

Fiscal Austerity Measures: Spending Cuts vs. Tax Increases

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The Current State of Public Finance

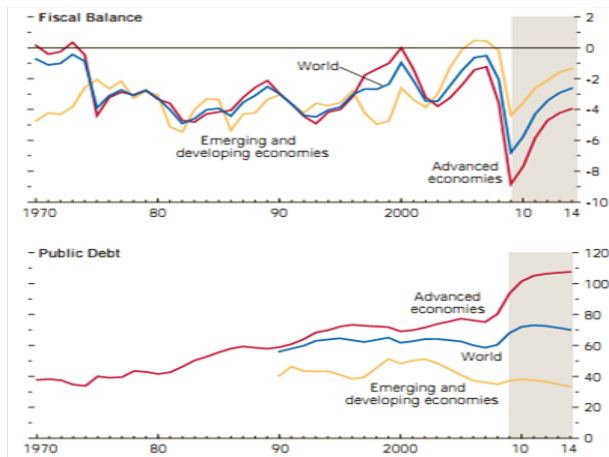


Figure: Government Fiscal Balances and Public Debt (Percent of GDP) by IMF 2011

A Closer Look

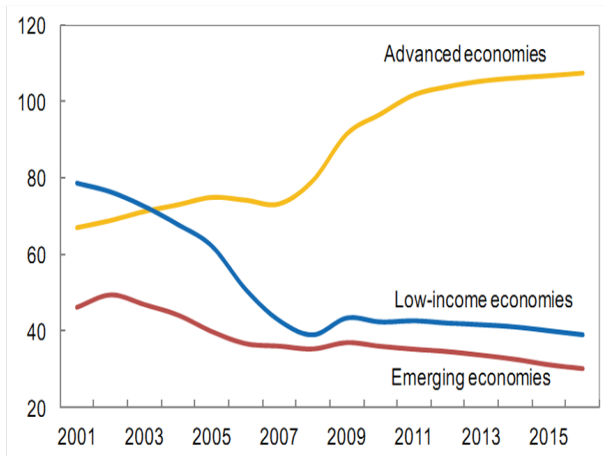


Figure: Public Debt to GDP Ratio by IMF 2011

An Era of Fiscal Stress: Long-Run Projections

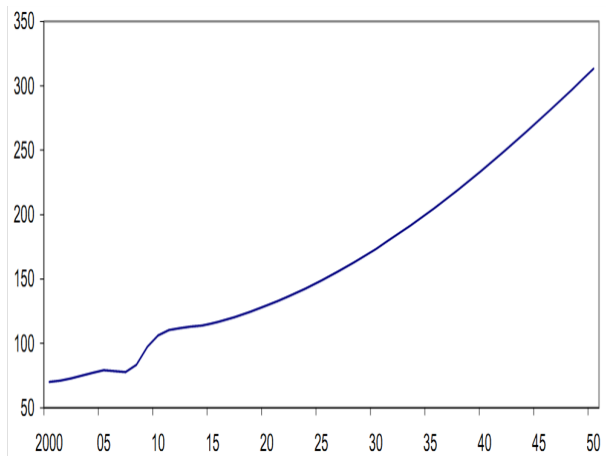


Figure: Government Debt to GDP in Advanced G-20 Countries by IMF 2011

Is There any Way Out?

- 1 Economies will grow out the projected deficits
- 2 Governments will default
- 3 Governments will improve fiscal imbalances

Fiscal Austerity

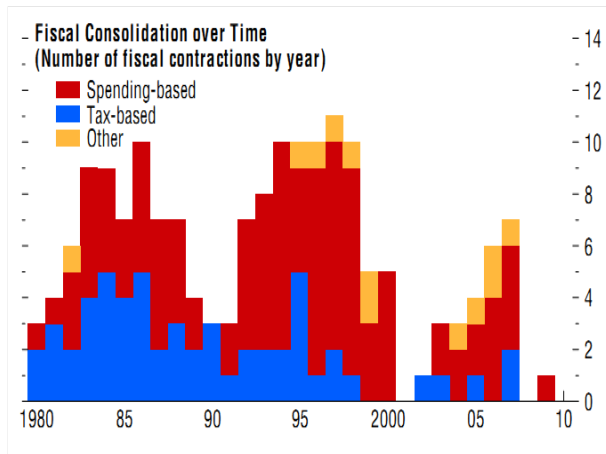


Figure: Action-Based Fiscal Consolidation by IMF 2010

Fiscal Austerity: Data

- 1 Outcomes: Contractionary or Expansionary
- 2 Factors driving these outcomes:
 - Composition: tax or spending: Alesina and Perotti(1995), Perotti (1996), Alesina and Ardagna (2010)
 - Size: Giavazzi and Pagano (1996)) and Strauch and Von Hagen (2001)
 - The state of public finance: Giavazzi, Jappelli and Ardagna (2004)
 - The state of macroeconomy: Perotti(1996), Alesina, Ardagna and Trebbi (2006), Guichard et al (2007)
 - Monetary policy and exchange rate policy: Strauch and Von Hagen (2001) Ardagna (2004), Lambertini and Tavares (2005)

Fiscal Austerity: Theory

- ① Static framework:
 - CONTRACTIONARY!
 - Traditional Keynesian model
 - Keynesian effect

- ② Dynamic framework
 - EXPANSIONARY is possible - Non-Keynesian effect!

 - Neoclassical growth model: Bertola and Drazen (1993), Ireland (1993), Sutherland(1997), and Bruce and Turnovsky (1999)

 - New Keynesian model: Forni et al (2010), Bi, Leeper, and Leith (2011), Leeper and Bi (2012)

This Paper

- 1 Construct an overlapping generations model with
 - intra-cohort heterogeneity
 - incomplete credit market
 - details of fiscal activities
- 2 Evaluate the macroeconomic and welfare effects of fiscal austerity measures
 - tax-based measures
 - spending-based measures
 - or a mix of both measures

Main Results

- 1 In the long run a case for adjusting consumption taxes
- 2 Cutting public sector employment is preferable to cutting public sector wages.
- 3 Adjustment of public investment generates larger short term losses and smaller long term losses.
- 4 Potentially large long term welfare gains from debt reduction
- 5 Bigger long-run gains for rich than for poor from debt reduction

MODEL

The Model: Key Features

- General equilibrium model
- Overlapping generations and intra-cohort heterogeneity
- Exogenous economic and population growth
- Sectors: household, firm, and government
- Markets: consumption, labor and capital
- Incomplete credit markets
- Small open economy

Household sector

- Overlapping generations
- Exogenous survival probabilities; maximum age 90 years
- Labor productivity: skill-and age-dependent
- Derive utility from consumption and leisure

$$u(c, l) = \frac{(c^\gamma l^{1-\gamma})^{1-\sigma}}{1-\sigma}$$

- Decide on sequences of consumption, savings and labor supply to maximize lifetime utility

Household optimization problem

$$V_j(a_j, \theta) = \max_{\{a_j, c_j, l_j\}} \{u(c_j, l_j) + \beta \pi_j V_{j+1}(a_{j+1}, \theta)\}$$

s.t.

$$\left\{ \begin{array}{ll} (1 + \tau_C) c_j + (1 + g) a_{j+1} & \text{if } j \leq J_1 \\ = Ra_j + (1 - \tau_L - \tau_{SS})(1 - l_j) e_j w_t + (1 - \tau_{Beq}) T_{Beq} & \\ (1 + \tau_C) c_j + (1 + g) a_{j+1} & \text{if } J_1 < j \\ = Ra_j + (1 - l_j) e_j(\theta) w_{P,t} + (1 - \tau_{Beq}) T_{Beq} + Pen_j & \end{array} \right.$$

$$0 \leq a_j$$

$$0 < l_j \leq 1$$

Firm sector

- Competitive
- Production Technology: $Y = F_P(G_t, K_{P,t}, H_{P,t}) = A_1 G_t^{\alpha_1} K_{P,t}^{\alpha_2} H_{P,t}^{\alpha_3}$
- Firm choose capital, labor to maximize its profit as

$$\max_{\{H_{P,t}, K_{P,t}\}} F_P(G_t, K_{P,t}, H_{P,t}) - w_{P,t}H_{P,t} - q_{P,t}K_{P,t}$$

$$\text{given } (w_{P,t}, q_{P,t}, G_t)$$

Government sector

1 Government production

- Public goods

$$G_t = F_G(K_{G,t}, H_{G,t}) = A_2 K_{P,t}^{\eta_3} (\omega_h H_{P,t})^{(1-\eta_3)}.$$

- Law of motion for public capital:

$$K_{G,t+1} = \frac{1}{(1+n)(1+g)} ((1-\delta_G) K_{G,t} + I_{G,t})$$

2 Government inter-temporal budget constraint

$$B_{t+1} = \frac{1}{(1+g)(1+n)} \{(1+r_t) B_t + Spend_t - Tax_t\}$$

- B_{t+1} : one-period bond
- Tax_t : tax revenue from labor tax, consumption tax, capital tax, and bequest tax
- $Spend_t$: government spending
 - Productive: investment in public capital, wage bill for civil servant
 - Non-productive: pension, general consumption

A competitive equilibrium

A competitive equilibrium is a collection of sequences of household decisions, aggregate capital stocks of physical and human capital, and market prices such that

- Household solves the utility maximization problem
- Firm solves the profit maximization problem
- Government budget clears
- All markets clear
- Domestic interest rate is determined by world interest rate:

$$r_t = \bar{r}_t$$

CALIBRATION

Calibration Strategy

- To match the Greek economy in early 2000s
- Preferences and technology: previous literature
- Agent heterogeneity: data from Greece
- Government activities: data from Greece

Parameter Values 1

Parameters	Model:	Observation/Source:
Preferences		
Discount factor	$\beta = 1.032$	To match $\frac{K}{Y}$ and R
Inverse of inter-temp. elast. of subst.	$\sigma = 2.5$	To match $\frac{K}{Y}$ and R
Weight on consumption	$\gamma = 0.34$	To match average hours worked.
Private Production:		
TFP	$A_P = 1$	Normalization
Productivity of public good G	$\alpha_1 = 0.09$	
Capital productivity	$\alpha_2 = 0.35$	
Human capital productivity	$\alpha_3 = 0.65$	
Capital depreciation	$\delta = 10\%$	
Long run growth rate	$g = 1.0\%$	Akram et al. (2011, p. 312)
Public Production:		
TFP for public good production	$A_G = 4.25$	To match public sector size
	$\eta = 0.42$	Sensitivity analysis
Productive civil servants	$\omega_h = 35\%$	Sensitivity analysis
Public capital depreciation	$\delta_G = 10\%$	To match public sector size
Human Capital:		
Efficiency profile	$e_j(\theta)$	To match size of public good sector and hours worked
population growth rate	$n = 0.2\%$	UN Data Country Profile

Parameter Values 2

Policy parameters	Model:	Observation/Source:
Labor Allocation:		
Fraction of gov't employees	$N^G = 20\%$	18% in OECD (2011b, p. 12) and 24% OECD (2011a, p. 8)
Private sector employees	$N^P = 80\%$	OECD (2011, p. 8)
Retirement age	60	62.4 for men and 60.9 for women OECD (2011, p. 9)
Proportion working age	67%	BOG (2005)
Expenditures:		
Public wages markup	$\xi^W = 20\%$	to match public sector wage bill
Replacement rates (generosity of pensions)	$\Psi_P = 50\%$ $\Psi_G = 87\%$	OECD (2011) or to match pension sizes
Investment in public good (in % of priv. sector output)	$\Delta_{K_G} = 5\%$	2% of GDP in capital expenditure, Koutsogeorgopou and Turner (2007)
Residual gov't consumption (in % of priv. sector output)	$\Delta_{C_G} = 0.01\%$	to match G/Y of 40% Residual (thrown into ocean), to match income tax revenue
Taxes:		
margin. income tax rates for four income groups	$\tau_I = [0, 0.27, 0.37, 0.4]$	http://www.taxexperts.eu/
income tax polynomial:	$\beta_0 = 0.24$ $\beta_1 = -0.005$ $\beta_2 = 3.0E - 5$	
Consumption tax rate	$\tau_C = 18.9\%$	21% but collection is low (about 50%) share in tax rev. of VAT: 6-7% of GDP OECD (2011,p. 13)
Tax on bequests	$\tau_{Beq} = 15\%$	To match tax revenue of income tax
Social security tax-private	$\tau_{SS}^P = 12\%$	To match pension deficit 3 – 4% of GDP
Social security tax-public	$\tau_{SS}^G = 15\%$	To match pension deficit 1 – 1.5% of GDP

Model vs. Data

Moments I	Model:	Data:	Observation/Source:
Capital output ratio: $\frac{K}{Y}$	1.56	1.54	IMF (2006, p. 31)
Annual interest rate: r	4.0	4.5%	OECD (2011b, p. 5)
debt-to-GDP ratio:	105%	105%	Eurostat (2009)
Public sector share of GDP: $\frac{G}{Y}$	40.1%	40%	Based on Economy_of_Greece
Hours worked/week:	37.6	38.64	42 hours according to OECD StatExtracts
Hours worked/week, private:	38.7	38.64	
Hours worked/week, public:	37.6	28.98	75% of average work hours, OECD (2011b, p. 12)
CA deficit in % of GDP	-14%	10 - 14.4%	CA balance in % of GDP Akram et al. (2011, p. 309) and Ministry of Finance (2011, p. 15)

Model vs. Data

Moments II	Model:	Data:	Observation/Source:
Tax Revenues: (all in % of GDP)			
Total tax revenue	36.6%	32 – 34.2%	OECD 2011, p. 13 and Akram et al. (2011, p. 308)
Income tax revenue	13.4%	7%	OECD 2011, p. 13
Consumption tax revenue	12.9%	7%	OECD 2011, p. 13
Soc.Sec.Rev.:private sector	7.8%		To match pension deficit
Soc.Sec.Rev.:public sector	1.8%		To match pension deficit
Bequest tax revenue	0.7%	1%	Property tax, OECD 2011, p. 13
Expenditures: (all in % of GDP)			
Wage bill public sector	7.5%	11.5%	Koutsogeorgopoulou and Turner (2007, p 8) 33% of total wage bill in OECD (2011, p. 8)
Wage bill private sector	65.0%	20%	33% of total wage bill, OECD (2011, p. 8)
Private pensions	10.4%	8.5%	residual from below
Public pension	3.4%	2.5 – 5%	Hellenic Country Fiche (2011, p. 19)
All pension payments	13.9%	11.5 – 13.9%	OECD 2011, p. 9 and Hellenic Country Fiche (2011, p. 19)
Debt-to-GDP	105%	105%	http://stats.oecd.org
Pension Deficit: (all in % of GDP)			
Pension deficit	-4.2%	-4 to -5% of GDP	O'Donnel and Tinios (2003) and Greek Finance Ministry (2012)
Pension deficit priv. sector	-2.64%	-3 to -4% of GDP	own calculations
Pension deficit pub. sector	-1.6%	-1 to -1.5% of GDP	own calculations

POLICY EXPERIMENTS

	[1] τ_I	[2] τ_C	[3] Δ_{K_G}
Output Y	98.31	98.39	98.59
Capital K	109.98	109.40	109.96
Capital in final K_P	96.72	96.81	97.01
Human capital private H_P	99.25	99.33	99.34
Human capital public H_G	98.96	99.08	99.08
Public good G	99.40	99.46	100.88
Consumption C	99.56	100.11	99.89
Current account: CA	-76.95	-78.04	-77.68
Interest rate r	103.78	103.78	103.78
Risk premium	121.97	121.97	121.97
Wages w	99.05	99.06	99.25
Income tax τ_I	100.37	100.00	100.00
Consumption tax τ_C	100.00	97.19	100.00
Infrastruc. Inv. Δ_{K_G}	100.00	100.00	104.89
Debt to GDP ratio in %	105.00	105.00	105.00
Total govt spending	98.78	98.86	99.34
Bonds	98.31	98.39	98.59
Govt consumption C_G	100.00	100.00	100.00
Govt investment I_{K_G}	100.00	100.00	103.42
Pub. sec. wages	98.02	98.14	98.34
Pensions	98.26	98.35	98.53
Tax revenue	100.05	99.14	100.21
Bequest tax rev.	104.87	104.41	104.90
Cons tax rev.	99.56	97.28	99.89
Soc. sec. tax rev.	98.25	98.35	98.54
Income tax rev.	101.55	101.20	101.45
TaxableInc: all	99.71	99.76	99.98
TaxableInc: labor	98.12	98.22	98.42
TaxableInc: pension	98.30	98.39	98.58
TaxableInc: asset	109.74	109.44	109.86

Welfare measures			
	[1] τ_I	[2] τ_C	[3] Δ_{K_G}
Aggregate Comp.Cons. in % of GDP	0.22	-0.09	0.05
Aggregate-Private in % of GDP	0.16	-0.09	0.02
Aggregate-Public in % of GDP	0.06	-0.00	0.03
Private-Low income: Avge.% Δ in C	-0.07	-0.48	-0.28
Private-High income: Avge.% Δ in C	0.47	0.00	0.21
Public-Low income: Avge.% Δ in C	0.14	-0.28	-0.07
Public-High income: Avge.% Δ in C	0.81	0.27	0.51

	[1] N_G, τ_I	[2] $N_G, \Delta K_G$	[3] w_G, τ_I	[4] $w_G, \Delta K_G$	[5] Ψ_G, τ_I	[6] $\Psi_G, \Delta K_G$
Output Y	99.17	101.36	98.00	99.61	97.98	98.87
Capital K	109.54	109.52	112.15	112.06	114.27	114.21
Capital in final K_P	97.58	99.73	96.42	98.01	96.40	97.28
Human capital private H_P	101.27	102.11	98.66	99.22	98.92	99.20
Human capital public H_G	85.90	86.59	102.42	102.95	98.94	99.30
Public good G	91.56	100.99	101.39	109.57	99.38	103.98
Consumption C	98.17	100.66	97.82	99.64	98.99	100.00
Current account: CA	-79.74	-85.12	-72.95	-77.06	-69.74	-72.03
Interest rate r	103.78	103.78	103.78	103.78	103.78	103.78
Risk premium	121.97	121.97	121.97	121.97	121.97	121.97
Wages w	97.93	99.27	99.32	100.39	99.05	99.67
Income tax τ_I	103.28	100.00	102.31	100.00	101.17	100.00
Consumption tax τ_C	100.00	100.00	100.00	100.00	100.00	100.00
Infrastruc. Inv. ΔK_G	100.00	123.21	100.00	119.89	100.00	112.06
Debt to GDP ratio in %	105.00	105.00	105.00	105.00	105.00	105.00
Total govt spending	95.59	99.64	95.46	98.55	97.69	99.45
Bonds	99.17	101.36	98.00	99.61	97.98	98.87
Govt consumption C_G	100.00	100.00	100.00	100.00	100.00	100.00
Govt investment I_{K_G}	100.00	124.88	100.00	119.42	100.00	110.79
Pub. sec. wages	84.12	85.95	86.46	87.85	97.99	98.97
Pensions	95.53	97.58	95.20	96.72	94.40	95.25
Tax revenue	98.52	99.51	98.09	98.86	100.00	100.47
Bequest tax rev.	105.90	106.22	106.86	107.09	107.96	108.06
Cons tax rev.	98.17	100.66	97.82	99.64	98.99	100.00
Soc. sec. tax rev.	96.32	98.44	95.81	97.38	97.98	98.89
Income tax rev.	100.03	98.84	99.52	98.75	101.98	101.67
TaxableInc: all	98.06	100.11	96.09	97.59	99.04	99.89
TaxableInc: labor	96.76	98.99	94.14	95.77	97.79	98.73
TaxableInc: pension	93.55	95.58	93.50	95.00	92.55	93.39
TaxableInc: asset	109.39	110.47	109.22	109.97	111.92	112.32

Welfare measures

	[1] N_G, τ_I	[2] $N_G, \Delta K_G$	[3] w_G, τ_I	[4] $w_G, \Delta K_G$	[5] Ψ_G, τ_I	[6] $\Psi_G, \Delta K_G$
Agg. Comp.Cons. % of GDP	0.84	-0.38	1.44	0.53	0.59	0.07
Agg.-Private % of GDP	0.75	-0.24	0.24	-0.53	0.20	-0.22
Agg.-Public % of GDP	0.08	-0.14	1.20	1.06	0.38	0.30
Priv.-Low inc.: Avge.% Δ in C	0.84	-0.69	-0.11	-1.28	-0.11	-0.76
Priv.-High inc.: Avge.% Δ in C	1.67	-0.30	0.73	-0.78	0.60	-0.22
Pub.-Low inc.: Avge.% Δ in C	1.05	-0.45	10.57	9.37	1.43	0.79
Pub.-High inc.: Avge.% Δ in C	0.34	-1.75	11.03	9.39	5.19	4.26

	[1] τ_I	[2] τ_C	[3] Δ_{K_G}
Output Y	103.67	104.34	105.34
Capital K	109.07	105.74	106.72
Capital in final K_P	108.40	109.10	110.15
Human capital private H_P	100.95	101.71	101.72
Human capital public H_G	103.18	101.80	101.80
Public good G	101.83	101.04	108.27
Consumption C	102.56	103.97	103.94
Current account: CA	-107.40	-114.11	-115.26
Interest rate r	89.78	89.78	89.78
Risk premium	40.16	40.16	40.16
Wages w	102.69	102.58	103.57
Income tax τ_I	102.81	100.00	100.00
Consumption tax τ_C	100.00	93.84	100.00
Infrastruc. Inv. Δ_{K_G}	100.00	100.00	111.91
Debt to GDP ratio in %	85.02	85.02	85.02
Total govt spending	93.96	93.91	96.29
Bonds	83.94	84.48	85.30
Govt consumption C_G	100.00	100.00	100.00
Govt investment I_{K_G}	100.00	100.00	117.89
Pub. sec. wages	105.95	104.43	105.43
Pensions	104.24	104.34	105.36
Tax revenue	101.84	99.32	102.18
Bequest tax rev.	95.31	93.66	94.55
Cons tax rev.	102.56	97.59	103.94
Soc. sec. tax rev.	104.10	104.35	105.36
Income tax rev.	99.88	97.67	98.61
TaxableInc: all	96.30	97.20	98.14
TaxableInc: labor	98.89	100.68	101.65
TaxableInc: pension	95.80	93.34	94.25
TaxableInc: asset	82.56	81.68	82.45

Welfare measures			
	[1] τ_I	[2] τ_C	[3] Δ_{K_G}
Agg. Comp.Cons in % of GDP	-0.82	-1.63	-1.61
Agg.-Private in % of GDP	-0.59	-1.34	-1.32
Agg.-Public in % of GDP	-0.23	-0.29	-0.29
Priv.-Low income: Avge.% Δ in C	-0.81	-1.79	-1.76
Priv.-High income: Avge.% Δ in C	-1.14	-2.56	-2.54
Pub.-Low income: Avge.% Δ in C	-1.45	-1.60	-1.57
Pub.-High income: Avge.% Δ in C	-2.29	-3.11	-3.08

	[1] N_G, τ_I	[2] $N_G, \Delta K_G$	[3] w_G, τ_I	[4] $w_G, \Delta K_G$	[5] Ψ_G, τ_I	[6] $\Psi_G, \Delta K_G$
Output Y	104.32	108.44	103.11	106.49	103.24	105.66
Capital K	110.29	108.33	111.39	109.14	113.08	111.70
Capital in final K_P	109.08	113.40	107.82	111.35	107.95	110.49
Human capital private H_P	102.87	104.65	100.27	101.60	100.61	101.57
Human capital public H_G	88.21	89.63	105.06	106.27	102.24	103.33
Public good G	92.98	108.77	102.90	118.08	101.29	111.84
Consumption C	100.73	105.10	100.17	103.70	101.58	104.21
Current account: CA	-107.28	-120.95	-102.49	-114.65	-100.29	-108.67
Interest rate r	89.78	89.78	89.78	89.78	89.78	89.78
Risk premium	40.16	40.16	40.16	40.16	40.16	40.16
Wages w	101.41	103.63	102.84	104.82	102.61	104.03
Income tax τ_I	106.31	100.00	104.99	100.00	103.65	100.00
Consumption tax τ_C	100.00	100.00	100.00	100.00	100.00	100.00
Infrastruc. Inv. ΔK_G	100.00	131.03	100.00	128.25	100.00	118.07
Debt to GDP ratio in %	85.02	85.02	85.02	85.02	85.02	85.02
Total govt spending	89.87	96.69	89.86	95.63	92.52	96.66
Bonds	84.47	87.81	83.49	86.23	83.59	85.56
Govt consumption C_G	100.00	100.00	100.00	100.00	100.00	100.00
Govt investment I_{K_G}	100.00	142.09	100.00	136.58	100.00	124.75
Pub. sec. wages	89.45	92.88	91.83	94.68	104.92	107.50
Pensions	100.72	104.61	100.39	103.58	99.81	102.14
Tax revenue	99.87	101.63	99.48	100.92	101.62	102.70
Bequest tax rev.	96.96	96.80	97.37	96.82	98.44	98.16
Cons tax rev.	100.73	105.10	100.17	103.70	101.58	104.21
Soc. sec. tax rev.	101.50	105.49	100.97	104.25	103.55	106.01
Income tax rev.	98.03	95.81	97.86	96.11	100.44	99.14
TaxableInc: all	94.13	97.72	92.74	95.03	96.36	98.53
TaxableInc: labor	96.94	101.09	95.57	98.16	99.67	102.21
TaxableInc: pension	89.75	93.32	87.31	90.16	89.23	91.38
TaxableInc: asset	82.79	83.25	82.22	82.33	84.75	84.94

Welfare measures

	[1] N_G, τ_I	[2] $N_G, \Delta K_G$	[3] w_G, τ_I	[4] $w_G, \Delta K_G$	[5] Ψ_G, τ_I	[6] $\Psi_G, \Delta K_G$
Agg CompCons in % of GDP	0.03	-2.15	0.64	-1.15	-0.30	-1.62
Agg-Priv % of GDP	0.17	-1.62	-0.42	-1.95	-0.51	-1.61
Agg-Pub % of GDP	-0.14	-0.53	1.06	0.80	0.21	-0.02
Priv-Low inc: Avge% Δ in C	0.27	-2.21	-0.75	-2.79	-0.79	-2.27
Priv-High inc.: Avge% Δ in C	0.32	-3.07	-0.75	-3.58	-0.95	-3.00
Pub-Low inc.: Avge% Δ in C	-0.54	-2.99	10.35	8.22	1.03	-0.49
Pub-High inc: Avge% Δ in C	-1.73	-5.29	8.78	5.74	2.55	0.24

Transition Dynamics: Aggregates

