Game Over: Simulating Unsustainable Fiscal Policy

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Household problem

$$\max_{c_{1,t},k_{2,t+1},c_{2,t+1}} \quad u(c_{1,t}) + \beta E_t\left[u(c_{2,t+1})\right]$$

$$\text{where} \quad c_{1,t} + k_{2,t+1} \leq w_t - H_t$$

$$\text{and} \quad c_{2,t+1} \leq (1 + r_{t+1} - \delta)k_{2,t+1} + H_{t+1}$$

$$\text{and} \quad c_{1,t}, c_{2,t+1}, k_{2,t+1} \geq 0$$

$$\text{and where} \quad u(c_{i,t}) = \frac{(c_{i,t})^{1-\gamma} - 1}{1-\gamma}$$

Household problem

$$c_{1,t} + k_{2,t+1} = w_t - H_t$$

$$H_t = \min\left(\bar{H}, w_t\right)$$

$$u'(c_{1,t}) = \beta E_t\left[\left(1 + r_{t+1} - \delta\right)u'(c_{2,t+1})\right]$$

Firms problem

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \quad \forall t \quad \text{where} \quad A_t = e^{z_t}$$

$$z_t = \rho z_{t-1} + (1-\rho)\mu + \varepsilon_t \quad \text{where} \quad z_t \sim N(0, \sigma)$$

$$r_t = \alpha e^{z_t} K_t^{\alpha-1} L_t^{1-\alpha} \quad \forall t$$

$$w_t = (1-\alpha) e^{z_t} K_t^{\alpha} L_t^{-\alpha} \quad \forall t$$

Market clearing

$$L_t = l_{1,1} = \bar{l} = 1 \quad \forall t$$

$$K_t = k_{2,t} \quad \forall t$$

$$Y_t - C_t = K_{t+1} - (1-\delta)K_t \quad \forall t$$

Equilibrium with shutdown

Euler equation

$$u'\left(c_{1,t}\right) = \beta E_{z_{t+1}|z_t}\left[\left(1 + \alpha e^{z_{t+1}}\left[(1-\alpha)e^{z_t}k_{2,t}^{\alpha} - \bar{H} - c_{1,t}\right]^{\alpha-1} - \delta\right) \times \ldots\right.$$

$$\left. u'\left(\left[1 + \alpha e^{z_{t+1}}\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - \bar{H} - c_{1,t}\right)^{\alpha-1} - \delta\right]\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - \bar{H} - c_{1,t}\right) + H_{t+1}\right)\right]$$

Calibration

Table 1: Calibration of 2-period lived agent OLG model with promised transfer $\bar{H}$

Parameter	Source to match	Value
β	annual discount factor of 0.96	0.29
γ	coefficient of relative risk aversion between 1.5 and 4.0	2
α	capital share of income	0.35
δ	annual capital depreciation of 0.05	0.79
ρ	AR(1) persistence of normally distributed shock to match annual persistence of 0.95	0.21
μ	AR(1) long-run average shock level	0
σ	standard deviation of normally distributed shock to match the annual standard deviation of real GDP of 0.49	1.55
$\bar{H}$	set to be 32% of the median real wage	0.11

The Appendix gives a detailed description of the calibration of all parameters.

Simulation with Shut down

Table 2: Initial values relative to median values

	$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
	w_{med} $\bar{H}/w_{med}$	k_{med} $k_{2,0}/k_{med}$	w_{med} $\bar{H}/w_{med}$	k_{med} $k_{2,0}/k_{med}$	w_{med} $\bar{H}/w_{med}$	k_{med} $k_{2,0}/k_{med}$
$\bar{H} = 0.05$	0.3030 0.1650	0.0992 1.1093	0.3026 0.1652	0.0996 1.4062	0.3008 0.1662	0.0991 1.7148
$\bar{H} = 0.11$	0.3445 0.3193	0.1344 0.8187	0.3433 0.3204	0.1358 1.0311	0.3474 0.3166	0.1365 1.2457
$\bar{H} = 0.17$	0.2562 0.6635	0.1043 1.0550	0.2709 0.6275	0.1090 1.2846	0.2825 0.6018	0.1134 1.4988

w_{med} is the median wage and k_{med} is the median capital stock across all 3,000 simulations before economic shut down.

Simulation with Shut down

Table 3: Periods to shut down simulation statistics

		$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
		Periods	CDF	Periods	CDF	Periods	CDF
$\bar{H} = 0.05$	min	1	0.1620	1	0.1543	1	0.1477
	med	4	0.5370	4	0.5320	4	0.5283
	mean	5.95	0.6704	6.00	0.6703	6.04	0.6694
	max	45	1.0000	45	1.0000	45	1.0000
$\bar{H} = 0.11$	min	1	0.3623	1	0.3480	1	0.3357
	med	2	0.5653	2	0.5543	2	0.5433
	mean	3.29	0.7060	3.35	0.7029	3.41	0.7022
	max	24	1.0000	24	1.0000	25	1.0000
$\bar{H} = 0.17$	min	1	0.5203	1	0.4987	1	0.4807
	med	1	0.5203	2	0.6833	2	0.6707
	mean	2.42	0.7373	2.48	0.7336	2.54	0.7295
	max	18	1.0000	18	1.0000	18	1.0000

Equity Premium

Table 6: Components of the equity premium in period 1

		$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
		30-year	annual	30-year	annual	30-year	annual
$\bar{H} = 0.05$	$E[R_{t+1}]$	8.2070	1.0361	7.5150	1.0334	7.0113	1.0313
	$\sigma(R_{t+1})$	23.3433	n.a.	21.3222	n.a.	19.8511	n.a.
	$R_{t,t+1}$	0.6428	0.9854	0.6291	0.9847	0.6177	0.9841
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	7.5641	0.0507	6.8859	0.0487	6.3936	0.0473
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.3240	n.a.	0.3229	n.a.	0.3221	n.a.
$\bar{H} = 0.11$	$E[R_{t+1}]$	11.3042	1.0459	10.0769	1.0423	9.2241	1.0396
	$\sigma(R_{t+1})$	32.3859	n.a.	28.8049	n.a.	26.3140	n.a.
	$R_{t,t+1}$	0.5963	0.9829	0.5819	0.9821	0.5658	0.9812
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	10.7080	0.0630	9.4950	0.0602	8.6582	0.0584
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.3306	n.a.	0.3296	n.a.	0.3290	n.a.
$\bar{H} = 0.17$	$E[R_{t+1}]$	16.2082	1.0574	13.7520	1.0521	12.1889	1.0483
	$\sigma(R_{t+1})$	46.7126	n.a.	39.5389	n.a.	34.9735	n.a.
	$R_{t,t+1}$	0.6310	0.9848	0.5948	0.9828	0.5778	0.9819
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	15.5772	0.0727	13.1572	0.0693	11.6112	0.0664
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.3335	n.a.	0.3328	n.a.	0.3320	n.a.

Equity Premium

Table 7: Equity premium and Sharpe ratio in period immediately before shutdown

		$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
		Eq. prem.	Sharpe ratio	Eq. prem.	Sharpe ratio	Eq. prem.	Sharpe ratio
$\bar{H} = 0.05$	period 1	0.0507	0.3240	0.0487	0.3229	0.0473	0.3221
	before shutdown	0.0710	0.3356	0.0707	0.3337	0.0706	0.3370
	percent bigger	0.6617	0.5410	0.6843	0.5570	0.6960	0.5690
	percent smaller	0.1763	0.2970	0.1613	0.2887	0.1563	0.2833
$\bar{H} = 0.11$	period 1	0.0630	0.3306	0.0602	0.3296	0.0584	0.3290
	before shutdown	0.0679	0.3339	0.0667	0.3333	0.0664	0.3343
	percent bigger	0.3740	0.3760	0.4023	0.3970	0.4227	0.4153
	percent smaller	0.2637	0.2617	0.2497	0.2550	0.2417	0.2490
$\bar{H} = 0.17$	period 1	0.0727	0.3335	0.0693	0.3328	0.0664	0.3320
	before shutdown	0.0709	0.3353	0.0686	0.3354	0.0673	0.3348
	percent bigger	0.2027	0.2740	0.2253	0.2937	0.2543	0.3070
	percent smaller	0.2770	0.2057	0.2760	0.2077	0.2650	0.2123

Pricing of "safe" bonds

$$p_{t,j} = \begin{cases} 1 & \text{if} \quad j = 0 \\ \beta \dfrac{E_t\left[u'\left(c_{2,t+1}\right)p_{t+1,j-1}\right]}{u'\left(c_{1,t}\right)} & \text{if} \quad j \geq 1 \end{cases} \qquad \forall t$$

Pricing of "safe" bonds

Table 4: Term structure of prices and interest rates

		$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
	s	$p_{t,t+s}$	$r_{t,t+s}$ APR	$p_{t,t+s}$	$r_{t,t+s}$ APR	$p_{t,t+s}$	$r_{t,t+s}$ APR
$\bar{H} = 0.05$	0	1	0	1	0	1	0
	1	1.5556	-0.0146	1.5897	-0.0153	1.6190	-0.0159
	2	0.3115	0.0196	0.3466	0.0178	0.3782	0.0163
	3	0.0385	0.0369	0.0441	0.0353	0.0493	0.0340
	4	0.0088	0.0403	0.0096	0.0395	0.0099	0.0392
	5	0.0049	0.0360	0.0063	0.0344	0.0063	0.0344
	6	0.0014	0.0372	0.0025	0.0338	0.0024	0.0342
$\bar{H} = 0.11$	0	1	0	1	0	1	0
	1	1.6771	-0.0171	1.7186	-0.0179	1.7673	-0.0188
	2	0.1543	0.0316	0.1793	0.0291	0.2137	0.0261
	3	0.0074	0.0560	0.0092	0.0535	0.0118	0.0506
	4	0.0072	0.0420	0.0077	0.0414	0.0085	0.0405
	5	0.0029	0.0397	0.0032	0.0390	0.0038	0.0379
	6	4.3×10^{-4}	0.0440	5.0×10^{-4}	0.0431	5.9×10^{-4}	0.0421
$\bar{H} = 0.17$	0	1	0	1	0	1	0
	1	1.5848	-0.0152	1.6811	-0.0172	1.7308	-0.0181
	2	0.0092	0.0812	0.0156	0.0718	0.0359	0.0570
	3	0.0010	0.0794	0.0031	0.0663	0.0038	0.0639
	4	9.0×10^{-5}	0.0808	0.0046	0.0459	0.0049	0.0453
	5	1.3×10^{-5}	0.0780	0.0010	0.0470	0.0011	0.0463
	6	1.7×10^{-5}	0.0630	5.6×10^{-5}	0.0558	6.1×10^{-5}	0.0554

Fiscal Gap

$$\text{fiscal gap}_t = x_t \equiv \frac{NPV(\bar{H}) - NPV(H_t)}{NPV(Y_t)}$$

$$x_t = \frac{\sum_{s=0}^{\infty} d_{t+s}\bar{H} - \sum_{s=0}^{\infty} d_{t+s}E\left[H_s\right]}{\sum_{s=0}^{\infty} d_{t+s}E\left[Y_s\right]}$$

Fiscal Gap

Table 5: Measures of the fiscal gap as percent of NPV(GDP)

	$k_{2,0} = 0.11$		$k_{2,0} = 0.14$		$k_{2,0} = 0.17$	
	fgap 1	fgap 2	fgap 1	fgap 2	fgap 1	fgap 2
	fgap 3	fgap 4	fgap 3	fgap 4	fgap 3	fgap 4
$\bar{H} = 0.05$	0.0037	0.0078	0.0034	0.0096	0.0033	0.0118
	0.0033	0.0035	0.0030	0.0032	0.0028	0.0029
$\bar{H} = 0.11$	0.0192	0.0373	0.0175	0.0427	0.0164	0.555
	0.0168	0.0176	0.0152	0.0159	0.0140	0.0147
$\bar{H} = 0.17$	0.0474	0.0876	0.0421	0.1041	0.0385	0.1171
	0.0408	0.0426	0.0361	0.0378	0.0328	0.0344

Fiscal gap 1 uses the gross sure return rates $R_{t,t+s}$ from Table 4 as the discount rates for NPV calculation. Fiscal gap 2 uses the current period gross return on capital R_t from the model as the constant discount rate. Fiscal gap 3 uses the International Monetary Fund (2009) method of an annual discount rate equal to 1 plus the average percent change in GDP plus 0.01 (≈ 2.05). And fiscal gap 4 uses the Gohkhale and Smetters (2007) method of an annual discount rate equal to 1 plus 0.0365 (≈ 1.93).

Equilibrium with regime switch: 80% tax

$$H_t = \begin{cases} \bar{H} & \text{if} \quad w_s > \bar{H} \quad \text{for all} \quad s \leq t \\ 0.8 w_t & \text{if} \quad w_s \leq \bar{H} \quad \text{for any} \quad s \leq t \end{cases}$$

$$u'\left(c_{1,t}\right) = \beta E_{z_{t+1}|z_t}\Bigg[\left(1 + \alpha e^{z_{t+1}}\left[(1-\alpha)e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right]^{\alpha-1} - \delta\right) \times \ldots$$

$$u'\left(\left[1 + \alpha e^{z_{t+1}}\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right)^{\alpha-1} - \delta\right]\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right) + H_{t+1}\right)\Bigg]$$

Simulation with 80% tax regime shift

Table 8: Initial values relative to median values from regime 1: 80-percent tax

	$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
	w_{med}	k_{med}	w_{med}	k_{med}
	$\bar{H}/w_{med}$	$k_{2,0}/k_{med}$	$\bar{H}/w_{med}$	$k_{2,0}/k_{med}$
$\bar{H} = 0.09$	0.2827	0.0878	0.2883	0.0895
	0.3184	0.9967	0.3121	1.5642
$\bar{H} = 0.11$	0.2944	0.0886	0.3021	0.0899
	0.3736	0.9873	0.3641	1.5567

w_{med} is the median wage and k_{med} is the median capital stock across all 3,000 simulations before the regime switch (in regime 1).

Simulation with 80% tax regime shift

Table 9: Periods to regime switch simulation statistics: 80-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		Periods	CDF	Periods	CDF
$\bar{H} = 0.09$	min	1	0.3677	1	0.3340
	med	2	0.5727	2	0.5470
	mean	3.25	0.7124	3.40	0.7066
	max	24	1.0000	25	1.0000
$\bar{H} = 0.11$	min	1	0.4517	1	0.4060
	med	2	0.6430	2	0.6127
	mean	2.78	0.7314	2.94	0.7244
	max	24	1.0000	24	1.0000

Equity Premium with 80% tax regime shift

Table 12: Components of the equity premium with regime switching: 80-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		30-year	annual	30-year	annual
$\bar{H} = 0.09$	$E[R_{t+1}]$	17.1319	1.0592	12.9708	1.0503
	$\sigma(R_{t+1})$	49.4105	n.a.	37.2570	n.a.
	$R_{t,t+1}$	3.0589	1.0380	2.1526	1.0259
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	14.0731	0.0213	10.8182	0.0244
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.2848	n.a.	0.2904	n.a.
$\bar{H} = 0.11$	$E[R_{t+1}]$	22.1773	1.0678	16.0801	1.0572
	$\sigma(R_{t+1})$	64.1466	n.a.	46.3385	n.a.
	$R_{t,t+1}$	4.2960	1.0498	3.0985	1.0384
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	17.8813	0.0180	12.9816	0.0188
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.2788	n.a.	0.2801	n.a.

Equity Premium with 80% tax regime shift

Table 13: Equity premium and Sharpe ratio in period immediately before regime switch: 80-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		Eq. prem.	Sharpe ratio	Eq. prem.	Sharpe ratio
$\bar{H} = 0.09$	period 1	0.0213	0.2848	0.0244	0.2904
	before shutdown	0.0737	0.3231	0.0773	0.3272
	percent bigger	0.6287	0.5353	0.6600	0.5523
	percent smaller	0.0037	0.0970	0.0060	0.1137
$\bar{H} = 0.11$	period 1	0.0180	0.2788	0.0188	0.2801
	before shutdown	0.0637	0.3152	0.0675	0.3201
	percent bigger	0.5457	0.4770	0.5910	0.5180
	percent smaller	0.0027	0.0713	0.0030	0.0760

Fiscal Gap with 80% tax regime shift

Table 10: Term structure of prices and interest rates in regime switching economy: 80-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
	s	$p_{t,t+s}$	$r_{t,t+s}$ APR	$p_{t,t+s}$	$r_{t,t+s}$ APR
$\bar{H} = 0.09$	0	1	0	1	0
	1	0.3269	0.0380	0.4645	0.0259
	2	1.1607	-0.0025	2.5547	-0.0155
	3	0.3534	0.0116	0.4138	0.0099
	4	0.6753	0.0033	1.2121	-0.0016
	5	0.4117	0.0059	0.2982	0.0081
	6	0.1304	0.0114	0.4420	0.0045
$\bar{H} = 0.11$	0	1	0	1	0
	1	0.2328	0.0498	0.3227	0.0384
	2	1.3063	-0.0044	1.5334	-0.0071
	3	2.5521	-0.0104	1.5811	-0.0051
	4	0.2606	0.0113	0.8424	0.0014
	5	1.7532	-0.0037	1.8832	-0.0042
	6	0.3762	0.0054	0.4895	0.0040

Fiscal Gap with 80% tax regime shift

Table 11: Measures of the fiscal gap with regime switching as percent of NPV(GDP): 80-percent tax

	$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
	fgap 1	fgap 2	fgap 1	fgap 2
	fgap 3	fgap 4	fgap 3	fgap 4
$\bar{H} = 0.09$	-0.0519	0.0003	-0.0343	-0.0157
	0.0067	0.0066	0.0052	0.0051
$\bar{H} = 0.11$	-0.0861	0.0057	-0.0749	-0.0075
	0.0130	0.0129	0.0103	0.0102

Fiscal gap 1 uses the gross sure return rates $R_{t,t+s}$ from Table 4 as the discount rates for NPV calculation. Fiscal gap 2 uses the current period gross return on capital R_t from the model as the constant discount rate. Fiscal gap 3 uses the International Monetary Fund (2009) method of an annual discount rate equal to 1 plus the average percent change in GDP plus 0.01 ($\approx$ 2.05). And fiscal gap 4 uses the Gohkhale and Smetters (2007) method of an annual discount rate equal to 1 plus 0.0365 ($\approx$ 1.93).

Equilibrium with regime switch: 30% tax

$$H_t = \begin{cases} \bar{H} & \text{if} \quad w_s > \bar{H} \quad \text{for all} \quad s \leq t \\ 0.3w_t & \text{if} \quad w_s \leq \bar{H} \quad \text{for any} \quad s \leq t \end{cases}$$

$$u'\left(c_{1,t}\right) = \beta E_{z_{t+1}|z_t}\Bigg[\left(1 + \alpha e^{z_{t+1}}\left[(1-\alpha)e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right]^{\alpha-1} - \delta\right) \times ...$$

$$u'\left(\left[1 + \alpha e^{z_{t+1}}\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right)^{\alpha-1} - \delta\right]\left([1-\alpha]e^{z_t}k_{2,t}^{\alpha} - H_t - c_{1,t}\right) + H_{t+1}\right)\Bigg]$$

Simulation with 30% tax regime shift

Table 14: Initial values relative to median values from regime 1: 30-percent tax

	$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
	w_{med}	k_{med}	w_{med}	k_{med}
	$\bar{H}/w_{med}$	$k_{2,0}/k_{med}$	$\bar{H}/w_{med}$	$k_{2,0}/k_{med}$
$\bar{H} = 0.09$	0.2828	0.0864	0.2880	0.0885
	0.3183	1.0130	0.3125	1.5819
$\bar{H} = 0.11$	0.2963	0.0868	0.3051	0.0877
	0.3712	1.0082	0.3605	1.5970

w_{med} is the median wage and k_{med} is the median capital stock across all 3,000 simulations before the regime switch (in regime 1).

Simulation with 30% tax regime shift

Table 15: Periods to regime switch simulation statistics: 30-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		Periods	CDF	Periods	CDF
$\bar{H} = 0.09$	min	1	0.3677	1	0.3340
	med	2	0.5697	2	0.5440
	mean	3.28	0.7116	3.42	0.7054
	max	24	1.0000	25	1.0000
$\bar{H} = 0.11$	min	1	0.4517	1	0.4060
	med	2	0.6390	2	0.6080
	mean	2.80	0.7302	2.96	0.7228
	max	24	1.0000	24	1.0000

Equity Premium with 30% tax regime shift

Table 18: Components of the equity premium with regime switching: 30-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		30-year	annual	30-year	annual
$\bar{H} = 0.09$	$E[R_{t+1}]$	17.1319	1.0592	12.9708	1.0503
	$\sigma(R_{t+1})$	49.4105	n.a.	37.2570	n.a.
	$R_{t,t+1}$	2.9703	1.0370	2.2457	1.0273
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	14.1616	0.0223	10.7251	0.0229
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.2866	n.a.	0.2879	n.a.
$\bar{H} = 0.11$	$E[R_{t+1}]$	22.1773	1.0678	16.0801	1.0572
	$\sigma(R_{t+1})$	64.1466	n.a.	46.3385	n.a.
	$R_{t,t+1}$	4.2986	1.0498	3.1006	1.0384
	Equity premium $E[R_{t+1}] - R_{t,t+1}$	17.8787	0.0180	12.9795	0.0187
	Sharpe ratio $\frac{E[R_{t+1}]-R_{t,t+1}}{\sigma(R_{t+1})}$	0.2787	n.a.	0.2801	n.a.

The gross risky one-period return on capital is $R_{t+1} = 1 + r_{t+1} - \delta$. The annualized gross risky one-period return is $(R_{t+1})^{1/30}$. The expected value and standard deviation of the gross risky one-period return R_{t+1} are calculated as the average and standard deviation, respectively, across simulations. The annual equity premium is the expected value of the annualized risky return in the next period minus the annualized return on the one-period riskless bond.

Equity Premium with 30% tax regime shift

Table 19: Equity premium and Sharpe ratio in period immediately before regime switch: 30-percent tax

		$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
		Eq. prem.	Sharpe ratio	Eq. prem.	Sharpe ratio
$\bar{H} = 0.09$	period 1	0.0223	0.2866	0.0229	0.2879
	before shutdown	0.0819	0.3266	0.0848	0.3276
	percent bigger	0.6290	0.5367	0.6617	0.5660
	percent smaller	0.0033	0.0957	0.0043	0.1000
$\bar{H} = 0.11$	period 1	0.0180	0.2787	0.0187	0.2801
	before shutdown	0.0701	0.3173	0.0739	0.3199
	percent bigger	0.5460	0.4807	0.5913	0.5153
	percent smaller	0.0023	0.0677	0.0027	0.0787

Fiscal Gap with 30% tax regime shift

Table 16: Term structure of prices and interest rates in regime switching economy: 30-percent tax

	s	$k_{2,0} = 0.0875$ $p_{t,t+s}$	$k_{2,0} = 0.0875$ $r_{t,t+s}$ APR	$k_{2,0} = 0.14$ $p_{t,t+s}$	$k_{2,0} = 0.14$ $r_{t,t+s}$ APR
$\bar{H} = 0.09$	0	1	0	1	0
	1	0.3367	0.0370	0.4453	0.0273
	2	6.0523	-0.0296	8.0476	-0.0342
	3	2.0412	-0.0079	6.7823	-0.0210
	4	8.5075	-0.0177	16.8480	-0.0233
	5	15.9863	-0.0183	25.3856	-0.0213
	6	7.5427	-0.0112	6.1479	-0.0100
$\bar{H} = 0.11$	0	1	0	1	0
	1	0.2326	0.0498	0.3225	0.0384
	2	7.3132	-0.0326	7.1394	-0.0322
	3	11.5166	-0.0268	5.8534	-0.0194
	4	16.4777	-0.0231	12.1299	-0.0206
	5	9.2992	-0.0148	15.5375	-0.0181
	6	23.4145	-0.0174	31.7886	-0.0190

Fiscal Gap with 30% tax regime shift

Table 17: Measures of the fiscal gap with regime switching as percent of NPV(GDP): 30-percent tax

	$k_{2,0} = 0.0875$		$k_{2,0} = 0.14$	
	fgap 1 fgap 3	fgap 2 fgap 4	fgap 1 fgap 3	fgap 2 fgap 4
$\bar{H} = 0.09$	-0.1241 0.0099	0.0002 0.0096	-0.1214 0.0079	-0.0148 0.0078
$\bar{H} = 0.11$	-0.1194 0.0172	0.0064 0.0171	-0.1190 0.0139	-0.0108 0.0138

Fiscal gap 1 uses the gross sure return rates $R_{t,t+s}$ from Table 4 as the discount rates for NPV calculation. Fiscal gap 2 uses the current period gross return on capital R_t from the model as the constant discount rate. Fiscal gap 3 uses the International Monetary Fund (2009) method of an annual discount rate equal to 1 plus the average percent change in GDP plus 0.01 ($\approx$ 2.05). And fiscal gap 4 uses the Gohkhale and Smetters (2007) method of an annual discount rate equal to 1 plus 0.0365 ($\approx$ 1.93).