Public Pensions and Capital Accumulation:
The Case of Brazil

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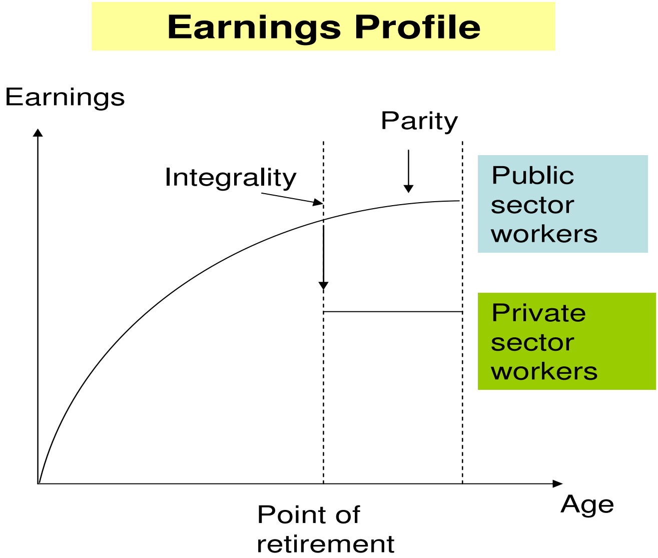
Outline

Introduction

- Generosity
- "Integrality"
- "Parity"
- Public sector retirees account for 5% of all retirees in Brazil, but receive 50% of all retirement payments.



Earnings Profile
Earnings
Parity
Integrality
Public sector workers
Private sector workers
Point of retirement
Age

- The average contribution rate of public sector employees towards their pension fund is 11%.
- Private sector the contribution rates are, roughly 27% (7.6% employees contribution and 20% employer contribution) in the manufacturing and service sector.
- Agricultural (rural) sector contribution rates are around 16%.
- The average pension paid to private sector retirees amounts from 70% to 80% of their (average?) wage income.
- Souza et al. (2004) report that the deficit of the pension system is around 4.5% of GDP, 3.5% is caused by the public sector, the remaining 1% comes from the private sector.
- Sustainability?
- Lula Reform 2003.

Outlook

- In this paper we study the effects of public sector pension reforms on capital accumulation.
- We use an OLG framework in which the government hires workers and invests in a public capital.
- The government also finances public expenditures on education and social security payments to the private sector workers.
- We focus on reduction of public sector pensions.
- The extra resources from cutting public sector pensions can be used to:

(*i*) increase private sector pension, (*ii*) increase public education expenditure, (*iii*) increase investment in the public capital stock, (*iv*) "decrease" debt.

The Model

- OLG, 2 periods, constant population: $N^r + N^u = 1$
- Preferences:

$$u\left(c_t, G_t, c_{t+1}, G_{t+1}\right) = \frac{\left[\left(c_t^\rho + \Theta G_t^\rho\right)^{\frac{1}{\rho}}\right]^{1-\sigma}}{1-\sigma} + \beta \frac{\left[\left(c_{t+1}^\rho + \Theta G_{t+1}^\rho\right)^{\frac{1}{\rho}}\right]^{1-\sigma}}{1-\sigma}$$

- Technology:

$$Y_t = A G_t^{\alpha_1} K_t^{\alpha_2} \left(H_t^r\right)^{\alpha_3} \text{ with } \alpha_2 + \alpha_3 = 1$$

- Public goods production:

$$G_t = Y_t^G = Z\left[\left(K_t^G\right)^\eta + \left(H_t^u\right)^\eta\right]^{1/\eta} \text{ with } \eta \leq 1$$

- Law of motion for public capital:

$$K_{t+1}^{G} = (1 - \delta_{K^G})\, K_t^G + I_t^G$$

- Private sector human capital: $H_t^r = H_t N_t^r$
- Public sector human capital: $H_t^u = H_t N_t^u = H_t\,(1 - N_t^r)$
- Human capital production:

$$h_{t+1} = D E_t^{\gamma_1} h_t^{\gamma_2}$$

Government Policies

The government budget constraint:

$$(1+r_t)B_t + \overbrace{\Delta_{E,t}Y_t}^{\text{public education}} + \overbrace{\Delta_{G,t}Y_t}^{\text{public sector capital}} +$$

$$\overbrace{\Delta_{T^r,t}Y_t}^{\text{private pension } T^r} + \overbrace{w_t^u H_t N_t^u}^{\text{public wages}} + \overbrace{\Psi w_t^u H_t N_{t-1}^u}^{\text{public pension } T^u}$$

$$=$$

$$B_{t+1} + \left(\tau_{L,t}^{ssu} + \tau_{L,t}^{u}\right) w_t^u H_t N_t^u +$$

$$\left(\tau_{L,t}^{ssr} + \tau_{L,t}^{ssrf} + \tau_{L,t}^{r}\right) w_t^r H_t N_t^r + \tau_{K,t} r_t K_t$$

The Household and Firm Problem

$$\max_{c_t^j, c_{t+1}^j, i_{t+1}^j} \frac{\left[\left(\left(c_t^j\right)^{\rho} + \Theta G_t^{\rho}\right)^{\frac{1}{\rho}}\right]^{1-\sigma}}{1-\sigma} + \beta \frac{\left[\left(\left(c_{t+1}^j\right)^{\rho} + \Theta G_{t+1}^{\rho}\right)^{\frac{1}{\rho}}\right]^{1-\sigma}}{1-\sigma}$$

$$s.t.$$

$$\begin{aligned} c_t^j + i_t^j &\leq \left(1 - \tau_{Lt}^{ssj} - \tau_{Lt}^j\right) w_t^j h_t = \mathcal{I}_t^j \\ c_{t+1}^j &\leq R_{t+1} i_t^j + \frac{T_{t+1}^j}{N_t^j} \end{aligned}$$

$$\max_{\left(H_t^r, K_t\right)} F\left(G_t, K_t, H_t^r\right) - \left(1 + \tau_t^{ssrf}\right) w_t^r H_t^r - r_t^k K_t$$

- We assume the government indexes public worker wages to private worker wages as:

$$w_t^u = w_t^r$$

- Non-arbitrage condition between assets:

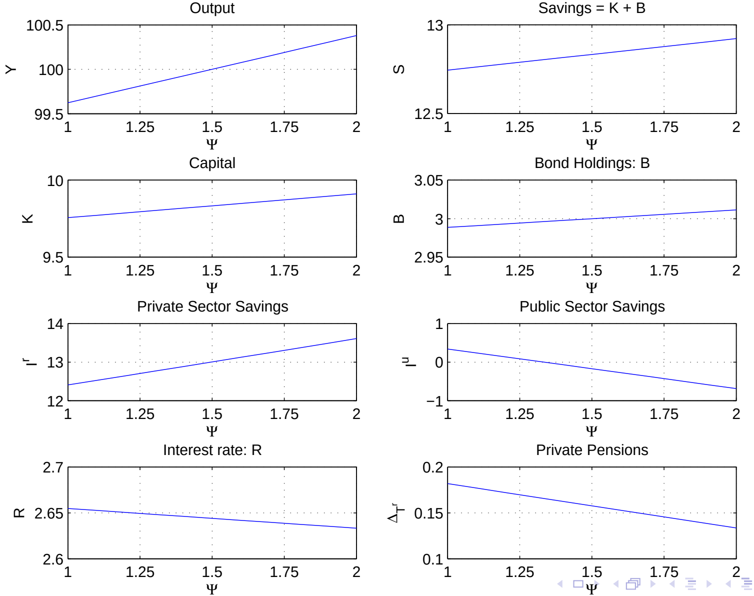
$$(1 - \tau_{Kt+1})\, r_{t+1}^k = R_{t+1}$$

	Parameters	
Preferences		
		$\sigma = 1.5$
		$\Theta = 0.05$
		$\theta = 0.95$
		$\beta = 0.995^{30}$
	Consumption Good:	
		$A = 35.26$
		$\alpha_1 = 0.1$
		$\alpha_2 = 0.4$
		$\alpha_3 = 0.6$
		$\delta = 1$
	Public Good:	
		$Z = 1$
		$\chi_2 = 1$
	public capital and labor are substitutes:	$\eta_2 = 0.5$
	public capital and labor are complements:	$\eta_2 = -0.25$
		$\delta_G = 0.8$
	Human Capital:	
		$D = 1$
		$\chi_1 = 0.2$
		$\eta_1 = 0.5$
		$\gamma_1 = 0.1$
		$\gamma_2 = 0.5$

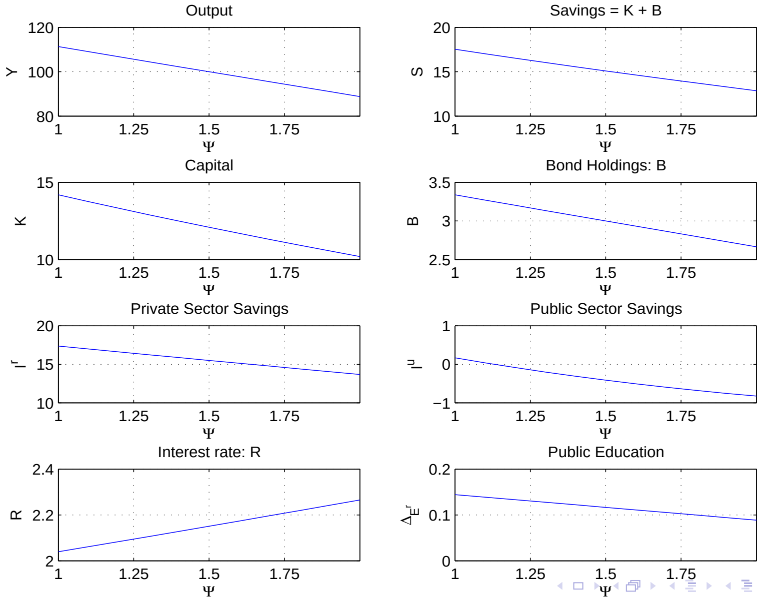
Government Policy Parameters

Policies:		
Δ_E	Public education excl. teacher salaries (in % of GDP)	1%
Δ_G	Investment in public good (in % of GDP)	1%
Δ_{Tr}	Transfers to old in private sector (in % of GDP)	6.6%
Δ_B	Debt level	3%
$w_t^u H_t N_t^u$	wages to current civil servants (in % of GDP)	3.5%
$\Psi w_t^u H_t N_{t-1}^u$	pension payments to public sector retirees (in % of GDP)	5%
ξ	public wages as a fraction of private wages	1.28
Ψ	indexation parameter (generosity of public pensions)	1.5
Taxes:		
τ_L^{ssu}	social security contribution rate of civil servants	11%
τ_L^{ssr}	social security contribution rate of private sector employees	11%
τ_L^{ssrf}	social security contribution rate of private sector employers	10%
τ_K	capital tax rate (with bonds)	35%
τ_L^r	labor tax rate private sector, net of social security	12%
τ_L^u	labor tax rate public sector, net of social security	12%
Population:		
N_t^u	fraction of civil servants	6%
N^r	fraction of private sector employees	94%
a	fraction of teachers in public sector	42%

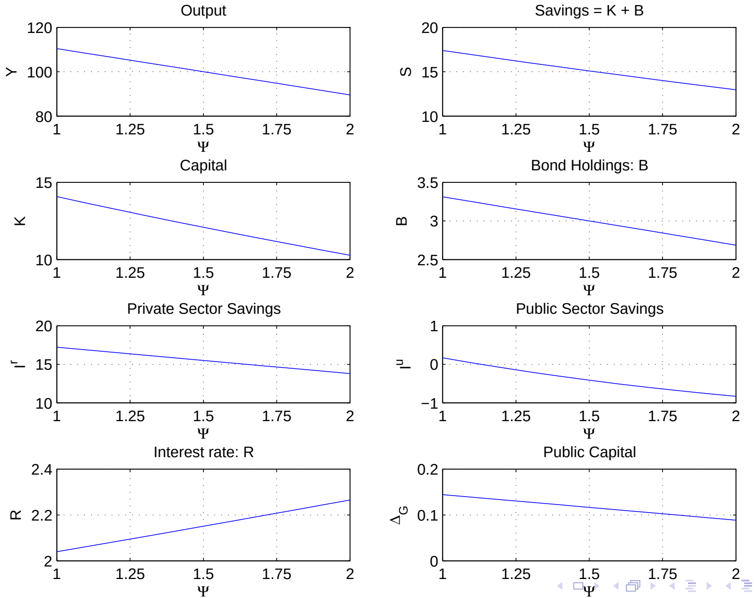
Decreasing public sector pensions Ψ and increasing private pensions Δ_{T^r}



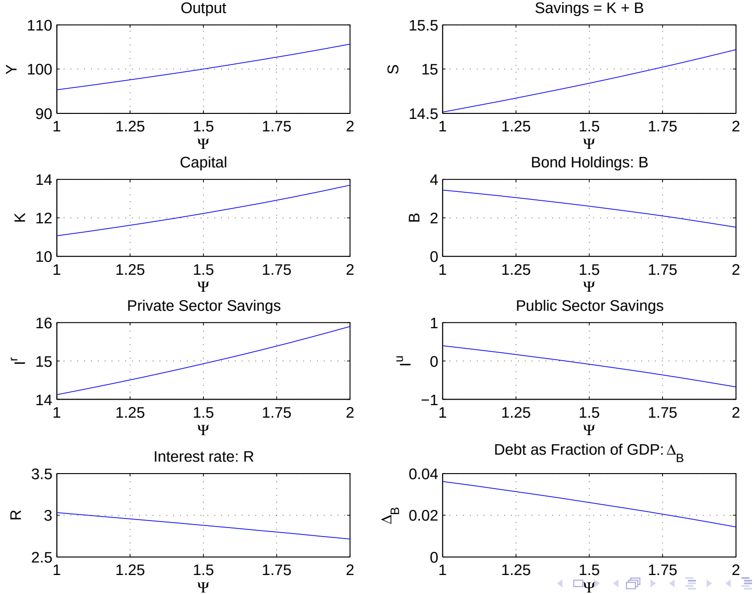
Decreasing public sector pensions Ψ and increasing public education Δ_E



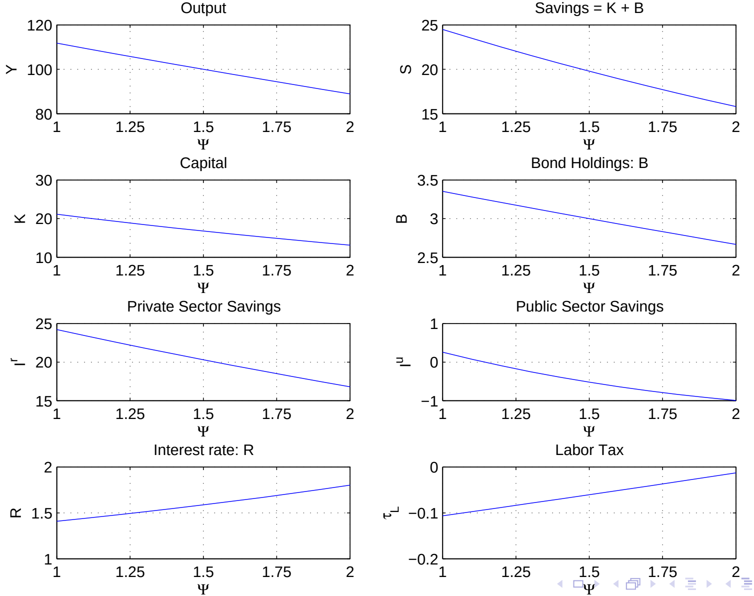
Decreasing public sector pensions Ψ and increasing public capital Δ_G



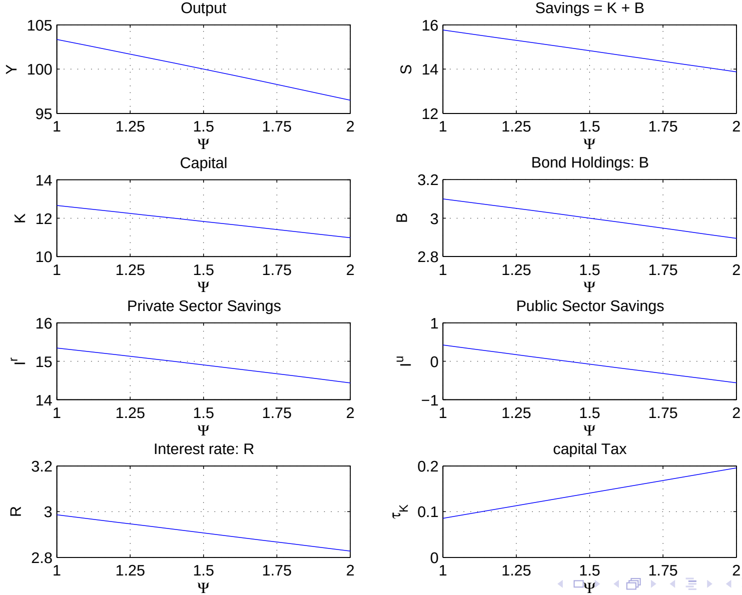
Decreasing public sector pensions Ψ and increasing government debt Δ_B



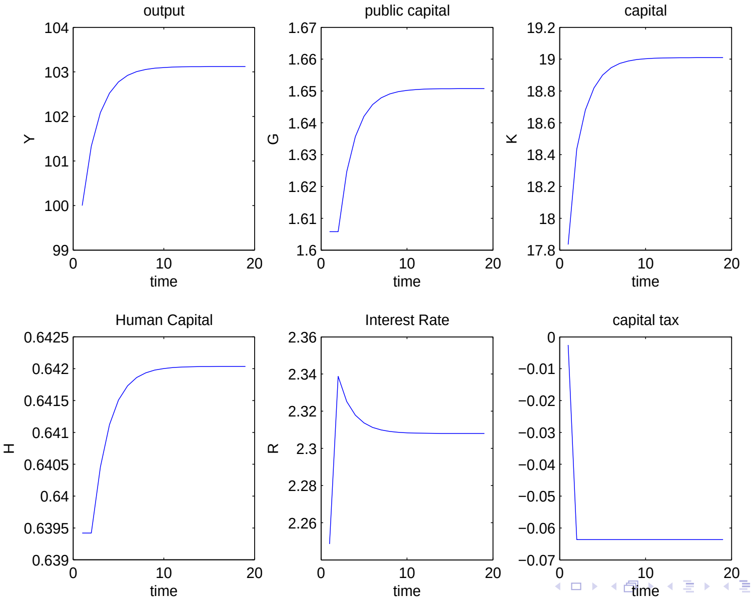
Decreasing public sector pensions Ψ and decreasing labor taxes τ_L



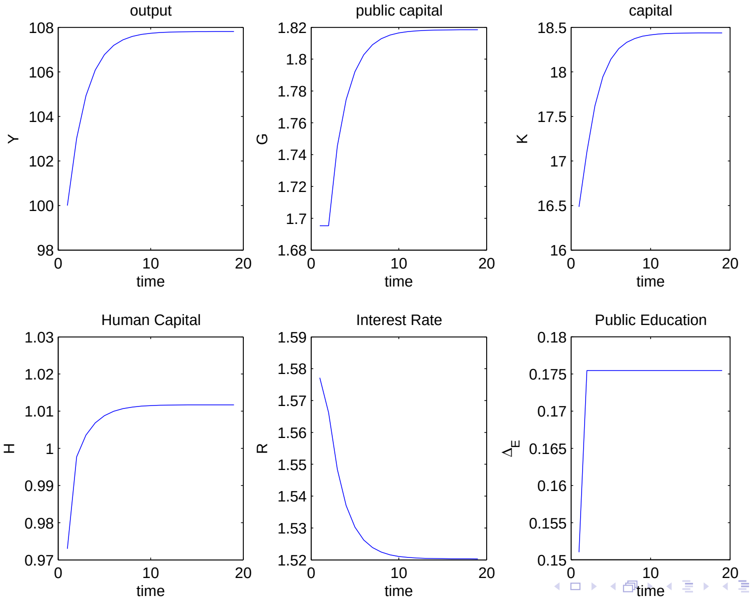
Decreasing public sector pensions Ψ and adjusting capital taxes τ_K



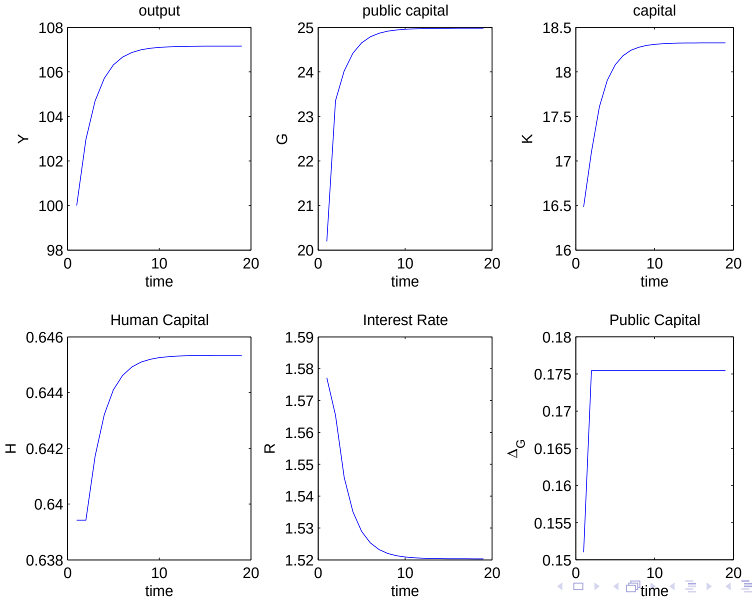
Transition: Decreasing public sector pensions Ψ and adjusting capital taxes τ_K



Transition: Decreasing Ψ and adjusting public education Δ_E



Transition: Decreasing Ψ and adjusting public capital investment Δ_G



	Ψ	1	1.25	1.5	1.75
	0.050	107.252	103.606	100.000	96.412
	0.060	107.966	103.963	100.000	96.050
	0.070	108.724	104.342	100.000	95.670
	0.080	109.531	104.743	100.000	95.270
	0.090	110.391	105.169	100.000	94.849
γ_1	0.100	111.311	105.623	100.000	94.405
	0.110	112.296	106.107	100.000	93.935
	0.120	113.354	106.624	100.000	93.438
	0.130	114.493	107.179	100.000	92.912
	0.140	115.723	107.774	100.000	92.353
	0.150	117.054	108.416	100.000	91.758

Table: Change in Output with Δ_E adjusting ($\eta_2 = 0.5$)

	Ψ	1	1.25	1.5	1.75
	0.000	105.572	102.764	100.000	97.266
	0.250	108.314	104.132	100.000	95.892
η_1	0.500	111.311	105.623	100.000	94.405
	0.750	112.559	106.252	100.000	93.758
	1.000	112.864	106.408	100.000	93.591

Table: Change in Output with Δ_E adjusting

	Ψ	1	1.25	1.5	1.75
	0.050	106.870	103.421	100.000	96.585
	0.060	107.506	103.741	100.000	96.257
	0.070	108.176	104.077	100.000	95.915
	0.080	108.884	104.431	100.000	95.557
	0.090	109.634	104.805	100.000	95.183
α_1	0.100	110.429	105.199	100.000	94.791
	0.110	111.273	105.617	100.000	94.379
	0.120	112.172	106.060	100.000	93.946
	0.130	113.131	106.531	100.000	93.491
	0.140	114.157	107.032	100.000	93.011
	0.150	115.257	107.567	100.000	92.504

Table: Change in Output with Δ_G adjusting ($\eta_2 = 0.5$)

	ψ	1	1.25	1.5	1.75
	-1.000	104.157	102.045	100.000	98.019
	-0.750	104.217	102.077	100.000	97.982
	-0.500	104.440	102.193	100.000	97.851
η_2	-0.250	105.187	102.578	100.000	97.438
	0.000	107.004	103.490	100.000	96.509
	0.250	109.548	104.757	100.000	95.244
	0.500	110.429	105.199	100.000	94.791

Table: Change in Output with Δ_G adjusting

	ψ	1	1.25	1.5	1.75
	0.050	-23.947	-23.214	-22.383	-21.425
	0.060	-20.008	-19.431	-18.773	-18.010
	0.070	-15.638	-15.246	-14.790	-14.254
	0.080	-10.771	-10.597	-10.380	-10.109
	0.090	-5.325	-5.410	-5.477	-5.516
γ_1	0.100	0.799	0.403	-0.000	-0.407
	0.110	7.719	6.950	6.146	5.303
	0.120	15.584	14.364	13.078	11.715
	0.130	24.577	22.808	20.940	18.954
	0.140	34.928	32.487	29.911	27.173
	0.150	46.926	43.657	40.214	36.561

Table: Relative Difference: $\frac{\Delta_E - \Delta_G}{\Delta_G}100$, $(\eta_2 = 0.5)$

	ψ	1	1.25	1.5	1.75
	0.050	30.041	28.220	26.275	24.177
	0.060	24.142	22.628	21.013	19.275
	0.070	18.263	17.045	15.750	14.361
	0.080	12.408	11.476	10.490	9.440
	0.090	6.585	5.927	5.238	4.516
α_1	0.100	0.799	0.403	-0.000	-0.407
	0.110	-4.942	-5.089	-5.219	-5.325
	0.120	-10.630	-10.542	-10.414	-10.232
	0.130	-16.256	-15.947	-15.576	-15.122
	0.140	-21.810	-21.297	-20.699	-19.988
	0.150	-27.284	-26.583	-25.774	-24.825

Table: Relative Difference: $\frac{\Delta_E - \Delta_G}{\Delta_G} 100$, $(\eta_2 = 0.5)$

	ψ	1	1.25	1.5	1.75
	0.050	8.573	7.757	6.905	6.013
	0.060	13.862	12.727	11.538	10.285
	0.070	19.688	18.188	16.614	14.948
	0.080	26.129	24.209	22.191	20.056
	0.090	33.278	30.870	28.342	25.667
γ_1	0.100	41.246	38.270	35.150	31.855
	0.110	50.164	46.524	42.715	38.702
	0.120	60.192	55.772	51.158	46.311
	0.130	71.526	66.183	60.623	54.801
	0.140	84.406	77.965	71.287	64.319
	0.150	99.128	91.372	83.362	75.042

Table: Relative Difference: $\frac{\Delta_E - \Delta_G}{\Delta_G} 100$, $(\eta_2 = -0.25)$

	Ψ	1	1.25	1.5	1.75
	0.050	51.927	48.630	45.134	41.395
	0.060	50.034	46.790	43.356	39.693
	0.070	48.020	44.834	41.470	37.888
	0.080	45.885	42.763	39.473	35.981
	0.090	43.627	40.575	37.367	33.970
α_1	0.100	41.246	38.270	35.150	31.855
	0.110	38.742	35.848	32.822	29.636
	0.120	36.116	33.310	30.384	27.313
	0.130	33.370	30.656	27.836	24.888
	0.140	30.503	27.889	25.181	22.362
	0.150	27.520	25.010	22.420	19.735

Table: Relative Difference: $\frac{\Delta_E - \Delta_G}{\Delta_G}100$, $(\eta_2 = -0.25)$

	Ψ	1	1.25	1.5	1.75
	0.000	109.138	104.572	100.000	95.385
	0.250	109.691	104.842	100.000	95.129
η_1	0.500	110.429	105.199	100.000	94.791
	0.750	111.043	105.498	100.000	94.507
	1.000	111.374	105.661	100.000	94.350

Table: Change in Output with Δ_G adjusting

Summary

- The direct effects of pension reform through savings of public sector employees are small
- Shifting government funds from public to private sector pensions leaves steady state GDP unaffected
- The indirect effects of reduction of public pensions by freeing resources for public education or investment in public capital are large
- Extensions:
  - government produces two types of public goods
  - transitions
  - endogenous timing of retirement
  - heterogeneity