Optimal Design of Social Security Reforms

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Motivation

Sustainability and efficiency considerations call for Social Security reforms ⇒ we focus only on efficiency issues

Size of welfare losses much bigger than welfare gains: Huang, Imrohoroglu and Sargent (1997), Kotlikoff, Smetters and Walliser (1999), Feldstein and Samwick (1998),…

Status Quo Bias: more than 50% loose along transition from PAYG to Fully Funded (Conesa and Krueger (1999)), unless additional reforms (Conesa and Garriga (2003), Prescott (2003)).
Question

Could we design a Pareto improving social security reform?

Answer

No Pareto improvement is possible if the economy is \textit{dynamically efficient} and there are \textit{no distortions}: results of Diamond (1965) and Gale (1973)

Our economy is \textit{dynamically efficient}, but the \textit{financing of social security is distortionary} (among other distortions)
Approach in this paper…

Government decides endogenously how to finance the transition from PAYG to Fully Funded

Alternatively, optimal financing of PAYG

Rationalization of Distortions is well defined in the literature:
⇒ Optimal Fiscal Policy (second-best)
Issues to analyze

What are the associated changes in the tax system?

What tax instruments are crucial?

Should we issue government debt? If so, how much

Are the welfare gains quantitatively important?
Main results: a preview

PAYG social security systems are an Implicit Debt

Sizeable welfare gains from optimal management of that debt and reduction of labor supply distortions. Little gains from setting capital income taxes to its optimal level

Need little compensatory transfers if we allow for tax “discrimination”: Debt issued much smaller than implicit debt
PAYG Social Security as Debt

Workers contributions generate an entitlement to future payments. Those entitlements are an implicit debt.

Privatization can be viewed as an explicit recognition of this debt and implies no efficiency gains.

Initial (big) welfare losses found in the literature come from partial or complete default on that debt.
**Proposition:** Let \((\hat{\tau}, \hat{p}, \hat{B})\) be a fiscal policy, and let \(\{(\hat{c}_j, \hat{l}_j)_{j=1}^J, \hat{K}\}\) be the associated St.St. allocation. Then, there exists a fiscal policy \((\hat{\tau}, 0, \hat{B})\) and a distribution of assets \((\hat{a}_j)_{j=1}^J\) such that \(\{(\hat{c}_j, \hat{l}_j)_{j=1}^J, \hat{K}\}\) is the St.St. allocation corresponding to \((\hat{\tau}, 0, \hat{B})\).

**Proof:** Fix prices and tax rates. Construct assets recursively from consumer budget constraints. Clearly, consumers FOC’s are satisfied. The allocation is feasible. Thus, Walras’ Law guarantees that the Government Budget Constraint holds.
\( \tilde{B} - \hat{B} \) is the implicit Social Security debt \( \Rightarrow \) A privatization can be viewed as making explicit this implicit debt.

Decentralizations with different tax rates and different levels of debt are also possible.

Thus, ALL efficiency (welfare) gains MUST come from the reduction of distortions and optimal management of that debt.

CLAIM \( \Rightarrow \) OPTIMAL FISCAL POLICY IS THE RIGHT APPROACH TO SOCIAL SECURITY REFORM.
The Environment

Generations live for $I$ periods, $\mu_{i,t}$ is measure of generation $i$ in period $t$

Preferences

$$U(c^t, l^t) = \sum_{i=1}^{I} \beta^{i-1} u(c_{i,t+i-1}, 1 - l_{i,t+i-1})$$

Endowments: efficiency units of labor

$$\varepsilon = \{\varepsilon_1, ..., \varepsilon_I\}$$
Technology

Production Possibility Frontier

\[ Y_t = F(K_t, L_t) \]

with \[ L_t = \sum_{i=1}^{I} \mu_{i,t} \varepsilon_i l_{i,t} \]

Constant Depreciation Rate \( \delta \)
The Status Quo Economy

Stationary economy with a PAYG social security system and fiscal policies such as the ones observed today

Payroll taxes finance transfers to the retired (exogenously specified mandatory retirement)

Linear consumption, capital and labor income taxes used to finance exogenous government consumption, $G$

Constant level of government debt
Calibration of the Benchmark Economy

1 period = 5 years

Demographics:

I=12 (20-79 years)

Compulsory Retirement=10
  65 years, 1/3 ratio

Equal mass
Calibration: Exogenous variables

Figure 1: Age-Profile of Efficiency Units of Labor from Hansen (1993)
Government sector:

Social security:
  Payroll tax = 0.105 (excludes Disability Insurance)

Government budget (own estimates of 2000 effective tax rates):
  Consumption Tax = 0.05
  Capital Income Tax = 0.33
  Labor Income Tax = 0.16

Government consumption (18.6% of GDP)
Calibration: Functional Forms

Preferences:

\[
\sum_{i=1}^{I} \beta^{i-1} \frac{c_i \gamma (1 - l_i)^{1-\gamma})^{1-\sigma}}{1-\sigma}
\]

Technology:

\[
Y_t = K_t^\alpha L_t^{1-\alpha}
\]
Calibration: Empirical Targets

Assets from Flow of Funds Accounts US 2000:

\[ A = K (\text{Non Resid’l Fixed Assets} + \text{Consumer Durables}) + B (\text{Outstanding Gov’t Debt}) \]
\[ Y = \text{GDP} – \text{Residential Investment} \]
\[ K/Y \text{ (3 year)} \quad B/Y \text{ (0.5 year)} \]

Depreciation of Non Resid’l
Fixed Assets + Consumer Durables / Y
= 0.12
Additional empirical targets

Average hours worked: 1/3

Capital Income Share $\alpha = 0.3$ (Gollin, JPE’2002)
Calibration Results

<table>
<thead>
<tr>
<th>Targets</th>
<th>K/Y</th>
<th>B/Y</th>
<th>Av. $\ell$</th>
<th>wN/Y</th>
<th>Dep./Y</th>
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</thead>
<tbody>
<tr>
<td>Empirical Values</td>
<td>3.0</td>
<td>0.5</td>
<td>1/3</td>
<td>0.7</td>
<td>0.12</td>
</tr>
<tr>
<td>Parameters</td>
<td>$\beta$</td>
<td>$\sigma$</td>
<td>$\gamma$</td>
<td>$\alpha$</td>
<td>$\delta$</td>
</tr>
<tr>
<td>Calibrated Values</td>
<td>1.003</td>
<td>4</td>
<td>0.327</td>
<td>0.3</td>
<td>0.0437</td>
</tr>
</tbody>
</table>

Gov’t Budget Constraint implies: B/Y=0.5 (as in data)

Yearly Social Security Payments 7.35% GDP (bit too large relative to data)

Social Security Implicit Debt 128% GDP
Social Security as Implicit Debt: an Illustration

Leave all tax rates and prices unchanged. Clearly, the Euler and Labor Supply conditions are satisfied

Construct a sequence of assets in the following way:

\[
a_j = \frac{(1 + \tau^c) c_j}{1 + (1 - \tau^k) r} \left[ 1 + (1 - \tau^k) r \right]
\]

\[
a_j = \frac{(1 + \tau^c) c_j + a_{j+1} - (1 - \tau^l) \omega \varepsilon_l}{1 + (1 - \tau^k) r}, j = J - 1, J - 2, ..., 1
\]
Figure 2: Implicit Assets of the PAYG Social Security System
Notice $a_1 > 0$ (Transfer, or a Tax Break of 62%).

$a_1 =$ Net Present Value of Soc.Sec. Payments for an age 1 agent

Implicit level of debt = 128% of GDP = $\sum_{j=1}^{J} \mu_j T_j$

where Social Security Entitlements are defined as:

$$T_j = \frac{\sum_{s=1}^{j-1} \frac{\tau^p \omega \varepsilon_s l_s}{\left[1 + (1 - \tau^k) r \right]^{s-j}}}{\sum_{n=1}^{j} \frac{\tau^p \omega \varepsilon_n l_n}{\left[1 + (1 - \tau^k) r \right]^{n-j}}} \sum_{m=j}^{J} \frac{(1 - \tau^l) SS_m}{\left[1 + (1 - \tau^k) r \right]^{m-j}}$$
The government problem

In period $t = 1$ the economy is in a steady state with PAYG system

The social security privatization and the fiscal reform are announced and implemented in period $t = 2$

The government specifies fiscal policy for $t = 2, 3, ...$

Full Commitment
Participation constraints of initial generations alive

Define Status Quo steady state utilities:

\[
\bar{U}_j = \sum_{s=j}^{I} \beta^{s-j} u(\hat{c}_s, 1 - \hat{l}_s)
\]

Impose a Participation Constraint: individuals should be given at least \( \bar{U}_j \)
Strategies to deal with Status Quo constraints

1) Buy out the initial generations with a transfer

Note: The size of the transfer does not need to be equal to the present value of the expected social security payments
How to finance the transfers?

2) Allow optimal taxes and debt to deal with the problem
The Government Problem

\[
\begin{align*}
\text{max} & \quad \sum_{t=2}^{\infty} \lambda^{t-2} U(c^t, l^t) \\
\text{s.t.} & \quad \sum_{i=1}^{L} \mu_{i,t} c_{i,t} + K_{t+1} - (1 - \delta)K_t + G_t \leq F(K_t, \sum_{i=1}^{L} \mu_{i,t} c_{i,t}) + \lambda^{t-1} + \lambda^{t-2} + \cdots + \lambda^{t-2} \geq 0, \quad t \geq 2
\end{align*}
\]

\[
\sum_{i=1}^{L} \beta^{t-1} (c_{i,t+i-1} u_{c_{i,t+i-1}} + l_{i,t+i-1} u_{l_{i,t+i-1}}) = 0, \quad t \geq 2
\]

\[
\sum_{s=i}^{L} \beta^{s-i} [c_{s,s-i+2} u_{c_{s,s-i+2}} + l_{s,s-i+2} u_{l_{s,s-i+2}}] = \frac{u_{c_{i,2}}}{1 + \tau_0^c} \left[ (1 + (1 - \tau_k^c) r_2) \bar{a}_{i,2} + T_i \right], \quad i = 2, \ldots, I
\]

\[
\sum_{s=i}^{L} \beta^{s-i} u(c_{s,s-i+2}, 1 - l_{s,s-i+2}) \geq \bar{U}_i, \quad i = 2, \ldots, I
\]

\[
U(c^t, l^t) \geq \bar{U}_1, \quad t \geq 2
\]
Note 1: no surplus to initial generations!!

Note 2: $\lambda$ needs to be big enough

**Range of admissible $\lambda$**

Pareto improvement of the reform imposes discipline

Low $\lambda \Rightarrow$ Low capital… For $\lambda$ low enough the newborn in the Steady State of the Ramsey solution is worst off than in the Status Quo economy
Constraints in the set of tax instruments

In order to understand the role of different tax instruments we also compute the solution imposing additional constraints in the set of instruments

Specifically, leaving capital income taxes unchanged:

\[
\frac{u_{c_1,t}}{u_{c_2,t+1}} = \frac{u_{c_2,t}}{u_{c_3,t+1}} = \cdots = \frac{u_{c_{I-1},t}}{u_{c_I,t+1}} = \beta \left[ 1 + (1 - \tau^k)(f_{k,t+1} - \delta) \right], \quad t \geq 2
\]
Constrained Solution

\[ \lambda = 0.964 \text{ (year) Chosen so that new debt issued is fully eliminated along the transition} \]

Debt goes up to 90% of yearly output (50% in the benchmark economy and 128% social security implicit debt)

Little need for transfers (25% of PAYG Entitlements):

<table>
<thead>
<tr>
<th>Transfers to Initial Generations (% Entitlements)</th>
<th>20-64</th>
<th>65-69</th>
<th>70-74</th>
<th>75-79</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.46</td>
<td>0.64</td>
<td>0.82</td>
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Figure 3: Evolution of Average Taxes
Figure 4: Labor Income Taxes across Different Cohorts at Different Time
Figure 5: Evolution of Debt to GDP Ratio
Figure 6: Welfare Gains of Newborn Generations

- Planner
- Ramsey
Unconstrained Solution

Debt goes up less (to 85%) and its long run level is roughly zero

Less need for transfers (18% of PAYG Entitlements):

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<td>70-74</td>
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<tr>
<td>75-79</td>
<td>0.81</td>
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</tbody>
</table>
Figure 7: Evolution of Average Taxes

![Graph showing the evolution of average taxes over time, with categories for Capital, Labor, and Consumption.]
Figure 8: Capital Income Taxes across Different Cohorts at Different Time
Figure 9: Labor Income Taxes across Different Cohorts at Different Time
Figure 10: Evolution of Debt to GDP Ratio
Figure 11: Welfare Gains of Newborn Generations

- Planner
- Unconstr. Ramsey
- Ramsey Fix.K.Tax
We learn…

PAYG social security systems are Implicit Debt

Sizeable welfare gains from optimal management of that debt and reduction of labor supply distortions. Little gains from setting capital income taxes to their optimal level

Need little transfers if we allow for tax “discrimination”: Debt issued much smaller than implicit debt

Further Experiments: Equality of labor income taxes does impose important constraints (need capital income taxes, welfare gains delayed and higher transfers/debt)
Further research…

Conesa and Garriga (2005), “Optimal Response to a Transitory Demographic Shock”.

Address the sustainability issue left out in this paper:

- Government is committed to provide the retirement pensions promised in the past
- Demographic shock calls for reforms in financing of existing retirement pensions
- Use same methodology to figure out optimal strategy such that PAYG system is financially sustainable and no cohort pays the welfare cost of the shock