows:

$$V_{MPA}^* < V_{MPAf}^* < V_{VPAC}^* < \hat{V}^* < G_{VPAC}^* < G_{MPAf}^* < G_{MPA}^*$$

Proposition 4. When the government introduces a mandatory public annuity with flexibility (MPAf) plan such that appropriate boundary conditions hold, then there are exactly two thresholds, θ_L^{MPAf} and a higher level θ_H^{MPAf} , that systematically separate buyers in three categories according to the change in utility level:

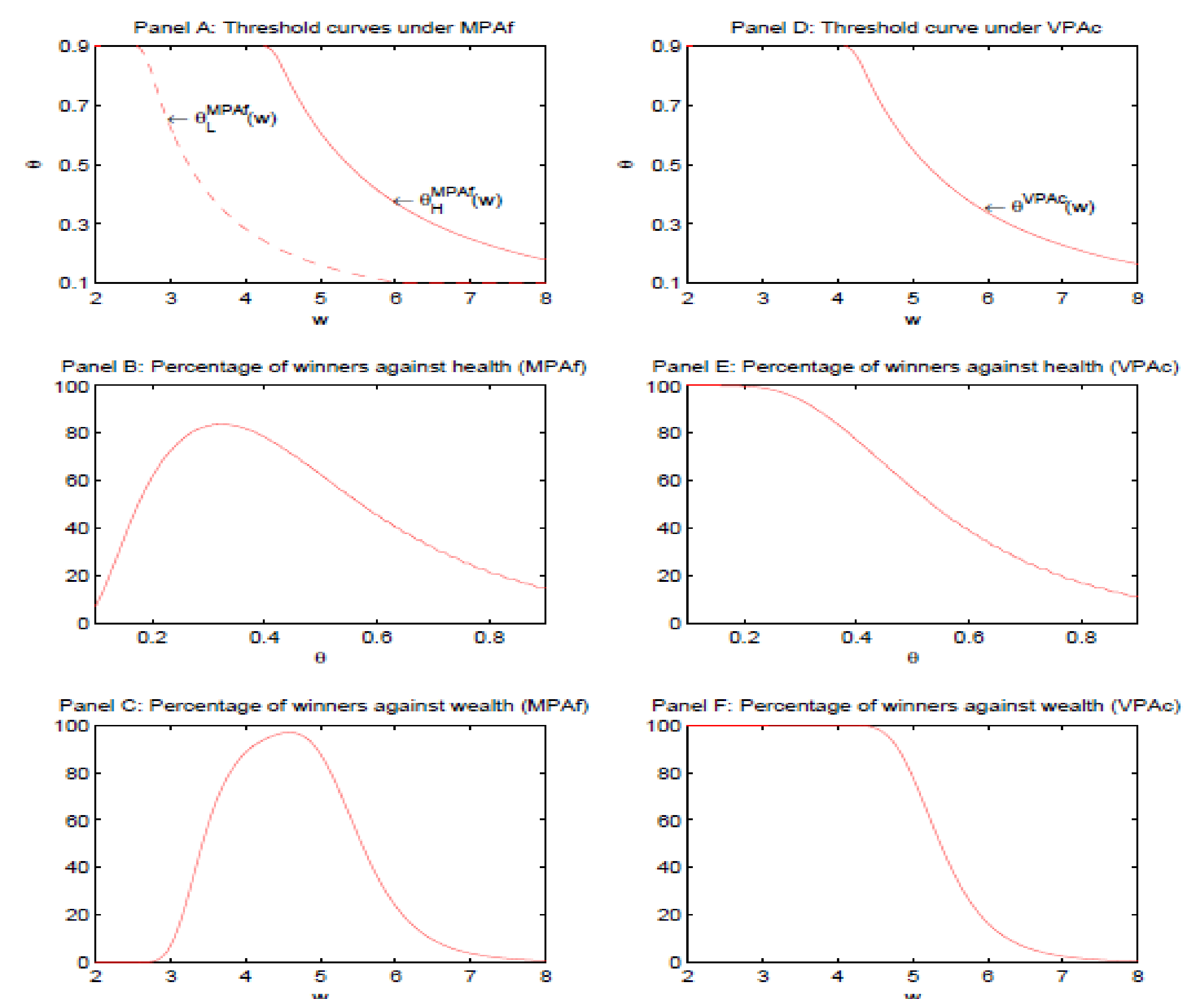
- $U_\theta^* - \hat{U}_\theta^* < 0$ for poor health group $\theta \in (\theta_0, \theta_L^{MPAf})$;
- $U_\theta^* - \hat{U}_\theta^* > 0$ for intermediate health group $\theta \in (\theta_L^{MPAf}, \theta_H^{MPAf})$; and
- $U_\theta^* - \hat{U}_\theta^* < 0$ for good health group $\theta \in (\theta_H^{MPAf}, \bar{\theta})$.

Proposition 5. When the government introduces a voluntary public annuity with ceiling (VPAC) plan such that the appropriate condition holds, then there is one threshold, θ^{VPAC} , that systematically separates buyers in two categories according to the change in utility level:

- $U_\theta^* - \hat{U}_\theta^* > 0$ for less healthy group $\theta \in (\theta_0, \theta^{VPAC})$; and
- $U_\theta^* - \hat{U}_\theta^* < 0$ for more healthy group $\theta \in (\theta^{VPAC}, \bar{\theta})$.

An extension: heterogeneous wealth correlated with health (See Figure)

The pattern of different groups holds (along both wealth and health dimensions).



Conclusion

We develop a unified framework to study the pros and cons of voluntary PA plan with restriction versus mandatory PA plan with flexibility. We find that a PA plan, either voluntary or mandatory, leads to a two-tier annuity market, with the severity of adverse selection in the PA market mitigated but that in the private market amplified. Due to these effects, the PA plan divides the population into different groups based on the change of their utility levels.

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