Analyzing Tax Policy Changes Using a Stochastic OLG Model with Heterogeneous Households[*]

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Abstract

This paper describes a stochastic overlapping generations (OLG) model with heterogeneous agents, which is one of five models used at the Congressional Budget Office for recent fiscal policy analyses. In this model economy, households are heterogeneous with respect to their age, wealth holding, and working ability, and working history, and households receive idiosyncratic working ability shocks every year. The paper also explains the choice of parameters, the characteristics of the baseline economy, and the features of the model through policy experiments under several different assumptions. The solution algorithm is also shown in the Appendix.

Journal of Economic Literature Classification Numbers: D9, H3, H6.

Key Words: overlapping generations; dynamic general equilibrium.

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1 Introduction

The present paper describes a stochastic overlapping generations (OLG) model, which is one of five macroeconomic models used in Congressional Budget Office (2003a) and for several other fiscal policy analyses at the Congressional Budget Office.[1]

The model is a life-cycle general equilibrium growth model, in which Households are heterogeneous with respect to their ages, working abilities (measured by hourly wages), wealth holdings, and earnings histories (which determine their Social Security benefits). Every year a large number of households of age 20 enter the model economy. For simplicity, a household is assumed to be a married couple with some children. At the beginning of each year, households below age 80 receive idiosyncratic working ability shocks (which follow a first-order Markov process). There are 8 distinct working ability levels for each age below 80. At the end of each age a fraction of households die, according to the mortality rate of each age. Households can live at most 110 years, that is, the mortality rate at the end of age 109 is one.

Each household (with different age, working ability, wealth holding, and earnings history) chooses its optimal consumption, labor supply (working hours), and savings, taking series of current and future factor prices (such as the interest rate and wage rate) and policy variables (such as marginal income tax rates) as given. Households in the model expect rationally those future factor prices and policy variables by using the information of the government policy schedule (whether deficit financing or balanced budget, or whether tax rates are raised or government consumption is cut after several years, etc.) and the current distribution of households. Because there are no aggregate shocks in the model, households can actually foresight those future factor prices and policy variables. But, they still do not know their own future working ability and mortality.

The utility function of a household is a combination of Cobb-Douglas and CRRA (constant relative risk aversion). Government consumption is not included in the utility function, so it is assumed to be a waste, because the effect of government consumption on the well

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[1]For example, a memo distributed at the CBO Director's Conference on Dynamic Scoring (August 7, 2002). The other four macroeconomic models used at CBO are a Solow growth model, an infinite-horizon (Ramsey) growth model, the Global Insight model, and the Macroeconomic Advisers model.

being a household can possibly differ across households and it is hard to parameterize it in the utility function. One of the easiest alternatives is assuming government consumption a perfect substitute of private goods. In this case, we can use a lump-sum transfer (tax) as the proxy of government consumption increase (cut).

The model has a representative (but perfectly-competitive) firm with Cobb-Douglas production technology. Regarding the openness of the economy, the model assumes two polar cases—a closed economy and a small open economy. In a closed economy, no international capital flow is assumed, and trade surplus (deficit) is assumed to be zero. The interest rate and the wage rate are determined by domestic capital stock (which is equal to the sum of total private wealth and net government wealth) and labor supply. In a small open economy, a perfectly flexible international capital flow is assumed. The interest rate and the wage rate are fixed at their international levels. Domestic capital stock is determined by the labor supply of the economy, and the difference between domestic capital and national wealth (the sum of private wealth and net government wealth) are filled up by international capital inflow (or outflow).

The model includes progressive federal income tax, flat (but progressive) state income tax, and Social Security system calibrated to those of the United States. For federal income tax, the statutory marginal tax rates are modified by two adjustment factors so that the effective tax rates on labor income and capital income are roughly the same as those in the U.S. economy. For the Social Security system, the payroll tax for both OASDI and HI are assumed, and OASDI benefits are assumed, but HI benefits are treated as government consumption (a waste) rather than transfers to households.

To solve a dynamic model for equilibrium, the model economy has to be on a balanced growth path with constant per-capita real growth rate and population growth rate in the long run. To make the economy return to a balanced growth path, we need to make some future financing assumption to stabilize the debt-GDP ratio at some time in the future. (When the baseline economy is sustainable, i.e., it is stable in the long run, the alternative economy with any tax cuts or spending increases is not sustainable unless those policy changes are self financing. So, we need to make additional financing assumption beyond the 10-year budget window.)

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In the model, no intergenerational altruism is assumed. All of the bequests in the model are accidental, due to uncertain life span. For simplicity, the wealth left by the deceased households are collected and distributed to the working-age households (ages 20 to 64) in a lump-sum manner. Each working-age households expect rationally the future accidental inheritances when it makes a decision on consumption, labor supply, and savings.

The rest of the paper is laid out as follows: Section 2 describes the model, Section 3 explains the calibration of the model, Section 4 shows the characteristics of the baseline economy very briefly, and Section 5 shows a policy experiment—a 10 percent marginal rates cut—with 50 different assumptions. The Appendix explain the algorithm of computing equilibria and the adjustment of government bond yields in some experiments.

2 Model

The model is a standard general equilibrium growth model with uninsurable idiosyncratic shocks (also known as Bewley model), which is similar to the models in Aiyagari (1994), Huggett (1996), and many others. The present model is also an extension of those in Nishiyama (2002) and Nishiyama and Smetters (2003).[2]

The economy consists of three sectors: heterogeneous households with elastic labor supply; a perfectly competitive representative firm with constant-returns-to-scale production technology; and a government with a full commitment technology. Time is discrete, and a period of the model corresponds to a year.

2.1 The Household Sector

Households are heterogeneous with respect to ages i, working abilities e_i (measured by their hourly wages), beginning-of-period wealth holdings a_i, and average historical earnings b_i that determine their Social Security benefits. Every year, a large number (normalized to unity) of new households of age 20 enter into the economy. The population of this economy is normalized by a constant population growth rate ν. A household of age i observes idiosyncratic working ability shock, e_i, at the beginning of each year and chooses its optimal consumption c_i, working hours h_i, and end-of-period wealth holding a_{i+1}, taking the

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[2]The model is also influenced by Auerbach and Kotlikoff (1987) in many aspects.

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government's policy rule and series of factor prices and the government's policy variables as given.[34] At the end of each year, a fraction of households die. Households are alive at most up to 109 years old, and the mortality rate at the end of age 109 is one. For simplicity, all households are assumed to be two-earner married couples of the same age.

2.1.1 The Household's Problem

Let $\mathbf{s}_i$ denote the state of an age i household,

$$\mathbf{s}_i = (i, e_i, a_i, b_i), \tag{1}$$

where $i \in I = \{20, ..., 109\}$ is the household's age, $e_i \in E = [e^{\min}, e^{\max}]$ is its working ability (measured by hourly wage), $a_i \in A = [a^{\min}, a^{\max}]$ is its beginning-of-period wealth, and $b_i \in B = [b^{\min}, b^{\max}]$ is its average historical earnings.[5] Let $\mathbf{S}_t$ denote the state of the economy at the beginning of year t,

$$\mathbf{S}_t = (x_t(\mathbf{s}_i), W_{G,t}), \tag{2}$$

where $x_t(\mathbf{s}_i)$ is the joint distribution of households with $\mathbf{s}_i \in I \times E \times A \times B$, and $W_{G,t}$ is the beginning-of-period net government's wealth. Let $\mathbf{\Psi}_t$ denote a series of government policy rules known at the beginning of year t,[6]

$$\mathbf{\Psi}_t = \{W_{G,s+1}, C_{G,s}, tr_{LS,s}, \tau_{I,s}(.), \tau_{P,s}(.), tr_{SS,s}(.)\}_{s=t}^{\infty}, \tag{3}$$

where $C_{G,s}$ is government's consumption, $tr_{LS,s}$ is lump-sum transfers (lump-sum tax if negative), $\tau_{I,s}(.)$ is an income tax function, $\tau_{P,s}(.)$ is a payroll tax function for Social Security, and $tr_{SS,s}(.)$ is a Social Security benefit function.[7] The household's problem is

$$v(\mathbf{s}_i, \mathbf{S}_t; \mathbf{\Psi}_t) = \max_{c_i, h_i, a_{i+1}} u_i(c_i, h_i) + \beta \phi_i E\left[v(\mathbf{s}_{i+1}, \mathbf{S}_{t+1}; \mathbf{\Psi}_{t+1}) \mid e_i\right] \tag{4}$$

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[3]Because there are no aggregate shocks in the present model, households can perfectly foresight these factor prices and policy variables, using the current distribution of households and the current policy variables. But, they still do not know their own future working ability and mortality.

[4]In this model economy, the government does not solve its optimization problem. The government's policy rule is described as a set of tax and spending functions, which functional forms are possibly time variant, and a financing rule to satisfy its intertemporal budget constraint.

[5]The average historical earnings are used to calculate the Social Security benefits of each household. The variable b_i approximates the average indexed monthly earnings (AIME) multiplied 12 as of age i.

[6]At least one of the series in $\mathbf{\Psi}_t$ is unknown to the households, and it is rationally expected by them through the government's policy rule and intertemporal budget constraint.

[7]In this paper, the payroll tax function covers taxes for the Old-Age, Survivors, and Disability Insurance (OASDI) and Hospital Insurance (HI). For computational convenience, the function $\tau_{P,t}(.)$ denotes the OASDI-

subject to

$$a_{i+1} = \frac{1}{1+\mu} \{ w_t e_i h_i + (1+r_t)a_i - \tau_{I,t} \left(w_t e_i h_i, r_t a_i, tr_{SS,t}\left(i, b_i\right)\right) \tag{5}$$

$$-\tau_{P,t}\left(w_t e_i h_i\right) + tr_{SS,t}\left(i, b_i\right) + tr_{LS,t} - c_i \} \geq a^{\min},$$

$$a_{20} = 0, \quad a_{110} \geq 0,$$

where $u_i(.)$ is a period utility function of an age i household, β is the time-preference factor, ϕ_i is the survival rate, w_t is the wage rate per efficiency unit of labor, and r_t is the interest rate (the rate of return to capital).[8] Individual variables of the model are normalized by the steady-state per capita growth rate μ. Let $\pi_{i,i+1}\left(e_{i+1} \,|\, e_i\right)$ denote the conditional probability for the age $i+1$ working ability being e_{i+1} when the age i working ability is e_i. Then,

$$E\left[v\left(\mathbf{s}_{i+1}, \mathbf{S}_{t+1}; \mathbf{\Psi}_{t+1}\right)\,|\,e_i\right] = \int_E v\left(\mathbf{s}_{i+1}, \mathbf{S}_{t+1}; \mathbf{\Psi}_{t+1}\right)\pi_{i,i+1}\left(e_{i+1}\,|\,e_i\right)\mathrm{d}\,e_{i+1}. \tag{6}$$

At the beginning of the next period, the state of the household, the state of the economy, and the government policy rule become

$$\mathbf{s}_{i+1} = \left(i+1, e_{i+1}, a_{i+1} + q_t, b_{i+1}\right) \quad \text{with} \quad \pi_{i,i+1}\left(e_{i+1}\,|\,e_i\right), \tag{7}$$

$$\mathbf{S}_{t+1} = \left(x_{t+1}\left(.\right), W_{G,t+1}\right), \tag{8}$$

$$\mathbf{\Psi}_{t+1} = \{ W_{G,s+1}, C_{G,s}, tr_{LS,s}, \tau_{I,s}\left(.\right), \tau_{P,s}\left(.\right), tr_{SS,s}\left(.\right)\}_{s=t+1}^{\infty}, \tag{9}$$

where q_t denotes accidental bequests that a household receives at the end of the period, and net government wealth $W_{G,t+1}$ is determined by the government budget constraint. The average historical earnings b_i follows

$$b_{i+1} = \begin{cases} 0 & \text{if } i \leq 24 \\ \frac{1}{i-24}\{(i-25)b_i\frac{w_t}{w_{t-1}} + \min\left(w_t e_i h_i/2, weh_t^{\max}\right)\} & \text{if } 25 \leq i \leq 59 \\ b_i/(1+\mu) & \text{if } i \geq 60, \end{cases} \tag{10}$$

where $weh_t^{\max}$ is the Old-Age, Survivors, and Disability Insurance (OASDI) tax cap, which is \$80,400 in 2001. For simplicity, the model assumes that the highest 35 years of earnings correspond to those in ages between 25 and 59.[9]

HI tax levied to employees (a married couple) only. The payroll tax levied to their employers is included by multiplying the tax revenue by 2 when the aggregate tax revenue is calculated. For simplicity the Social Security benefit function $tr_{SS,s}\left(.\right)$ includes the OASDI benefits only and does not include Medicare and Medicaid (HI) benefits.

[8]So, $w_t e_i h_i$ is the earnings of a household of age i with working ability e_i in year t.

[9]Social Security benefits in the United States are computed on the basis of the highest 35 years of earnings,

2.1.2 The Measure of Households

Let $x_t(\mathbf{s}_i)$ denote the measure of households, and let $X_t(\mathbf{s}_i)$ be the corresponding cumulative measure. The measure of households is adjusted by the steady-state population growth rate ν. The population of age 20 households is normalized to be unity in the baseline economy on the balanced growth path, that is,

$$\int_E dX_t(20, e_{20}, 0, 0) = 1. \tag{11}$$

Let $\mathbf{1}_{[a=y]}$ be an indicator function that returns 1 if $a = y$ and 0 if $a \neq y$. Then, the law of motion of the measure of households is, for $i \in I = \{20, ..., 109\}$,

$$x_{t+1}(\mathbf{s}_{i+1}) = \frac{\phi_i}{1+\nu} \int_{E \times A \times B} \mathbf{1}_{[a_{i+1}=a_{i+1}(\mathbf{s}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t)+q_t]} \tag{12}$$

$$\times \mathbf{1}_{[b_{i+1}=b_{i+1}(w_t e_i h_i(\mathbf{s}_i, \mathbf{S}_t; \boldsymbol{\Psi}), b_i)]} \pi_{i,i+1}(e_{i+1} \mid e_i) dX_t(\mathbf{s}_i).$$

For simplicity, accidental bequests due to uncertain life span are captured by the government and distributed to all surviving working-age households in a lump-sum manner. The accidental bequests per household at the end of year t is

$$q_t = \frac{\sum_{i=20}^{109}(1-\phi_i)\int_{E \times A \times B} a_{i+1}(\mathbf{s}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t) dX_t(\mathbf{s}_i)}{\sum_{i=20}^{64} \phi_i \int_{E \times A \times B} dX_t(\mathbf{s}_i)}. \tag{13}$$

The steady-state condition is

$$\mathbf{S}_{t+1} = \mathbf{S}_t \tag{14}$$

for all t and $\mathbf{s}_i \in I \times E \times A \times B$.

2.2 The Firm

National wealth W_t is the sum of total private wealth and government's net wealth $W_{G,t}$. Total labor supply L_t is measured in efficiency units.

$$W_t = \sum_{i=20}^{109} \int_{E \times A \times B} a_i \, dX_t(\mathbf{s}_i) + W_{G,t}, \tag{15}$$

$$L_t = \sum_{i=20}^{109} \int_{E \times A \times B} e_i \, h_i(\mathbf{s}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t) \, dX_t(\mathbf{s}_i). \tag{16}$$

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adding an additional state variable to the model. Earnings before age 60 are wage indexed and earnings after age 60 are price indexed.

There is a perfectly competitive representative firm in this economy. In a closed economy, capital stock is equal to national wealth, that is, $K_t = W_t$, and gross national product Y_t is determined by a constant-returns-to-scale production function,

$$Y_t = F(K_t, L_t). \tag{17}$$

The profit-maximizing condition of the firm is

$$r_t + \delta = F_K(K_t, L_t), \tag{18}$$

$$(1 + \tau'_{P,t})w_t = F_L(K_t, L_t), \tag{19}$$

where δ is the depreciation rate of capital and $\tau'_{P,t}$ is the marginal payroll tax rate.[10]

In a small open economy, factor prices, r_t^* and w_t^* are fixed at international levels, and domestic capital stock $K_{D,t}$ and labor supply L_t are determined so that the firm's profit maximizing condition satisfies,

$$r_t^* + \delta = F_K(K_{D,t}, L_t), \tag{20}$$

$$(1 + \tau'_{P,t})w_t^* = F_L(K_{D,t}, L_t). \tag{21}$$

Gross domestic product $Y_{D,t}$ is determined by the production function,

$$Y_{D,t} = F(K_{D,t}, L_t),$$

and gross national product Y_t is determined by

$$Y_t = (r_t^* + \delta) W_t + (1 + \tau'_{P,t})w_t^* L_t.$$

Net foreign investment is shown by the difference between national wealth and domestic capital stock, that is, $W_t - K_{D,t}$.

2.3 The Government

Government tax revenue consists of federal income tax $T_{I,t}$ and payroll tax for Social Security $T_{P,t}$. These revenues are

$$T_{I,t} = \sum_{i=20}^{109} \int_{E \times A \times B} \tau_{I,t}\left(w_t e_i h_i(\mathbf{s}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t), r_t a_i, tr_{SS,t}(i, b_i)\right) \mathrm{d}X_t(\mathbf{s}_i), \tag{22}$$

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[10]U.S. payroll taxes are divided equally between firms and employees. While the incidence of the tax does not depend on this division, the present model explicitly includes the division for calibration purposes.

$$T_{P,t} = 2 \times \sum_{i=20}^{109} \int_{E \times A \times B} \tau_{p,t} \left(w_t e_i h_i(\mathbf{s}_i, \mathbf{S}_t; \mathbf{\Psi}_t) \right) \, \mathrm{d}X_t \left(\mathbf{s}_i \right). \tag{23}$$

Total lump-sum transfer $Tr_{LS,t}$ is

$$Tr_{LS,t} = tr_{LC,t} \sum_{i=20}^{109} \int_{E \times A \times B} \mathrm{d}X_t \left(\mathbf{s}_i \right), \tag{24}$$

and Social Security (OASDI) benefit expenditure $Tr_{SS,t}$ is

$$Tr_{SS,t} = \sum_{i=20}^{109} \int_{E \times A \times B} tr_{SS,t} \left(i, b_i \right) \, \mathrm{d}X_t \left(\mathbf{s}_i \right). \tag{25}$$

The law of motion of the government wealth (normalized by productivity growth and population growth) is

$$W_{G,t+1} = \frac{1}{(1+\mu)(1+\nu)} \left\{ (1+r_t)W_{G,t} + T_{I,t} + T_{P,t} - T_{LS,t} - Tr_{SS,t} - C_{G,t} \right\}, \tag{26}$$

where $C_{G,t}$ is government consumption.

2.4 Recursive Competitive Equilibrium

Definition **Recursive Competitive Equilibrium (Steady State):** Let $\mathbf{s}_i = (i, e_i, a_i, b_i)$ be the individual state of households and let $\mathbf{\Psi}$ be the time-invariant government policy rules,

$$\mathbf{\Psi} = \{W_G, C_G, tr_{LS}, \tau_I(.), \tau_P(.), tr_{SS}(.)\}.$$

Factor prices (r, w); accidental bequests q; the policy variables (W_G, C_G, τ_{LS}); the parameters φ of policy functions $(\tau_I(.), \tau_P(.), tr_{SS}(.))$; the value function of households, $v(\mathbf{s}_i; \mathbf{\Psi})$; the decision rule of households,

$$\mathbf{d}(\mathbf{s}_i; \mathbf{\Psi}) = \{c_i(\mathbf{s}_i; \mathbf{\Psi}), h_i(\mathbf{s}_i; \mathbf{\Psi}), a_{i+1}(\mathbf{s}_i; \mathbf{\Psi})\};$$

and the measure of households, $x(\mathbf{s}_i)$, are in a steady-state recursive competitive equilibrium if, in every period, each household solves the utility maximization problem (1) – (5) taking $\mathbf{\Psi}$ as given; the firm solves the profit maximization problem, and the capital and labor markets clear, that is, (15) – (21) hold; the government policy rules satisfy (22) – (26); the goods market clears; and the measure of households is constant, that is, (14) holds.

***Definition* Recursive Competitive Equilibrium (Equilibrium Transition Path):** Let $\mathbf{s}_i = (i, e_i, a_i, b_i)$ be the individual state of households, let $\mathbf{S}_t = (x_t(\mathbf{s}_i), W_{G,t})$ be the aggregate state of the economy, and let $\mathbf{\Psi}_t$ be the government policy rules known at the beginning of year t,

$$\mathbf{\Psi}_t = \{W_{G,s+1}, C_{G,s}, tr_{LS,s}, \tau_{I,s}(.), \tau_{P,s}(.), tr_{SS,s}(.)\}_{s=t}^{\infty}.$$

A series of factor prices, accidental bequests, the policy variables, and the parameters of policy functions,

$$\mathbf{\Omega} = \{r_s, w_s, q_s, W_{G,s+1}, C_{G,s}, \tau_{LS,s}, \varphi_s\}_{s=t}^{\infty};$$

the value function of households, $\{v(\mathbf{s}_i, \mathbf{S}_s; \mathbf{\Psi}_s)\}_{s=t}^{\infty}$; the decision rule of households,

$$\{\mathbf{d}(\mathbf{s}_i, \mathbf{S}_s; \mathbf{\Psi}_s)\}_{s=t}^{\infty} = \{c_i(\mathbf{s}_i, \mathbf{S}_s; \mathbf{\Psi}_s), h_i(\mathbf{s}_i, \mathbf{S}_s; \mathbf{\Psi}_s), a_{i+1}(\mathbf{s}_i, \mathbf{S}_s; \mathbf{\Psi}_s)\}_{s=t}^{\infty};$$

and a series of the measure of households, $\{x_s(\mathbf{s}_i)\}_{s=t}^{\infty}$, are in a recursive competitive equilibrium if, in every period $s = t, ..., \infty$, each household solves the utility maximization problem (1) – (5) taking $\mathbf{\Psi}_t$ as given; the firm solves the profit maximization problem, and the capital and labor markets clear, that is, (15) – (21) hold; the government policy rules satisfy (22) – (26); and the goods market clears.

3 Calibration

Table 1 summarizes the parameter choices. For the baseline economy on a balanced growth path, the degree of time preference β is chosen so that the capital-output ratio is 2.74; total factor productivity A is chosen so that the wage rate equals unity, and the share parameter of consumption α is chosen so that the average annual working hours of married couples between the ages of 20 and 64 are consistent with U.S. data. The coefficient or relative risk aversion γ is set to either 4.0 or 2.0, following the previous literature. As explained below, a Cobb-Douglas-CRRA utility function and a Cobb-Douglas production function are used for the calibration.[11]

The following sections describe the choice of functional forms and parameter values, the choice of four target variables and values.

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[11]The calibration strategy is roughly the same as those in Nishiyama (2002) and Nishiyama and Smetters (2003), but many parameters are revised.

Table 1: Parameters

		Labor Supply Elasticity Assumption	
		(1) Low	(2) High
Time preference parameter	β	0.992	0.969
Share parameter for consumption	α	0.689	0.448
Coefficient of relative risk aversion	γ	4.0	2.0
Capital share of output	θ	0.30	0.30
Depreciation rate of capital stock	δ	0.047	0.047
Long-term real growth rate	μ	0.018	0.018
Population growth rate	ν	0.010	0.010
Total factor productivity	A	0.988	0.988

3.1 Households

Utility Function. The model has elastic labor supply and uses the following Cobb-Douglas utility function with constant relative risk aversion (CRRA),

$$u(c_i, h_i) = \frac{\left\{((1 + n_i/2)^{-\zeta} c_i)^\alpha (h_i^{\max} - h_i)^{1-\alpha}\right\}^{1-\gamma}}{1 - \gamma},$$

where γ is the coefficient of relative risk aversion, n_i is the number of dependent children, ζ is the consumption adjustment parameter, and $h_i^{\max}$ is the maximum working hours.[12] The coefficient of relative risk aversion is assumed to be either 4.0 or 2.0. The numbers of dependent children by age cohorts are calculated from the Panel Study of Income Dynamics (PSID) 1993 Family Data (see Table 2). The consumption adjustment parameter is assumed to be 0.6.[13]

The annual working hours in the model are the sum of the working hours of a husband and a wife. The average working hours of married households between ages 20 and 64 are 3,368 hours in the 1998 Survey of Consumer Finances (SCF). In the lower labor supply elasticity case, $h_i^{\max}$ is set to be 5,460 hours per couple, which is the 95th percentile of working hours in the 1998 SCF. In the higher labor supply elasticity case, $h_i^{\max}$ is set to be 8,760, which is simply calculated from two persons times 12 hours times 365 days. In this

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[12]In this setting, the growth-adjusted β becomes $\beta(1 + \mu)^{\alpha(1-\gamma)}$.

[13]When $\zeta = 0.6$, since $2^{0.6} = 1.517$, a married couple with two dependent children needs to consume 52 percent more than a married couple with no children does to attain the same level of utility if other things are equal.

Table 2: Number of People Under 18 Years of Age in a Married Household

Age cohorts	Number of people under age 18	Age cohorts	Number of people under age 18
20-24	0.895	45-49	1.011
25-29	1.149	50-54	0.445
30-34	1.617	55-59	0.188
35-39	1.905	60-64	0.094
40-44	1.649	65-plus	0.000*

Source: Previously used in Nishiyama and Smetters (2003). The authors' calculations from the Panel Study of Income Dynamics (PSID) 1993 Family Data.
*The number 0.000 for ages 65-plus is an assumption and not from PSID data.

calibration, the parameter α is chosen to be 0.689 or 0.448 so that average working hours of age 20 and age 64 become 3,368 hours in the steady-state baseline economy.

Working Ability. The working ability in this calibration corresponds to the hourly wage (labor income per hour) of each household in the 1998 SCF. The average hourly wage of a married couple (family members #1 and #2 in SCF) used for the calibration is calculated by

$$\text{Hourly Wage} = \frac{\text{Regular and Additional Salaries (\#1 + \#2) + Welfare or Assistance}}{\max\left\{\text{Working Hours (\#1 + \#2), 520}\right\}}.$$

To capture the earnings risk a household is exposed to more precisely, unemployment or worker's compensation, Temporary Assistance for Needy Families (TANF), food stamps, and other forms of welfare or assistance are added to the salaries before calculating the hourly wage. Table 3 shows the eight discrete levels of working abilities of five-year age cohorts.[14] Using a shape-preserving cubic spline interpolation, the working ability of each age cohort is obtained. The average hourly earnings of production workers have increased by 16.7 percent during the years from 1997 to 2001.[15] In the calibration, the numbers in the table are multiplied by 1.167 to convert the hourly wages in 1997 into those in 2001.

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[14]Here, the hourly wage of a household that works less than 520 hours (10 hours a week per couple) is assumed to be zero. In the real economy, some households have fairly high working ability but choose not to work (for example, because of schooling). One observation of the age 20-24 cohort, which has an hourly wage of $193.01, is ignored.

[15]Data source: Bureau of Labor Statistics.

Table 3: Working Abilities of a Household (in U.S. Dollars per Hour)

	Percentile	Age cohorts					
		20-24	25-29	30-34	35-39	40-44	45-49
e^1	0-20th	3.83	5.42	5.42	6.93	6.12	6.59
e^2	20-40th	7.07	8.64	9.76	11.28	11.36	12.70
e^3	40-60th	8.68	10.91	13.46	15.01	15.59	17.22
e^4	60-80th	10.67	14.01	18.08	19.96	22.09	23.22
e^5	80-90th	14.05	17.52	27.17	25.27	30.89	31.58
e^6	90-95th	18.20	22.48	33.71	33.38	48.59	44.31
e^7	95-99th	28.43	32.64	54.11	52.16	76.13	86.50
e^8	99-100th	36.81	46.09	167.15	186.47	221.34	301.99
	Percentile	Age cohorts					
		50-54	55-59	60-64	65-69	70-74	75-79
e^1	0-20th	5.48	3.52	0.00	0.00	0.00	0.00
e^2	20-40th	11.53	10.06	4.54	0.00	0.00	0.00
e^3	40-60th	16.16	14.26	11.18	2.82	0.00	0.00
e^4	60-80th	23.44	21.28	18.16	10.37	1.81	0.00
e^5	80-90th	32.14	30.93	28.56	19.48	12.57	0.00
e^6	90-95th	43.01	44.10	59.36	27.68	29.03	1.96
e^7	95-99th	78.61	85.29	96.22	59.34	64.91	14.25
e^8	99-100th	314.59	379.44	421.55	299.25	195.73	146.14

Source: Previously used in Nishiyama and Smetters (2003). The authors'
calculations from the 1998 SCF data.

Markov Transition Matrix. The Markov transition matrix, Γ, of working ability is cal-culated from the hourly wage of people ages 30-39 in 1991 in the PSID individual data. To make the working ability process more persistent, the matrix is calculated as the transition from the average of years 1989 and 1990 to the average of years 1990 and 1991.

$$\Gamma = \begin{pmatrix} 0.7674 & 0.2049 & 0.0183 & 0.0045 & 0.0049 & 0.0000 & 0.0000 & 0.0000 \\ 0.1810 & 0.6033 & 0.1844 & 0.0129 & 0.0000 & 0.0086 & 0.0046 & 0.0052 \\ 0.0388 & 0.1517 & 0.6768 & 0.1220 & 0.0011 & 0.0046 & 0.0050 & 0.0000 \\ 0.0126 & 0.0361 & 0.1039 & 0.7210 & 0.0980 & 0.0139 & 0.0145 & 0.0000 \\ 0.0000 & 0.0081 & 0.0332 & 0.2360 & 0.6306 & 0.0676 & 0.0145 & 0.0100 \\ 0.0000 & 0.0000 & 0.0000 & 0.0582 & 0.3224 & 0.5303 & 0.0891 & 0.0000 \\ 0.0007 & 0.0000 & 0.0000 & 0.0354 & 0.0000 & 0.2827 & 0.6433 & 0.0379 \\ 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.3553 & 0.6447 \end{pmatrix},$$

where $\Gamma(j,k) = \pi(e_{i+1} = e_{i+1}^k \mid e_i = e_i^j)$.[16]

Population Growth and Mortality. The population growth rate ν is assumed to be 1.0 percent per year in a balanced growth path. The survival rates ϕ_i at the end of age $i = \{20, ..., 109\}$ are the weighted average of males and females in 1998 from Social Security Administration (2001).[17] (See Table 4.) The survival rate at the end of age 109 is replaced by zero.

3.2 The Firm

Production Function. Production takes the Cobb-Douglas form,

$$F(K_t, L_t) = A_t K_t^\theta L_t^{1-\theta}.$$

To compute GNP, the model uses the sum of working hours in efficiency units as total labor supply L_t. The capital share of output θ is chosen by

$$\theta = 1 - \frac{\text{Compensation of Employees} + (1 - \theta) \times \text{Proprietors' Income}}{\text{National Income} + \text{Consumption of Fixed Capital}}.$$

The number of θ in 2000 is 0.30.[18] The annual growth rate μ is assumed to be 1.8 percent. The annual population growth rate ν is assumed to be 1.0 percent. Total factor productivity A is chosen to be 0.988 so that the wage per unit of efficient labor is normalized to be unity.

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[16]The Markov transition matrix is fairly stable across age cohorts, although the diagonal elements tend to be smaller in age 20s and slightly larger in age 50s.

[17]The numbers are calculated from Table 4.C6 in the Social Security Administration (2001).

[18]Data source: Bureau of Economic Analysis. The average of θ in years between 1996 and 2000 is 0.31.

Table 4: Survival Rates in the United States in 1998 (Weighted Average of Males and Females of Each Age)

Age	Survival Rate	Age	Survival Rate	Age	Survival Rate	Age	Survival Rate	Age	Survival Rate
20	0.999113	40	0.997978	60	0.989365	80	0.938048	100	0.676941
21	0.999066	41	0.997820	61	0.988361	81	0.931804	101	0.658846
22	0.999037	42	0.997654	62	0.987195	82	0.924980	102	0.639629
23	0.999028	43	0.997465	63	0.985840	83	0.917566	103	0.619216
24	0.999032	44	0.997267	64	0.984324	84	0.909481	104	0.597532
25	0.999043	45	0.997044	65	0.982631	85	0.900623	105	0.574495
26	0.999049	46	0.996797	66	0.980851	86	0.890904	106	0.550021
27	0.999041	47	0.996534	67	0.979101	87	0.880258	107	0.524022
28	0.999014	48	0.996258	68	0.977433	88	0.868650	108	0.496402
29	0.998970	49	0.995960	69	0.975763	89	0.856070	109	0.467066
30	0.998919	50	0.995626	70	0.973892	90	0.842518		
31	0.998865	51	0.995247	71	0.971745	91	0.828007		
32	0.998804	52	0.994823	72	0.969406	92	0.812554		
33	0.998735	53	0.994352	73	0.966856	93	0.796181		
34	0.998660	54	0.993826	74	0.964033	94	0.778913		
35	0.998573	55	0.993231	75	0.960839	95	0.761457		
36	0.998475	56	0.992570	76	0.957219	96	0.744011		
37	0.998368	57	0.991857	77	0.953175	97	0.726790		
38	0.998250	58	0.991094	78	0.948673	98	0.710031		
39	0.998122	59	0.990263	79	0.943665	99	0.693980		

Source: Previously used in Nishiyama and Smetters (2003). The authors' calculations from the Social Security Administration (2001). In the calibration, the survival rate at the end of age 109 is set to zero.

Fixed Capital and Private Wealth. Fixed capital K for the calibration is the sum of private fixed assets and government fixed assets. In 2000, private fixed assets are \$21,165 billion, government fixed assets are \$5,743 billion, and the government debt held by the public is \$3,410 billion.[19] From these numbers, the government net wealth is set to a 9.5 percent of total private wealth in the initial steady-state economy. In 2000, the capital-GDP ratio is 2.74. The time preference parameter β is chosen so that the capital-GDP ratio of the steady state economy (a balanced growth path) is 2.74.

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[19]Data sources: Bureau of Economic Analysis.

The Depreciation Rate of Fixed Capital. The depreciation rate of fixed capital δ is chosen by the steady-state condition,

$$\delta = \frac{\text{Total Gross Investment}}{\text{Fixed Capital}} - \mu - \nu.$$

In 2000, private gross fixed investment accounted for 17.2 percent of GDP, and government (federal and state) gross investment accounted for 3.3 percent of GDP.[20] When the capital-output ratio is 2.74, the ratio of gross investment to fixed capital is 7.5 percent. Subtracting the productivity and population growth rates, the annual depreciation rate is assumed to be 4.7 percent.

3.3 Taxes and Transfers

Income Taxes. To impose a steady-state condition to the baseline economy, the model uses the federal income tax schedule in 2006. Because all of the individual variables are growth adjusted to those in the 2001 economy, the model uses the tax brackets in 2001.[21] For simplicity, all of the households in the model are assumed to be married households that file tax returns jointly. The adjusted gross income is the sum of labor income and capital income. To adjust the effective capital income tax rates at lower levels than labor income tax rates, the taxable capital income ratio 0.700 is multiplied to the capital income.[22] For elderly households, a part of Social Security benefits are included to the adjusted gross income.[23] Then, following the tax schedule in 2001, a standard deduction of $7,600, the exemptions $5,800 for a married couple, and the exemptions for dependant children—$2,900 per capita—are deducted to calculate taxable income. The average numbers of dependent children are in Table 2.

Because economic income is higher than taxable income, the effective marginal tax rates are lower than the statutory ones. According to Congressional Budget Office (2003b), the

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[20]Data source: Bureau of Economic Analysis.

[21]According to "Economic Growth and Tax Relief Reconciliation Act of 2001—Conference Report," H.R. 1836, the tax brackets projected in 2006 are approximately 14.3 percent higher than those in 2001. This implies there is a real bracket creep between these years.

[22]The model assumed that corporate income is included into the capital income of households. Here, effective capital income and corporate tax rates are assumed to be about 30 percent lower than effective labor income tax rate.

[23]See Table 2.A32 in Social Security Administration (2001).

Table 5: Marginal Income Tax Rates

If taxable Income is		Marginal Income Tax Rate (%)	
2006	2001	Statutory	Effective
(Projected)	(Growth Adjusted)	rate	rate
$0-$12,000	$0-$10,500	10	$10 \times \tau_{I,adj}$
$12,000-$51,700	$10,500-$45,200	15	$15 \times \tau_{I,adj}$
$51,700-$190,300	$45,200-$166,500	25	$25 \times \tau_{I,adj}$
$190,300-	$166,500-	33	$33 \times \tau_{I,adj}$

Source: House of Representatives (2001). The adjustment factor $\tau_{I,adj}$ is 0.746 under the lower labor supply elasticity assumption and 0.707 under the higher elasticity assumption.

projected ratios of total individual income tax and corporate income tax to nominal GDP are 8.1 percent and 2.1 percent, respectively, in 2006. The adjustment factor $\tau_{I,adj}$ is chosen to be 0.746 (when lower labor supply elasticity) or 0.707 (when higher labor supply elasticity) so that income tax revenue, including corporate income tax, is 10.2 percent of GDP in the baseline economy. In addition, refundable child tax credits ($500 per child, reduced if taxable income is above $110,000) are applied. State and local income tax in the model is simply a 4.0 percent flat tax for an income (excluding Social Security benefits) above the same standard deduction and exemptions.

Social Security. The tax rate levied on both employers and employees for Old-Age, Survivors, and Disability Insurance (OASDI) is 6.2 percent, and the tax rate for Medicare (HI) is 1.45 percent. In 2001, employee compensation above $80,400 was not taxable for OASDI. (See Table 6.) So, the firm's profit-maximization problem becomes

$$w \times (1 + \text{Marginal Payroll Tax Rate}) = AF_L(K, L),$$

where the marginal payroll tax rate is either 0.0765 or 0.0145 for high-earnings workers. Because the marginal payroll tax rates are not uniform across households, the calibration uses the average payroll tax rate (total payroll tax paid by employers divided by total labor income) instead.[24]

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[24]The marginal payroll tax rate faced by a representative firm depends on how the firm increases one additional unit of labor input. If the firm hires an additional set of workers of the same earnings distribution of existing workers, the marginal labor cost for the firm is the market wage rate plus the average payroll tax rate. If the firm does not increase its workers but make them work an additional hour, then, the marginal labor cost is the

Table 6: Marginal Payroll Tax Rates in 2001

Labor Income per worker $(w_t e_i h_i/2)$	Marginal Tax Rate (%)	
	OASDI	HI
$0 – $80,400	$6.2 \times \tau_{P,Adj}$	1.45
$80,400 –	$0.0 \times \tau_{P,Adj}$	1.45

The same taxes are levied to employers. The payroll tax
adjustment factor $\tau_{P,Adj}$ is assumed to be 1.0.

Table 7: OASDI Replacement Rates in 2001

AIME (b/12)	Marginal Replacement Rate (%)
$0 – $561	$90.0 \times tr_{SS,Adj}$
$561 – $3,381	$32.0 \times tr_{SS,Adj}$
$3,381 –	$15.0 \times tr_{SS,Adj}$

The OASDI benefit adjustment factor $tr_{SS,Adj}$ is assumed to be 1.448
to reflect disability insurance and survivors insurance.

Social Security benefits are based on each worker's Average Indexed Monthly Earnings
(AIME), $b_i/12$, and the replacement rate schedule in the United States. The replacement
rates are 90 percent for the first $561, 32 percent for amounts between $561 and $3,381, and
15 percent for amounts above $3,381.

The benefits received by retired workers accounted for 69.1 percent of total OASDI ben-
efits in December 2000.[25] The calibration simply assumes that each elderly household re-
ceives other benefits—those for spouses, children, and disabled workers—proportionally.
Benefits calculated from AIME are multiplied uniformly by 1.448 (= 1/0.691). For sim-
plicity, the model assumes that the government consumes the difference between the OASDI
payroll tax revenue and the OASDI benefits in the initial steady-state economy.[26]

market wage rate plus the weighted average of marginal payroll tax rates, which will likely be lower than the
average payroll tax rate. The calibration uses the average payroll tax rate, which is 5.94 percent in the baseline,
to calculate the marginal cost for the firm for simplicity.

[25]See Table 5.A1 in Social Security Administration (2001).

[26]In the real economy, the surplus is added to the Social Security trust fund after subtracting administration
costs.

Table 8: The Gini Coefficients in the Baseline Economy

	Earnings		Income	Wealth
	All	Ages 20-64		
Lower labor supply elasticity model	0.578	0.500	0.570	0.729
Higher labor supply elasticity model	0.618	0.529	0.601	0.777
Representative agent deterministic model	0.288	0.225	0.271	0.511
U.S. data (married households)[*]	0.60	–	–	0.75

[*]The author's calculation using data from the 1998 Survey of Consumer Finances.

Table 9: The Wealth Distribution in the Baseline Economy

	Percentage of wealth held by top				
	1%	5%	10%	20%	40%
Lower labor supply elasticity model	17.7	44.5	59.7	75.8	91.2
Higher labor supply elasticity model	20.2	49.5	65.2	81.0	94.0
Representative agent deterministic model	3.5	15.2	27.5	48.8	79.7
U.S. data (married households)[*]	30.5	53.9	64.9	77.2	90.4

[*]The author's calculation using data from the 1998 Survey of Consumer Finances.

4   The Baseline Economy (Initial Steady State)

Tables 8 and 9 show the distribution statistics of three overlapping generation models and those in the U.S. data. Two stochastic OLG model with heterogeneous agents roughly capture the distributions in earnings, income, and wealth. In terms of Gini coefficients, the earnings and wealth inequalities are slightly lower than the U.S. data under a lower labor supply elasticity assumption , and slightly higher under a higher labor supply elasticity assumption. The deterministic OLG model with representative agents clearly fails to replicate the inequalities in earnings and wealth. Two stochastic OLG models, however, do not replicate the wealth inequality completely. For example, the share of wealth held by top 1 percent of households is 17.7 percent (in the low labor supply elasticity model) and 20.2 percent (in the high labor supply elasticity model), and the number is significantly lower than 30.5 percent calculated from the 1998 Survey of Consumer Finances.

5 Policy Experiments

Two different assumptions on international capital flow (a closed economy or small-open economy); five different assumptions on government financing rules (government consumption is cut contemporaneously or after 10 years, lump-sum transfers are reduced contemporaneously or after 10 years, or marginal income tax rates are raised after 10 years); and five different assumptions on labor supply elasticity and others (lower labor supply elasticity, higher labor elasticity, no idiosyncratic income shocks, lower labor elasticity with 3 percent risk premium, and higher labor elasticity with risk premium) are considered.

Please see Appendixes 1–5 (in separate files) for detailed tables and figures of 50 policy experiments.

Appendix

A The Computation of Equilibria

The algorithm to solve the model for a steady-state equilibrium and an equilibrium transition path is similar to those in Conesa and Krueger (1999), Nishiyama (2002), and Nishiyama and Smetters (2003).[27]

A.1 The Discretization of the State Space

The state of a household is $\mathbf{s}_i = (i, e_i, a_i, b_i) \in I \times E \times A \times B$, where $I = \{20, ..., 109\}$, $E = [e^{\min}, e^{\max}]$, $A = [a^{\min}, a^{\max}]$, and $B = [b^{\min}, b^{\max}]$. To compute an equilibrium, the state space of a household is discretized as $\widehat{\mathbf{s}}_i \in I \times \widehat{E} \times \widehat{A} \times \widehat{B}$, where $\widehat{E} = \{e^1, e^2, ..., e^{N_e}\}$, $\widehat{A} = \{a^1, a^2, ..., a^{N_a}\}$, and $\widehat{B} = \{b^1, b^2, ..., b^{N_b}\}$.[28] For all these discrete points, the model computes the optimal decision of households, $\mathbf{d}(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \mathbf{\Psi}_t) = (c_i(.), h_i(.), a_{i+1}(.)) \in (0, c^{\max}] \times [0, h_i^{\max}] \times A$, the marginal values, $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \mathbf{\Psi}_t)$ and $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \mathbf{\Psi}_t)$, and the values $v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \mathbf{\Psi}_t)$, given the expected factor prices and policy variables.[29]

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[27]The computation algorithm in Appendix A is mostly taken from the author's Ph.D. thesis at the University of Pennsylvania. The author is grateful to José Víctor Ríos-Rull for his teaching and supervising.

[28]The grid points on the wealth space A is not equally spaced. The present calibration assumes $a^j = \$100 \times j^{3.5}$ for $j = 2, ..., N_a$ and $a^1 = \$0$.

[29]Because the marginal value with respect to historical earnings, $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \mathbf{\Psi}_t)$, is difficult to obtain analytically, it is approximated by $(v(., b^{j+1}, \mathbf{S}_t; \mathbf{\Psi}_t) - v(., b^j, \mathbf{S}_t; \mathbf{\Psi}_t))/(b^{j+1} - b^j)$ where $j = 1, 2, ..., N_b$.

To find the optimal end-of-period wealth, the model uses the Euler equation and bilinear interpolation (with respect to a and b) of marginal values at the beginning of the next period.[30] In this paper, N_e, N_a, and N_b are 8, 35, and 8, respectively. Since there are 90 different ages, the total number of discrete states is 201,600.[31]

A.2 A Steady-State Equilibrium

The algorithm to compute a steady-state equilibrium is as follows. Let $\boldsymbol{\Psi}$ denote the time-invariant government policy rule $\boldsymbol{\Psi} = (W_G, C_G, tr_{LS}, \tau_I(.), \tau_P(.), tr_{SS}(.))$.

1. Set the initial values of factor prices (r^0, w^0), accidental bequests q^0, the policy variables $(W_G^0, C_G^0, tr_{LS}^0)$, and the parameters φ^0 of policy functions $(\tau_I(.), \tau_P(.), tr_{SS}(.))$ if these are determined endogenously.[32]

2. Given $\boldsymbol{\Omega}^0 = (r^0, w^0, q^0, W_G^0, C_G^0, tr_{LS}^0, \varphi^0)$, find the decision rule of a household $\mathbf{d}(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ for all $\widehat{\mathbf{s}}_i \in I \times \widehat{E} \times \widehat{A} \times \widehat{B}$.[33]

   (a) For age $i = 109$, find the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_{109}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$. Since the survival rate $\phi_{109} = 0$, the end-of-period wealth $a_{i+1}(\widehat{\mathbf{s}}_{109}; .) = 0$ for all $\widehat{\mathbf{s}}_{109}$. Compute consumption and working hours $(c_i(\widehat{\mathbf{s}}_{109}; .), h_i(\widehat{\mathbf{s}}_{109}; .))$ and, then, marginal values $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{109}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ and values $v(\widehat{\mathbf{s}}_{109}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ for all $\widehat{\mathbf{s}}_{109}$.[34]

   (b) For age $i = 108, ..., 20$, find the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$, marginal values $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$, and values $v(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ for all $\widehat{\mathbf{s}}_i$, using $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{i+1}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ and $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_{i+1}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ recursively.[35]

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[30]The marginal values with respect to wealth, $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t)$, are used in the Euler equation to obtain optimal savings, the marginal values with respect to historical earnings, $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t)$, are used in the marginal rate of substitution condition of consumption for leisure to obtain optimal working hours, and the values, $v(\widehat{\mathbf{s}}_i, \mathbf{S}_t; \boldsymbol{\Psi}_t)$, are used to calculate welfare changes measured by compensating variations in wealth.

[31]When the number of grid points is 201,600, it takes AMD Athron$^{(TM)}$ XP 2600+ about 48 minutes to calculate one loop of iteration (120 years). It usually takes 5 to 10 loops, depending on the complexity of the experiment, to calculate an equilibrium transition path of 120 years.

[32]Actually, if we find the capital-labor ratio, both r and w are calculated from the given production function and depreciation rate.

[33]In the steady-state economy, the decision rule of a household $\mathbf{d}(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$ is not a function of the aggregate state of economy $\widehat{\mathbf{S}} = (x(\widehat{\mathbf{s}}_i), W_G)$. The measure of household $x(\widehat{\mathbf{s}}_i)$ is determined uniquely by the steady-state condition, and the government's wealth W_G is determined by the policy rule $\boldsymbol{\Psi}$.

[34]The marginal value with respect to historical earnings, $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$, is zero when $i > 60$ in this paper.

[35]Again, $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_i; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0)$, is obtained by $(v(., b^{j+1}; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0) - v(., b^j; \boldsymbol{\Psi}, \boldsymbol{\Omega}^0))/(b^{j+1} - b^j)$.

i. Set the initial guess of $a_{i+1}^0(\widehat{s}_i; .)$.

  ii. Given $a_{i+1}^0(\widehat{s}_i; .)$, compute $(c_i(\widehat{s}_i; .), h_i(\widehat{s}_i; .))$, using $\frac{\partial}{\partial b} v(\widehat{s}_{i+1}; \Psi, \Omega^0)$. Plug these into the Euler equation with $\frac{\partial}{\partial a} v(\widehat{s}_{i+1}; \Psi, \Omega^0)$.

  iii. If the Euler error is sufficiently small, then stop. Otherwise, update $a_{i+1}^0(\widehat{s}_i; .)$ and return to Step ii.

3. Find the steady-state measure of households $x(\widehat{s}_i; \Omega^0)$ using the decision rule obtained in Step 2. This computation is done forward from age 20 to age 109. Repeat this step to iterate q for q^1.

4. Compute new factor prices (r^1, w^1), the policy variables $(W_G^1, C_G^1, tr_{LS}^1)$, and the parameters φ^1 of policy functions.[36]

5. Compare $\Omega^1 = (r^1, w^1, q^1, W_G^1, C_G^1, tr_{LS}^1, \varphi^1)$ with Ω^0. If the difference is sufficiently small, then stop. Otherwise, update Ω^0 and return to Step 2.

A.3 An Equilibrium Transition Path

Let's assume that the economy is in the initial steady state in period 0, and that the new policy schedule (rule) Ψ_1, which was not expected in period 0, is announced at the beginning of period 1, where $\Psi_1 = \{W_{G,t+1}, C_{G,t}, tr_{LS,t}, \tau_{I,t}(.), \tau_{P,t}(.), tr_{SS,t}(.)\}_{t=1}^{\infty}$. Let $\widehat{S}_1 = (x_1(\widehat{s}_i), W_{G,1})$ be the state of the economy at the beginning of period 1. The state of the economy $\widehat{S}_1$ is usually equal to that of the initial steady state. The algorithm to compute a transition path to a new steady-state equilibrium (thereafter, final steady-state equilibrium) is as follows.

1. Choose a sufficiently large number, T, such that the economy is said to reach the new steady state within T periods.[37] Set the initial guess, $\{\Omega_t^0\}_{t=1}^T$, on factor prices (r_t^0, w_t^0), accidental bequests q_t^0, the policy variables $(W_{G,t+1}^0, C_{G,t}^0, tr_{LS,t}^0)$, and the parameters φ_t^0 of policy functions for $t = 1, 2, ..., T$.

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[36]In many cases, only one of the policy variables and parameters, $(W_G^1, C_G^1, tr_{LS}^1, \varphi^1)$, is assumed to be endogenous (by the government's financing rule), and it is calculated from the government's intertemporal budget constraint.

[37]For this to be the case, the government's policy rule has to be time-invariant sufficiently before period T, that is, $\Psi_s = \Psi_T$ for $1 \le s < T$.

2. Given $\boldsymbol{\Omega}_T^0 = (r_T^0, w_T^0, q_T^0, W_{G,T}^0, C_{G,T}^0, tr_{LS,T}^0, \varphi_T^0)$, find the final steady-state decision rule $\mathbf{d}(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_T; \boldsymbol{\Psi}_T; \boldsymbol{\Omega}_T^0)$, marginal values, $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_T; \boldsymbol{\Psi}_T; \boldsymbol{\Omega}_T^0)$, and values $v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_T; \boldsymbol{\Psi}_T; \boldsymbol{\Omega}_T^0)$ for all $\widehat{\mathbf{s}}_i \in I \times \widehat{E} \times \widehat{A} \times \widehat{B}$. (See the algorithm for a steady-state equilibrium.)

3. For period $t = T-1, T-2, ..., 1$, based on the guess, $\boldsymbol{\Omega}_t^0$, find backward the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$, marginal values $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$, and values $v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ for all $\widehat{\mathbf{s}}_i \in I \times \widehat{E} \times \widehat{A} \times \widehat{B}$, using the next period marginal values $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$ and values $v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$ recursively.

   (a) For age $i = 109$, find the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_{109}, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ and compute the marginal values $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{109}, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ and values $v(\widehat{\mathbf{s}}_{109}, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ for all $\widehat{\mathbf{s}}_{109}$.

   (b) For age $i = 108, ..., 20$, find the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ and compute $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ and $v(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ for all $\widehat{\mathbf{s}}_i$, using $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$ and $v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$ previously computed.[38]

      i. Set the initial guess of $a_{i+1}^0(\widehat{\mathbf{s}}_i; .)$.

      ii. Given $a_{i+1}^0(\widehat{\mathbf{s}}_i; .)$, compute $(c_i(\widehat{\mathbf{s}}_i; .), h_i(\widehat{\mathbf{s}}_i; .))$, using $\frac{\partial}{\partial b} v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$ calculated from $v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$. Plug these into the Euler equation with $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_{t+1}; \boldsymbol{\Psi}_{t+1}; \boldsymbol{\Omega}_{t+1}^0)$.

      iii. If the Euler error is sufficiently small, then stop. Otherwise, update $a_{i+1}^0(\widehat{\mathbf{s}}_i; .)$ and return to Step ii.

4. For period $t = 1, 2, ..., T-1$, compute forward $\boldsymbol{\Omega}_t^1 = (r_t^1, w_t^1, q_t^1, W_{G,t+1}^1, C_{G,t}^1, tr_{LS,t}^1, \varphi_t^1)$ and the measure of households $x_{t+1}(\widehat{\mathbf{s}}_i)$, using the decision rule $\mathbf{d}(\widehat{\mathbf{s}}_i, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ obtained in Step 3 and using the state of economy $\widehat{\mathbf{S}}_t = (x_t(\widehat{\mathbf{s}}_i), W_{G,t})$ recursively.

5. Compare $\{\boldsymbol{\Omega}_t^1\}_{t=1}^T$ with $\{\boldsymbol{\Omega}_t^0\}_{t=1}^T$. If the difference is sufficiently small, then stop. Otherwise, update $\{\boldsymbol{\Omega}_t^0\}_{t=1}^T$ and return to Step 2. If the final steady-state equilibrium is known, return to Step 3 instead.[39]

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[38]Note that this step does not use $\frac{\partial}{\partial a} v(\widehat{\mathbf{s}}_{i+1}, \widehat{\mathbf{S}}_t; \boldsymbol{\Psi}_t; \boldsymbol{\Omega}_t^0)$ recursively.

[39]For example, for a policy experiment with balanced budget assumption, the final steady state needs to be calculated only once, because the government wealth (debt) level in T is known and fixed. If deficit financing is assumed for the first several years, the government wealth level in T changes, and the final steady state needs to be calculated in every iteration.

B The Adjustment in Government Bond Yields

In the baseline economy, the real rate of return to capital, before corporate income tax and individual income tax, is about 6.25 percent. This rate is probably much higher than real government bond yields. Congressional Budget Office (2003a) and Appendixes 4 and 5 of the present paper assume an exogenous risk premium, $\rho = 0.03$ (or 300 basis points), between the market rate of return and the government bond yield as follows.[40]

Let W_G, K_G, and D_G be the government's net wealth, capital stock, and debt held by public, respectively, and let W_P and K_P be private (households') net wealth and private capital stock, respectively. Then, we have $W_G = K_G - D_G$ and $W_P = K_P + D_G$. National wealth W and capital stock K are defined as $W = W_P + W_G$ and $K = K_P + K_G$. In a closed economy we have $W = K$. The market rate of return r is determined by the marginal product of capital, that is, $r = F_K(K, L) - \delta$.

Suppose that the government bond yield r_G is defined as $r_G = r - \rho$, where $\rho > 0$ is a risk premium. If the market rate of return r is not stochastic, no households will purchase government bonds. One of the simplest ways to avoid this problem is, by assumption, making the households hold government bonds proportionally to their wealth levels.

The share of government bonds in a household's portfolio, s_B, is calculated as

$$s_B = \frac{D_G}{W_P} = \frac{D_G}{K_P + D_G}.$$

The average rate of return to the household's portfolio, $\widetilde{r}$, is

$$\widetilde{r} = (1 - s_B)\, r + s_B r_G = (1 - s_B)\, r + s_B\, (r - \rho).$$

This average rate of return $\widetilde{r}$ will be used to find the household's decision rules. For example, the capital income of a household becomes smaller if $\rho > 0$ and $s_B > 0$. In the government's intertemporal budget constraint, the market rate r will be used for the rate of return to the government capital stock K_G, but $r_G = r - \rho$ will be used for the cost of the government debt. When the debt-GDP ratio goes up, and s_B goes up, the market interest rate r will go up because of the crowding out, but the average interest rate $\widetilde{r}$ will not go up as much and it discourage private savings further.

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[40]There is a criticism on this *ad hoc* treatment of government bond yields, however. Appendix 1, 2, and 3 assume government bond yields to be equal to market rates of return.

Table 10: Parameters When the Risk Premium $\rho = 0.03$

| | | Labor Supply Elasticity Assumption | |
		(1) Low	(2) High
Time preference parameter	β	0.996	0.973
Share parameter for consumption	α	0.686	0.446
Coefficient of relative risk aversion	γ	4.0	2.0
Income tax adjustment factor	$\tau_{I,adj}$	0.755	0.715
Initial ratio of K_G to GDP	K_G/Y	0.586	0.586
Initial debt-GDP ratio	D_G/Y	0.348	0.348
Initial debt-private wealth ratio	s_B	0.139	0.139
Risk premium	ρ	0.003	0.003

When the exogenous risk premium ρ is assumed to be 0.03 rather than 0, main parameters and initial values used in the two baseline economies are shown in Table 10.

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Appendix 1

The Heterogeneous-Agent Stochastic OLG Model

with Lower Labor Supply Elasticity

October 2003

Model. Appendix 1 uses a heterogeneous agent stochastic OLG model with relatively low labor supply elasticity. The model assumes that the coefficient of relative risk aversion γ is 4.0, the consumption share parameter α is 0.69, and the maximum possible working hours (per couple) are 5,460. The experiments are done under both a closed economy assumption and a small open economy assumption.

Policy Experiment. Marginal income tax rates are reduced proportionally, and permanently, by 10 percent from the baseline. In the model, the adjustment factor of income tax, $\tau_{I,adj}$, is reduced to 0.672 from 0.746 in model year 1. (Model year 1 corresponds to year 2004.)

In the model economy, corporate income tax is included into individual income tax. The effective marginal tax rate on capital income is on average about 30 percent lower than the effective marginal tax rate on labor income, even if corporate income tax is considered. This is treated as that only 70 percent of capital income is taxable.

Government Financing Rules. There are five financing rules:

1. Government consumption (waste) $C_{G,t}$ reduced contemporaneously (See Tables and Figure A.1);

2. Lump-sum transfers $tr_{LS,t}$ reduced contemporaneously (A.2);

3. Government consumption $C_{G,t}$ reduced gradually after 10 years (A.3);

4. Lump-sum transfers $tr_{LS,t}$ reduced gradually after 10 years (A.4);

5. Income tax rates $\tau_{I,adj}$ raised gradually after 10 years (A.5).

The ratio of government debt (net wealth) to the baseline GDP is fixed throughout the transition path in financing rules 1 and 2, and the debt-GDP ratio is stabilized after 20 years in financing rules 3, 4, and 5. See Figure A.5(e) below.

Some Remarks. The *static* cost of this tax cut is 1.02 percent of GDP throughout the transition path, because the income tax revenue is 10.2 as a percentage of GDP in the baseline economy. The change in government consumption in Table A.1.A, for example, shows the *dynamic* cost of this tax cut under financing rule assumption 1. Under this assumption, about 8 percent of static revenue loss is recovered in year 1 and 13 percent is recovered in year 10. The revenue recovery is larger if lump-sum transfers are reduced contemporaneously and smaller if deficit financing is assumed.

Suppose that the effective marginal tax rate is on average 19 percent, marginal payroll tax rate is on average 6 percent, and marginal state and local tax rate is 5 percent, the after tax wage goes up by 2.7 percent if market wage rate does not change. The ratio of the percent change in labor supply to the percent change in after tax wage shows the average labor supply elasticity. In Table A.1.A, for example, the labor supply elasticity is about 0.15 for the first 10 years, which is roughly consistent with the uncompensated labor supply elasticity in the literature.

Table A.1A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.3	2.7	3.0	3.1	3.3	3.4	0.5	1.4	1.0
%ch(Labor)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
%ch(GNP=GDP)	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.8	1.0	1.1	1.2	1.2	1.3	1.3	0.5	0.8	0.6
%ch(Consumption)	0.9	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.7	1.9	2.0	2.1	2.2	2.3	1.0	1.4	1.2
%ch(Gross Investment)	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.5	3.5	3.5
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.94	-0.94	-0.93	-0.92	-0.92	-0.91	-0.90	-0.90	-0.89	-0.89	-0.87	-0.86	-0.86	-0.86	-0.87	-0.88	-0.93	-0.90	-0.91
ch(Income Tax/GDP%)	-1.00	-0.99	-0.99	-0.98	-0.97	-0.97	-0.96	-0.96	-0.95	-0.95	-0.93	-0.92	-0.91	-0.91	-0.90	-0.90	-0.99	-0.96	-0.97
ch(Interest Rate%)	0.04	0.02	0.00	-0.02	-0.03	-0.05	-0.06	-0.08	-0.09	-0.10	-0.14	-0.17	-0.19	-0.20	-0.22	-0.22	0.00	-0.07	-0.04
%ch(Wage Rate)	-0.2	-0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.6	0.7	0.8	0.8	0.9	0.9	0.0	0.3	0.1
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.0	2.5	3.1	3.5	4.0	4.4	4.8	6.4	7.4	8.1	8.6	9.1	9.3	1.3	4.0	2.6
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.8	2.4	2.9	3.3	3.5	3.7	3.9	0.5	1.5	1.0
%ch(Labor)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(GNP)	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.3	0.5	0.7	0.6
%ch(GDP)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(Consumption)	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.6	1.8	1.9	2.0	2.1	2.2	1.0	1.3	1.2
%ch(Gross Dom. Investment)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.92	-0.92	-0.93	-0.92	-0.93	-0.93	-0.93
ch(Income Tax/GDP%)	-0.99	-0.99	-0.99	-0.99	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.97	-0.97	-0.96	-0.96	-0.96	-0.96	-0.99	-0.98	-0.98
ch(Net Foreign Assets/GDP%)	-1.6	-0.7	0.0	0.7	1.4	2.0	2.5	3.1	3.6	4.0	6.0	7.3	8.3	9.0	9.7	10.2	0.0	3.0	1.5
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.0	2.6	3.1	3.6	4.1	4.5	4.9	6.7	8.0	8.9	9.5	10.2	10.6	1.3	4.1	2.7
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.44	0.00	0.00	0.00

Table A.1B: Welfare Changes Corresponding to Experiment Shown in Table A.1A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.1	0.0	-0.6	-0.3	1.5	2.4	1.7	0.4	0.8	1.0	1.2	1.2	1.2	1.2	1.2
20-40 percentile					-0.6	-0.1	2.7	4.8	4.2	2.5	3.7	4.5	5.0	5.1	5.1	5.1	5.1
40-60 percentile					-0.7	0.5	4.2	6.8	6.8	3.9	5.5	6.4	7.1	7.2	7.2	7.2	7.2
60-80 percentile					-0.3	2.5	7.2	10.0	10.3	5.9	7.9	9.0	9.8	9.9	9.9	9.9	9.9
80-90 percentile					1.6	5.4	10.8	13.5	14.2	8.3	10.6	11.8	12.7	12.8	12.8	12.8	12.8
90-95 percentile					5.0	12.9	15.7	19.5	18.0	11.8	14.5	16.0	17.0	17.1	17.1	17.1	17.1
95-99 percentile					15.8	28.9	28.2	30.3	25.4	16.6	19.6	21.2	22.3	22.4	22.4	22.4	22.4
99-100 percentile					59.3	111.0	86.7	68.7	49.6	24.4	27.9	29.8	31.1	31.2	31.2	31.3	31.3
Average	0.0	0.0	0.1	0.0	1.2	4.0	7.0	9.0	8.4	4.9	6.4	7.3	7.9	8.0	8.0	8.0	8.1
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.1	0.9	0.7	0.5	1.7	2.2	1.4	0.3	0.5	0.6	0.8	0.9	0.9	0.9	0.9
20-40 percentile					1.0	1.1	3.1	4.5	3.5	2.0	2.5	3.1	3.7	3.8	3.8	3.8	3.8
40-60 percentile					1.3	2.5	5.0	6.8	6.0	3.2	3.8	4.5	5.2	5.3	5.3	5.3	5.3
60-80 percentile					2.9	6.6	9.2	10.7	9.7	4.9	5.7	6.4	7.2	7.3	7.4	7.4	7.3
80-90 percentile					6.1	12.1	14.6	15.4	14.4	7.1	8.0	8.8	9.6	9.7	9.7	9.7	9.7
90-95 percentile					12.0	24.8	23.6	24.2	19.3	10.5	11.5	12.4	13.3	13.4	13.5	13.4	13.4
95-99 percentile					27.1	49.4	44.4	40.3	29.1	15.9	17.0	17.9	18.8	19.0	19.0	19.0	18.9
99-100 percentile					83.8	166.9	135.0	101.0	63.6	25.1	26.3	27.3	28.3	28.4	28.5	28.5	28.4
Average	0.0	0.0	0.1	0.9	4.3	8.2	9.6	10.2	8.3	4.2	4.8	5.4	6.0	6.1	6.2	6.2	6.1

Figure A.1: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

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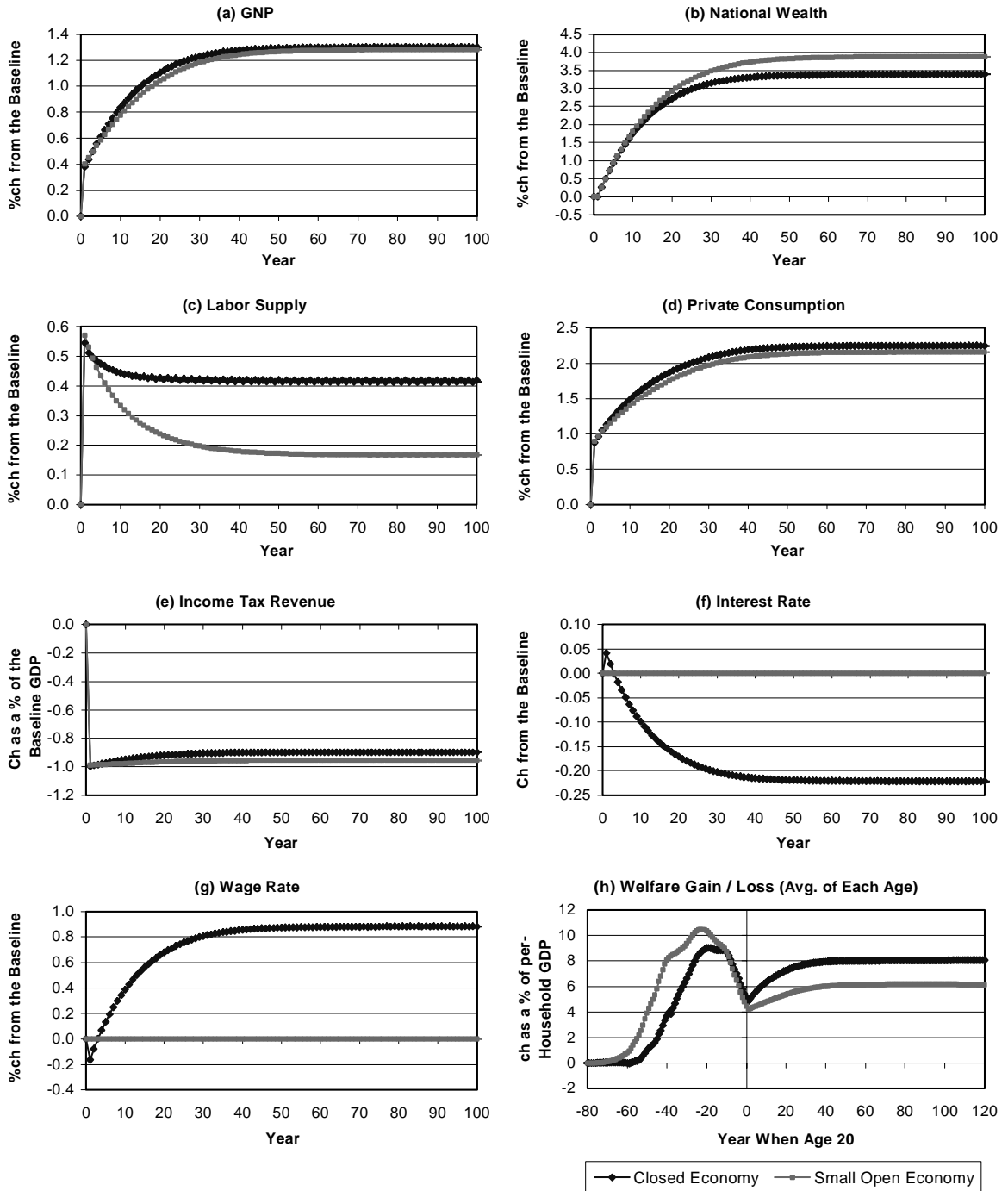
Table A.2A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.3	0.7	1.0	1.2	1.5	1.7	1.9	2.1	2.3	3.0	3.6	3.9	4.1	4.3	4.4	0.6	1.9	1.3
%ch(Labor)	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	1.0	0.9	0.9
%ch(GNP=GDP)	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.5	1.6	1.7	1.8	1.9	1.9	0.9	1.2	1.0
%ch(Consumption)	-0.4	-0.2	-0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.8	1.1	1.2	1.3	1.5	1.5	-0.1	0.4	0.1
%ch(Gross Investment)	4.7	4.7	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.7	4.7	4.6	4.6	4.5	4.4	4.7	4.6	4.6
ch(Lump-Sum Transfer/GDP%)	-0.85	-0.85	-0.84	-0.83	-0.82	-0.81	-0.80	-0.80	-0.79	-0.78	-0.76	-0.75	-0.75	-0.76	-0.78	-0.79	-0.84	-0.80	-0.82
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.96	-0.95	-0.94	-0.94	-0.93	-0.92	-0.92	-0.91	-0.91	-0.90	-0.88	-0.86	-0.85	-0.85	-0.84	-0.84	-0.94	-0.91	-0.93
ch(Interest Rate%)	0.08	0.05	0.02	0.00	-0.02	-0.04	-0.06	-0.08	-0.09	-0.11	-0.16	-0.20	-0.23	-0.24	-0.26	-0.27	0.02	-0.08	-0.03
%ch(Wage Rate)	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.2	0.3	0.4	0.4	0.6	0.8	0.9	1.0	1.0	1.1	-0.1	0.3	0.1
ch(Private Wealth/GDP%)	0.0	0.9	1.8	2.6	3.3	4.0	4.7	5.2	5.8	6.3	8.3	9.7	10.7	11.3	11.9	12.2	1.7	5.2	3.5
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.4	0.7	1.0	1.3	1.5	1.8	2.0	2.2	2.4	3.3	3.9	4.3	4.6	4.9	5.1	0.7	2.0	1.3
%ch(Labor)	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.5	1.0	0.8	0.9
%ch(GNP)	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.5	1.6	1.7	1.8	1.9	1.9	0.9	1.2	1.0
%ch(GDP)	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.5	1.0	0.8	0.9
%ch(Consumption)	-0.4	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.2	0.3	0.4	0.6	0.8	1.0	1.1	1.3	1.4	-0.2	0.2	0.0
%ch(Gross Dom. Investment)	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.5	1.0	0.8	0.9
ch(Lump-Sum Transfer/GDP%)	-0.82	-0.82	-0.82	-0.82	-0.83	-0.83	-0.83	-0.83	-0.83	-0.83	-0.83	-0.83	-0.83	-0.83	-0.84	-0.84	-0.82	-0.83	-0.83
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.94	-0.94	-0.94	-0.94	-0.94	-0.93	-0.93	-0.93	-0.93	-0.93	-0.92	-0.92	-0.91	-0.91	-0.90	-0.90	-0.94	-0.93	-0.93
ch(Net Foreign Assets/GDP%)	-3.0	-1.9	-0.8	0.1	1.0	1.9	2.6	3.3	4.0	4.6	7.1	8.9	10.2	11.1	12.0	12.5	-0.9	3.3	1.2
ch(Private Wealth/GDP%)	0.0	1.0	1.9	2.7	3.5	4.2	4.9	5.5	6.1	6.7	9.0	10.6	11.8	12.6	13.5	14.0	1.8	5.5	3.7
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.2B: Welfare Changes Corresponding to Experiment Shown in Table A.2A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP
(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.8	-3.8	-9.3	-14.8	-16.5	-14.8	-13.3	-8.9	-6.3	-2.7	-1.8	-1.4	-1.2	-1.3	-1.3	-1.3	-1.3
20-40 percentile					-16.9	-16.7	-13.6	-10.5	-7.5	-6.0	-4.0	-3.1	-2.7	-2.7	-2.7	-2.7	-2.7
40-60 percentile					-17.6	-18.3	-13.0	-10.3	-7.7	-6.3	-3.8	-2.8	-2.3	-2.3	-2.3	-2.3	-2.3
60-80 percentile					-19.1	-17.9	-10.9	-8.1	-6.5	-6.0	-3.2	-1.9	-1.4	-1.4	-1.4	-1.4	-1.4
80-90 percentile					-18.4	-15.8	-8.2	-5.1	-4.4	-5.7	-2.3	-0.8	-0.2	-0.2	-0.2	-0.2	-0.2
90-95 percentile					-15.1	-8.5	-4.6	0.0	-1.5	-4.4	-0.7	0.9	1.6	1.6	1.6	1.6	1.6
95-99 percentile					-3.0	6.7	5.9	8.4	4.4	-1.6	2.5	4.3	5.0	5.1	5.1	5.1	5.1
99-100 percentile					36.9	80.1	56.0	40.2	24.2	2.9	7.6	9.7	10.6	10.6	10.7	10.7	10.7
Average	-0.8	-3.8	-9.3	-14.8	-16.4	-14.5	-10.4	-7.3	-5.7	-5.0	-2.7	-1.6	-1.2	-1.2	-1.2	-1.2	-1.2
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.8	-3.8	-9.5	-14.5	-15.8	-14.2	-13.6	-9.7	-7.0	-2.9	-2.6	-2.3	-2.0	-2.0	-2.0	-1.9	-1.9
20-40 percentile					-15.8	-15.6	-13.6	-11.4	-8.8	-6.8	-6.0	-5.3	-4.7	-4.6	-4.6	-4.6	-4.6
40-60 percentile					-16.1	-16.1	-12.5	-11.0	-9.3	-7.5	-6.6	-5.8	-5.1	-4.9	-4.9	-4.9	-4.9
60-80 percentile					-16.0	-12.8	-8.6	-7.7	-8.0	-7.6	-6.5	-5.7	-4.9	-4.8	-4.7	-4.7	-4.7
80-90 percentile					-13.3	-7.3	-3.4	-3.2	-4.9	-7.6	-6.4	-5.5	-4.7	-4.5	-4.5	-4.5	-4.5
90-95 percentile					-6.9	5.6	4.7	4.7	-0.6	-6.4	-5.1	-4.1	-3.2	-3.1	-3.1	-3.1	-3.0
95-99 percentile					8.8	28.4	23.4	19.0	8.0	-2.7	-1.4	-0.4	0.5	0.6	0.7	0.7	0.7
99-100 percentile					62.7	142.8	110.9	76.9	40.2	3.3	4.8	5.9	6.8	7.0	7.0	7.0	7.1
Average	-0.8	-3.8	-9.5	-14.5	-13.4	-9.6	-7.7	-6.5	-6.4	-6.1	-5.2	-4.5	-3.9	-3.8	-3.7	-3.7	-3.7

Figure A.2: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy   Small Open Economy

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Table A.3A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.8	-1.0	-1.3	-1.6	-2.8	-3.0	-2.6	-2.4	-2.1	-2.0	-0.2	-1.1	-0.6
%ch(Labor)	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.4
%ch(GNP=GDP)	0.4	0.3	0.3	0.2	0.1	0.1	0.0	-0.1	-0.2	-0.3	-0.8	-0.9	-0.8	-0.7	-0.7	-0.6	0.3	-0.1	0.1
%ch(Consumption)	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.4	1.6	1.8	1.9	2.1	2.1	1.0	1.2	1.1
%ch(Gross Investment)	-0.9	-1.4	-1.9	-2.3	-2.8	-3.3	-3.9	-4.4	-5.0	-5.7	-4.7	-1.7	-1.8	-1.9	-2.0	-2.0	-1.9	-4.5	-3.2
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.78	-1.64	-1.61	-1.59	-1.58	-1.58	0.00	0.00	0.00
ch(Income Tax/GDP%)	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.01	-1.01	-1.01	-1.03	-1.02	-1.01	-1.00	-1.00	-0.99	-1.00	-1.01	-1.00
ch(Interest Rate%)	0.04	0.04	0.05	0.05	0.06	0.07	0.09	0.10	0.12	0.14	0.22	0.24	0.20	0.18	0.17	0.16	0.05	0.10	0.08
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.5	-0.5	-0.9	-0.9	-0.8	-0.7	-0.6	-0.6	-0.2	-0.4	-0.3
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.1	2.7	3.3	3.8	4.4	4.9	5.4	7.5	9.2	10.3	11.0	11.6	11.9	1.4	4.3	2.9
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.9	-2.9	-3.9	-5.0	-6.1	-7.2	-8.4	-9.6	-15.1	-17.5	-17.5	-17.5	-17.5	-17.5	-1.9	-7.2	-4.6
ch(Budget Deficit/GDP%)	0.95	1.01	1.07	1.13	1.20	1.27	1.35	1.43	1.51	1.60	1.21	0.49	0.49	0.49	0.49	0.49	1.07	1.43	1.25
(Small Open Economy)																			
%ch(National Wealth)	0.0	-0.1	-0.2	-0.3	-0.5	-0.6	-0.8	-1.1	-1.3	-1.6	-2.8	-3.1	-2.8	-2.6	-2.3	-2.2	-0.2	-1.1	-0.6
%ch(Labor)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(GNP)	0.4	0.3	0.3	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.2	-0.7	-0.8	-0.7	-0.6	-0.6	-0.5	0.3	-0.1	0.1
%ch(GDP)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(Consumption)	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.6	1.8	1.9	2.0	2.1	2.2	1.0	1.3	1.2
%ch(Gross Dom. Investment)	7.8	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	1.6	0.1	0.9
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.71	-1.49	-1.49	-1.49	-1.49	-1.49	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.99	-0.99	-0.99	-0.99	-0.98	-0.98	-0.98	-0.98	-0.98	-0.98	-0.97	-0.97	-0.96	-0.96	-0.96	-0.96	-0.99	-0.98	-0.98
ch(Net Foreign Assets/GDP%)	-1.6	-1.7	-1.8	-2.1	-2.4	-2.9	-3.4	-3.9	-4.6	-5.3	-8.5	-9.2	-8.3	-7.6	-6.9	-6.4	-1.9	-4.0	-3.0
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.0	2.6	3.1	3.6	4.1	4.5	4.9	6.7	8.0	8.9	9.5	10.2	10.6	1.3	4.0	2.7
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.8	-2.8	-3.8	-4.8	-5.9	-7.0	-8.2	-9.3	-14.5	-16.6	-16.6	-16.6	-16.6	-16.6	-1.9	-7.0	-4.5
ch(Budget Deficit/GDP%)	0.93	0.99	1.05	1.11	1.17	1.23	1.30	1.37	1.44	1.51	1.12	0.47	0.47	0.47	0.47	0.47	1.05	1.37	1.21

Table A.3B: Welfare Changes Corresponding to Experiment Shown in Table A.3A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP
(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.5	2.8	2.7	1.7	2.0	1.8	0.9	0.2	0.1	0.4	0.7	0.7	0.7	0.7	0.7
20-40 percentile					3.3	2.9	3.6	4.1	2.6	1.2	1.2	2.0	3.0	3.1	3.1	3.1	3.1
40-60 percentile					4.3	5.6	6.0	6.7	4.8	2.0	2.0	3.0	4.1	4.2	4.2	4.2	4.2
60-80 percentile					8.1	12.8	11.9	11.7	8.8	3.5	3.4	4.5	5.8	5.9	5.9	5.9	5.9
80-90 percentile					13.9	21.8	19.7	17.8	14.3	5.4	5.2	6.5	7.9	7.9	8.0	8.0	8.0
90-95 percentile					23.7	41.8	34.2	29.9	20.6	8.6	8.3	9.7	11.2	11.4	11.4	11.4	11.4
95-99 percentile					44.7	77.9	65.4	52.4	33.3	14.7	14.2	15.3	17.0	17.1	17.2	17.2	17.1
99-100 percentile					118.4	239.5	194.7	138.3	79.3	25.2	24.2	25.0	27.0	27.2	27.2	27.2	27.2
Average	0.0	0.0	0.5	2.8	9.2	14.4	13.0	11.6	8.0	3.2	3.1	4.0	5.0	5.1	5.1	5.1	5.1
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.1	0.9	0.7	0.5	1.7	2.2	1.4	0.3	0.5	0.7	0.8	0.9	0.9	0.9	0.9
20-40 percentile					1.0	1.1	3.1	4.5	3.5	2.0	2.5	3.1	3.7	3.8	3.8	3.8	3.8
40-60 percentile					1.3	2.5	5.0	6.8	6.0	3.2	3.9	4.5	5.2	5.3	5.3	5.3	5.3
60-80 percentile					2.9	6.6	9.2	10.8	9.7	5.0	5.8	6.5	7.2	7.3	7.4	7.4	7.4
80-90 percentile					6.1	12.1	14.6	15.4	14.4	7.1	8.0	8.8	9.6	9.7	9.8	9.8	9.8
90-95 percentile					12.0	24.8	23.6	24.2	19.3	10.5	11.6	12.4	13.3	13.4	13.5	13.5	13.5
95-99 percentile					27.1	49.4	44.4	40.3	29.1	15.9	17.1	18.0	18.8	19.0	19.0	19.0	19.0
99-100 percentile					83.8	166.9	135.0	101.0	63.7	25.1	26.4	27.4	28.3	28.5	28.5	28.5	28.5
Average	0.0	0.0	0.1	0.9	4.3	8.2	9.6	10.2	8.3	4.2	4.9	5.4	6.0	6.2	6.2	6.2	6.2

Figure A.3: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
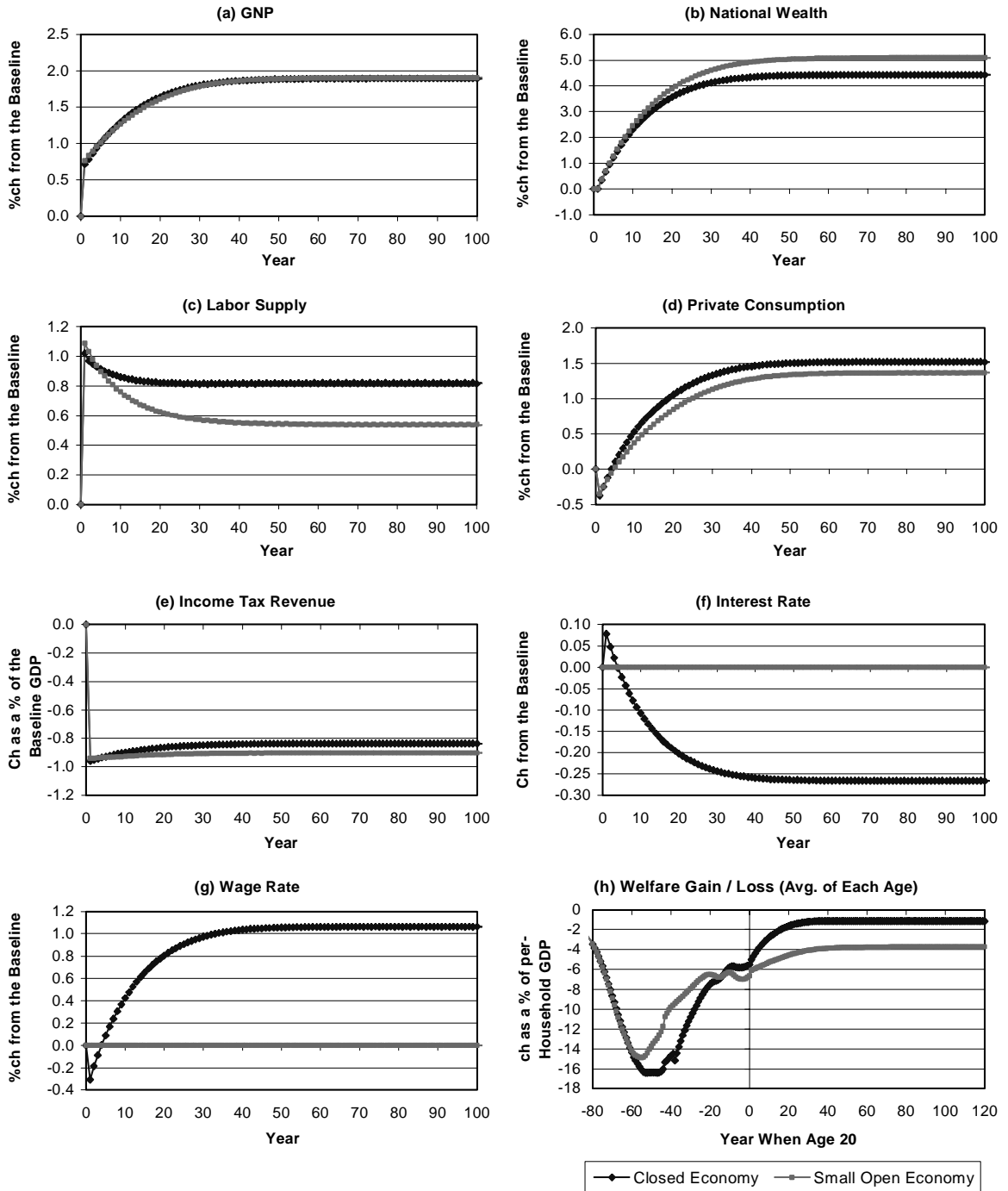
Closed Economy — Small Open Economy

Table A.4A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.1	0.2	0.2
%ch(Labor)	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
%ch(GNP=GDP)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5
%ch(Consumption)	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.9	0.9	0.6	0.8	0.7
%ch(Gross Investment)	1.1	0.9	0.7	0.5	0.3	0.2	0.1	-0.1	-0.1	-0.2	0.0	0.3	0.4	0.4	0.4	0.3	0.7	0.0	0.3
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.64	-1.32	-1.31	-1.31	-1.31	-1.33	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.98	-0.97	-0.97	-0.96	-0.96	-0.95	-0.95	-0.94	-0.94	-0.93	-0.91	-0.89	-0.89	-0.88	-0.88	-0.88	-0.97	-0.94	-0.96
ch(Interest Rate%)	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.04	0.04	0.03	0.03	0.04	0.03	0.04
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1
ch(Private Wealth/GDP%)	0.0	1.1	2.2	3.2	4.2	5.2	6.2	7.2	8.2	9.3	13.7	15.6	15.9	16.1	16.3	16.2	2.1	7.2	4.7
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.8	-2.7	-3.7	-4.6	-5.6	-6.7	-7.7	-8.8	-13.5	-15.4	-15.4	-15.4	-15.4	-15.4	-1.8	-6.7	-4.3
ch(Budget Deficit/GDP%)	0.90	0.95	1.00	1.06	1.11	1.17	1.22	1.28	1.34	1.40	1.02	0.43	0.43	0.43	0.43	0.43	1.01	1.28	1.14
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.1	0.2	0.3	0.3	0.1	0.2	0.1
%ch(Labor)	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7
%ch(GNP)	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5
%ch(GDP)	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7
%ch(Consumption)	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.6	0.8	0.7
%ch(Gross Dom. Investment)	10.8	0.3	0.2	0.4	0.3	0.5	0.4	0.5	0.5	0.6	0.8	0.9	0.7	0.8	0.8	0.8	2.4	0.5	1.5
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.63	-1.29	-1.29	-1.29	-1.30	-1.31	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.97	-0.96	-0.96	-0.95	-0.95	-0.95	-0.94	-0.94	-0.93	-0.92	-0.90	-0.88	-0.88	-0.88	-0.87	-0.87	-0.96	-0.94	-0.95
ch(Net Foreign Assets/GDP%)	-2.2	-1.9	-1.6	-1.4	-1.3	-1.2	-1.2	-1.2	-1.3	-1.3	-1.7	-1.8	-1.6	-1.4	-1.2	-1.3	-1.7	-1.3	-1.5
ch(Private Wealth/GDP%)	0.0	1.1	2.1	3.1	4.1	5.1	6.1	7.0	8.0	9.0	13.3	15.2	15.5	15.7	15.9	15.9	2.1	7.1	4.6
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.7	-2.7	-3.6	-4.6	-5.5	-6.6	-7.6	-8.7	-13.3	-15.1	-15.1	-15.1	-15.1	-15.1	-1.8	-6.6	-4.2
ch(Budget Deficit/GDP%)	0.88	0.93	0.99	1.04	1.09	1.15	1.20	1.26	1.32	1.38	1.00	0.43	0.43	0.43	0.43	0.43	0.99	1.26	1.12

Table A.4B: Welfare Changes Corresponding to Experiment Shown in Table A.4A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	-0.5	-3.9	-7.9	-6.6	-3.9	-4.4	-1.8	-0.3	-1.4	-4.1	-3.9	-3.9	-4.0	-3.9	-3.9
20-40 percentile					-7.8	-8.9	-4.3	-5.7	-3.0	-1.2	-5.7	-10.1	-9.7	-9.8	-9.8	-9.8	-9.8
40-60 percentile					-7.7	-9.6	-3.8	-5.3	-3.7	-1.6	-7.3	-11.7	-11.2	-11.3	-11.3	-11.3	-11.3
60-80 percentile					-6.7	-5.7	-0.8	-2.0	-3.0	-1.9	-8.4	-12.7	-12.1	-12.3	-12.4	-12.4	-12.4
80-90 percentile					-3.4	0.3	3.1	2.2	-0.3	-2.1	-9.5	-13.7	-13.1	-13.3	-13.4	-13.4	-13.4
90-95 percentile					3.2	13.3	10.8	9.9	3.5	-1.6	-9.2	-13.4	-12.8	-13.0	-13.0	-13.0	-13.0
95-99 percentile					18.0	38.2	31.1	25.1	12.2	1.1	-6.3	-10.6	-10.0	-10.2	-10.3	-10.3	-10.3
99-100 percentile					74.3	160.1	125.1	86.4	45.3	6.5	-1.3	-5.6	-5.0	-5.2	-5.3	-5.3	-5.3
Average	0.0	0.0	-0.5	-3.9	-4.8	-2.3	0.8	-0.9	-1.2	-1.2	-6.3	-10.2	-9.8	-9.9	-9.9	-9.9	-9.9
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	-0.9	-5.0	-8.8	-7.2	-4.0	-4.1	-1.5	-0.2	-1.3	-4.0	-3.8	-3.8	-3.8	-3.8	-3.8
20-40 percentile					-8.8	-9.5	-4.4	-5.3	-2.5	-0.8	-5.3	-9.8	-9.4	-9.4	-9.5	-9.5	-9.5
40-60 percentile					-9.0	-10.5	-4.0	-5.1	-3.2	-1.1	-6.8	-11.2	-10.8	-10.9	-10.9	-10.9	-10.9
60-80 percentile					-8.9	-7.5	-1.5	-2.0	-2.4	-1.3	-7.7	-12.1	-11.6	-11.8	-11.8	-11.8	-11.8
80-90 percentile					-6.4	-2.4	2.0	1.9	0.1	-1.4	-8.7	-13.0	-12.5	-12.7	-12.7	-12.7	-12.7
90-95 percentile					-0.8	9.3	8.4	8.9	3.6	-0.8	-8.3	-12.6	-12.1	-12.3	-12.3	-12.3	-12.3
95-99 percentile					13.1	31.6	26.5	22.8	11.9	1.9	-5.5	-9.8	-9.4	-9.5	-9.6	-9.6	-9.6
99-100 percentile					66.1	145.2	113.2	79.6	43.5	7.2	-0.6	-4.9	-4.5	-4.6	-4.7	-4.7	-4.7
Average	0.0	0.0	-0.9	-5.0	-6.6	-4.0	0.0	-1.0	-0.8	-0.7	-5.7	-9.8	-9.4	-9.5	-9.5	-9.5	-9.5

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Figure A.4: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
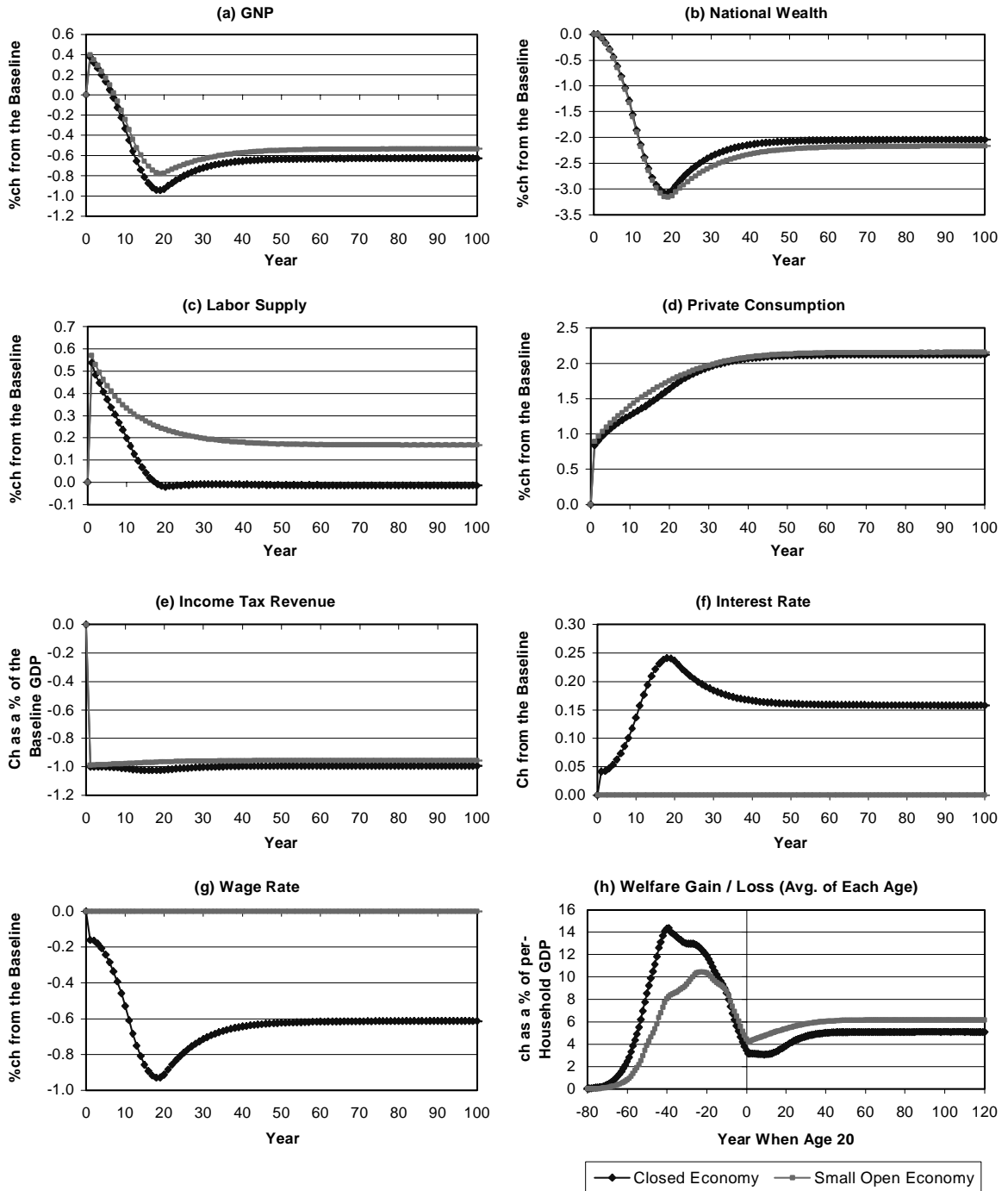
Closed Economy — Small Open Economy

Table A.5A: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.0	-0.1	-0.2	-0.3	-0.5	-0.6	-0.8	-1.0	-1.2	-2.5	-3.9	-5.2	-6.1	-7.3	-8.1	-0.1	-0.8	-0.5
%ch(Labor)	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	-0.3	-0.9	-0.9	-0.9	-0.9	-0.8	0.5	0.4	0.4
%ch(GNP=GDP)	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0	-0.1	-0.1	-0.9	-1.8	-2.2	-2.5	-2.8	-3.1	0.3	0.0	0.1
%ch(Consumption)	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	0.6	-0.3	-0.7	-1.1	-1.6	-2.1	0.9	1.1	1.0
%ch(Gross Investment)	-0.7	-1.1	-1.5	-1.9	-2.3	-2.7	-3.1	-3.5	-3.8	-4.2	-6.3	-7.9	-8.0	-8.2	-8.4	-8.1	-1.5	-3.4	-2.5
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-1.00	-1.00	-1.00	-0.99	-0.99	-0.99	-0.99	-0.99	-0.99	-0.99	-0.24	0.72	0.73	0.74	0.74	0.68	-1.00	-0.99	-0.99
ch(Interest Rate%)	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.17	0.23	0.34	0.42	0.53	0.60	0.05	0.09	0.07
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5	-0.7	-0.9	-1.3	-1.6	-2.0	-2.3	-0.2	-0.4	-0.3
ch(Private Wealth/GDP%)	0.0	0.8	1.5	2.2	2.9	3.6	4.2	4.9	5.5	6.1	8.1	6.6	3.1	0.5	-2.7	-5.0	1.5	4.9	3.2
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.9	-2.8	-3.9	-4.9	-6.0	-7.1	-8.3	-9.5	-14.9	-17.3	-17.3	-17.3	-17.3	-17.3	-1.9	-7.2	-4.5
ch(Budget Deficit/GDP%)	0.94	1.00	1.06	1.12	1.19	1.26	1.32	1.40	1.47	1.55	1.20	0.49	0.49	0.49	0.49	0.49	1.06	1.40	1.23
(Small Open Economy)																			
%ch(National Wealth)	0.0	-0.1	-0.1	-0.2	-0.4	-0.5	-0.7	-0.8	-1.0	-1.3	-2.5	-3.9	-5.2	-6.1	-7.3	-8.4	-0.2	-0.9	-0.5
%ch(Labor)	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.0	-0.6	-0.4	-0.3	-0.2	-0.1	0.5	0.5	0.5
%ch(GNP)	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0	-0.1	-0.8	-1.6	-1.8	-2.0	-2.3	-2.6	0.3	0.1	0.2
%ch(GDP)	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.0	-0.6	-0.4	-0.3	-0.2	-0.1	0.5	0.5	0.5
%ch(Consumption)	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	0.8	0.1	-0.2	-0.5	-0.9	-1.3	1.0	1.2	1.1
%ch(Gross Dom. Investment)	8.3	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.5	-1.3	-2.1	0.0	-0.1	-0.2	-0.2	1.8	0.3	1.1
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.99	-0.98	-0.98	-0.98	-0.98	-0.97	-0.97	-0.97	-0.96	-0.96	-0.25	0.61	0.61	0.60	0.60	0.59	-0.98	-0.97	-0.97
ch(Net Foreign Assets/GDP%)	-1.7	-1.7	-1.8	-2.0	-2.3	-2.7	-3.1	-3.6	-4.1	-4.7	-6.7	-9.1	-13.1	-15.9	-19.6	-22.7	-1.9	-3.6	-2.8
ch(Private Wealth/GDP%)	0.0	0.8	1.5	2.1	2.8	3.4	4.0	4.6	5.2	5.8	7.4	5.7	2.3	-0.3	-3.7	-6.5	1.4	4.6	3.0
ch(Gov't Wealth/GDP%)	0.0	-0.9	-1.8	-2.8	-3.8	-4.8	-5.8	-6.9	-8.0	-9.2	-14.2	-16.4	-16.4	-16.4	-16.4	-16.4	-1.9	-7.0	-4.4
ch(Budget Deficit/GDP%)	0.92	0.98	1.04	1.09	1.15	1.21	1.28	1.34	1.41	1.47	1.13	0.46	0.46	0.46	0.46	0.46	1.04	1.34	1.19

Table A.5B: Welfare Changes Corresponding to Experiment Shown in Table A.5A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

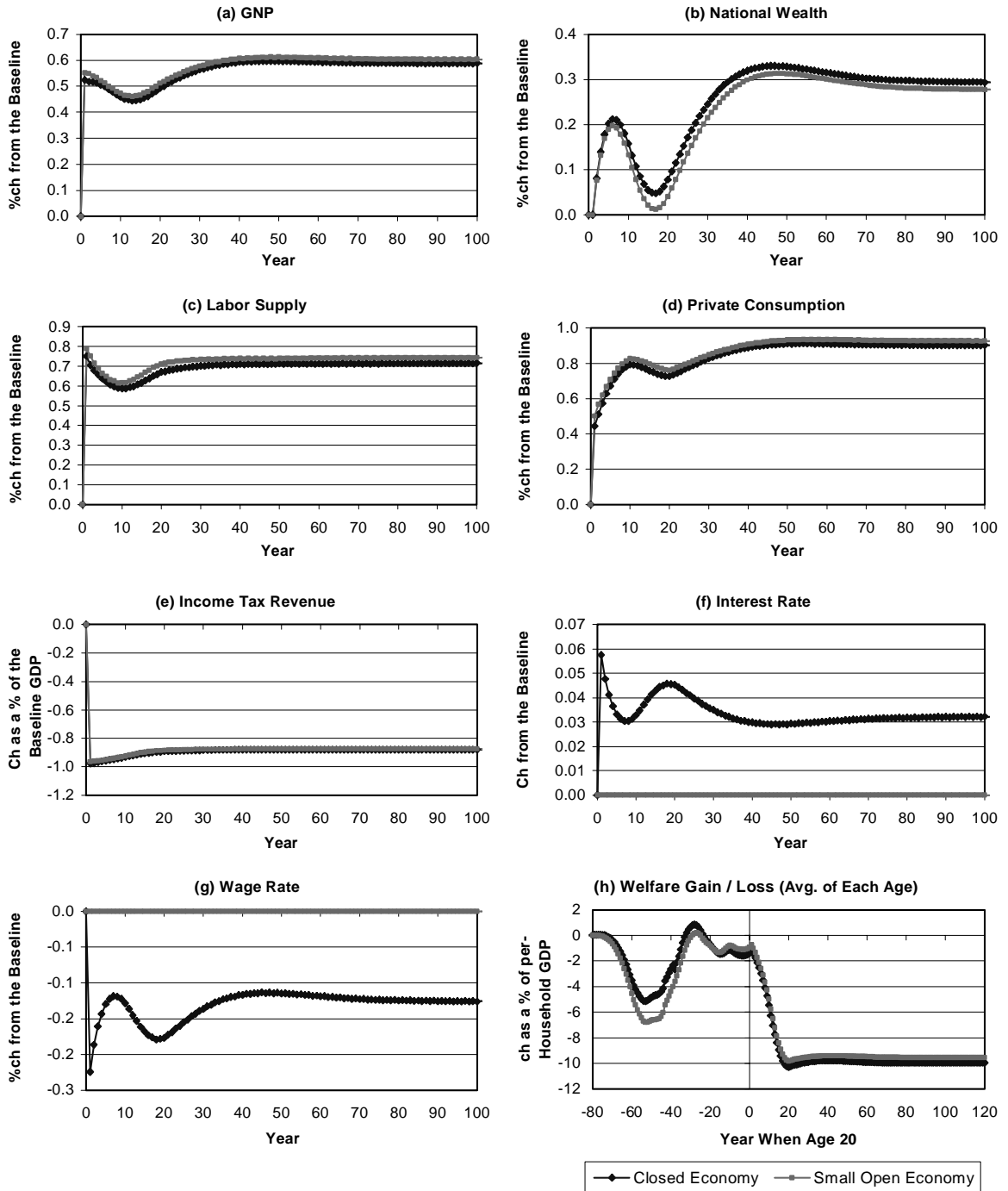|	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy) Temporary Hourly Wage Class																	
0-20 percentile	0.0				2.4	1.6	2.0	1.3	0.2	-0.1	-0.3	-0.7	-1.3	-1.5	-1.6	-1.6	-1.6
20-40 percentile					3.0	2.7	3.6	3.0	0.8	0.0	-1.6	-3.4	-5.3	-5.9	-6.0	-5.9	-5.9
40-60 percentile					3.9	5.3	5.9	5.2	1.9	0.1	-2.4	-5.2	-7.8	-8.5	-8.5	-8.5	-8.5
60-80 percentile					7.3	12.1	11.5	9.5	4.5	0.6	-3.4	-7.6	-10.8	-11.6	-11.6	-11.6	-11.6
80-90 percentile					12.6	20.5	18.8	15.0	8.6	1.2	-4.6	-10.4	-14.0	-14.6	-14.6	-14.6	-15.1
90-95 percentile					21.7	38.7	32.1	26.1	13.7	2.7	-5.0	-12.9	-17.3	-18.2	-18.2	-18.1	-18.1
95-99 percentile					41.3	71.1	60.4	47.0	24.7	6.8	-3.5	-15.9	-20.9	-21.8	-21.8	-21.7	-21.7
99-100 percentile					109.9	215.9	176.2	127.8	67.4	14.2	-1.2	-19.6	-25.3	-26.2	-26.2	-26.2	-26.1
Average	0.0	0.0	0.5	2.6	8.4	13.3	12.3	9.8	4.7	0.8	-2.4	-5.9	-8.4	-9.0	-9.0	-9.0	-9.0
(Small Open Economy) Temporary Hourly Wage Class																	
0-20 percentile	0.0				0.6	0.4	1.5	1.5	0.7	0.1	0.1	0.0	-0.3	-0.5	-0.5	-0.5	-0.5
20-40 percentile					0.9	0.9	2.8	3.3	1.9	0.9	0.3	-0.4	-1.5	-2.2	-2.3	-2.3	-2.3
40-60 percentile					1.2	2.2	4.4	5.1	3.2	1.5	0.3	-1.0	-2.4	-3.1	-3.2	-3.2	-3.2
60-80 percentile					2.5	5.8	7.9	8.2	5.5	2.3	0.2	-2.0	-3.5	-4.3	-4.4	-4.4	-4.4
80-90 percentile					5.5	10.5	12.3	11.9	8.7	3.4	0.0	-3.4	-5.2	-6.1	-6.2	-6.2	-6.3
90-95 percentile					10.9	21.3	19.1	18.8	12.3	5.1	-0.1	-5.1	-7.2	-8.0	-8.2	-8.2	-8.2
95-99 percentile					25.0	41.9	35.2	31.6	20.0	8.5	0.6	-8.4	-10.6	-11.5	-11.6	-11.7	-11.7
99-100 percentile					77.9	141.5	106.6	79.8	48.2	14.2	1.0	-13.6	-16.0	-16.9	-17.1	-17.2	-17.2
Average	0.0	0.0	0.1	0.9	3.9	7.1	8.0	7.8	5.0	2.1	0.2	-1.8	-3.0	-3.6	-3.8	-3.8	-3.8

Figure A.5: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

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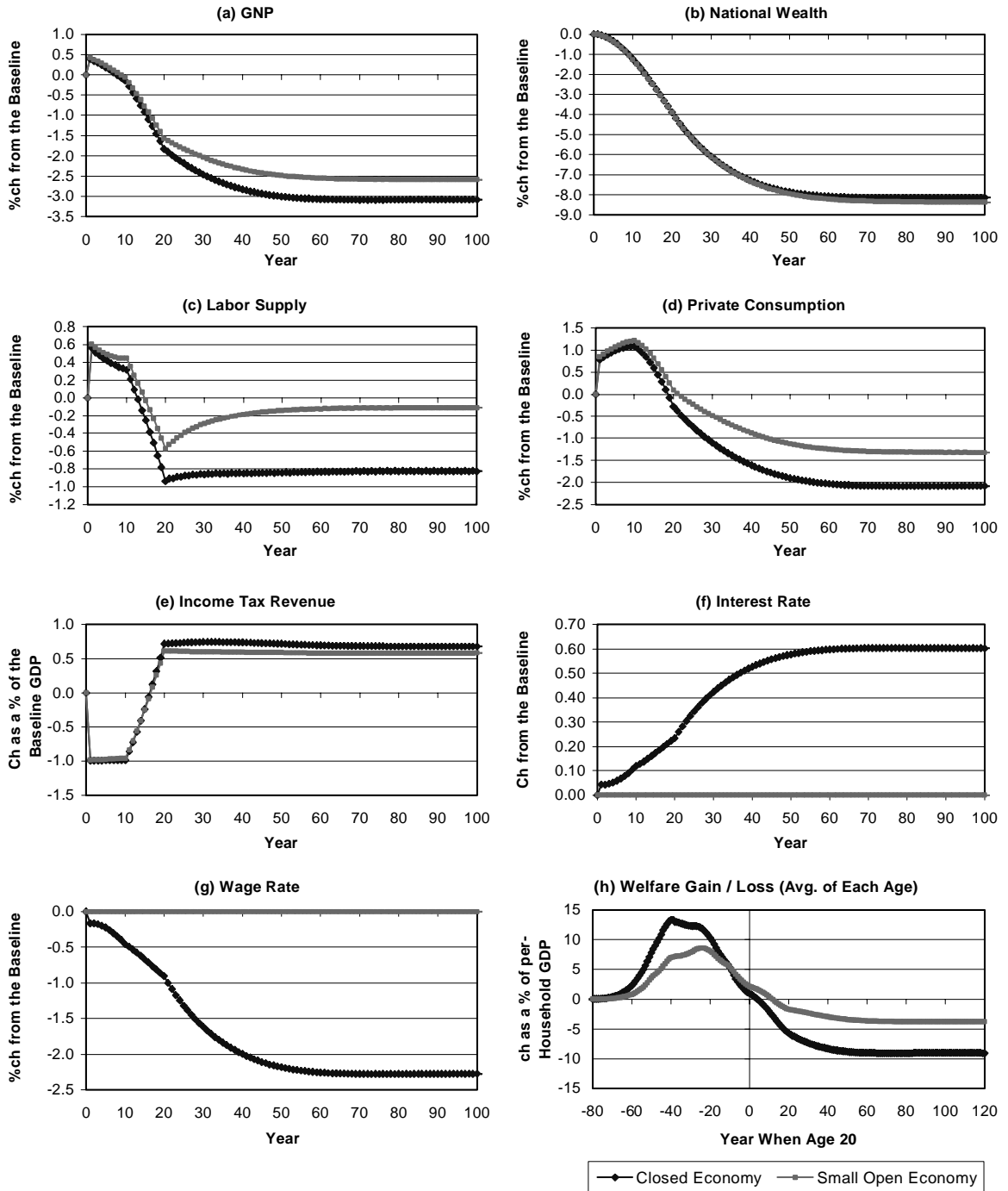
Appendix 2

The Heterogeneous-Agent Stochastic OLG Model

with Higher Labor Supply Elasticity

October 2003

Model.　Appendix 2 uses a heterogeneous agent stochastic OLG model with relatively high labor supply elasticity. The model assumes that the coefficient of relative risk aversion γ is 2.0, the consumption share parameter α is 0.45, and the maximum possible working hours (per couple) are 8,760. This assumption is similar to that in Congressional Budget Office (2003a). The experiments are done under both a closed economy assumption and a small open economy assumption.

Policy Experiment.　Marginal income tax rates are reduced proportionally, and permanently, by 10 percent from the baseline. In the model, the adjustment factor of income tax, $\tau_{I,adj}$, is reduced to 0.636 from 0.707 in model year 1. (Model year 1 corresponds to year 2004.)

In the model economy, corporate income tax is included into individual income tax. The effective marginal tax rate on capital income is on average about 30 percent lower than the effective marginal tax rate on labor income, even if corporate income tax is considered. This is treated as that only 70 percent of capital income is taxable.

Government Financing Rules.　There are five financing rules:

1. Government consumption (waste) $C_{G,t}$ reduced contemporaneously (See Tables and Figure A.6);

2. Lump-sum transfers $tr_{LS,t}$ reduced contemporaneously (A.7);

3. Government consumption $C_{G,t}$ reduced gradually after 10 years (A.8);

4. Lump-sum transfers $tr_{LS,t}$ reduced gradually after 10 years (A.9);

5. Income tax rates $\tau_{I,adj}$ raised gradually after 10 years (A.10).

The ratio of government debt (net wealth) to the baseline GDP is fixed throughout the transition path in financing rules 1 and 2, and the debt-GDP ratio is stabilized after 20 years in financing rules 3, 4, and 5. See Figure A.10(e) below.

Some Remarks. The *static* cost of this tax cut is 1.02 percent of GDP throughout the transition path, because the income tax revenue is 10.2 as a percentage of GDP in the baseline economy. The change in government consumption in Table A.6.A, for example, shows the *dynamic* cost of this tax cut under financing rule assumption 1. Under this assumption, about 14 percent of static revenue loss is recovered in year 1 and 16 percent is recovered in year 10. The revenue recovery is larger if lump-sum transfers are reduced contemporaneously and smaller if deficit financing is assumed.

Suppose that the effective marginal tax rate is on average 19 percent, marginal payroll tax rate is on average 6 percent, and marginal state and local tax rate is 5 percent, the after tax wage goes up by 2.7 percent if market wage rate does not change. The ratio of the percent change in labor supply to the percent change in after tax wage shows the average labor supply elasticity. In Table A.6.A, for example, the (uncompensated) labor supply elasticity is about 0.26 for the first 10 years.

Table A.6A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.3	0.6	0.8	1.0	1.2	1.3	1.5	1.6	1.8	2.2	2.5	2.6	2.7	2.8	2.8	0.5	1.5	1.0
%ch(Labor)	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.6	0.7
%ch(GNP=GDP)	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.1	1.2	1.2	1.2	1.2	0.7	0.9	0.8
%ch(Consumption)	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.3	1.2	1.6	1.4
%ch(Gross Investment)	4.1	3.9	3.7	3.6	3.5	3.4	3.4	3.3	3.3	3.3	3.1	3.0	2.9	2.9	2.8	2.8	3.8	3.3	3.6
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.88	-0.89	-0.88	-0.88	-0.88	-0.88	-0.87	-0.87	-0.87	-0.86	-0.86	-0.86	-0.86	-0.87	-0.88	-0.88	-0.88	-0.87	-0.88
ch(Income Tax/GDP%)	-0.96	-0.96	-0.96	-0.96	-0.95	-0.95	-0.95	-0.94	-0.94	-0.94	-0.93	-0.92	-0.91	-0.91	-0.91	-0.91	-0.96	-0.94	-0.95
ch(Interest Rate%)	0.06	0.04	0.01	-0.01	-0.03	-0.04	-0.06	-0.07	-0.08	-0.09	-0.13	-0.15	-0.16	-0.17	-0.17	-0.17	0.02	-0.07	-0.03
%ch(Wage Rate)	-0.3	-0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.7	-0.1	0.3	0.1
ch(Private Wealth/GDP%)	0.0	0.8	1.5	2.2	2.7	3.2	3.7	4.1	4.5	4.8	6.0	6.8	7.2	7.5	7.6	7.7	1.4	4.1	2.8
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.3	0.7	1.0	1.2	1.5	1.7	1.9	2.1	2.3	3.0	3.6	3.9	4.1	4.3	4.4	0.6	1.9	1.3
%ch(Labor)	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(GNP)	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.5	0.8	1.0	0.9
%ch(GDP)	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(Consumption)	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.7	1.9	2.0	2.1	2.2	2.3	1.0	1.4	1.2
%ch(Gross Dom. Investment)	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.9	0.6	0.7
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.82	-0.84	-0.85	-0.85	-0.86	-0.87	-0.87	-0.87	-0.88	-0.88	-0.89	-0.89	-0.89	-0.89	-0.90	-0.90	-0.84	-0.87	-0.86
ch(Income Tax/GDP%)	-0.93	-0.93	-0.94	-0.94	-0.94	-0.95	-0.95	-0.95	-0.95	-0.95	-0.94	-0.94	-0.94	-0.94	-0.94	-0.94	-0.94	-0.95	-0.94
ch(Net Foreign Assets/GDP%)	-3.0	-1.7	-0.6	0.4	1.3	2.2	2.9	3.6	4.3	4.9	7.2	8.8	9.9	10.5	11.1	11.5	-0.7	3.6	1.4
ch(Private Wealth/GDP%)	0.0	1.0	1.8	2.6	3.4	4.0	4.7	5.2	5.8	6.3	8.3	9.7	10.7	11.3	11.8	12.1	1.7	5.2	3.5
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.6B: Welfare Changes Corresponding to Experiment Shown in Table A.6A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																	
-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																
Temporary Hourly Wage Class																
0-20 percentile																
0.0	0.0	0.1	0.5	0.1	0.3	2.6	4.0	3.6	2.1	2.6	2.9	3.0	3.0	3.0	3.0	3.0
20-40 percentile																
				0.4	0.8	4.4	7.2	6.8	4.7	5.9	6.4	6.6	6.7	6.7	6.7	6.6
40-60 percentile																
				0.4	1.6	6.5	9.9	9.8	6.5	8.0	8.6	8.9	8.9	8.9	8.9	8.9
60-80 percentile																
				1.2	4.0	10.5	14.4	14.1	9.1	10.9	11.6	11.9	11.9	11.9	11.9	11.9
80-90 percentile																
				2.9	7.6	14.5	18.5	18.6	11.7	13.8	14.6	14.9	15.0	14.9	15.0	14.9
90-95 percentile																
				7.0	16.8	19.7	25.0	22.8	15.1	17.5	18.4	18.8	18.8	18.9	18.9	18.8
95-99 percentile																
				19.2	37.3	36.0	38.4	32.1	21.2	24.2	25.3	25.7	25.8	25.8	25.8	25.7
99-100 percentile																
				71.8	149.1	117.0	88.3	63.6	28.4	31.7	33.0	33.4	33.5	33.5	33.5	33.5
Average																
0.0	0.0	0.1	0.5	2.5	5.9	9.9	12.6	11.8	7.5	9.0	9.6	9.9	9.9	9.9	9.9	9.9
(Small Open Economy)																
Temporary Hourly Wage Class																
0-20 percentile																
0.0	0.0	0.0	0.7	0.7	0.8	2.8	4.0	3.3	1.8	2.2	2.4	2.7	2.7	2.7	2.7	2.7
20-40 percentile																
				1.1	1.6	5.0	7.3	6.5	4.3	4.9	5.4	5.8	5.9	5.9	5.9	5.9
40-60 percentile																
				1.3	3.1	7.5	10.2	9.5	6.0	6.7	7.2	7.7	7.7	7.8	7.8	7.8
60-80 percentile																
				2.9	7.1	12.8	15.7	14.2	8.4	9.2	9.8	10.3	10.3	10.4	10.4	10.4
80-90 percentile																
				5.5	12.8	18.7	21.5	19.8	11.0	11.9	12.5	13.0	13.1	13.1	13.1	13.1
90-95 percentile																
				11.4	26.5	27.8	31.6	25.5	14.6	15.5	16.2	16.7	16.8	16.8	16.8	16.8
95-99 percentile																
				26.8	54.5	52.5	52.1	38.8	22.0	22.9	23.6	24.2	24.2	24.3	24.3	24.3
99-100 percentile																
				90.8	201.6	168.1	129.1	86.7	31.1	32.1	32.8	33.3	33.4	33.4	33.4	33.4
Average																
0.0	0.0	0.0	0.7	4.3	9.3	12.7	14.5	12.4	7.1	7.8	8.3	8.7	8.8	8.8	8.8	8.8

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Figure A.6: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy   Small Open Economy
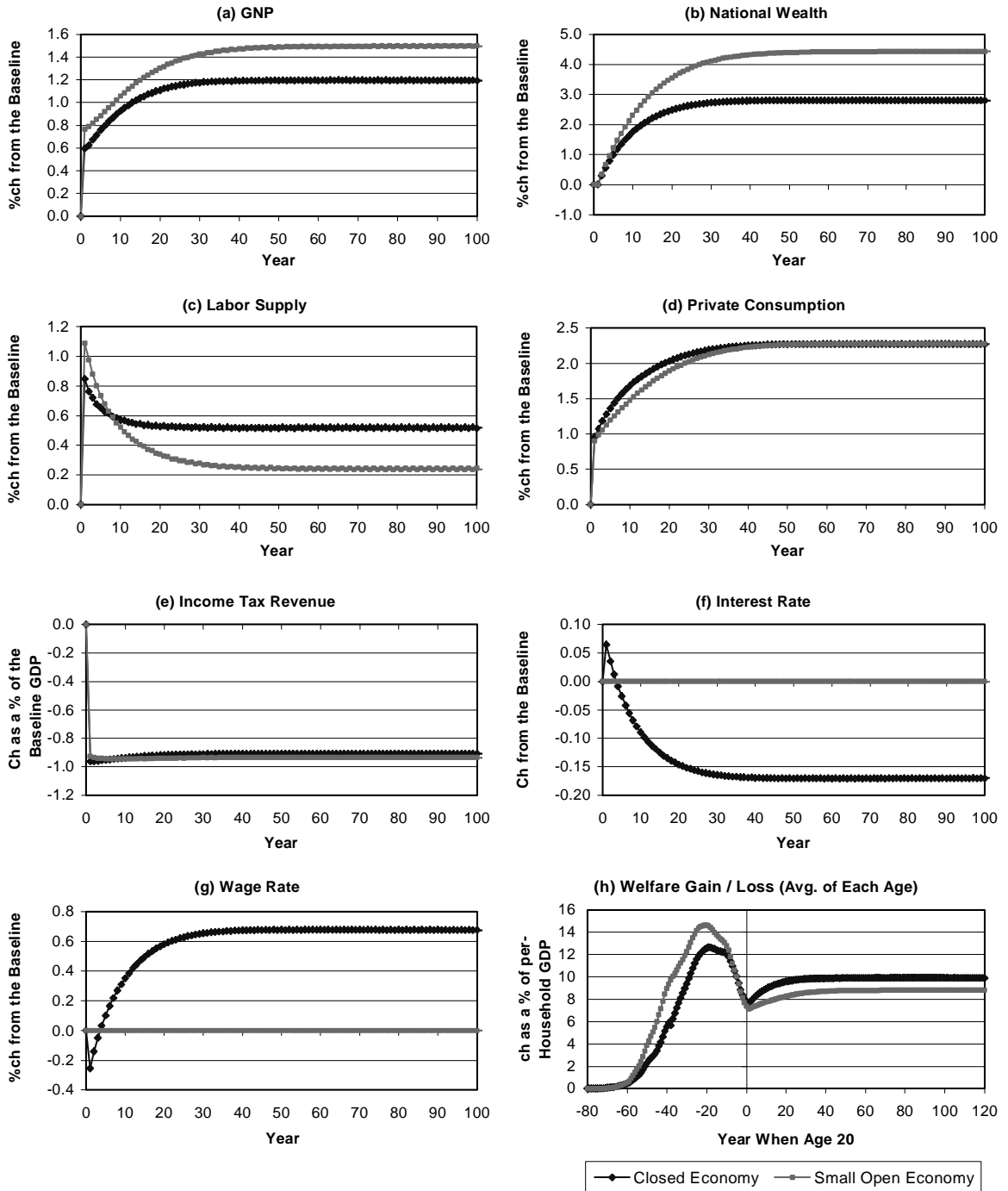
Table A.7A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.4	0.7	1.0	1.3	1.6	1.8	2.0	2.1	2.3	2.9	3.2	3.4	3.5	3.6	3.6	0.7	1.9	1.3
%ch(Labor)	1.6	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.4	1.2	1.3
%ch(GNP=GDP)	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.8	1.9	1.2	1.4	1.3
%ch(Consumption)	0.0	0.1	0.3	0.4	0.5	0.7	0.8	0.8	0.9	1.0	1.3	1.4	1.6	1.6	1.7	1.7	0.3	0.8	0.6
%ch(Gross Investment)	5.5	5.1	4.9	4.8	4.6	4.5	4.4	4.3	4.3	4.2	4.0	3.9	3.8	3.7	3.6	3.6	5.0	4.4	4.7
ch(Lump-Sum Transfer/GDP%)	-0.75	-0.75	-0.75	-0.75	-0.74	-0.74	-0.74	-0.74	-0.73	-0.73	-0.72	-0.72	-0.73	-0.74	-0.76	-0.77	-0.75	-0.74	-0.74
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.91	-0.91	-0.90	-0.90	-0.89	-0.89	-0.89	-0.88	-0.88	-0.88	-0.86	-0.85	-0.85	-0.85	-0.84	-0.84	-0.90	-0.88	-0.89
ch(Interest Rate%)	0.12	0.08	0.05	0.02	0.00	-0.02	-0.04	-0.06	-0.07	-0.08	-0.13	-0.16	-0.17	-0.18	-0.18	-0.18	0.05	-0.06	0.00
%ch(Wage Rate)	-0.5	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.2	0.3	0.3	0.5	0.6	0.7	0.7	0.7	0.7	-0.2	0.2	0.0
ch(Private Wealth/GDP%)	0.0	1.1	2.0	2.9	3.6	4.3	4.9	5.4	5.9	6.3	7.9	8.8	9.3	9.6	9.8	9.9	1.9	5.3	3.6
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.5	0.9	1.2	1.6	1.9	2.2	2.4	2.7	2.9	3.8	4.4	4.8	5.1	5.3	5.4	0.8	2.4	1.6
%ch(Labor)	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.8	1.6	1.2	1.4
%ch(GNP)	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	2.0	2.1	2.1	2.2	2.2	1.4	1.6	1.5
%ch(GDP)	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.8	1.6	1.2	1.4
%ch(Consumption)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.8	1.0	1.3	1.4	1.5	1.7	1.7	0.2	0.6	0.4
%ch(Gross Dom. Investment)	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.0	0.9	0.9	0.8	0.8	0.8	1.6	1.2	1.4
ch(Lump-Sum Transfer/GDP%)	-0.67	-0.68	-0.69	-0.71	-0.71	-0.72	-0.73	-0.73	-0.73	-0.74	-0.75	-0.76	-0.76	-0.77	-0.78	-0.79	-0.69	-0.73	-0.71
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.86	-0.87	-0.87	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	-0.87	-0.87	-0.87	-0.87	-0.87	-0.88	-0.88
ch(Net Foreign Assets/GDP%)	-5.1	-3.4	-2.0	-0.7	0.4	1.5	2.4	3.3	4.1	4.8	7.7	9.6	10.8	11.6	12.3	12.5	-2.2	3.2	0.5
ch(Private Wealth/GDP%)	0.0	1.2	2.4	3.4	4.3	5.2	6.0	6.7	7.4	8.0	10.4	12.1	13.2	13.9	14.5	14.8	2.3	6.6	4.4
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.7B: Welfare Changes Corresponding to Experiment Shown in Table A.7A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP
(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
The Year When Age 20 (Top) / the Age in Year 1 (Bottom)	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.7	-2.2	-5.1	-8.9	-11.8	-11.0	-10.1	-6.7	-5.0	-3.8	-2.9	-2.6	-2.7	-2.7	-2.7	-2.7	-2.7
20-40 percentile					-11.7	-12.3	-9.7	-7.0	-5.3	-5.2	-3.6	-3.1	-3.2	-3.3	-3.3	-3.3	-3.3
40-60 percentile					-11.8	-13.0	-8.4	-5.9	-4.6	-5.0	-3.1	-2.6	-2.7	-2.8	-2.8	-2.8	-2.7
60-80 percentile					-11.5	-11.2	-5.1	-2.1	-2.0	-4.0	-1.7	-1.1	-1.2	-1.3	-1.3	-1.3	-1.3
80-90 percentile					-10.1	-7.6	-1.6	1.5	1.1	-2.9	-0.3	0.4	0.4	0.3	0.2	0.3	0.3
90-95 percentile					-5.5	1.9	3.2	7.0	4.5	-1.0	2.0	2.8	2.8	2.7	2.6	2.7	2.7
95-99 percentile					7.0	21.6	18.5	19.1	12.5	3.1	6.7	7.8	7.8	7.7	7.6	7.7	7.7
99-100 percentile					58.0	130.2	95.9	65.8	40.8	8.9	13.0	14.2	14.3	14.2	14.2	14.2	14.2
Average	-0.7	-2.2	-5.1	-8.9	-9.8	-8.0	-4.9	-2.4	-2.1	-3.7	-1.8	-1.2	-1.3	-1.4	-1.4	-1.4	-1.4
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.6	-2.0	-5.0	-9.1	-11.4	-10.5	-9.7	-6.6	-5.1	-3.9	-3.6	-3.4	-3.2	-3.2	-3.2	-3.2	-3.2
20-40 percentile					-11.2	-11.5	-9.0	-6.7	-5.4	-5.4	-5.0	-4.6	-4.3	-4.3	-4.3	-4.3	-4.3
40-60 percentile					-11.3	-11.5	-7.2	-5.3	-4.7	-5.3	-4.9	-4.4	-4.1	-4.1	-4.1	-4.1	-4.1
60-80 percentile					-10.5	-8.1	-2.5	-0.4	-1.6	-4.4	-3.9	-3.4	-3.1	-3.1	-3.1	-3.1	-3.1
80-90 percentile					-8.4	-2.5	2.8	4.8	2.7	-3.3	-2.7	-2.2	-1.9	-1.8	-1.8	-1.8	-1.8
90-95 percentile					-2.5	10.6	11.0	14.0	7.8	-1.1	-0.4	0.1	0.4	0.4	0.5	0.5	0.5
95-99 percentile					12.6	37.8	34.8	33.6	20.2	4.4	5.1	5.7	6.0	6.1	6.1	6.1	6.1
99-100 percentile					75.3	183.7	148.9	109.3	66.6	12.5	13.2	13.8	14.1	14.1	14.1	14.1	14.2
Average	-0.6	-2.0	-5.0	-9.1	-8.6	-4.7	-1.9	-0.2	-1.2	-3.9	-3.4	-3.0	-2.7	-2.7	-2.7	-2.7	-2.7

Figure A.7: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy   Small Open Economy

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Table A.8A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	-0.4	-1.2	-1.3	-1.0	-0.8	-0.7	-0.7	0.1	-0.1	0.0
%ch(Labor)	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.3	0.1	0.1	0.1	0.1	0.1	0.9	0.6	0.8
%ch(GNP=GDP)	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.2	-0.2	-0.3	-0.2	-0.2	-0.1	-0.1	0.7	0.4	0.5
%ch(Consumption)	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.6	1.9	2.1	2.2	2.3	2.3	0.9	1.2	1.1
%ch(Gross Investment)	1.4	0.9	0.4	-0.1	-0.5	-1.0	-1.4	-2.0	-2.5	-3.1	-2.5	-0.2	-0.3	-0.5	-0.6	-0.6	0.4	-2.0	-0.8
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.70	-1.48	-1.46	-1.45	-1.44	-1.44	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.94	-0.95	-0.94	-0.94	-0.94	-0.94	-0.94	-0.95	-0.95	-0.95	-0.96	-0.96	-0.95	-0.95	-0.95	-0.94	-0.94	-0.95	-0.95
ch(Interest Rate%)	0.08	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.11	0.11	0.09	0.07	0.06	0.06	0.06	0.05	0.06
%ch(Wage Rate)	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
ch(Private Wealth/GDP%)	0.0	1.1	2.1	3.0	3.9	4.7	5.5	6.2	6.9	7.6	10.2	11.9	12.9	13.4	13.7	13.8	2.0	6.2	4.1
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.7	-2.6	-3.5	-4.4	-5.4	-6.4	-7.5	-8.6	-13.5	-15.6	-15.6	-15.6	-15.6	-15.6	-1.7	-6.5	-4.1
ch(Budget Deficit/GDP%)	0.84	0.90	0.96	1.02	1.08	1.14	1.20	1.27	1.34	1.42	1.08	0.44	0.44	0.44	0.44	0.44	0.96	1.28	1.12
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.0	0.0	-0.1	-0.3	-0.4	-0.6	-0.8	-1.8	-2.1	-1.7	-1.5	-1.3	-1.2	0.0	-0.4	-0.2
%ch(Labor)	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(GNP)	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.1	-0.3	-0.4	-0.3	-0.3	-0.2	-0.2	0.6	0.3	0.5
%ch(GDP)	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(Consumption)	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.7	1.9	2.0	2.1	2.2	2.3	1.0	1.4	1.2
%ch(Gross Dom. Investment)	14.8	-0.3	-0.4	-0.1	-0.2	0.1	-0.1	0.2	0.0	0.2	0.1	0.3	0.1	0.3	0.3	0.2	2.7	0.1	1.4
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.67	-1.42	-1.42	-1.42	-1.43	-1.42	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.93	-0.93	-0.94	-0.94	-0.94	-0.94	-0.95	-0.95	-0.95	-0.95	-0.94	-0.94	-0.94	-0.94	-0.94	-0.94	-0.94	-0.95	-0.94
ch(Net Foreign Assets/GDP%)	-3.0	-2.5	-2.2	-2.1	-2.1	-2.2	-2.4	-2.8	-3.2	-3.7	-6.2	-6.6	-5.5	-4.9	-4.2	-3.9	-2.4	-2.9	-2.6
ch(Private Wealth/GDP%)	0.0	1.0	1.8	2.6	3.4	4.0	4.7	5.2	5.8	6.3	8.3	9.7	10.7	11.3	11.8	12.1	1.7	5.2	3.5
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.5	-3.4	-4.4	-5.4	-6.4	-7.5	-8.6	-13.4	-15.4	-15.4	-15.4	-15.4	-15.4	-1.7	-6.4	-4.1
ch(Budget Deficit/GDP%)	0.82	0.88	0.95	1.01	1.08	1.14	1.21	1.27	1.34	1.41	1.05	0.43	0.43	0.43	0.43	0.43	0.95	1.28	1.11

Table A.8B: Welfare Changes Corresponding to Experiment Shown in Table A.8A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

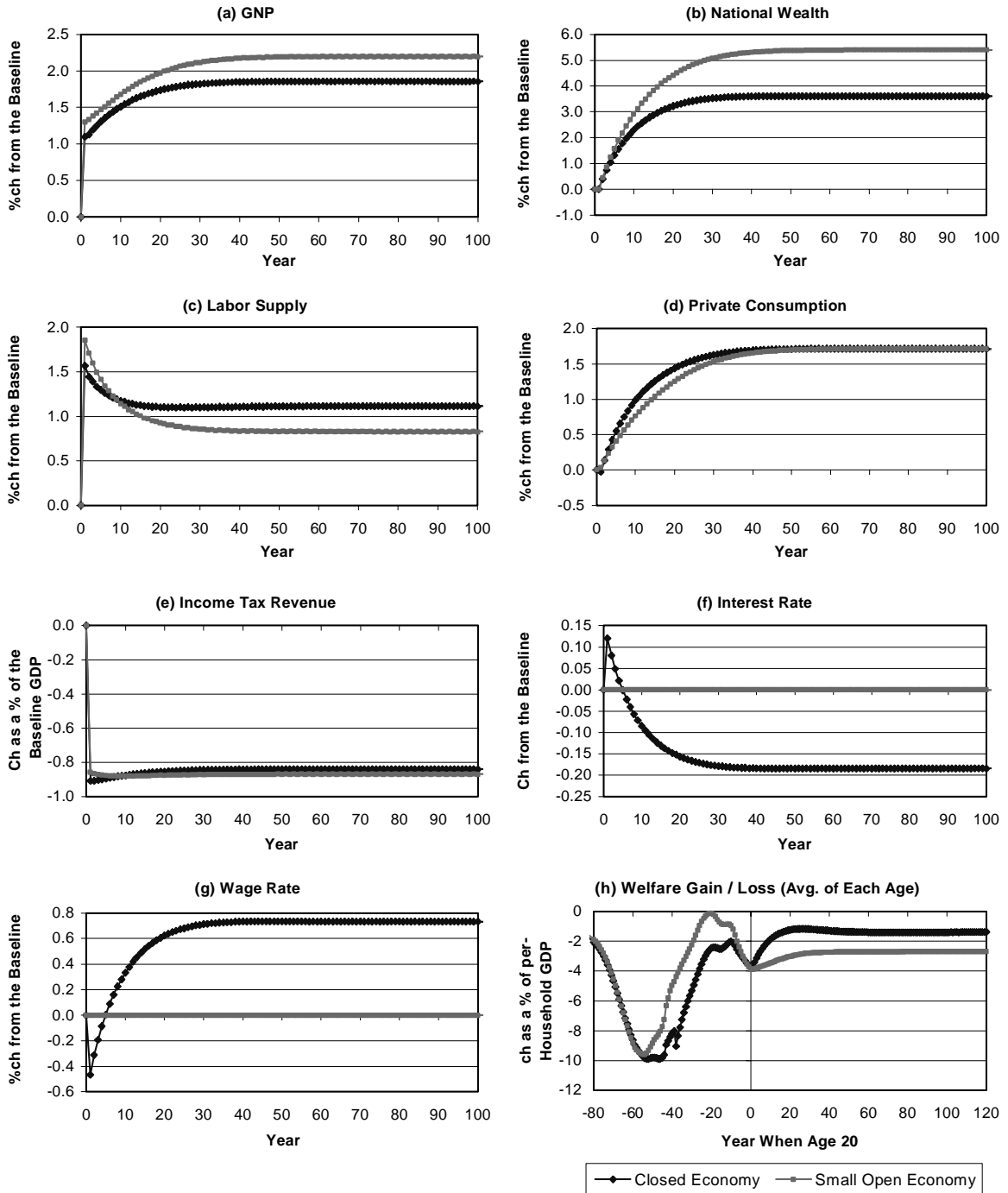|	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.2	1.7	1.8	1.6	2.9	3.7	2.9	1.6	1.9	2.3	2.6	2.6	2.6	2.6	2.6
20-40 percentile					2.3	2.7	5.3	6.9	5.9	3.7	4.4	5.1	5.7	5.7	5.7	5.7	5.7
40-60 percentile					3.0	4.8	8.1	10.0	8.7	5.2	5.9	6.8	7.4	7.5	7.5	7.5	7.5
60-80 percentile					5.7	10.4	14.6	16.2	13.7	7.5	8.1	9.1	9.9	9.9	9.9	9.9	9.9
80-90 percentile					9.7	18.1	22.2	23.2	19.8	10.0	10.6	11.7	12.5	12.6	12.6	12.6	12.6
90-95 percentile					17.8	35.6	34.7	36.0	26.6	13.5	14.2	15.3	16.2	16.3	16.3	16.3	16.3
95-99 percentile					36.0	69.7	65.6	61.1	42.1	21.2	21.8	22.8	23.9	23.9	23.9	23.9	23.9
99-100 percentile					106.6	237.7	201.8	153.7	98.3	31.1	31.5	32.2	33.4	33.5	33.5	33.5	33.5
Average	0.0	0.0	0.2	1.7	6.9	12.7	14.8	15.4	12.2	6.4	7.0	7.8	8.5	8.5	8.5	8.5	8.5
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.0	0.7	0.7	0.8	2.8	4.0	3.3	1.8	2.2	2.4	2.7	2.7	2.7	2.7	2.7
20-40 percentile					1.1	1.6	5.0	7.3	6.5	4.3	4.9	5.4	5.8	5.9	5.9	5.9	5.9
40-60 percentile					1.3	3.1	7.5	10.2	9.5	6.0	6.7	7.2	7.7	7.7	7.8	7.8	7.8
60-80 percentile					2.9	7.1	12.8	15.7	14.2	8.4	9.2	9.8	10.3	10.3	10.4	10.4	10.4
80-90 percentile					5.5	12.8	18.8	21.5	19.8	11.0	11.9	12.5	13.0	13.1	13.1	13.1	13.1
90-95 percentile					11.4	26.5	27.8	31.7	25.5	14.6	15.5	16.2	16.7	16.8	16.8	16.8	16.8
95-99 percentile					26.8	54.5	52.5	52.1	38.8	22.0	22.9	23.6	24.2	24.3	24.3	24.3	24.3
99-100 percentile					90.8	201.6	168.1	129.1	86.7	31.1	32.1	32.8	33.3	33.4	33.4	33.4	33.4
Average	0.0	0.0	0.0	0.7	4.3	9.3	12.7	14.5	12.4	7.1	7.8	8.3	8.7	8.8	8.8	8.8	8.8

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Figure A.8: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

Table A.9A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.2	0.3	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.0	1.0	0.3	0.7	0.5
%ch(Labor)	1.3	1.2	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	0.9	1.0
%ch(GNP=GDP)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0.9	0.8	0.9
%ch(Consumption)	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.3	1.3	1.4	1.4	0.7	1.0	0.9
%ch(Gross Investment)	2.6	2.2	1.9	1.6	1.4	1.2	1.0	0.8	0.7	0.6	0.7	1.1	1.1	1.1	1.0	1.0	1.9	0.9	1.4
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.58	-1.19	-1.18	-1.18	-1.18	-1.21	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.92	-0.92	-0.92	-0.92	-0.91	-0.91	-0.90	-0.90	-0.89	-0.89	-0.87	-0.85	-0.84	-0.84	-0.84	-0.84	-0.92	-0.90	-0.91
ch(Interest Rate%)	0.10	0.07	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.06	0.02	0.04
%ch(Wage Rate)	-0.4	-0.3	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.2	-0.1	-0.2
ch(Private Wealth/GDP%)	0.0	1.3	2.5	3.7	4.8	5.8	6.8	7.8	8.8	9.8	14.0	15.9	16.2	16.4	16.6	16.5	2.4	7.8	5.1
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.4	-3.3	-4.2	-5.1	-6.0	-7.0	-8.0	-12.2	-13.9	-13.9	-13.9	-13.9	-13.9	-1.6	-6.0	-3.8
ch(Budget Deficit/GDP%)	0.80	0.86	0.90	0.95	1.00	1.06	1.11	1.16	1.21	1.27	0.92	0.39	0.39	0.39	0.39	0.39	0.90	1.16	1.03
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.9	0.9	0.3	0.6	0.4
%ch(Labor)	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.2	0.9	1.1
%ch(GNP)	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	1.1	1.1	0.9	0.8	0.9
%ch(GDP)	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.2	0.9	1.1
%ch(Consumption)	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	0.8	1.1	0.9
%ch(Gross Dom. Investment)	18.8	-0.1	-0.1	0.3	0.1	0.5	0.3	0.7	0.5	0.9	1.1	1.5	1.0	1.3	1.3	1.1	3.8	0.6	2.2
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.57	-1.17	-1.17	-1.17	-1.17	-1.20	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.90	-0.90	-0.90	-0.90	-0.91	-0.90	-0.90	-0.90	-0.89	-0.89	-0.86	-0.85	-0.84	-0.84	-0.84	-0.84	-0.90	-0.90	-0.90
ch(Net Foreign Assets/GDP%)	-3.8	-3.0	-2.3	-1.8	-1.4	-1.2	-0.9	-0.9	-0.8	-0.8	-1.1	-1.3	-1.0	-0.7	-0.5	-0.6	-2.5	-0.9	-1.7
ch(Private Wealth/GDP%)	0.0	1.2	2.4	3.5	4.6	5.6	6.6	7.6	8.5	9.5	13.5	15.4	15.8	16.0	16.3	16.2	2.3	7.6	4.9
ch(Gov't Wealth/GDP%)	0.0	-0.7	-1.5	-2.3	-3.2	-4.0	-4.9	-5.9	-6.8	-7.8	-12.0	-13.7	-13.7	-13.7	-13.7	-13.7	-1.5	-5.9	-3.7
ch(Budget Deficit/GDP%)	0.76	0.82	0.87	0.93	0.99	1.04	1.10	1.15	1.21	1.26	0.91	0.39	0.39	0.39	0.39	0.39	0.87	1.15	1.01

Table A.9B: Welfare Changes Corresponding to Experiment Shown in Table A.9A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

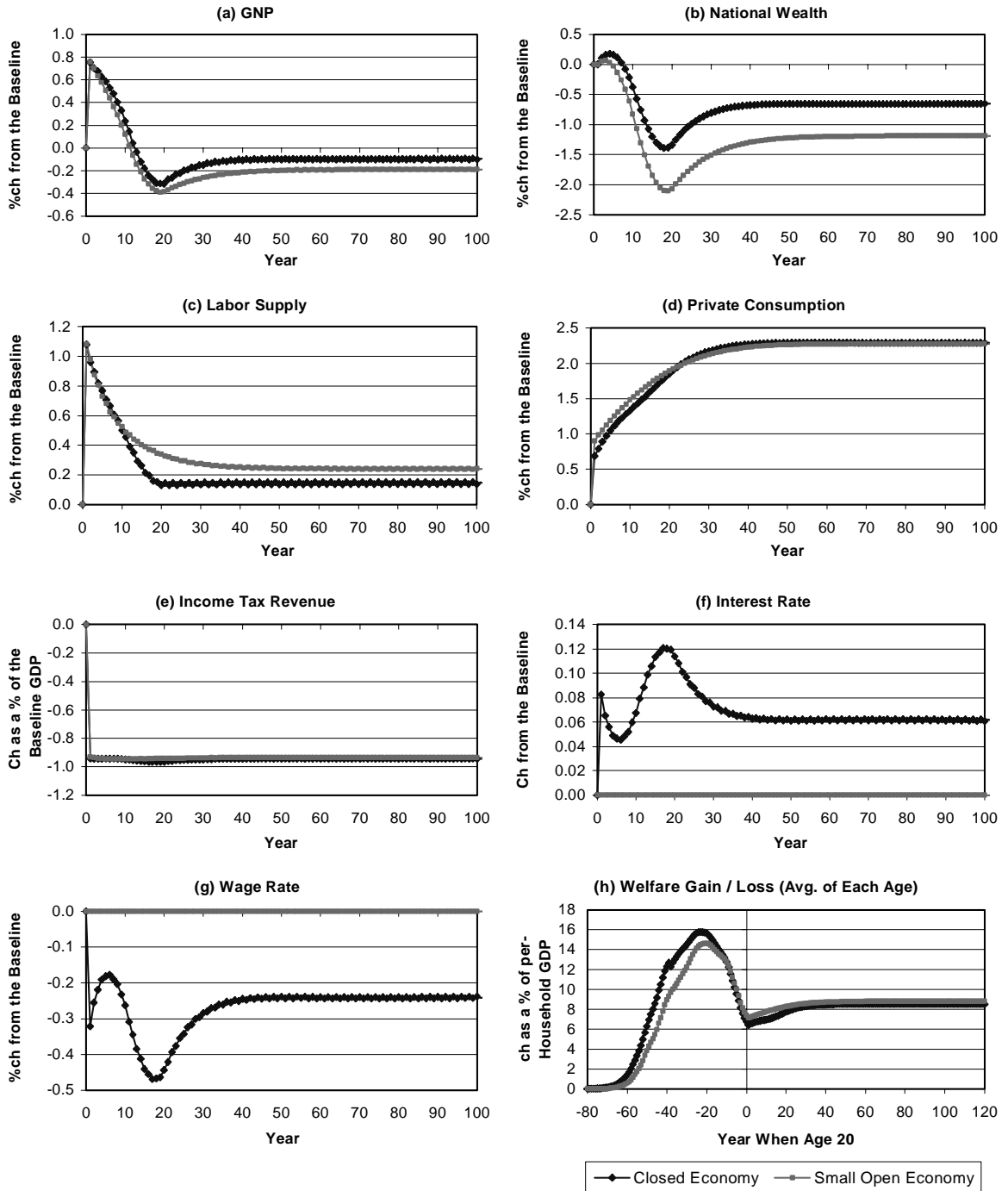|								The Year When Age 20 (Top) / the Age in Year 1 (Bottom)									
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.0	-0.9	-4.6	-5.1	-4.0	-3.0	-1.6	-0.8	-3.6	-7.1	-6.9	-7.1	-7.1	-7.1	-7.1
20-40 percentile					-4.3	-6.1	-3.6	-2.8	-1.6	-1.3	-6.0	-9.9	-9.7	-9.9	-9.9	-9.9	-9.9
40-60 percentile					-4.1	-5.9	-2.1	-1.5	-1.0	-1.2	-6.6	-10.5	-10.3	-10.5	-10.6	-10.6	-10.6
60-80 percentile					-2.6	-2.0	2.3	3.1	1.7	-0.6	-6.3	-10.3	-10.1	-10.3	-10.4	-10.4	-10.4
80-90 percentile					0.1	4.0	7.5	8.4	5.7	0.3	-5.9	-9.9	-9.7	-9.9	-10.0	-10.0	-10.0
90-95 percentile					6.5	17.7	16.6	18.0	10.6	2.1	-4.2	-8.2	-8.0	-8.3	-8.4	-8.4	-8.4
95-99 percentile					21.7	46.3	41.7	38.2	22.9	6.8	0.6	-3.5	-3.2	-3.5	-3.6	-3.6	-3.6
99-100 percentile					84.5	193.9	158.1	115.4	69.2	14.3	8.2	4.1	4.4	4.1	4.0	4.0	4.1
Average	0.0	0.0	0.0	-0.9	-1.1	1.3	3.3	3.6	2.2	-0.2	-5.2	-9.0	-8.9	-9.1	-9.1	-9.1	-9.1
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	-0.1	-1.8	-5.3	-5.6	-4.0	-2.7	-1.3	-0.7	-3.5	-7.0	-6.8	-7.0	-7.0	-7.0	-7.0
20-40 percentile					-5.1	-6.7	-3.6	-2.5	-1.2	-0.9	-5.8	-9.7	-9.6	-9.7	-9.8	-9.8	-9.8
40-60 percentile					-5.2	-6.7	-2.2	-1.1	-0.5	-0.8	-6.3	-10.3	-10.2	-10.3	-10.4	-10.4	-10.4
60-80 percentile					-4.5	-3.4	1.8	3.3	2.2	0.0	-6.0	-10.0	-9.9	-10.1	-10.2	-10.2	-10.2
80-90 percentile					-2.5	1.9	6.5	8.3	6.1	1.0	-5.6	-9.6	-9.5	-9.7	-9.8	-9.8	-9.8
90-95 percentile					3.1	14.4	14.3	17.2	10.9	2.8	-3.9	-7.9	-7.8	-8.0	-8.1	-8.1	-8.1
95-99 percentile					17.3	41.4	37.8	36.5	23.1	7.9	0.9	-3.1	-3.0	-3.3	-3.3	-3.4	-3.4
99-100 percentile					79.6	186.9	151.7	111.9	69.1	15.4	8.4	4.4	4.5	4.3	4.2	4.2	4.1
Average	0.0	0.0	-0.1	-1.8	-2.6	0.0	2.8	3.7	2.6	0.2	-5.0	-8.8	-8.7	-8.9	-8.9	-9.0	-9.0

Figure A.9: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

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Table A.10A: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.0	-0.8	-2.0	-3.3	-4.1	-4.9	-5.2	0.2	0.1	0.2
%ch(Labor)	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7	-0.1	-1.1	-0.9	-0.8	-0.8	-0.7	1.0	0.8	0.9
%ch(GNP=GDP)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	-0.3	-1.4	-1.7	-1.8	-2.0	-2.1	0.7	0.6	0.7
%ch(Consumption)	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.2	0.8	-0.1	-0.6	-0.9	-1.3	-1.5	0.8	1.1	1.0
%ch(Gross Investment)	1.7	1.2	0.8	0.4	0.1	-0.2	-0.5	-0.8	-1.1	-1.3	-3.8	-6.4	-5.8	-5.7	-5.5	-5.2	0.8	-0.8	0.0
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.94	-0.94	-0.94	-0.94	-0.93	-0.93	-0.93	-0.92	-0.92	-0.91	-0.26	0.63	0.64	0.64	0.63	0.57	-0.94	-0.92	-0.93
ch(Interest Rate%)	0.09	0.07	0.06	0.05	0.05	0.04	0.04	0.05	0.05	0.06	0.05	0.07	0.19	0.26	0.33	0.36	0.06	0.05	0.06
%ch(Wage Rate)	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.7	-1.0	-1.3	-1.4	-0.2	-0.2	-0.2
ch(Private Wealth/GDP%)	0.0	1.1	2.2	3.2	4.1	5.0	5.9	6.7	7.5	8.4	11.0	9.6	6.1	4.0	1.9	1.0	2.1	6.7	4.4
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.5	-3.4	-4.3	-5.3	-6.3	-7.3	-8.4	-13.1	-15.2	-15.2	-15.2	-15.2	-15.2	-1.7	-6.3	-4.0
ch(Budget Deficit/GDP%)	0.83	0.89	0.94	1.00	1.05	1.11	1.17	1.23	1.29	1.35	1.07	0.43	0.43	0.43	0.43	0.43	0.94	1.23	1.08
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.1	0.1	0.0	0.0	-0.1	-0.2	-0.4	-1.4	-3.1	-4.9	-6.0	-7.3	-8.1	0.1	-0.2	0.0
%ch(Labor)	1.2	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	-0.1	-1.3	-0.7	-0.4	-0.2	-0.1	1.0	0.8	0.9
%ch(GNP)	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4	-0.5	-1.8	-2.0	-2.1	-2.4	-2.5	0.7	0.5	0.6
%ch(GDP)	1.2	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.8	-0.1	-1.3	-0.7	-0.4	-0.2	-0.1	1.0	0.8	0.9
%ch(Consumption)	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.3	0.9	0.1	-0.3	-0.5	-1.0	-1.3	1.0	1.3	1.1
%ch(Gross Dom. Investment)	15.8	-0.2	-0.2	0.2	0.1	0.4	0.3	0.7	0.6	1.1	-2.7	-4.6	-0.1	0.4	0.3	0.1	3.1	0.6	1.9
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.92	-0.93	-0.93	-0.93	-0.93	-0.93	-0.93	-0.92	-0.92	-0.91	-0.27	0.64	0.60	0.57	0.55	0.54	-0.93	-0.92	-0.92
ch(Net Foreign Assets/GDP%)	-3.2	-2.7	-2.3	-2.2	-2.1	-2.1	-2.2	-2.5	-2.8	-3.2	-3.5	-5.0	-11.4	-15.4	-19.4	-21.8	-2.5	-2.6	-2.5
ch(Private Wealth/GDP%)	0.0	1.0	1.9	2.8	3.6	4.4	5.1	5.8	6.6	7.2	9.2	6.7	1.8	-1.4	-4.9	-7.0	1.9	5.8	3.9
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.5	-3.4	-4.3	-5.2	-6.2	-7.2	-8.3	-13.0	-15.2	-15.2	-15.2	-15.2	-15.2	-1.6	-6.2	-3.9
ch(Budget Deficit/GDP%)	0.81	0.87	0.93	0.98	1.05	1.10	1.16	1.22	1.28	1.33	1.07	0.43	0.43	0.43	0.43	0.43	0.93	1.22	1.07

Table A.10B: Welfare Changes Corresponding to Experiment Shown in Table A.10A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

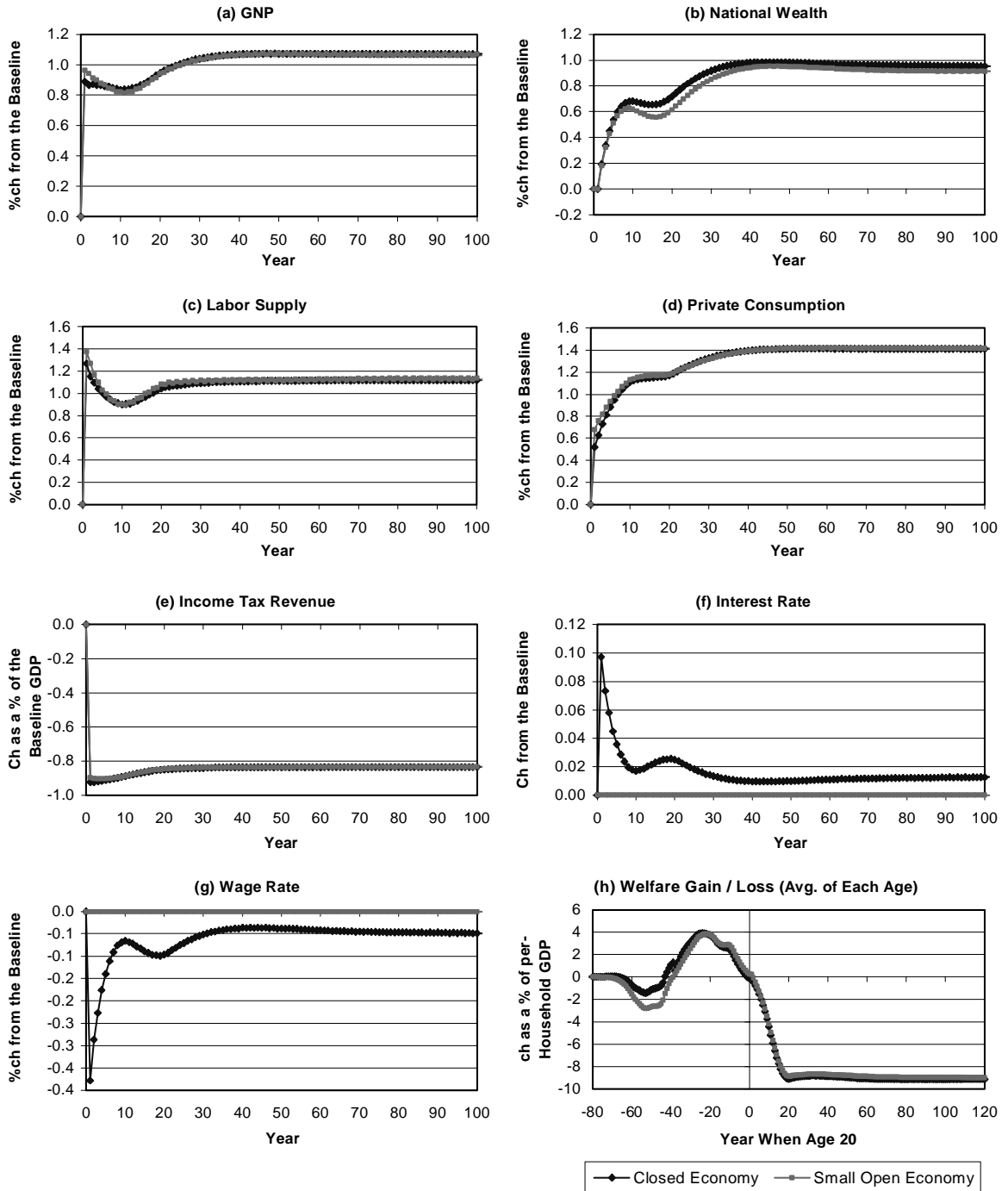|	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.2	1.6	1.6	1.4	2.4	2.2	0.6	-0.1	-0.8	-1.6	-2.5	-2.5	-2.5	-2.4	-2.5
20-40 percentile					2.1	2.3	4.5	4.5	1.7	0.2	-1.7	-3.8	-5.1	-5.2	-5.1	-5.1	-5.1
40-60 percentile					2.6	4.1	7.0	6.8	3.0	0.5	-2.4	-5.2	-6.9	-7.0	-6.9	-6.8	-6.9
60-80 percentile					5.1	9.1	12.6	11.9	6.1	1.2	-3.2	-7.3	-9.4	-9.4	-9.3	-9.2	-9.3
80-90 percentile					8.7	15.8	19.2	17.8	10.6	2.1	-3.9	-9.3	-11.6	-11.7	-11.6	-11.5	-11.6
90-95 percentile					16.0	31.0	29.7	29.2	16.1	4.0	-3.7	-11.4	-14.1	-14.0	-13.9	-13.8	-13.9
95-99 percentile					32.9	60.6	55.9	51.7	29.9	9.1	-1.5	-13.9	-17.1	-17.0	-16.9	-16.7	-16.7
99-100 percentile					98.7	208.3	173.0	134.6	82.8	16.8	2.0	-16.7	-20.3	-20.1	-20.0	-19.8	-19.8
Average	0.0	0.0	0.2	1.6	6.2	11.0	12.7	11.7	6.2	1.3	-2.2	-5.8	-7.5	-7.6	-7.5	-7.4	-7.5
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	0.0	0.0	0.0	0.7	0.7	0.6	2.1	2.0	0.7	0.1	-0.4	-0.8	-1.4	-1.6	-1.7	-1.7	-1.7
20-40 percentile					1.0	1.3	3.9	4.1	1.9	0.6	-0.9	-2.0	-3.0	-3.4	-3.4	-3.5	-3.5
40-60 percentile					1.3	2.6	6.1	6.1	3.2	1.0	-1.3	-2.9	-4.0	-4.4	-4.5	-4.5	-4.5
60-80 percentile					2.7	6.2	10.3	10.2	5.8	1.8	-1.9	-4.3	-5.6	-6.0	-6.1	-6.1	-6.1
80-90 percentile					5.1	11.1	15.0	14.6	9.5	2.7	-2.5	-6.0	-7.3	-7.7	-7.8	-7.8	-7.8
90-95 percentile					10.7	23.0	21.7	22.6	13.6	4.4	-2.7	-8.2	-9.4	-9.8	-9.9	-9.9	-10.0
95-99 percentile					25.5	47.2	41.2	39.0	24.2	8.7	-2.0	-12.6	-13.6	-13.9	-14.1	-14.1	-14.2
99-100 percentile					86.8	176.8	135.2	101.0	64.6	14.7	-1.5	-18.5	-19.1	-19.5	-19.6	-19.7	-19.8
Average	0.0	0.0	0.0	0.7	4.1	8.1	10.1	9.6	5.6	1.7	-1.4	-3.7	-4.7	-5.1	-5.2	-5.2	-5.2

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Figure A.10: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy ⎯ Small Open Economy

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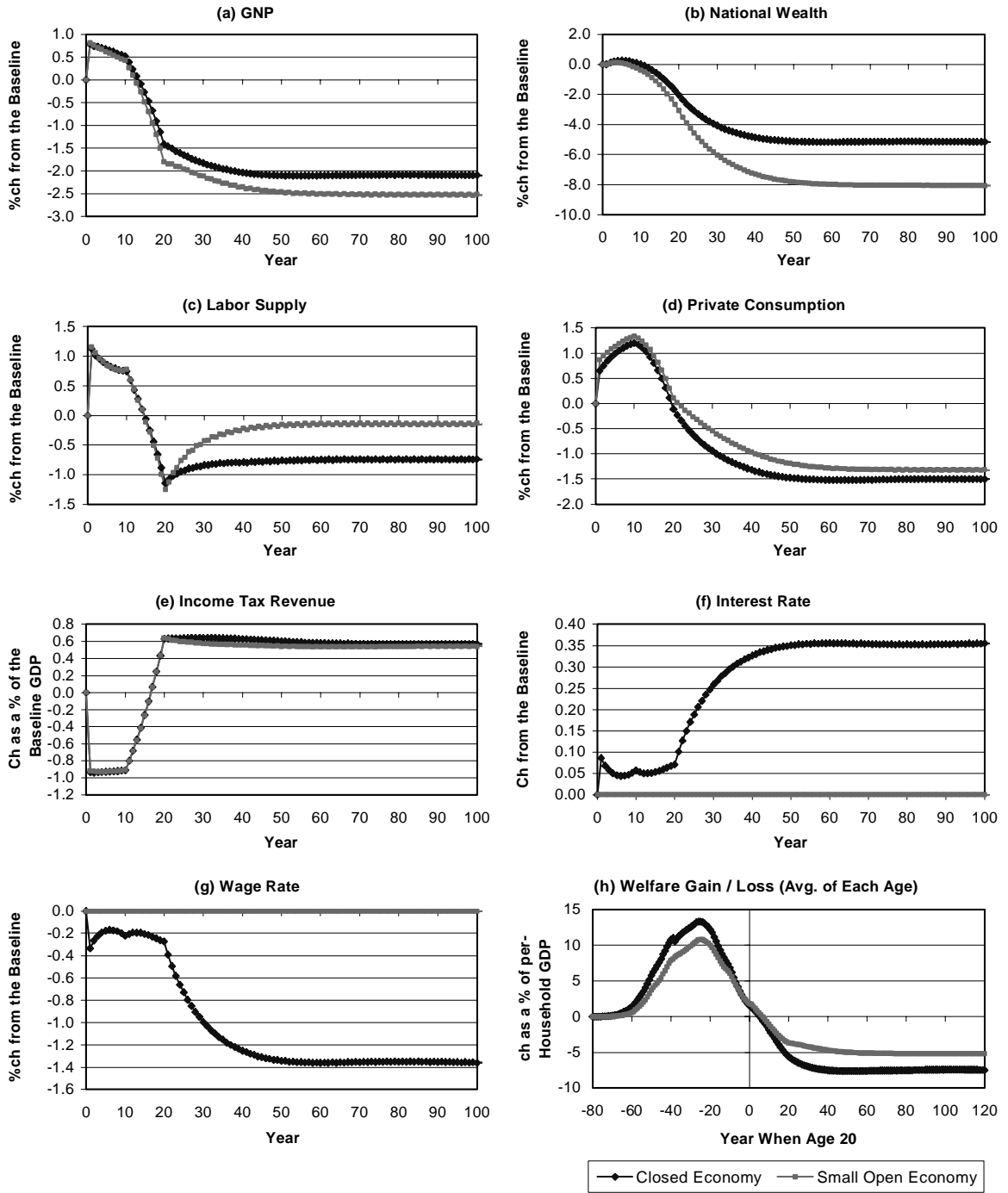
Appendix 3

The Representative-Agent Deterministic OLG Model

with Lower Labor Supply Elasticity

October 2003

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Model.   Appendix 3 uses a representative agent deterministic OLG model with relatively low labor supply elasticity. The model assumes that the coefficient of relative risk aversion γ is 4.0, the consumption share parameter α is 0.64, and the maximum possible working hours (per couple) are 5,460. This assumption is similar to Appendix 1. The experiments are done under both a closed economy assumption and a small open economy assumption.

Policy Experiment.   Marginal income tax rates are reduced proportionally, and permanently, by 10 percent from the baseline. In the model, the adjustment factor of income tax, $\tau_{I,adj}$, is reduced to 0.916 from 1.018 in model year 1. (Model year 1 corresponds to year 2004.)

In the model economy, corporate income tax is included into individual income tax. The effective marginal tax rate on capital income is on average about 30 percent lower than the effective marginal tax rate on labor income, even if corporate income tax is considered. This is treated as that only 70 percent of capital income is taxable.

Government Financing Rules.   There are five financing rules:

1. Government consumption (waste) $C_{G,t}$ reduced contemporaneously (See Tables and Figure A.11);

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2. Lump-sum transfers $tr_{LS,t}$ reduced contemporaneously (A.12);

3. Government consumption $C_{G,t}$ reduced gradually after 10 years (A.13);

4. Lump-sum transfers $tr_{LS,t}$ reduced gradually after 10 years (A.14);

5. Income tax rates $\tau_{I,adj}$ raised gradually after 10 years (A.15).

The ratio of government debt (net wealth) to the baseline GDP is fixed throughout the transition path in financing rules 1 and 2, and the debt-GDP ratio is stabilized after 20 years in financing rules 3, 4, and 5.

Some Remarks. The *static* cost of this tax cut is 1.02 percent of GDP throughout the transition path, because the income tax revenue is 10.2 as a percentage of GDP in the baseline economy. The change in government consumption in Table A.11.A, for example, shows the *dynamic* cost of this tax cut under financing rule assumption 1. Under this assumption, about 21 percent of static revenue loss is recovered in year 1 and 27 percent is recovered in year 10. (Note that these numbers are much larger than those in Appendix 1.) The revenue recovery is larger if lump-sum transfers are reduced contemporaneously and smaller if deficit financing is assumed.

Suppose that the effective marginal tax rate is on average 19 percent, marginal payroll tax rate is on average 6 percent, and marginal state and local tax rate is 5 percent, the after tax wage goes up by 2.7 percent if market wage rate does not change. The ratio of the percent change in labor supply to the percent change in after tax wage shows the average labor supply elasticity. In Table A.11.A, for example, the (uncompensated) labor supply elasticity is about 0.33 for the first 10 years.

Table A.11A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.2	0.4	0.6	0.8	0.9	1.1	1.2	1.4	1.5	2.0	2.3	2.6	2.7	2.8	3.0	0.4	1.2	0.8
%ch(Labor)	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9
%ch(GNP=GDP)	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.2	1.3	1.3	1.4	1.4	1.4	0.8	1.0	0.9
%ch(Consumption)	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.9	2.0	2.1	2.2	2.3	2.4	1.4	1.6	1.5
%ch(Gross Investment)	2.9	2.9	3.0	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.0	3.0	2.9	3.0	3.0	3.0	3.0
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.81	-0.82	-0.81	-0.80	-0.79	-0.78	-0.78	-0.77	-0.76	-0.75	-0.73	-0.72	-0.72	-0.73	-0.74	-0.76	-0.81	-0.77	-0.79
ch(Income Tax/GDP%)	-0.92	-0.93	-0.92	-0.91	-0.91	-0.90	-0.90	-0.89	-0.89	-0.88	-0.86	-0.85	-0.84	-0.84	-0.83	-0.83	-0.92	-0.89	-0.90
ch(Interest Rate%)	0.08	0.05	0.04	0.02	0.01	-0.01	-0.02	-0.03	-0.04	-0.05	-0.09	-0.12	-0.13	-0.14	-0.15	-0.16	0.04	-0.03	0.00
%ch(Wage Rate)	-0.3	-0.2	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.5	0.5	0.6	0.6	0.6	-0.1	0.1	0.0
ch(Private Wealth/GDP%)	0.0	0.6	1.1	1.7	2.1	2.6	3.0	3.4	3.8	4.1	5.5	6.4	7.0	7.4	7.8	8.2	1.1	3.4	2.2
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.2	0.4	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.6	3.3	3.8	4.2	4.8	5.9	0.4	1.5	0.9
%ch(Labor)	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.9	0.8	0.9
%ch(GNP)	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.3	1.4	1.5	1.6	1.8	2.1	0.8	1.0	0.9
%ch(GDP)	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.9	0.8	0.9
%ch(Consumption)	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4	1.3	1.4	1.3
%ch(Gross Dom. Investment)	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.9	0.8	0.9
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	-0.79	-0.79	-0.79	-0.79	-0.79	-0.79	-0.79	-0.78	-0.78	-0.78	-0.78	-0.78	-0.79	-0.79	-0.79	-0.78	-0.79	-0.78	-0.79
ch(Income Tax/GDP%)	-0.91	-0.91	-0.91	-0.91	-0.90	-0.90	-0.90	-0.90	-0.90	-0.89	-0.89	-0.88	-0.87	-0.87	-0.86	-0.85	-0.91	-0.90	-0.90
ch(Net Foreign Assets/GDP%)	-2.7	-2.0	-1.3	-0.7	0.0	0.6	1.2	1.8	2.3	2.9	5.3	7.3	8.9	10.1	11.8	15.0	-1.3	1.8	0.2
ch(Private Wealth/GDP%)	0.0	0.6	1.2	1.8	2.4	2.9	3.5	4.0	4.5	5.0	7.2	9.0	10.4	11.6	13.2	16.1	1.2	4.0	2.6
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.11B: Welfare Changes Corresponding to Experiment Shown in Table A.11A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																
0.0	0.0	0.3	0.3	-0.6	6.0	20.9	32.5	35.3	24.6	27.1	28.5	29.5	29.5	29.6	29.6	29.6
(Small Open Economy)																
0.0	0.0	0.0	0.5	2.0	11.5	27.6	38.6	40.0	27.3	28.6	29.9	31.4	31.9	32.1	32.2	32.3

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Figure A.11: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

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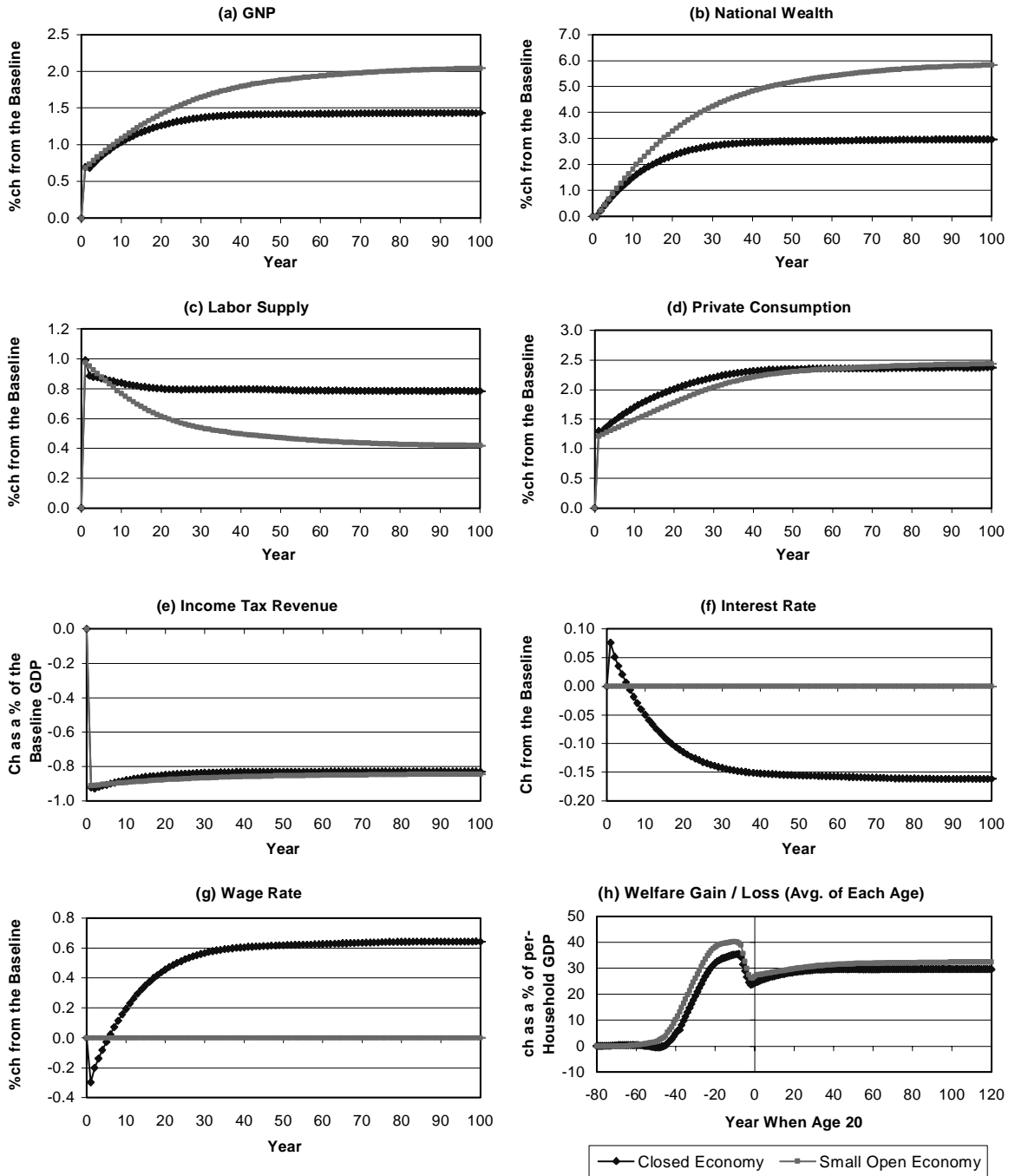
Table A.12A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.2	0.4	0.6	0.8	0.9	1.1	1.2	1.4	1.5	2.0	2.4	2.6	2.8	3.0	3.0	0.4	1.2	0.8
%ch(Labor)	1.5	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.3	1.2	1.3
%ch(GNP=GDP)	1.1	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.0	1.2	1.1
%ch(Consumption)	0.6	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.7	0.6	0.9	0.7
%ch(Gross Investment)	3.3	2.9	2.9	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.2	3.2	3.2	3.1	3.1	3.0	3.0	3.1	3.0
ch(Lump-Sum Transfer/GDP%)	-0.67	-0.73	-0.72	-0.71	-0.70	-0.70	-0.69	-0.68	-0.68	-0.67	-0.65	-0.64	-0.64	-0.64	-0.66	-0.69	-0.71	-0.68	-0.70
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.85	-0.88	-0.87	-0.87	-0.86	-0.85	-0.85	-0.84	-0.84	-0.84	-0.82	-0.81	-0.80	-0.79	-0.79	-0.78	-0.87	-0.84	-0.86
ch(Interest Rate%)	0.12	0.08	0.06	0.05	0.03	0.02	0.01	0.00	-0.01	-0.02	-0.06	-0.09	-0.11	-0.12	-0.14	-0.14	0.07	0.00	0.03
%ch(Wage Rate)	-0.5	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	0.0	0.1	0.1	0.3	0.4	0.4	0.5	0.5	0.6	-0.3	0.0	-0.1
ch(Private Wealth/GDP%)	0.0	0.7	1.2	1.7	2.2	2.6	3.0	3.4	3.8	4.1	5.5	6.5	7.2	7.7	8.1	8.3	1.1	3.4	2.3
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.2	0.5	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.6	3.2	3.8	4.1	4.7	5.5	0.4	1.5	0.9
%ch(Labor)	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	1.3	1.2	1.3
%ch(GNP)	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2	1.1	1.3	1.2
%ch(GDP)	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	1.3	1.2	1.3
%ch(Consumption)	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.7	0.5	0.7	0.6
%ch(Gross Dom. Investment)	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	1.3	1.2	1.3
ch(Lump-Sum Transfer/GDP%)	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.69	-0.69	-0.70	-0.70	-0.68	-0.68	-0.68
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.85	-0.85	-0.85	-0.85	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.83	-0.82	-0.82	-0.81	-0.81	-0.79	-0.85	-0.84	-0.84
ch(Net Foreign Assets/GDP%)	-3.8	-3.1	-2.4	-1.7	-1.1	-0.5	0.1	0.7	1.3	1.8	4.2	6.1	7.6	8.8	10.3	12.9	-2.4	0.7	-0.9
ch(Private Wealth/GDP%)	0.0	0.6	1.2	1.8	2.4	3.0	3.5	4.0	4.5	5.0	7.1	8.9	10.3	11.4	12.8	15.1	1.2	4.0	2.6
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.12B: Welfare Changes Corresponding to Experiment Shown in Table A.12A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																
-0.6	-4.2	-8.7	-11.4	-14.0	-8.6	4.4	14.0	15.7	8.6	11.3	12.6	13.1	12.8	12.7	12.7	12.7
(Small Open Economy)																
-0.7	-4.2	-9.4	-12.7	-13.5	-4.6	9.7	19.3	19.8	10.7	11.9	13.1	14.3	14.7	14.9	15.0	15.1

Figure A.12: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy   Small Open Economy

Table A.13A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-1.3	-1.2	-0.6	-0.2	0.1	0.5	0.0	-0.4	-0.2
%ch(Labor)	1.1	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.9	0.7	0.8
%ch(GNP=GDP)	0.8	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.0	-0.1	0.1	0.2	0.3	0.4	0.6	0.4	0.5
%ch(Consumption)	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.5	1.8	2.0	2.1	2.3	2.5	1.1	1.2	1.2
%ch(Gross Investment)	0.2	-0.3	-0.5	-0.8	-1.1	-1.4	-1.7	-2.1	-2.5	-2.9	-1.9	0.6	0.6	0.5	0.4	0.5	-0.5	-2.1	-1.3
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.65	-1.36	-1.32	-1.29	-1.28	-1.29	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.91	-0.93	-0.92	-0.92	-0.92	-0.92	-0.91	-0.91	-0.91	-0.91	-0.92	-0.90	-0.88	-0.87	-0.86	-0.85	-0.92	-0.91	-0.92
ch(Interest Rate%)	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.10	0.14	0.12	0.08	0.05	0.02	0.00	0.07	0.09	0.08
%ch(Wage Rate)	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.5	-0.5	-0.3	-0.2	-0.1	0.0	-0.3	-0.3	-0.3
ch(Private Wealth/GDP%)	0.0	0.8	1.6	2.3	3.1	3.8	4.5	5.1	5.8	6.5	9.3	11.6	13.1	14.1	15.2	16.0	1.6	5.1	3.3
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.4	-3.3	-4.2	-5.2	-6.1	-7.1	-8.2	-12.8	-14.8	-14.8	-14.8	-14.8	-14.8	-1.6	-6.2	-3.9
ch(Budget Deficit/GDP%)	0.79	0.87	0.92	0.97	1.03	1.08	1.14	1.21	1.27	1.35	1.01	0.42	0.42	0.42	0.42	0.42	0.92	1.21	1.06
(Small Open Economy)																			
%ch(National Wealth)	0.0	-0.1	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7	-0.9	-1.1	-1.8	-1.8	-1.3	-0.9	-0.3	0.8	-0.1	-0.7	-0.4
%ch(Labor)	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.9	0.8	0.9
%ch(GNP)	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.2	-0.1	-0.1	0.0	0.1	0.3	0.5	0.6	0.4	0.5
%ch(GDP)	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.9	0.8	0.9
%ch(Consumption)	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.2	2.4	1.3	1.4	1.3
%ch(Gross Dom. Investment)	13.3	0.7	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.5	0.4	0.5	0.5	0.4	3.2	0.5	1.8
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.60	-1.26	-1.27	-1.27	-1.27	-1.26	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.91	-0.91	-0.91	-0.91	-0.90	-0.90	-0.90	-0.90	-0.90	-0.89	-0.89	-0.88	-0.87	-0.87	-0.86	-0.85	-0.91	-0.90	-0.90
ch(Net Foreign Assets/GDP%)	-2.7	-2.8	-2.9	-3.0	-3.2	-3.5	-3.8	-4.2	-4.6	-5.0	-6.9	-6.7	-5.1	-3.9	-2.2	1.0	-2.9	-4.2	-3.6
ch(Private Wealth/GDP%)	0.0	0.6	1.2	1.8	2.4	2.9	3.5	4.0	4.5	5.0	7.2	9.0	10.4	11.6	13.2	16.1	1.2	4.0	2.6
ch(Gov't Wealth/GDP%)	0.0	-0.8	-1.6	-2.4	-3.2	-4.1	-5.0	-5.9	-6.9	-7.9	-12.2	-14.0	-14.0	-14.0	-14.0	-14.0	-1.6	-6.0	-3.8
ch(Budget Deficit/GDP%)	0.79	0.84	0.89	0.93	0.99	1.04	1.10	1.15	1.22	1.28	0.95	0.39	0.39	0.39	0.39	0.39	0.89	1.16	1.02

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Table A.13B: Welfare Changes Corresponding to Experiment Shown in Table A.13A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)	0.0	0.1	0.9	3.7	8.1	18.2	30.7	38.7	38.7	26.0	27.5	29.7	32.0	32.2	32.2	32.1	32.2
(Small Open Economy)	0.0	0.0	0.0	0.5	2.0	11.5	27.6	38.6	40.0	27.3	28.6	29.9	31.4	31.9	32.1	32.2	32.3

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Figure A.13: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
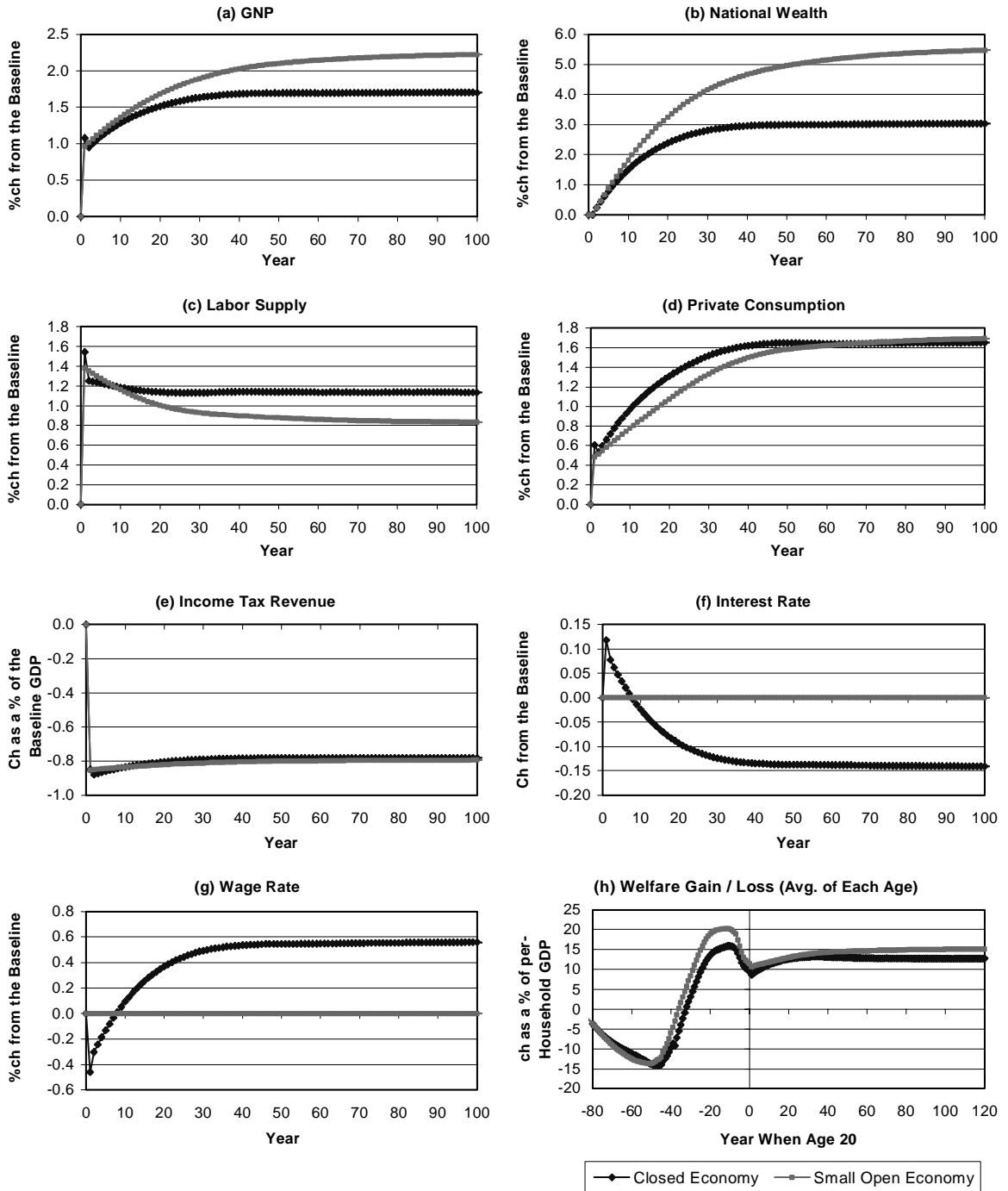
Closed Economy   Small Open Economy

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Table A.14A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.1	1.2	1.3	1.4	1.3	1.0	0.3	0.7	0.5
%ch(Labor)	1.4	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.2	1.1	1.1
%ch(GNP=GDP)	1.0	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.0	0.9	1.0	0.9
%ch(Consumption)	0.8	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.3	0.8	1.0	0.9
%ch(Gross Investment)	2.2	1.8	1.8	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.6	1.5	1.4	1.2	1.0	1.8	1.6	1.7
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.49	-1.01	-1.01	-1.02	-1.04	-1.08	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.87	-0.89	-0.88	-0.87	-0.86	-0.85	-0.84	-0.83	-0.82	-0.81	-0.77	-0.76	-0.75	-0.75	-0.76	-0.76	-0.87	-0.83	-0.85
ch(Interest Rate%)	0.11	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.01	0.00	-0.02	-0.02	-0.03	-0.02	0.00	0.07	0.03	0.05
%ch(Wage Rate)	-0.4	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.1	0.1	0.1	0.0	-0.3	-0.1	-0.2
ch(Private Wealth/GDP%)	0.0	1.1	2.2	3.3	4.3	5.4	6.4	7.4	8.5	9.5	13.7	15.6	15.9	16.0	15.8	15.0	2.2	7.4	4.8
ch(Gov't Wealth/GDP%)	0.0	-0.7	-1.5	-2.2	-3.0	-3.8	-4.6	-5.4	-6.3	-7.2	-10.8	-12.2	-12.2	-12.2	-12.2	-12.2	-1.5	-5.5	-3.5
ch(Budget Deficit/GDP%)	0.71	0.80	0.83	0.87	0.90	0.94	0.98	1.02	1.06	1.11	0.80	0.35	0.35	0.35	0.35	0.35	0.82	1.02	0.92
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.2	1.4	1.6	1.6	1.6	1.1	0.2	0.7	0.5
%ch(Labor)	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.2
%ch(GNP)	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.0	0.9	1.0	1.0
%ch(GDP)	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.2
%ch(Consumption)	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.3	0.8	0.9	0.9
%ch(Gross Dom. Investment)	17.3	0.9	0.9	0.9	0.8	0.9	0.8	0.9	0.8	0.9	0.9	1.0	0.9	1.0	1.0	1.0	4.2	0.8	2.5
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.49	-1.01	-1.02	-1.03	-1.04	-1.07	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.87	-0.86	-0.86	-0.85	-0.84	-0.84	-0.83	-0.82	-0.82	-0.81	-0.78	-0.76	-0.76	-0.76	-0.76	-0.77	-0.86	-0.82	-0.84
ch(Net Foreign Assets/GDP%)	-3.5	-3.0	-2.6	-2.3	-1.9	-1.6	-1.2	-1.0	-0.7	-0.4	0.5	1.2	1.7	1.9	1.7	0.0	-2.7	-1.0	-1.8
ch(Private Wealth/GDP%)	0.0	1.0	2.1	3.1	4.2	5.2	6.2	7.3	8.3	9.3	13.7	15.8	16.2	16.4	16.3	14.8	2.1	7.3	4.7
ch(Gov't Wealth/GDP%)	0.0	-0.7	-1.4	-2.1	-2.9	-3.6	-4.4	-5.2	-6.0	-6.9	-10.5	-11.9	-11.9	-11.9	-11.9	-11.9	-1.4	-5.2	-3.3
ch(Budget Deficit/GDP%)	0.71	0.75	0.78	0.82	0.86	0.90	0.95	0.99	1.03	1.08	0.78	0.34	0.34	0.34	0.34	0.34	0.78	0.99	0.89

Table A.14B: Welfare Changes Corresponding to Experiment Shown in Table A.14A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

						The Year When Age 20 (Top) / the Age in Year 1 (Bottom)										
-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																
0.0	0.1	-0.7	-4.0	-6.2	-0.9	11.4	21.0	21.9	13.3	9.8	6.9	7.0	6.6	6.5	6.5	6.4
(Small Open Economy)																
0.0	0.0	-1.7	-6.1	-8.2	-1.2	12.6	22.4	22.9	13.9	9.7	6.7	7.3	6.9	6.7	6.6	6.6

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Figure A.14: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years
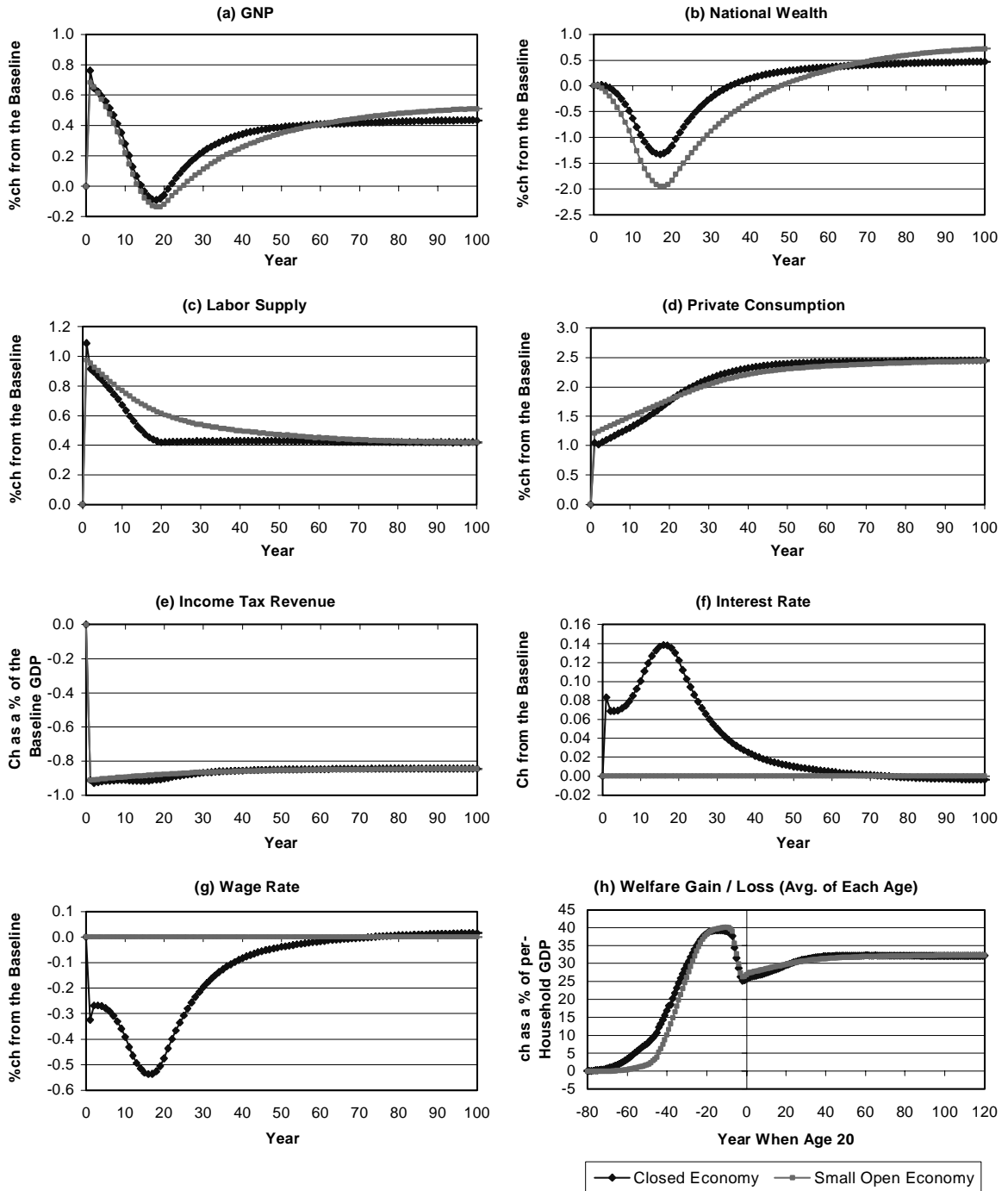

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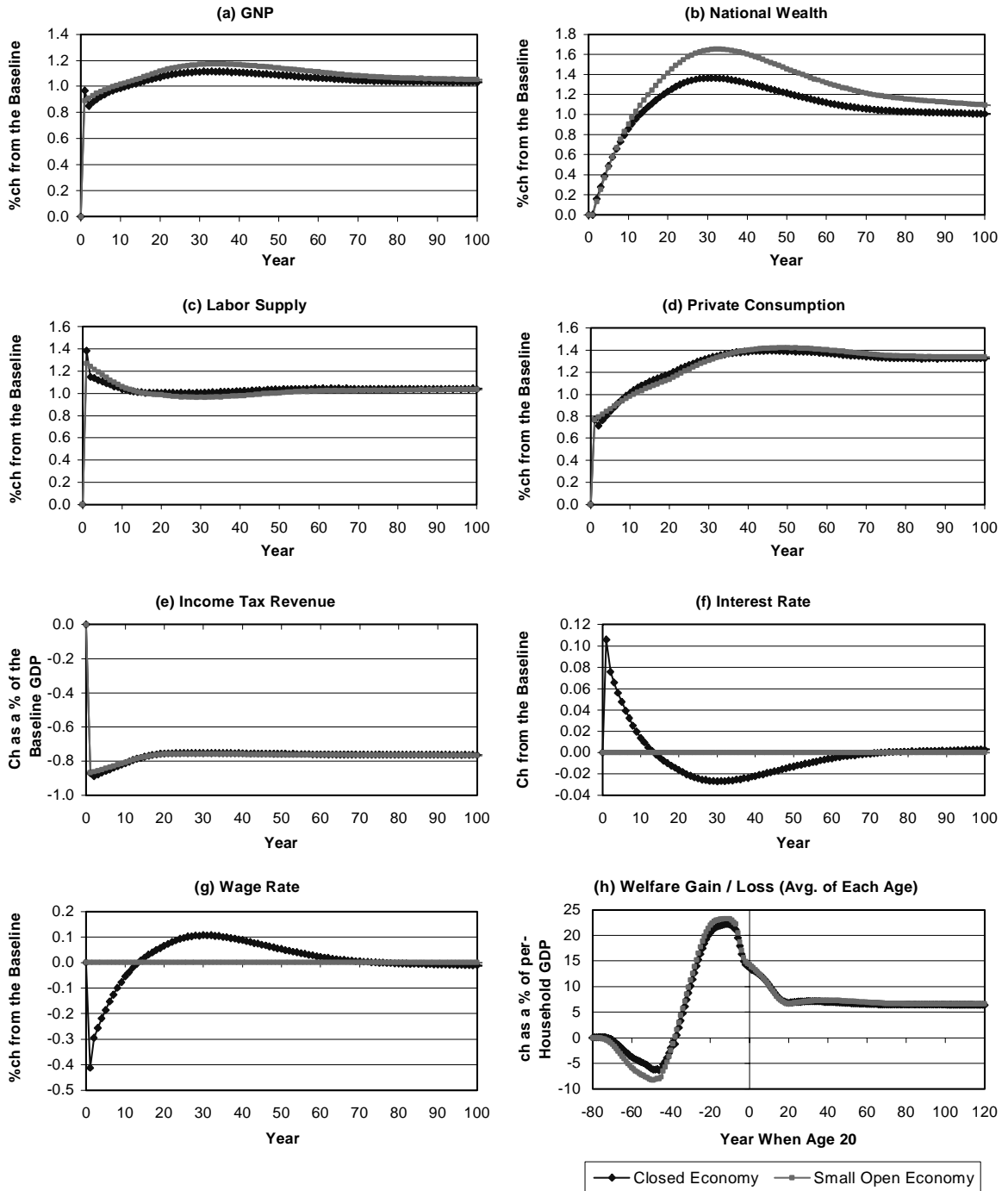
Table A.15A: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	-0.1	-0.9	-1.7	-2.8	-3.9	0.2	0.4	0.3
%ch(Labor)	1.3	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.4	-0.8	-0.9	-0.9	-1.0	-0.9	1.1	1.1	1.1
%ch(GNP=GDP)	0.9	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.4	-0.6	-0.9	-1.1	-1.5	-1.8	0.8	0.9	0.9
%ch(Consumption)	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	0.7	0.0	-0.3	-0.6	-1.0	-1.4	0.9	1.0	1.0
%ch(Gross Investment)	1.4	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	-0.3	-2.6	-3.1	-3.6	-4.1	-3.9	1.0	0.9	1.0
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.88	-0.90	-0.89	-0.88	-0.87	-0.86	-0.85	-0.84	-0.83	-0.82	-0.28	0.50	0.54	0.57	0.61	0.52	-0.89	-0.84	-0.87
ch(Interest Rate%)	0.10	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	-0.01	-0.06	0.01	0.06	0.15	0.24	0.08	0.05	0.06
%ch(Wage Rate)	-0.4	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.0	0.2	0.0	-0.2	-0.6	-0.9	-0.3	-0.2	-0.3
ch(Private Wealth/GDP%)	0.0	1.0	1.9	2.9	3.8	4.8	5.7	6.7	7.7	8.7	12.5	12.9	10.5	8.5	5.3	2.4	1.9	6.7	4.3
ch(Gov't Wealth/GDP%)	0.0	-0.7	-1.5	-2.3	-3.1	-3.9	-4.7	-5.6	-6.5	-7.3	-11.2	-13.1	-13.1	-13.1	-13.1	-13.1	-1.5	-5.6	-3.6
ch(Budget Deficit/GDP%)	0.73	0.82	0.85	0.89	0.93	0.97	1.01	1.05	1.09	1.13	0.90	0.37	0.37	0.37	0.37	0.37	0.85	1.05	0.95
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.0	-1.2	-2.3	-4.1	-7.6	0.1	0.5	0.3
%ch(Labor)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.4	-1.0	-0.9	-0.8	-0.6	-0.2	1.2	1.2	1.2
%ch(GNP)	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.5	-0.7	-1.0	-1.2	-1.6	-2.4	0.9	1.0	0.9
%ch(GDP)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.4	-1.0	-0.9	-0.8	-0.6	-0.2	1.2	1.2	1.2
%ch(Consumption)	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	0.8	0.0	-0.1	-0.2	-0.5	-1.3	1.0	1.1	1.0
%ch(Gross Dom. Investment)	17.0	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.2	-2.0	-5.5	-0.6	-0.5	-0.4	-0.2	4.3	1.2	2.7
ch(Lump-Sum Transfer/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.88	-0.87	-0.86	-0.85	-0.85	-0.84	-0.83	-0.82	-0.81	-0.80	-0.29	0.53	0.53	0.52	0.51	0.46	-0.86	-0.82	-0.84
ch(Net Foreign Assets/GDP%)	-3.4	-3.2	-3.0	-2.8	-2.6	-2.4	-2.2	-2.1	-1.9	-1.8	0.6	2.8	-0.8	-4.2	-9.8	-20.1	-3.0	-2.1	-2.5
ch(Private Wealth/GDP%)	0.0	0.9	1.8	2.7	3.6	4.6	5.5	6.5	7.4	8.4	12.3	12.4	9.1	6.1	1.0	-8.4	1.8	6.5	4.1
ch(Gov't Wealth/GDP%)	0.0	-0.7	-1.4	-2.1	-2.9	-3.6	-4.4	-5.2	-6.0	-6.8	-10.5	-12.3	-12.3	-12.3	-12.3	-12.3	-1.4	-5.2	-3.3
ch(Budget Deficit/GDP%)	0.72	0.76	0.79	0.83	0.86	0.90	0.94	0.98	1.01	1.05	0.87	0.35	0.35	0.35	0.35	0.35	0.79	0.98	0.88

Table A.15B: Welfare Changes Corresponding to Experiment Shown in Table A.15A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Deterministic OLG Model with Representative Households, Gamma=4.0, Alpha=0.64, Low Labor Supply Elasticity)

| The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																
0.0	0.1	0.8	2.6	4.1	11.9	23.3	23.2	10.9	-0.3	-8.3	-11.3	-13.3	-13.6	-13.6	-13.7	-13.5
(Small Open Economy)																
0.0	0.0	0.0	0.5	1.8	10.6	22.0	18.7	6.1	-3.4	-9.9	-12.0	-13.5	-14.9	-15.7	-16.0	-16.2

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Figure A.15: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy   Small Open Economy
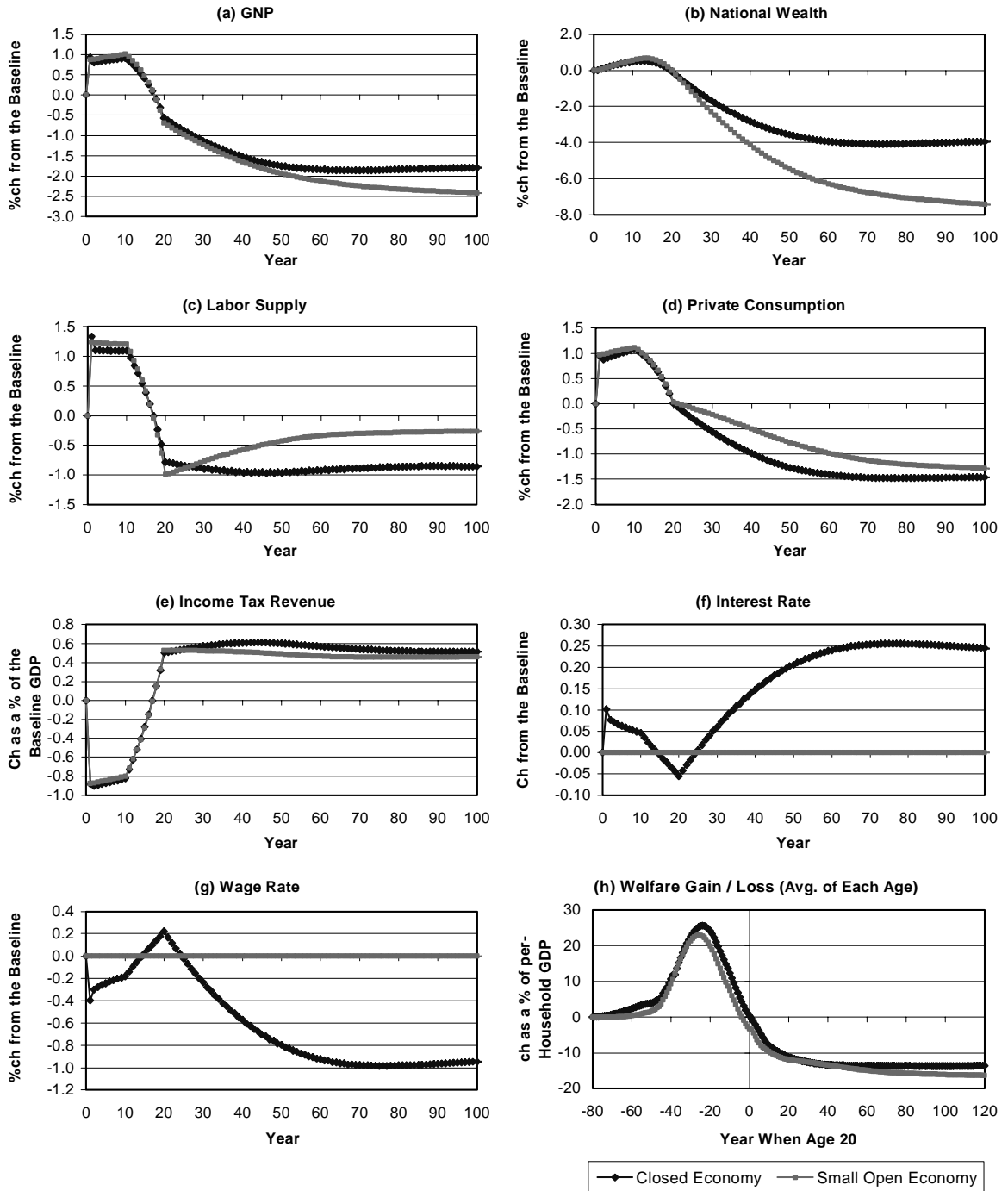
Appendix 4

The Heterogeneous-Agent Stochastic OLG Model
with Lower Labor Supply Elasticity and Adjustments

October 2003

Model. Appendix 4 uses a heterogeneous agent stochastic OLG model with relatively low labor supply elasticity. The model assumes that the coefficient of relative risk aversion γ is 4.0, the consumption share parameter α is 0.69, and the maximum possible working hours (per couple) are 5,460. The experiments are done under both a closed economy assumption and a small open economy assumption.

In addition, the model assumes that government bond yields are 3.0 percent (300 basis points) lower than pre-tax market rate of return, which is about 6.25 percent in the baseline economy. This assumption will reduce debt service cost of the government. For more explanation, see Appendix B of the paper.

Policy Experiment. First, the changes in effective marginal income tax rates due to a 10 percent statutory marginal rate cut are calculated separately by CBO. The results are shown in Table 1 below. Then the pecent changes in marginal tax rates on labor income and capital income are reflected to the stochastic OLG model: The income tax adjustment factor $\tau_{I,adj}$ is reduced in each year to reflect the percent change in marginal tax rate on labor income. Since the percent changes in marginal tax rates on capital income is much smaller, the taxable capital income ratio (another adjustment factor) is raised from 0.700 in each year so that the change in effective marginal rate on capital income is similar to the number in Table 1.

Table 1: Effective Marginal Tax Rates on Labor Income and Capital Income (%)

Model Year	Calendar Year	Tax Rate on Labor Income			Rate on Capital Income		
		Current Law	Proposal	%ch	Current Law	Proposal	%ch
1	2004	18.1	16.3	-9.7	13.9	13.5	-3.1
2	2005	19.0	17.1	-9.7	13.9	13.5	-3.2
3	2006	19.0	17.2	-9.7	14.0	13.5	-3.2
4	2007	19.3	17.4	-10.0	14.0	13.6	-3.2
5	2008	19.5	17.6	-9.8	13.9	13.5	-3.1
6	2009	19.8	17.8	-9.7	14.9	14.3	-3.5
7	2010	20.0	18.1	-9.6	14.9	14.3	-3.6
8	2011	21.8	19.7	-9.6	15.5	14.9	-3.9
9	2012	22.0	19.8	-9.8	15.5	14.9	-3.9
10-	2013-	22.0	19.8	-10.2	15.5	14.9	-3.9

Second, the experiment uses static revenue changes calculated by the Joint Committee on Taxation (JCT). The numbers in the table are converted to calendar year from fiscal year. Then, lump-sum transfers $tr_{LS,t}$ are adjusted so that the static revenue changes are matched to JCT estimates. See Table 2.

Table 2: Static Revenue Change Adjustment

Model Year	Calendar Year	Static Revenue Change (as % of GDP)		Lump-sum Transfer Adjustment (in 2001 dollars)
		JCT Estimate[1]	OLG Model[2]	
1	2004	-0.65	-0.90	-237
2	2005	-0.76	-0.90	-128
3	2006	-0.81	-0.90	-87
4	2007	-0.82	-0.92	-94
5	2008	-0.85	-0.90	-55
6	2009	-0.86	-0.90	-45
7	2010	-0.93	-0.90	36
8	2011	-1.02	-0.90	106
9	2012	-0.99	-0.92	65
10-	2013-	-1.01	-0.96	55

[1]Converted to calender year from fiscal year.

[2]Before lump-sum transfer adjustments.

Government Financing Rules. There are five financing rules:

1. Government consumption (waste) $C_{G,t}$ reduced contemporaneously (See Tables and Figure B.1);

2. Lump-sum transfers $tr_{LS,t}$ reduced contemporaneously (B.2);

3. Government consumption $C_{G,t}$ reduced gradually after 10 years (B.3);

4. Lump-sum transfers $tr_{LS,t}$ reduced gradually after 10 years (B.4);

5. Income tax rates $\tau_{I,adj}$ raised gradually after 10 years (B.5).

The ratio of government debt (net wealth) to the baseline GDP is fixed throughout the transition path in financing rules 1 and 2, and the debt-GDP ratio is stabilized after 20 years in financing rules 3, 4, and 5.

Table B.1A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.3	0.5	0.6	0.7	0.9	1.0	1.2	1.3	1.9	2.3	2.5	2.7	2.9	3.0	0.3	1.0	0.7
%ch(Labor)	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5
%ch(GNP=GDP)	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.9	1.0	1.0	1.1	1.1	1.2	0.4	0.6	0.5
%ch(Consumption)	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.6	1.8	1.9	2.0	2.1	2.2	0.9	1.3	1.1
%ch(Gross Investment)	2.0	2.3	2.4	2.5	2.5	2.4	2.7	3.1	3.0	3.1	3.1	3.1	3.1	3.1	3.0	3.0	2.3	2.9	2.6
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	-0.53	-0.65	-0.69	-0.70	-0.72	-0.73	-0.81	-0.88	-0.85	-0.86	-0.85	-0.84	-0.83	-0.83	-0.84	-0.85	-0.66	-0.83	-0.74
ch(Income Tax/GDP%)	-0.84	-0.84	-0.83	-0.85	-0.83	-0.83	-0.82	-0.82	-0.83	-0.86	-0.84	-0.83	-0.82	-0.82	-0.81	-0.81	-0.84	-0.83	-0.84
ch(Interest Rate%)	0.04	0.03	0.01	0.00	-0.01	-0.02	-0.03	-0.05	-0.06	-0.06	-0.11	-0.14	-0.16	-0.17	-0.19	-0.19	0.01	-0.04	-0.01
%ch(Wage Rate)	-0.2	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	-0.1	0.2	0.1
ch(Private Wealth/GDP%)	0.0	0.4	0.8	1.3	1.7	2.0	2.4	2.8	3.2	3.5	5.1	6.2	6.9	7.4	7.9	8.2	0.8	2.8	1.8
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.3	0.5	0.6	0.8	0.9	1.0	1.2	1.3	2.0	2.5	2.8	3.1	3.3	3.5	0.3	1.0	0.7
%ch(Labor)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(GNP)	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	0.4	0.6	0.5
%ch(GDP)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(Consumption)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.3	1.5	1.7	1.8	1.9	2.0	2.1	0.9	1.2	1.1
%ch(Gross Dom. Investment)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.5	0.4	0.4
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	-0.52	-0.64	-0.69	-0.70	-0.73	-0.74	-0.82	-0.90	-0.87	-0.89	-0.89	-0.88	-0.88	-0.88	-0.88	-0.88	-0.66	-0.85	-0.75
ch(Income Tax/GDP%)	-0.83	-0.83	-0.83	-0.85	-0.84	-0.84	-0.83	-0.83	-0.85	-0.88	-0.87	-0.86	-0.86	-0.86	-0.85	-0.85	-0.84	-0.84	-0.84
ch(Net Foreign Assets/GDP%)	-1.6	-1.1	-0.5	-0.1	0.5	0.9	1.4	1.9	2.3	2.7	4.6	6.1	7.1	7.8	8.6	9.2	-0.6	1.8	0.6
ch(Private Wealth/GDP%)	0.0	0.4	0.8	1.3	1.7	2.1	2.4	2.8	3.3	3.7	5.5	6.8	7.7	8.4	9.1	9.7	0.8	2.9	1.8
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.44	0.00	0.00	0.00

Table B.1B: Welfare Changes Corresponding to Experiment Shown in Table B.1A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.5	-0.7	-0.8	-0.8	1.2	2.0	1.2	0.0	0.9	1.1	1.3	1.3	1.3	1.3	1.3
20-40 percentile					-0.9	-0.4	2.3	4.4	3.7	1.8	4.0	4.7	5.3	5.4	5.4	5.4	5.3
40-60 percentile					-1.2	0.2	3.7	6.5	6.4	3.4	5.8	6.7	7.4	7.5	7.6	7.6	7.5
60-80 percentile					-1.8	1.5	6.3	9.4	10.0	5.4	8.3	9.4	10.2	10.4	10.4	10.4	10.3
80-90 percentile					-1.0	3.2	9.1	12.5	13.7	7.9	11.0	12.3	13.2	13.4	13.4	13.4	13.3
90-95 percentile					0.9	7.8	12.0	17.5	17.2	11.5	15.1	16.5	17.6	17.8	17.9	17.8	17.7
95-99 percentile					9.3	19.2	20.9	26.2	23.9	16.2	20.2	21.8	23.0	23.2	23.3	23.2	23.1
99-100 percentile					44.8	83.1	64.7	55.9	45.1	23.8	28.5	30.4	31.7	32.0	32.0	32.0	31.9
Average	-0.3	-0.5	-0.5	-0.7	-0.2	2.4	5.7	8.2	7.9	4.4	6.7	7.6	8.3	8.4	8.4	8.4	8.3
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.5	-0.2	0.1	-0.2	1.4	1.9	1.1	0.0	0.7	0.8	1.0	1.0	1.0	1.0	1.0
20-40 percentile					0.2	0.6	2.7	4.3	3.3	1.5	3.0	3.5	4.1	4.3	4.3	4.3	4.3
40-60 percentile					0.3	2.0	4.4	6.6	5.9	2.9	4.5	5.1	5.8	5.9	6.0	6.0	6.0
60-80 percentile					0.7	4.9	8.0	10.1	9.7	4.8	6.6	7.3	8.0	8.2	8.2	8.2	8.2
80-90 percentile					2.5	8.5	12.4	14.1	14.0	7.1	9.0	9.8	10.6	10.8	10.8	10.8	10.8
90-95 percentile					6.0	17.1	18.7	21.4	18.5	10.7	12.8	13.6	14.5	14.8	14.8	14.8	14.8
95-99 percentile					17.2	35.0	34.2	34.7	27.3	16.0	18.4	19.3	20.2	20.4	20.5	20.5	20.5
99-100 percentile					62.4	126.2	103.8	83.0	57.5	24.8	27.7	28.7	29.8	30.0	30.0	30.0	30.0
Average	-0.3	-0.5	-0.5	-0.2	2.1	5.8	7.9	9.3	8.0	4.0	5.5	6.0	6.7	6.8	6.8	6.9	6.9

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Figure B.1: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
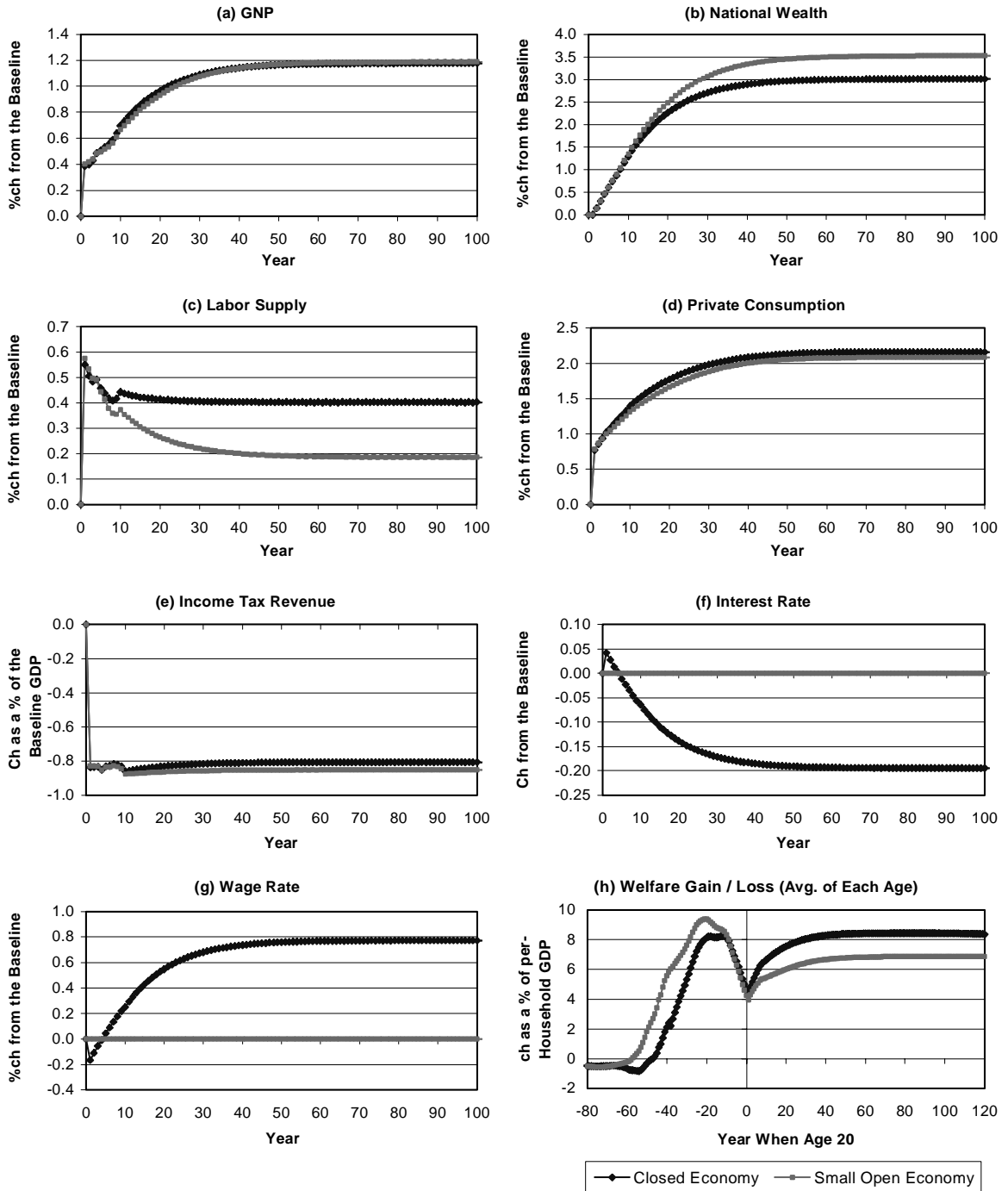
Closed Economy — Small Open Economy

Table B.2A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.3	0.6	0.9	1.1	1.4	1.7	2.0	2.4	2.7	3.1	3.4	3.7	3.8	4.0	4.0	0.6	2.0	1.3
%ch(Labor)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
%ch(GNP=GDP)	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.6	1.7	1.7	1.8	0.7	1.1	0.9
%ch(Consumption)	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.5	0.5	0.8	0.7
%ch(Gross Investment)	3.7	4.3	4.6	4.8	5.1	5.3	5.9	6.5	6.8	3.9	4.1	4.2	4.2	4.2	4.1	4.0	4.5	5.7	5.1
ch(Lump-Sum Transfer/GDP%)	-0.75	-0.74	-0.73	-0.74	-0.71	-0.70	-0.68	-0.68	-0.67	-0.68	-0.67	-0.67	-0.67	-0.67	-0.69	-0.70	-0.74	-0.68	-0.71
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.82	-0.81	-0.81	-0.82	-0.79	-0.79	-0.77	-0.77	-0.77	-0.79	-0.78	-0.77	-0.76	-0.75	-0.75	-0.75	-0.81	-0.78	-0.79
ch(Interest Rate%)	0.06	0.03	0.01	-0.01	-0.04	-0.06	-0.08	-0.10	-0.12	-0.14	-0.17	-0.20	-0.21	-0.22	-0.24	-0.24	0.01	-0.10	-0.04
%ch(Wage Rate)	-0.2	-0.1	0.0	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	0.9	1.0	0.0	0.4	0.2
ch(Private Wealth/GDP%)	0.0	0.7	1.5	2.4	3.1	3.9	4.7	5.5	6.4	7.3	8.5	9.4	10.0	10.4	10.9	11.1	1.6	5.6	3.6
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.2	2.5	2.9	3.4	3.8	4.1	4.4	4.6	4.7	0.6	2.2	1.4
%ch(Labor)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.7	0.6	0.7
%ch(GNP)	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.3	1.5	1.6	1.6	1.7	1.8	1.8	0.7	1.1	0.9
%ch(GDP)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.7	0.6	0.7
%ch(Consumption)	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.1	1.1	1.3	1.3	0.5	0.6	0.6
%ch(Gross Dom. Investment)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.7	0.6	0.7
ch(Lump-Sum Transfer/GDP%)	-0.73	-0.72	-0.73	-0.74	-0.72	-0.72	-0.71	-0.71	-0.72	-0.74	-0.73	-0.73	-0.73	-0.73	-0.73	-0.74	-0.73	-0.72	-0.72
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.81	-0.80	-0.80	-0.82	-0.80	-0.80	-0.79	-0.79	-0.80	-0.82	-0.82	-0.81	-0.81	-0.80	-0.80	-0.80	-0.81	-0.80	-0.80
ch(Net Foreign Assets/GDP%)	-2.2	-1.3	-0.3	0.5	1.5	2.4	3.4	4.3	5.3	6.2	7.7	8.9	9.8	10.4	11.1	11.5	-0.3	4.3	2.0
ch(Private Wealth/GDP%)	0.0	0.8	1.6	2.5	3.3	4.2	5.0	6.0	7.0	8.0	9.4	10.5	11.4	11.9	12.6	13.0	1.6	6.0	3.8
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.44	0.00	0.00	0.00

Table B.2B: Welfare Changes Corresponding to Experiment Shown in Table B.2A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP
(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-2.9	-9.0	-10.8	-8.0	-5.9	-3.2	-1.2	-0.5	-1.5	-1.2	-1.1	-1.1	-1.1	-1.1	-1.2
20-40 percentile					-11.3	-10.5	-6.2	-3.9	-1.2	-0.7	-3.2	-2.7	-2.4	-2.4	-2.4	-2.4	-2.5
40-60 percentile					-12.5	-12.7	-5.9	-3.7	-0.9	-0.5	-3.0	-2.3	-2.0	-2.0	-2.0	-2.0	-2.1
60-80 percentile					-15.6	-14.3	-4.8	-1.9	0.2	0.1	-2.2	-1.4	-1.0	-1.0	-1.0	-1.1	-1.1
80-90 percentile					-17.3	-14.9	-4.0	0.1	1.9	0.8	-1.2	-0.2	0.2	0.1	0.1	0.1	0.1
90-95 percentile					-18.1	-13.7	-4.9	2.6	3.9	2.1	0.5	1.6	2.1	2.0	2.0	2.0	2.0
95-99 percentile					-11.5	-6.4	-1.2	7.6	8.5	4.7	3.8	4.9	5.5	5.5	5.4	5.4	5.4
99-100 percentile					18.5	42.1	28.8	26.6	23.3	9.1	8.9	10.2	10.9	10.9	10.9	10.9	10.8
Average	-0.3	-0.5	-2.9	-9.0	-13.0	-11.1	-5.0	-1.8	0.3	0.1	-1.8	-1.2	-0.8	-0.9	-0.9	-0.9	-0.9
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.6	-3.0	-7.9	-9.4	-7.1	-6.2	-4.0	-2.0	-0.6	-2.2	-2.0	-1.7	-1.7	-1.7	-1.7	-1.7
20-40 percentile					-9.6	-8.9	-6.1	-4.8	-2.6	-1.6	-5.1	-4.6	-4.1	-4.0	-4.0	-4.0	-4.0
40-60 percentile					-10.1	-9.8	-5.3	-4.3	-2.7	-1.7	-5.5	-4.9	-4.3	-4.3	-4.3	-4.2	-4.2
60-80 percentile					-10.9	-7.9	-2.3	-1.3	-1.2	-1.5	-5.3	-4.6	-4.0	-4.0	-4.0	-3.9	-3.9
80-90 percentile					-9.9	-4.3	1.2	2.2	1.5	-1.1	-5.1	-4.3	-3.6	-3.5	-3.5	-3.5	-3.5
90-95 percentile					-6.3	4.1	5.9	8.2	4.9	0.1	-3.6	-2.8	-2.0	-2.0	-2.0	-2.0	-2.0
95-99 percentile					5.4	20.8	19.9	20.1	12.6	3.5	0.1	1.0	1.8	1.8	1.8	1.8	1.8
99-100 percentile					48.7	111.0	88.1	66.6	40.9	9.5	6.3	7.3	8.1	8.2	8.2	8.2	8.2
Average	-0.3	-0.6	-3.0	-7.9	-8.6	-5.0	-1.9	-0.8	-0.4	-1.0	-4.3	-3.7	-3.1	-3.1	-3.1	-3.1	-3.1

Figure B.2: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
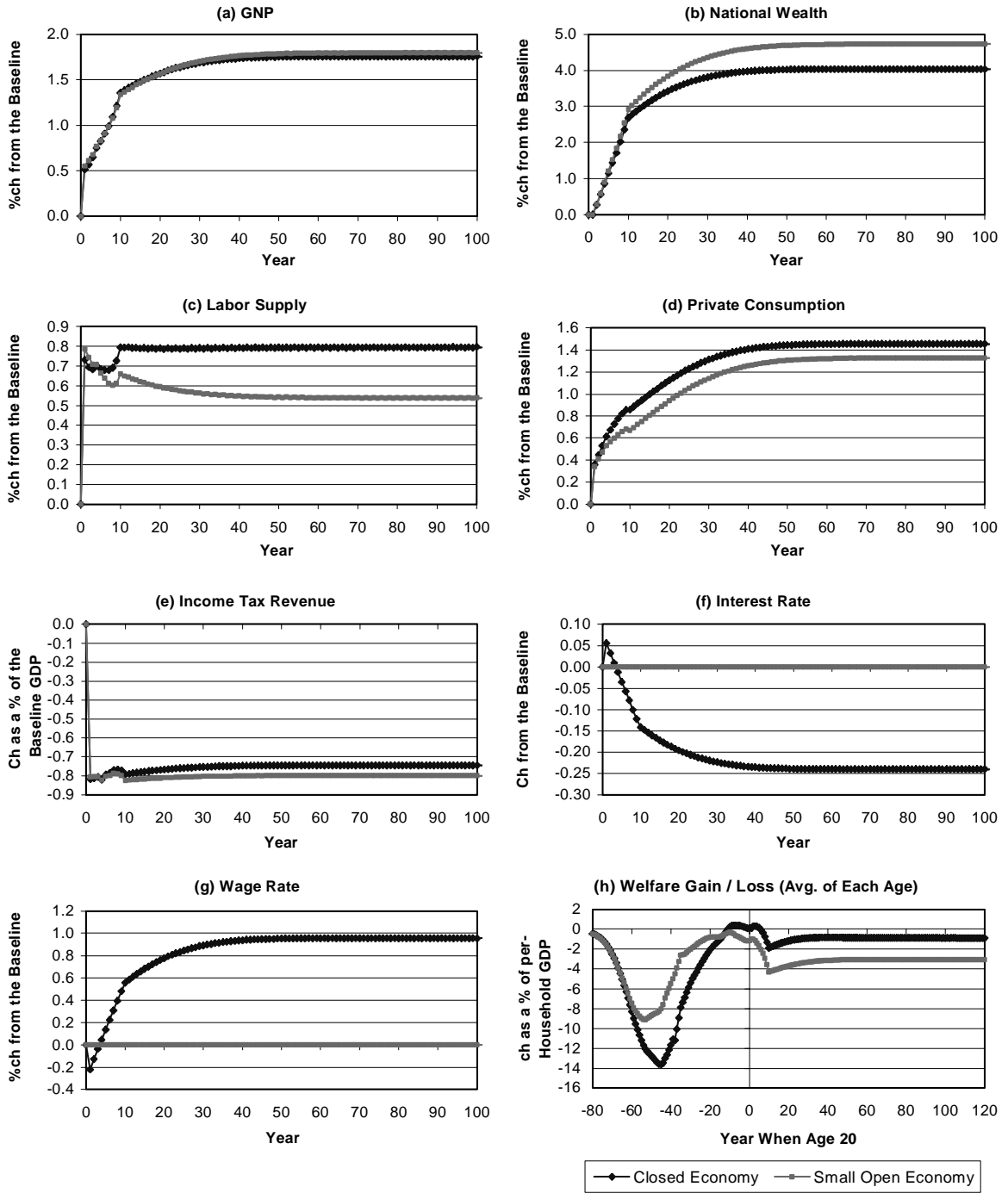
Closed Economy   Small Open Economy

Table B.3A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.0	-0.1	-0.1	-0.2	-0.4	-0.5	-0.7	-0.8	-1.0	-1.9	-2.1	-1.9	-1.7	-1.6	-1.5	-0.1	-0.7	-0.4
%ch(Labor)	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.4
%ch(GNP=GDP)	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.5	-0.4	-0.4	-0.4	-0.3	0.3	0.0	0.2
%ch(Consumption)	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.5	1.6	0.8	1.0	0.9
%ch(Gross Investment)	-0.3	-0.7	-1.1	-1.4	-1.8	-2.2	-2.7	-3.1	-3.5	-3.9	-3.2	-1.4	-1.4	-1.4	-1.5	-1.5	-1.1	-3.1	-2.1
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.52	-1.06	-1.04	-1.03	-1.03	-1.03	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.84	-0.84	-0.84	-0.87	-0.85	-0.86	-0.85	-0.86	-0.88	-0.92	-0.94	-0.95	-0.94	-0.93	-0.93	-0.93	-0.85	-0.87	-0.86
ch(Interest Rate%)	0.04	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.16	0.18	0.16	0.15	0.14	0.13	0.05	0.08	0.06
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.6	-0.6	-0.5	-0.5	-0.2	-0.3	-0.2
ch(Private Wealth/GDP%)	0.0	0.5	1.0	1.4	1.9	2.3	2.7	3.1	3.6	3.9	5.5	6.5	7.1	7.5	7.8	8.0	0.9	3.1	2.0
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.1	-1.8	-2.5	-3.3	-4.0	-4.9	-5.8	-6.8	-10.7	-12.2	-12.2	-12.2	-12.2	-12.2	-1.2	-5.0	-3.1
ch(Budget Deficit/GDP%)	0.53	0.67	0.74	0.78	0.83	0.88	0.99	1.11	1.11	1.17	0.82	0.34	0.34	0.34	0.34	0.34	0.71	1.05	0.88
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.7	-0.9	-1.1	-2.0	-2.2	-2.0	-1.9	-1.8	-1.7	-0.1	-0.7	-0.4
%ch(Labor)	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.5	0.4	0.5
%ch(GNP)	0.4	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.0	0.0	-0.3	-0.4	-0.4	-0.3	-0.3	-0.3	0.3	0.1	0.2
%ch(GDP)	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.5	0.4	0.5
%ch(Consumption)	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.6	0.9	1.1	1.0
%ch(Gross Dom. Investment)	8.4	0.0	0.2	0.4	0.0	0.0	0.1	0.1	0.5	0.6	0.4	0.2	0.4	0.2	0.2	0.3	1.8	0.3	1.0
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.48	-0.98	-0.98	-0.98	-0.98	-0.98	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.82	-0.83	-0.83	-0.86	-0.84	-0.84	-0.84	-0.85	-0.86	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.84	-0.86	-0.85
ch(Net Foreign Assets/GDP%)	-1.7	-1.6	-1.7	-1.9	-2.1	-2.3	-2.6	-3.0	-3.6	-4.1	-6.4	-7.1	-6.6	-6.2	-5.8	-5.6	-1.8	-3.1	-2.5
ch(Private Wealth/GDP%)	0.0	0.4	0.9	1.3	1.8	2.1	2.5	2.9	3.3	3.6	4.9	5.6	6.1	6.4	6.8	7.0	0.9	2.9	1.9
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.1	-1.8	-2.5	-3.2	-3.9	-4.8	-5.7	-6.6	-10.3	-11.7	-11.7	-11.7	-11.7	-11.7	-1.2	-4.8	-3.0
ch(Budget Deficit/GDP%)	0.51	0.65	0.72	0.76	0.81	0.85	0.96	1.07	1.07	1.12	0.77	0.33	0.33	0.33	0.33	0.33	0.69	1.01	0.85

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Table B.3B: Welfare Changes Corresponding to Experiment Shown in Table B.3A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.3	0.6	0.7	0.1	1.0	1.1	0.4	-0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.6
20-40 percentile					0.9	1.0	2.1	2.9	1.9	0.6	1.4	1.9	2.4	2.5	2.5	2.5	2.5
40-60 percentile					1.1	2.5	3.7	4.8	3.8	1.5	2.3	2.8	3.5	3.5	3.5	3.5	3.5
60-80 percentile					2.1	5.8	7.2	8.1	6.9	2.9	3.6	4.2	4.9	5.0	5.0	5.0	5.0
80-90 percentile					4.4	10.0	11.5	11.9	10.9	4.6	5.2	5.8	6.6	6.7	6.7	6.7	6.7
90-95 percentile					8.7	19.7	18.2	19.1	15.0	7.3	7.8	8.5	9.4	9.5	9.5	9.5	9.5
95-99 percentile					20.8	39.0	34.7	32.3	23.6	12.0	12.3	12.8	13.7	13.8	13.8	13.8	13.8
99-100 percentile					68.1	135.4	108.2	82.2	53.6	19.8	19.5	19.8	20.9	21.0	21.0	21.0	21.0
Average	-0.3	-0.5	-0.3	0.6	3.4	6.8	7.3	7.6	5.9	2.4	3.1	3.6	4.2	4.2	4.2	4.2	4.2
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.7	-1.5	-1.3	-1.1	0.7	1.4	0.8	-0.1	0.5	0.6	0.7	0.7	0.7	0.7	0.7
20-40 percentile					-1.5	-0.7	1.7	3.3	2.7	1.2	2.5	2.8	3.1	3.2	3.2	3.2	3.2
40-60 percentile					-1.9	-0.2	2.8	4.9	4.8	2.4	3.8	4.1	4.4	4.5	4.5	4.5	4.5
60-80 percentile					-3.0	0.6	5.0	7.5	7.8	4.1	5.5	5.8	6.2	6.3	6.3	6.3	6.3
80-90 percentile					-2.7	2.0	7.3	10.1	11.0	6.0	7.4	7.8	8.3	8.4	8.4	8.4	8.4
90-95 percentile					-1.3	6.1	9.7	14.7	14.1	9.0	10.4	10.9	11.3	11.4	11.4	11.4	11.4
95-99 percentile					6.9	17.0	18.2	22.9	20.4	13.2	14.5	15.0	15.5	15.5	15.6	15.6	15.6
99-100 percentile					41.9	80.3	62.0	52.7	41.6	19.9	21.1	21.6	22.1	22.2	22.3	22.3	22.3
Average	-0.3	-0.5	-0.7	-1.5	-1.2	1.7	4.6	6.6	6.3	3.3	4.5	4.8	5.1	5.2	5.2	5.2	5.2

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Figure B.3: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

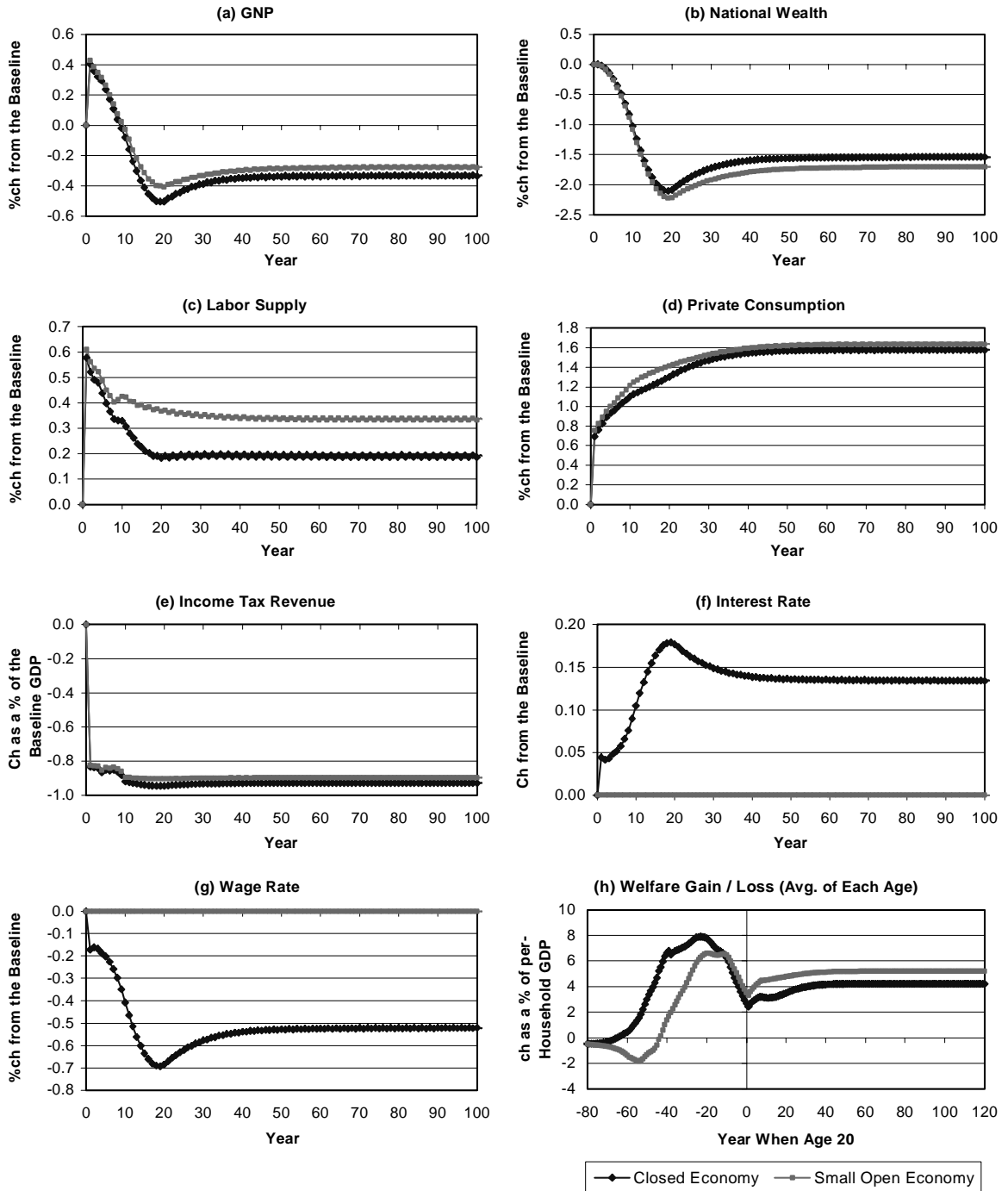Closed Economy   Small Open Economy

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Table B.4A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.2
%ch(Labor)	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.6
%ch(GNP=GDP)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
%ch(Consumption)	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.5	0.7	0.6
%ch(Gross Investment)	1.1	0.9	0.7	0.6	0.4	0.2	0.1	0.0	-0.1	-0.1	0.0	0.2	0.3	0.3	0.3	0.2	0.7	0.0	0.4
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	-0.41	-0.82	-0.82	-0.82	-0.82	-0.84	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.82	-0.82	-0.82	-0.84	-0.82	-0.82	-0.81	-0.82	-0.83	-0.86	-0.86	-0.85	-0.85	-0.84	-0.84	-0.84	-0.82	-0.83	-0.83
ch(Interest Rate%)	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.03	0.04
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1
ch(Private Wealth/GDP%)	0.0	0.7	1.5	2.2	3.0	3.7	4.4	5.1	5.9	6.7	9.7	10.9	11.1	11.2	11.3	11.3	1.5	5.2	3.3
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.1	-1.7	-2.4	-3.1	-3.8	-4.6	-5.4	-6.2	-9.5	-10.7	-10.7	-10.7	-10.7	-10.7	-1.1	-4.6	-2.9
ch(Budget Deficit/GDP%)	0.50	0.63	0.69	0.73	0.77	0.81	0.91	1.01	1.01	1.05	0.68	0.30	0.30	0.30	0.30	0.30	0.66	0.96	0.81
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.2	0.1	0.2	0.2
%ch(Labor)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7
%ch(GNP)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5
%ch(GDP)	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7
%ch(Consumption)	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.6	0.8	0.7
%ch(Gross Dom. Investment)	10.5	0.2	0.3	0.6	0.2	0.3	0.3	0.4	0.7	1.0	0.8	0.8	0.7	0.7	0.7	0.7	2.4	0.5	1.5
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	-0.40	-0.80	-0.80	-0.81	-0.81	-0.83	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.81	-0.81	-0.81	-0.83	-0.81	-0.81	-0.80	-0.81	-0.82	-0.85	-0.85	-0.84	-0.84	-0.84	-0.83	-0.83	-0.81	-0.82	-0.82
ch(Net Foreign Assets/GDP%)	-2.1	-1.8	-1.5	-1.4	-1.2	-1.1	-1.1	-1.1	-1.2	-1.3	-1.6	-1.8	-1.7	-1.5	-1.4	-1.5	-1.6	-1.2	-1.4
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.2	2.9	3.6	4.3	5.0	5.8	6.5	9.5	10.6	10.8	10.9	11.0	11.0	1.4	5.0	3.2
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.0	-1.7	-2.3	-3.0	-3.7	-4.5	-5.3	-6.1	-9.3	-10.5	-10.5	-10.5	-10.5	-10.5	-1.1	-4.5	-2.8
ch(Budget Deficit/GDP%)	0.48	0.61	0.68	0.71	0.76	0.79	0.89	1.00	1.00	1.04	0.67	0.30	0.30	0.30	0.30	0.30	0.65	0.94	0.80

Table B.4B: Welfare Changes Corresponding to Experiment Shown in Table B.4A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-1.2	-4.9	-7.5	-6.3	-3.7	-3.6	-1.8	-0.6	-0.9	-2.6	-2.5	-2.5	-2.6	-2.6	-2.6
20-40 percentile					-7.7	-8.1	-4.0	-4.4	-2.3	-1.2	-3.6	-6.4	-6.2	-6.2	-6.3	-6.3	-6.3
40-60 percentile					-8.3	-9.1	-3.9	-4.2	-2.6	-1.3	-4.5	-7.3	-7.0	-7.1	-7.2	-7.2	-7.2
60-80 percentile					-9.6	-8.4	-2.5	-2.0	-1.8	-1.2	-4.9	-7.7	-7.4	-7.6	-7.6	-7.6	-7.6
80-90 percentile					-9.3	-6.3	-0.7	0.7	0.1	-1.0	-5.5	-8.3	-8.0	-8.1	-8.2	-8.2	-8.2
90-95 percentile					-7.1	0.0	1.8	4.9	2.6	-0.4	-4.9	-7.7	-7.4	-7.5	-7.6	-7.6	-7.6
95-99 percentile					2.9	12.8	11.5	13.5	8.5	1.9	-2.7	-5.4	-5.1	-5.2	-5.3	-5.3	-5.3
99-100 percentile					39.5	85.3	63.5	47.7	30.1	6.0	1.1	-1.8	-1.4	-1.6	-1.7	-1.7	-1.7
Average	-0.3	-0.5	-1.2	-4.9	-7.4	-5.7	-1.7	-1.5	-0.9	-0.8	-3.7	-6.3	-6.0	-6.1	-6.2	-6.2	-6.2
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-1.6	-6.1	-8.4	-6.9	-3.8	-3.4	-1.5	-0.5	-0.9	-2.5	-2.4	-2.4	-2.5	-2.5	-2.5
20-40 percentile					-8.8	-8.8	-4.2	-4.1	-1.8	-0.9	-3.3	-6.1	-5.9	-5.9	-6.0	-6.0	-6.0
40-60 percentile					-9.7	-10.2	-4.1	-4.0	-2.0	-0.9	-4.0	-6.8	-6.6	-6.7	-6.8	-6.8	-6.8
60-80 percentile					-12.1	-10.5	-3.3	-2.1	-1.3	-0.7	-4.4	-7.2	-6.9	-7.0	-7.1	-7.1	-7.1
80-90 percentile					-12.8	-9.5	-2.2	0.2	0.4	-0.4	-4.8	-7.6	-7.4	-7.5	-7.5	-7.5	-7.5
90-95 percentile					-12.0	-5.3	-1.3	3.7	2.6	0.4	-4.2	-6.9	-6.7	-6.8	-6.9	-6.9	-6.9
95-99 percentile					-3.2	6.0	6.5	11.1	8.1	2.6	-2.0	-4.7	-4.5	-4.6	-4.6	-4.6	-4.6
99-100 percentile					31.9	71.0	51.8	40.8	28.0	6.7	1.7	-1.2	-1.0	-1.1	-1.1	-1.1	-1.1
Average	-0.3	-0.5	-1.6	-6.1	-9.5	-7.6	-2.6	-1.6	-0.6	-0.4	-3.3	-5.8	-5.6	-5.7	-5.7	-5.7	-5.7

Figure B.4: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

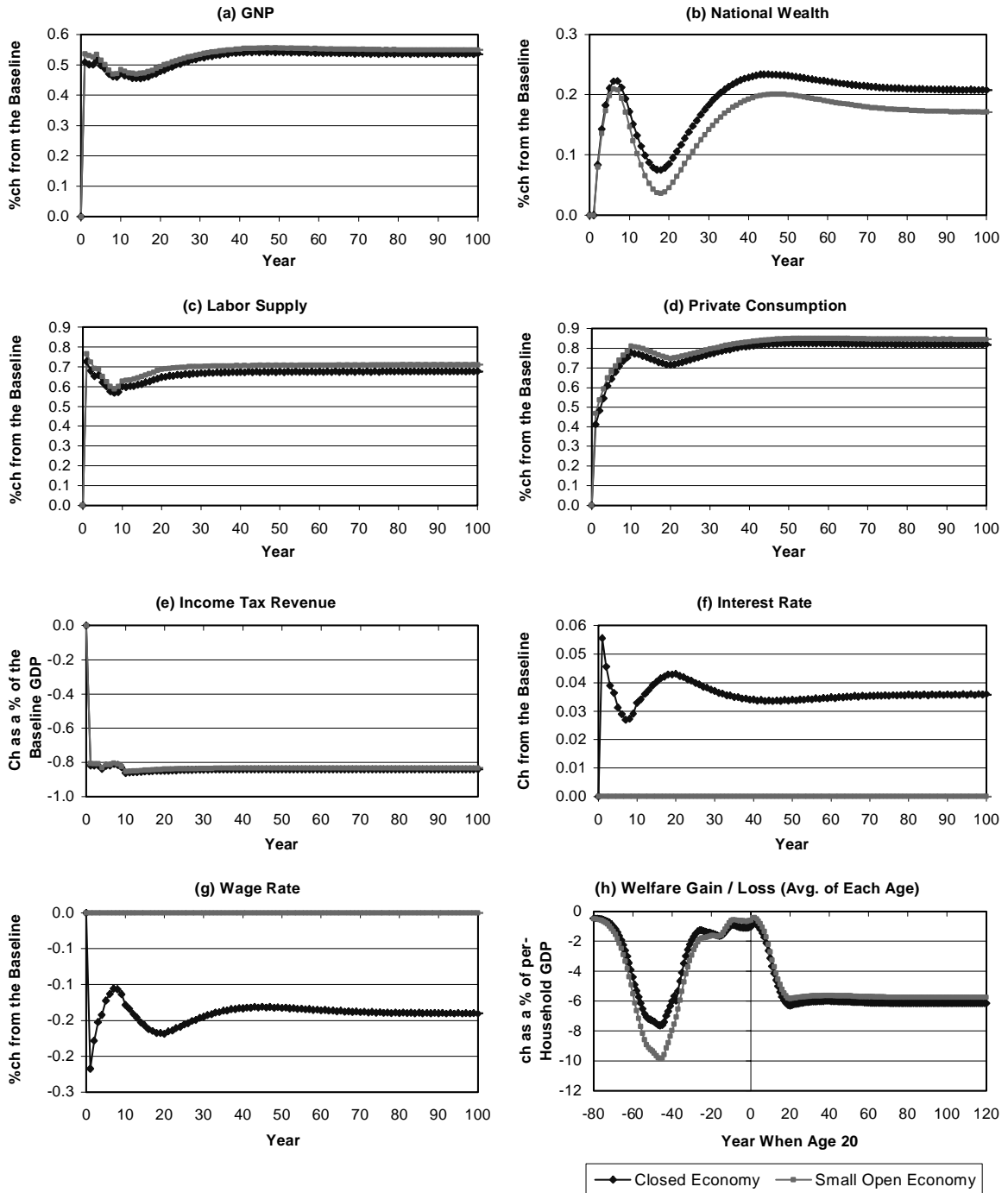Closed Economy —■— Small Open Economy

Table B.5A: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

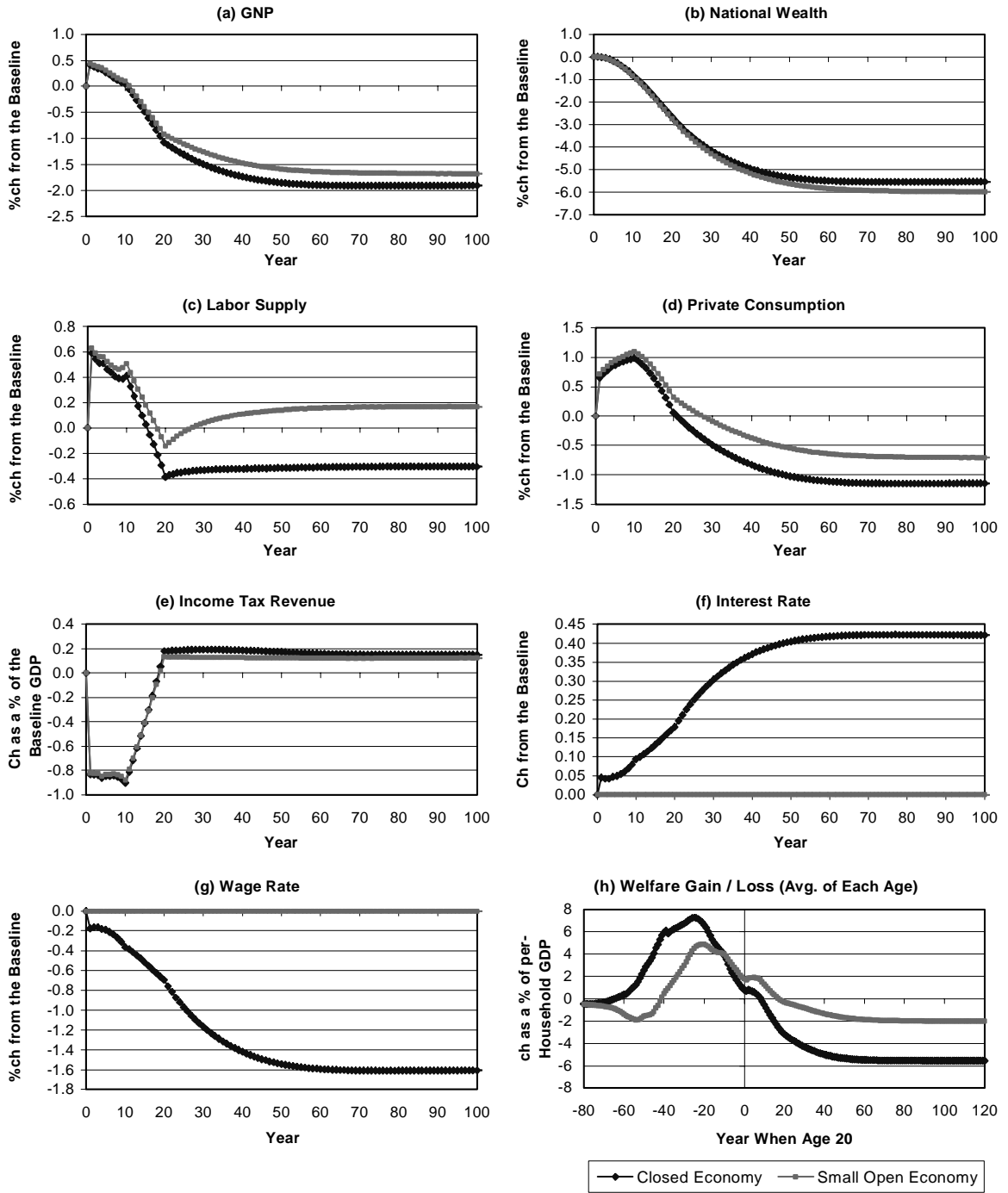(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.7	-0.8	-1.7	-2.7	-3.5	-4.2	-5.0	-5.5	-0.1	-0.5	-0.3
%ch(Labor)	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.0	-0.4	-0.3	-0.3	-0.3	-0.3	0.5	0.4	0.5
%ch(GNP=GDP)	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.0	-0.5	-1.1	-1.3	-1.5	-1.7	-1.9	0.3	0.1	0.2
%ch(Consumption)	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	0.6	0.1	-0.3	-0.5	-0.8	-1.1	0.8	0.9	0.9
%ch(Gross Investment)	-0.1	-0.5	-0.8	-1.1	-1.5	-1.8	-2.1	-2.5	-2.7	-2.9	-4.4	-5.4	-5.5	-5.6	-5.7	-5.5	-0.8	-2.4	-1.6
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.83	-0.84	-0.84	-0.86	-0.85	-0.85	-0.84	-0.85	-0.87	-0.90	-0.41	0.18	0.19	0.19	0.19	0.15	-0.84	-0.86	-0.85
ch(Interest Rate%)	0.05	0.04	0.04	0.05	0.05	0.05	0.06	0.07	0.08	0.09	0.13	0.18	0.25	0.30	0.37	0.42	0.05	0.07	0.06
%ch(Wage Rate)	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.5	-0.7	-1.0	-1.2	-1.4	-1.6	-0.2	-0.3	-0.2
ch(Private Wealth/GDP%)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.4	4.0	4.5	5.9	4.8	2.4	0.7	-1.5	-3.0	1.0	3.5	2.2
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.1	-1.8	-2.5	-3.3	-4.0	-4.8	-5.8	-6.7	-10.5	-12.1	-12.1	-12.1	-12.1	-12.1	-1.2	-4.9	-3.1
ch(Budget Deficit/GDP%)	0.52	0.66	0.73	0.77	0.83	0.86	0.97	1.09	1.09	1.14	0.82	0.34	0.34	0.34	0.34	0.34	0.70	1.03	0.87
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.0	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	-0.7	-0.8	-1.7	-2.7	-3.6	-4.3	-5.2	-6.0	-0.1	-0.6	-0.3
%ch(Labor)	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.2	-0.1	0.0	0.0	0.1	0.2	0.6	0.5	0.5
%ch(GNP)	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.1	-0.4	-0.9	-1.1	-1.3	-1.5	-1.7	0.4	0.2	0.3
%ch(GDP)	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.2	-0.1	0.0	0.0	0.1	0.2	0.6	0.5	0.5
%ch(Consumption)	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	0.8	0.3	0.1	-0.1	-0.4	-0.7	0.8	1.0	0.9
%ch(Gross Dom. Investment)	8.6	0.1	0.2	0.5	0.0	0.2	0.2	0.3	0.6	0.9	-0.6	-1.1	0.2	0.2	0.1	0.2	1.9	0.4	1.2
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.82	-0.82	-0.83	-0.85	-0.83	-0.83	-0.83	-0.84	-0.85	-0.88	-0.41	0.13	0.13	0.13	0.13	0.12	-0.83	-0.85	-0.84
ch(Net Foreign Assets/GDP%)	-1.7	-1.7	-1.7	-1.9	-2.0	-2.2	-2.4	-2.8	-3.2	-3.7	-5.3	-7.1	-9.9	-11.9	-14.5	-16.9	-1.8	-2.9	-2.3
ch(Private Wealth/GDP%)	0.0	0.5	1.0	1.5	1.9	2.4	2.8	3.2	3.7	4.1	5.3	4.1	1.6	-0.2	-2.6	-4.8	1.0	3.2	2.1
ch(Gov't Wealth/GDP%)	0.0	-0.5	-1.1	-1.8	-2.5	-3.2	-3.9	-4.7	-5.6	-6.5	-10.1	-11.6	-11.6	-11.6	-11.6	-11.6	-1.2	-4.8	-3.0
ch(Budget Deficit/GDP%)	0.51	0.64	0.71	0.75	0.80	0.84	0.94	1.05	1.05	1.10	0.78	0.33	0.33	0.33	0.33	0.33	0.68	1.00	0.84

Table B.5B: Welfare Changes Corresponding to Experiment Shown in Table B.5A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=4.0, Alpha=0.69, Low Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.3	0.4	0.6	0.0	1.0	0.7	-0.2	-0.4	-0.1	-0.4	-0.8	-0.9	-0.9	-0.9	-0.9
20-40 percentile					0.7	0.8	2.1	2.2	0.7	-0.3	-0.5	-1.9	-3.2	-3.6	-3.7	-3.7	-3.7
40-60 percentile					0.9	2.3	3.6	3.7	1.7	0.1	-0.9	-2.9	-4.6	-5.1	-5.1	-5.1	-5.1
60-80 percentile					1.6	5.4	6.8	6.6	3.8	0.7	-1.3	-4.2	-6.4	-7.0	-7.0	-7.1	-7.0
80-90 percentile					3.6	9.2	10.8	9.9	6.7	1.5	-1.7	-5.9	-8.6	-9.2	-9.3	-9.3	-9.3
90-95 percentile					7.4	17.7	16.7	16.4	10.0	3.0	-1.8	-7.3	-10.4	-11.0	-11.1	-11.1	-11.1
95-99 percentile					18.6	34.6	31.2	28.5	17.4	6.2	-0.6	-9.0	-12.5	-13.1	-13.1	-13.2	-13.2
99-100 percentile					62.7	119.9	95.4	74.6	45.0	11.6	1.1	-11.5	-15.7	-16.4	-16.4	-16.4	-16.4
Average	-0.3	-0.5	-0.3	0.4	2.9	6.1	6.8	6.3	3.5	0.7	-0.8	-3.3	-5.0	-5.5	-5.5	-5.5	-5.5
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.3	-0.5	-0.7	-1.5	-1.4	-1.3	0.6	0.9	0.3	-0.2	0.3	0.2	-0.1	-0.2	-0.3	-0.3	-0.3
20-40 percentile					-1.5	-0.9	1.4	2.4	1.5	0.5	0.9	0.3	-0.6	-1.1	-1.2	-1.2	-1.2
40-60 percentile					-2.1	-0.5	2.4	3.7	2.8	1.2	1.2	0.1	-1.0	-1.5	-1.6	-1.6	-1.6
60-80 percentile					-3.3	-0.2	3.9	5.5	4.6	2.1	1.4	-0.2	-1.5	-2.1	-2.2	-2.2	-2.2
80-90 percentile					-3.2	0.5	5.4	7.5	6.8	3.2	1.5	-0.8	-2.3	-3.0	-3.2	-3.2	-3.2
90-95 percentile					-2.3	3.0	5.8	10.5	8.9	4.9	1.9	-1.8	-3.5	-4.2	-4.3	-4.4	-4.4
95-99 percentile					5.3	11.0	10.5	16.1	13.6	7.5	2.4	-3.9	-5.9	-6.6	-6.8	-6.9	-6.9
99-100 percentile					38.1	62.5	41.3	36.7	29.7	11.6	2.4	-7.8	-10.1	-10.9	-11.1	-11.2	-11.2
Average	-0.3	-0.5	-0.7	-1.5	-1.5	0.7	3.3	4.8	3.8	1.7	1.1	-0.4	-1.4	-1.9	-2.0	-2.0	-2.0

Figure B.5: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

Appendix 5

The Heterogeneous-Agent Stochastic OLG Model with Higher Labor Supply Elasticity and Adjustments

October 2003

Model. Appendix 5 uses a heterogeneous agent stochastic OLG model with relatively high labor supply elasticity. The model assumes that the coefficient of relative risk aversion γ is 2.0, the consumption share parameter α is 0.45, and the maximum possible working hours (per couple) are 8,760. The experiments are done under both a closed economy assumption and a small open economy assumption.

In addition, the model assumes that government bond yields are 3.0 percent (300 basis points) lower than pre-tax market rate of return, which is about 6.25 percent in the baseline economy. This assumption will reduce debt service cost of the government. For more explanation, see Appendix B of the paper.

Policy Experiment. First, the changes in effective marginal income tax rates due to a 10 percent statutory marginal rate cut are calculated separately by CBO. The results are shown in Table 1 below. Then the pecent changes in marginal tax rates on labor income and capital income are reflected to the stochastic OLG model: The income tax adjustment factor $\tau_{I,adj}$ is reduced in each year to reflect the percent change in marginal tax rate on labor income. Since the percent changes in marginal tax rates on capital income is much smaller, the taxable capital income ratio (another adjustment factor) is raised from 0.700 in each year so that the change in effective marginal rate on capital income is similar to the number in Table 1.

Table 1: Effective Marginal Tax Rates on Labor Income and Capital Income (%)

Model Year	Calendar Year	Tax Rate on Labor Income			Rate on Capital Income		
		Current Law	Proposal	%ch	Current Law	Proposal	%ch
1	2004	18.1	16.3	-9.7	13.9	13.5	-3.1
2	2005	19.0	17.1	-9.7	13.9	13.5	-3.2
3	2006	19.0	17.2	-9.7	14.0	13.5	-3.2
4	2007	19.3	17.4	-10.0	14.0	13.6	-3.2
5	2008	19.5	17.6	-9.8	13.9	13.5	-3.1
6	2009	19.8	17.8	-9.7	14.9	14.3	-3.5
7	2010	20.0	18.1	-9.6	14.9	14.3	-3.6
8	2011	21.8	19.7	-9.6	15.5	14.9	-3.9
9	2012	22.0	19.8	-9.8	15.5	14.9	-3.9
10-	2013-	22.0	19.8	-10.2	15.5	14.9	-3.9

Second, the experiment uses static revenue changes calculated by the Joint Committee on Taxation (JCT). The numbers in the table are converted to calendar year from fiscal year. Then, lump-sum transfers $tr_{LS,t}$ are adjusted so that the static revenue changes are matched to JCT estimates. See Table 2.

Table 2: Static Revenue Change Adjustment

Model Year	Calendar Year	Static Revenue Change (as % of GDP)		Lump-sum Transfer Adjustment (in 2001 dollars)
		JCT Estimate[1]	OLG Model[2]	
1	2004	-0.65	-0.90	-252
2	2005	-0.76	-0.90	-136
3	2006	-0.81	-0.90	-93
4	2007	-0.82	-0.92	-101
5	2008	-0.85	-0.91	-60
6	2009	-0.86	-0.90	-48
7	2010	-0.93	-0.90	38
8	2011	-1.02	-0.90	113
9	2012	-0.99	-0.92	69
10-	2013-	-1.01	-0.96	58

[1]Converted to calender year from fiscal year.

[2]Before lump-sum transfer adjustments.

Government Financing Rules.   There are five financing rules:

1. Government consumption (waste) $C_{G,t}$ reduced contemporaneously (See Tables and Figure B.6);

2. Lump-sum transfers $tr_{LS,t}$ reduced contemporaneously (B.7);

3. Government consumption $C_{G,t}$ reduced gradually after 10 years (B.8);

4. Lump-sum transfers $tr_{LS,t}$ reduced gradually after 10 years (B.9);

5. Income tax rates $\tau_{I,adj}$ raised gradually after 10 years (B.10).

The ratio of government debt (net wealth) to the baseline GDP is fixed throughout the transition path in financing rules 1 and 2, and the debt-GDP ratio is stabilized after 20 years in financing rules 3, 4, and 5.

Table B.6A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

							Year										Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.2	0.3	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.7	2.0	2.1	2.2	2.3	2.3	0.3	1.0	0.7
%ch(Labor)	0.8	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.6
%ch(GNP=GDP)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.0	0.6	0.7	0.6
%ch(Consumption)	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.8	1.9	2.0	2.1	2.1	2.2	1.1	1.4	1.3
%ch(Gross Investment)	2.3	2.5	2.5	2.5	2.4	2.3	2.5	2.8	2.6	2.8	2.6	2.5	2.4	2.4	2.3	2.3	2.5	2.6	2.5
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	-0.48	-0.61	-0.65	-0.66	-0.69	-0.71	-0.79	-0.87	-0.83	-0.85	-0.84	-0.84	-0.84	-0.84	-0.85	-0.86	-0.62	-0.81	-0.71
ch(Income Tax/GDP%)	-0.81	-0.81	-0.82	-0.84	-0.82	-0.82	-0.81	-0.82	-0.83	-0.85	-0.84	-0.84	-0.83	-0.83	-0.83	-0.83	-0.82	-0.83	-0.82
ch(Interest Rate%)	0.06	0.04	0.03	0.01	0.00	-0.02	-0.03	-0.04	-0.05	-0.05	-0.09	-0.11	-0.12	-0.13	-0.14	-0.14	0.03	-0.04	0.00
%ch(Wage Rate)	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.4	0.4	0.5	0.5	0.5	0.5	-0.1	0.1	0.0
ch(Private Wealth/GDP%)	0.0	0.5	0.9	1.4	1.8	2.1	2.4	2.8	3.1	3.4	4.7	5.4	5.8	6.1	6.3	6.3	0.9	2.8	1.8
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.2	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.7	2.4	2.9	3.2	3.5	3.7	3.8	0.4	1.3	0.9
%ch(Labor)	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.6	0.4	0.4	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(GNP)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.3	0.7	0.8	0.8
%ch(GDP)	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.6	0.4	0.4	0.3	0.3	0.3	0.2	0.9	0.6	0.7
%ch(Consumption)	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.6	1.8	1.9	2.0	2.1	2.2	1.0	1.3	1.1
%ch(Gross Dom. Investment)	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.6	0.4	0.4	0.3	0.3	0.3	0.2	0.9	0.6	0.7
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	-0.43	-0.56	-0.62	-0.63	-0.67	-0.69	-0.77	-0.86	-0.83	-0.85	-0.85	-0.86	-0.86	-0.86	-0.87	-0.86	-0.58	-0.80	-0.69
ch(Income Tax/GDP%)	-0.78	-0.79	-0.80	-0.82	-0.81	-0.81	-0.80	-0.81	-0.82	-0.85	-0.85	-0.85	-0.84	-0.84	-0.84	-0.84	-0.80	-0.82	-0.81
ch(Net Foreign Assets/GDP%)	-2.8	-1.9	-1.1	-0.5	0.3	1.0	1.6	2.2	2.7	3.0	5.3	6.9	8.0	8.7	9.4	9.8	-1.2	2.1	0.4
ch(Private Wealth/GDP%)	0.0	0.6	1.1	1.7	2.2	2.7	3.2	3.6	4.1	4.6	6.5	7.9	8.9	9.5	10.1	10.5	1.1	3.6	2.4
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B.6B: Welfare Changes Corresponding to Experiment Shown in Table B.6A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.4	-0.1	-0.1	0.0	2.3	3.7	3.2	1.6	2.9	3.2	3.3	3.3	3.3	3.3	3.3
20-40 percentile					0.0	0.6	4.1	6.9	6.5	4.3	6.3	6.8	7.0	7.0	7.0	7.0	7.0
40-60 percentile					-0.1	1.4	6.1	9.5	9.5	6.1	8.5	9.1	9.4	9.4	9.3	9.4	9.3
60-80 percentile					0.1	3.1	9.5	13.7	13.8	8.8	11.4	12.2	12.5	12.5	12.5	12.5	12.5
80-90 percentile					0.8	5.5	12.7	17.2	18.1	11.4	14.4	15.2	15.6	15.6	15.6	15.6	15.5
90-95 percentile					3.5	11.6	15.8	22.4	21.8	14.9	18.2	19.2	19.6	19.6	19.6	19.6	19.5
95-99 percentile					12.9	27.0	27.8	33.0	30.1	20.9	24.8	26.0	26.5	26.5	26.5	26.5	26.4
99-100 percentile					57.5	118.8	91.4	71.6	56.8	27.7	32.2	33.5	34.1	34.1	34.1	34.1	34.1
Average	-0.2	-0.4	-0.4	-0.1	1.3	4.4	8.5	11.6	11.3	7.2	9.5	10.1	10.4	10.4	10.4	10.4	10.3
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.5	-0.2	0.2	0.4	2.6	3.8	3.2	1.6	2.6	2.8	3.1	3.1	3.1	3.1	3.1
20-40 percentile					0.4	1.2	4.7	7.2	6.5	4.1	5.6	6.1	6.5	6.6	6.6	6.6	6.6
40-60 percentile					0.4	2.5	7.0	10.1	9.6	6.0	7.6	8.1	8.6	8.6	8.6	8.6	8.6
60-80 percentile					0.9	5.3	11.5	15.1	14.3	8.6	10.3	10.9	11.4	11.4	11.5	11.5	11.4
80-90 percentile					2.2	9.2	16.1	20.0	19.6	11.3	13.2	13.8	14.3	14.4	14.4	14.4	14.4
90-95 percentile					5.8	18.4	22.1	28.1	24.7	15.0	17.0	17.6	18.2	18.3	18.3	18.3	18.3
95-99 percentile					17.3	39.3	40.5	44.4	36.3	22.1	24.4	25.1	25.7	25.8	25.8	25.8	25.8
99-100 percentile					69.8	157.3	130.9	105.1	76.7	30.7	33.3	34.1	34.7	34.8	34.8	34.8	34.8
Average	-0.2	-0.4	-0.5	-0.2	2.3	6.8	10.8	13.5	12.1	7.1	8.7	9.2	9.6	9.7	9.7	9.7	9.7

Figure B.6: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

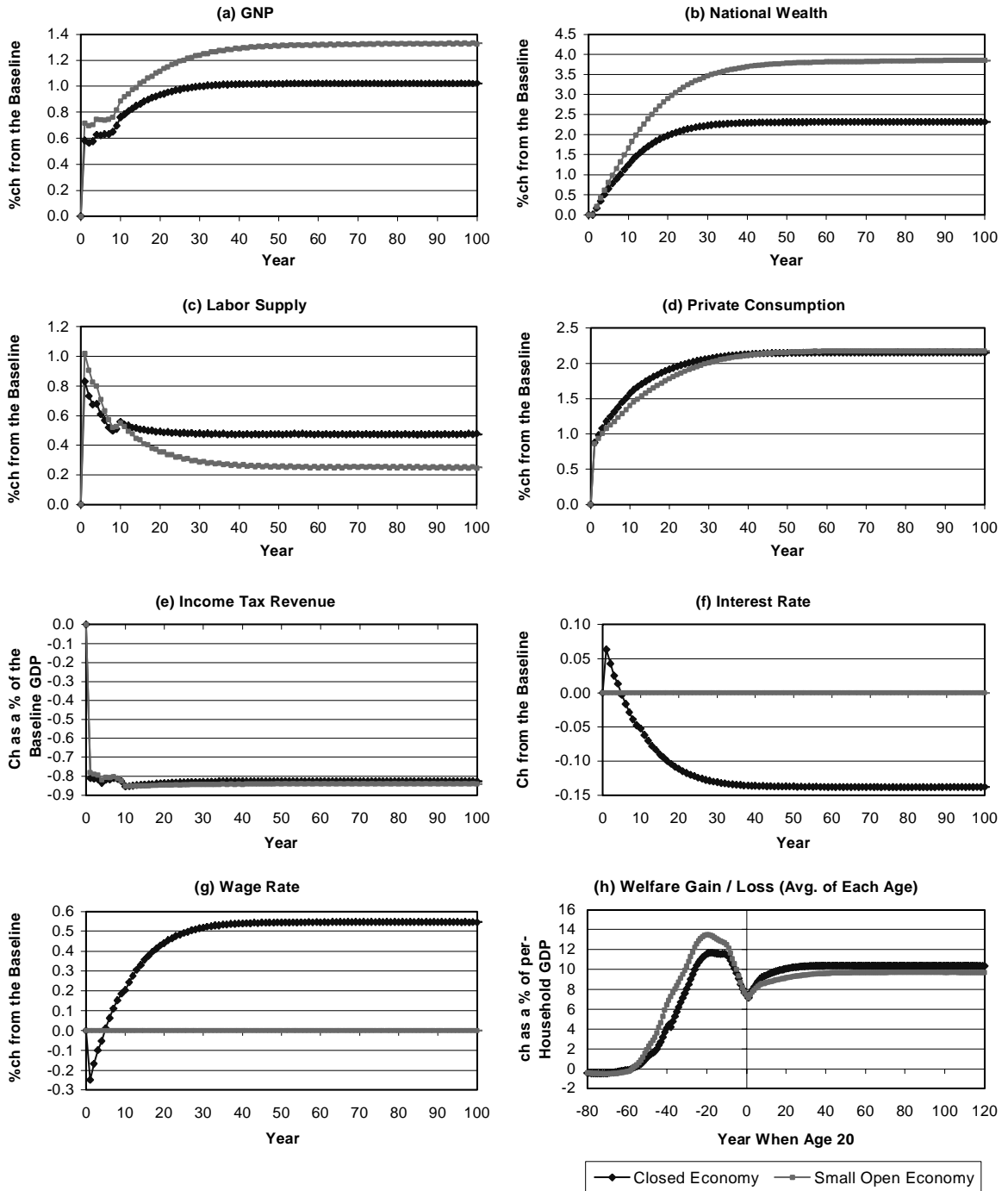—◆— Closed Economy   —■— Small Open Economy

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Table B.7A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.3	0.5	0.8	1.1	1.3	1.5	1.8	2.1	2.3	2.6	2.8	3.0	3.1	3.1	3.1	0.5	1.8	1.2
%ch(Labor)	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.9	1.1	1.0	1.0	1.0	1.0	1.1	1.1	0.9	0.9	0.9
%ch(GNP=GDP)	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.3	1.4	1.5	1.6	1.6	1.6	1.7	1.7	0.8	1.2	1.0
%ch(Consumption)	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.6	0.8	1.1	1.0
%ch(Gross Investment)	3.7	4.0	4.1	4.3	4.4	4.5	5.0	5.6	5.9	3.3	3.3	3.3	3.3	3.2	3.2	3.1	4.1	4.8	4.5
ch(Lump-Sum Transfer/GDP%)	-0.69	-0.69	-0.69	-0.70	-0.68	-0.68	-0.66	-0.66	-0.65	-0.65	-0.65	-0.65	-0.65	-0.66	-0.67	-0.70	-0.69	-0.66	-0.68
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.79	-0.79	-0.79	-0.80	-0.78	-0.78	-0.76	-0.76	-0.77	-0.78	-0.78	-0.77	-0.77	-0.76	-0.76	-0.76	-0.79	-0.77	-0.78
ch(Interest Rate%)	0.08	0.05	0.03	0.01	-0.01	-0.03	-0.05	-0.07	-0.09	-0.10	-0.12	-0.13	-0.15	-0.15	-0.15	-0.16	0.03	-0.07	-0.02
%ch(Wage Rate)	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.6	-0.1	0.3	0.1
ch(Private Wealth/GDP%)	0.0	0.7	1.5	2.2	2.9	3.6	4.2	4.9	5.6	6.4	7.2	7.8	8.2	8.4	8.6	8.6	1.5	4.9	3.2
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.3	0.7	1.0	1.3	1.6	1.9	2.3	2.6	3.0	3.6	4.0	4.3	4.5	4.7	4.8	0.7	2.3	1.5
%ch(Labor)	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8	0.8	0.8	1.1	0.9	1.0
%ch(GNP)	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.6	1.7	1.8	1.9	1.9	2.0	2.0	1.0	1.3	1.2
%ch(GDP)	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8	0.8	0.8	1.1	0.9	1.0
%ch(Consumption)	0.6	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	0.9	1.1	1.3	1.4	1.5	1.6	1.6	0.7	0.9	0.8
%ch(Gross Dom. Investment)	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8	0.8	0.8	1.1	0.9	1.0
ch(Lump-Sum Transfer/GDP%)	-0.62	-0.63	-0.64	-0.66	-0.65	-0.65	-0.65	-0.65	-0.66	-0.67	-0.67	-0.67	-0.67	-0.68	-0.68	-0.70	-0.64	-0.66	-0.65
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.75	-0.76	-0.76	-0.78	-0.76	-0.76	-0.76	-0.76	-0.77	-0.79	-0.79	-0.78	-0.78	-0.78	-0.78	-0.77	-0.76	-0.77	-0.77
ch(Net Foreign Assets/GDP%)	-3.6	-2.4	-1.3	-0.3	0.8	1.8	2.8	3.8	4.7	5.4	7.2	8.6	9.5	10.1	10.7	11.0	-1.4	3.7	1.2
ch(Private Wealth/GDP%)	0.0	0.9	1.8	2.7	3.6	4.4	5.3	6.2	7.2	8.1	9.8	11.0	11.9	12.4	13.0	13.2	1.8	6.2	4.0
ch(Gov't Wealth/GDP%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ch(Budget Deficit/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B.7B: Welfare Changes Corresponding to Experiment Shown in Table B.7A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	The Year When Age 20 (Top) / the Age in Year 1 (Bottom)																
	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-1.0	-4.3	-7.0	-6.2	-4.6	-2.1	-0.9	-0.6	-2.6	-2.4	-2.5	-2.6	-2.6	-2.6	-2.6
20-40 percentile					-7.1	-7.5	-4.2	-1.7	-0.2	-0.5	-3.2	-2.9	-3.0	-3.2	-3.2	-3.2	-3.2
40-60 percentile					-7.5	-8.3	-3.1	-0.5	0.8	0.0	-2.7	-2.4	-2.5	-2.6	-2.6	-2.6	-2.6
60-80 percentile					-8.5	-8.0	-0.9	2.5	3.3	1.3	-1.3	-0.9	-1.0	-1.1	-1.2	-1.2	-1.2
80-90 percentile					-8.8	-6.6	0.9	5.1	6.1	2.6	0.2	0.7	0.6	0.4	0.4	0.4	0.4
90-95 percentile					-7.1	-2.2	2.1	8.5	8.8	4.6	2.5	3.1	3.0	2.8	2.8	2.8	2.8
95-99 percentile					1.3	10.8	11.5	16.8	15.5	8.5	7.3	7.9	7.9	7.7	7.7	7.7	7.6
99-100 percentile					41.8	93.1	66.3	48.6	37.4	13.8	13.5	14.2	14.2	14.0	14.0	14.0	14.0
Average	-0.2	-0.4	-1.0	-4.3	-6.8	-5.4	-1.2	1.7	2.7	1.0	-1.4	-1.0	-1.1	-1.3	-1.3	-1.3	-1.3
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-1.1	-4.3	-6.6	-5.8	-4.5	-2.3	-1.2	-0.9	-3.2	-2.9	-2.8	-2.8	-2.8	-2.8	-2.8
20-40 percentile					-6.5	-6.7	-3.8	-1.7	-0.6	-0.9	-4.2	-3.9	-3.6	-3.7	-3.7	-3.7	-3.7
40-60 percentile					-6.7	-6.7	-2.2	-0.2	0.5	-0.5	-4.0	-3.6	-3.4	-3.4	-3.4	-3.4	-3.4
60-80 percentile					-6.9	-4.5	1.4	4.0	3.5	0.7	-2.9	-2.4	-2.2	-2.2	-2.2	-2.2	-2.2
80-90 percentile					-6.2	-0.8	5.3	8.4	7.5	2.0	-1.5	-1.0	-0.8	-0.8	-0.8	-0.8	-0.9
90-95 percentile					-2.6	7.8	10.6	15.7	11.9	4.3	0.8	1.3	1.6	1.5	1.5	1.5	1.5
95-99 percentile					8.6	28.3	28.5	31.4	22.8	9.6	6.4	6.9	7.2	7.2	7.2	7.2	7.2
99-100 percentile					60.4	146.8	119.0	91.9	62.4	17.1	14.3	14.9	15.2	15.1	15.1	15.1	15.1
Average	-0.2	-0.4	-1.1	-4.3	-5.1	-1.8	1.6	3.8	3.3	0.6	-2.6	-2.2	-2.0	-2.0	-2.0	-2.0	-2.0

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Figure B.7: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Contemporaneously

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
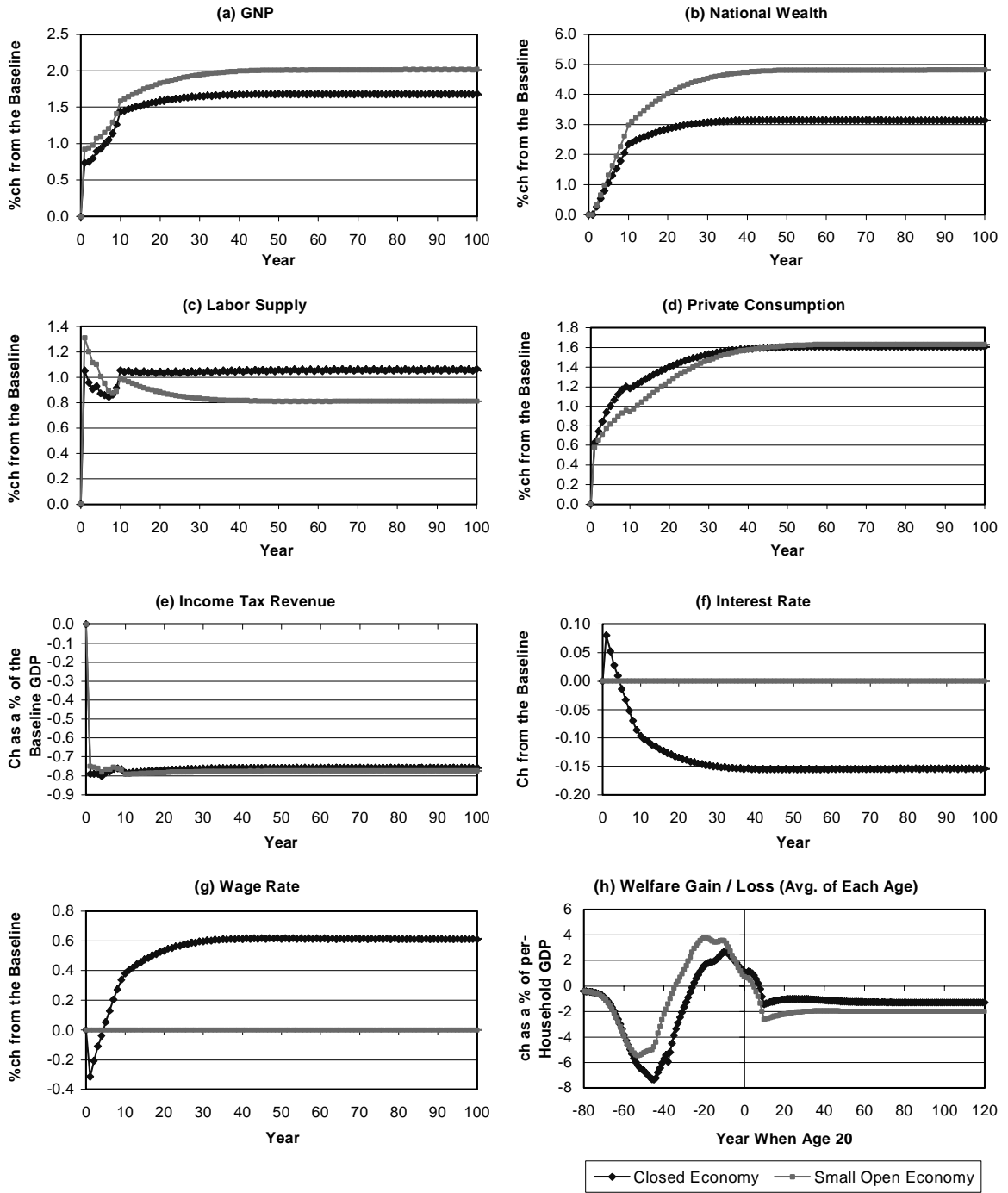
Closed Economy — Small Open Economy

Table B.8A: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2	-0.3	-0.5	-1.2	-1.4	-1.3	-1.2	-1.1	-1.1	0.1	-0.2	-0.1
%ch(Labor)	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.8	0.6	0.7
%ch(GNP=GDP)	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.2	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	0.6	0.3	0.5
%ch(Consumption)	0.7	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.4	1.5	1.6	1.6	1.7	1.7	0.9	1.2	1.0
%ch(Gross Investment)	1.1	0.5	0.0	-0.2	-0.7	-1.2	-1.7	-2.1	-2.5	-2.8	-2.5	-0.9	-1.0	-1.0	-1.1	-1.1	0.1	-2.1	-1.0
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.49	-1.01	-1.00	-0.99	-0.99	-0.99	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.80	-0.80	-0.81	-0.83	-0.82	-0.82	-0.82	-0.83	-0.85	-0.89	-0.91	-0.92	-0.91	-0.91	-0.91	-0.91	-0.81	-0.84	-0.83
ch(Interest Rate%)	0.08	0.06	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.08	0.12	0.13	0.12	0.11	0.11	0.11	0.06	0.06	0.06
%ch(Wage Rate)	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2
ch(Private Wealth/GDP%)	0.0	0.7	1.3	1.9	2.5	3.0	3.5	3.9	4.4	4.8	6.5	7.4	7.8	8.1	8.2	8.3	1.3	3.9	2.6
ch(Gov't Wealth/GDP%)	0.0	-0.4	-1.0	-1.6	-2.3	-2.9	-3.6	-4.4	-5.3	-6.2	-9.8	-11.3	-11.3	-11.3	-11.3	-11.3	-1.1	-4.5	-2.8
ch(Budget Deficit/GDP%)	0.45	0.59	0.67	0.70	0.76	0.80	0.92	1.03	1.04	1.09	0.77	0.32	0.32	0.32	0.32	0.32	0.63	0.98	0.80
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.8	-1.1	-2.1	-2.4	-2.4	-2.3	-2.3	-2.3	0.0	-0.6	-0.3
%ch(Labor)	1.0	0.8	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.7
%ch(GNP)	0.7	0.6	0.5	0.5	0.4	0.3	0.2	0.2	0.1	0.1	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	0.5	0.2	0.4
%ch(GDP)	1.0	0.8	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.7
%ch(Consumption)	0.9	1.0	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.6	1.7	1.7	1.1	1.3	1.2
%ch(Gross Dom. Investment)	13.1	-0.6	-0.2	0.5	-0.5	-0.3	-0.2	-0.1	0.6	1.0	0.5	0.4	0.5	0.4	0.4	0.5	2.5	0.2	1.3
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.48	-0.97	-0.97	-0.97	-0.98	-0.98	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.79	-0.80	-0.81	-0.83	-0.82	-0.83	-0.83	-0.84	-0.85	-0.89	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.81	-0.85	-0.83
ch(Net Foreign Assets/GDP%)	-2.6	-2.3	-2.1	-2.2	-2.2	-2.4	-2.6	-3.0	-3.6	-4.4	-7.0	-8.0	-7.8	-7.7	-7.6	-7.5	-2.3	-3.2	-2.8
ch(Private Wealth/GDP%)	0.0	0.5	1.0	1.4	1.8	2.2	2.5	2.7	3.1	3.3	4.2	4.5	4.7	4.8	4.9	5.0	0.9	2.7	1.8
ch(Gov't Wealth/GDP%)	0.0	-0.4	-1.0	-1.6	-2.3	-2.9	-3.7	-4.5	-5.3	-6.2	-9.8	-11.2	-11.2	-11.2	-11.2	-11.2	-1.1	-4.5	-2.8
ch(Budget Deficit/GDP%)	0.44	0.59	0.67	0.71	0.77	0.81	0.93	1.04	1.05	1.09	0.75	0.32	0.32	0.32	0.32	0.32	0.63	0.98	0.81

Table B.8B: Welfare Changes Corresponding to Experiment Shown in Table B.8A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.4	0.4	0.6	0.6	1.9	2.6	2.0	0.8	1.6	1.8	1.9	2.0	2.0	2.0	2.0
20-40 percentile					0.8	1.4	3.7	5.2	4.4	2.6	3.6	3.9	4.2	4.2	4.2	4.2	4.2
40-60 percentile					1.0	2.7	5.8	7.6	6.9	3.9	4.9	5.3	5.6	5.6	5.6	5.6	5.6
60-80 percentile					1.9	5.6	10.0	12.2	10.9	5.9	6.9	7.2	7.6	7.6	7.6	7.6	7.6
80-90 percentile					3.6	9.7	14.5	16.7	15.5	8.1	8.9	9.3	9.7	9.7	9.8	9.7	9.8
90-95 percentile					7.7	19.1	20.6	24.4	20.2	11.1	11.8	12.2	12.7	12.7	12.7	12.7	12.7
95-99 percentile					19.4	40.1	38.8	40.1	31.0	17.1	17.7	17.9	18.4	18.4	18.4	18.4	18.4
99-100 percentile					70.8	154.8	126.0	97.8	68.9	24.7	25.0	25.0	25.6	25.6	25.6	25.6	25.6
Average	-0.2	-0.4	-0.4	0.4	3.1	7.1	9.5	11.0	9.3	5.0	5.8	6.2	6.5	6.5	6.5	6.5	6.5
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.5	-0.8	-0.7	-0.4	1.6	2.8	2.3	1.1	1.9	2.0	2.1	2.1	2.1	2.1	2.1
20-40 percentile					-0.6	0.1	3.2	5.4	5.0	3.2	4.3	4.4	4.5	4.5	4.5	4.5	4.5
40-60 percentile					-1.0	0.6	4.8	7.6	7.5	4.7	5.8	6.0	6.1	6.1	6.1	6.1	6.1
60-80 percentile					-1.5	1.6	7.5	11.1	11.1	6.8	8.1	8.2	8.3	8.4	8.4	8.4	8.4
80-90 percentile					-1.4	3.2	9.9	14.1	14.9	9.0	10.3	10.5	10.6	10.6	10.6	10.6	10.6
90-95 percentile					0.4	8.0	11.6	18.3	18.1	12.0	13.2	13.4	13.5	13.5	13.5	13.5	13.5
95-99 percentile					9.0	21.6	21.9	27.7	25.7	17.4	18.4	18.5	18.7	18.7	18.7	18.7	18.7
99-100 percentile					52.3	109.5	81.5	63.7	51.5	23.6	24.4	24.5	24.7	24.7	24.7	24.7	24.7
Average	-0.2	-0.4	-0.5	-0.8	0.0	3.0	6.7	9.5	9.1	5.6	6.7	6.8	6.9	6.9	6.9	6.9	6.9

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Figure B.8: Income Tax Rates Reduced by 10 Percent Proportionally; Government Consumption Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
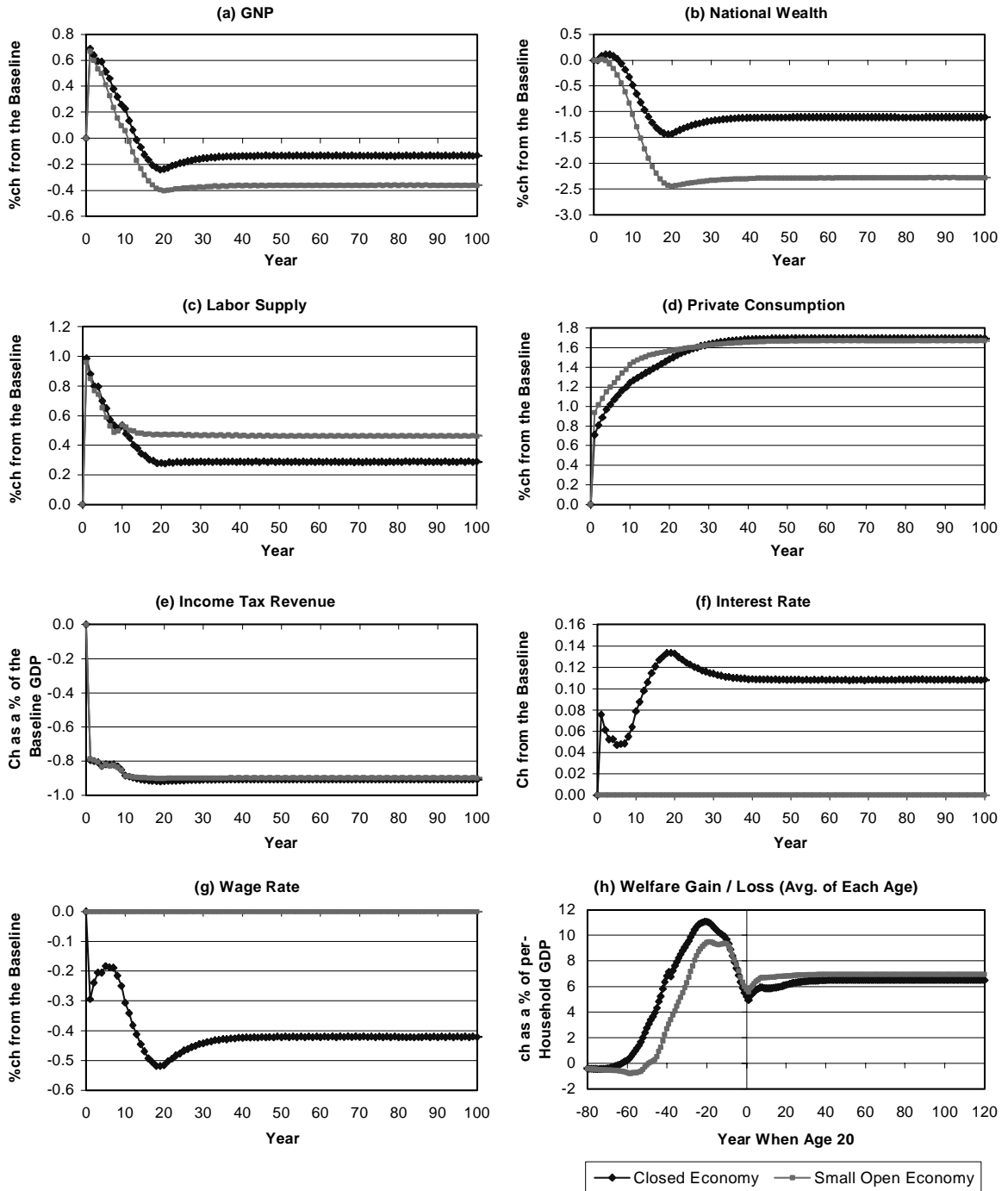
Closed Economy   Small Open Economy

Table B.9A: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.3
%ch(Labor)	1.1	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.8	0.9
%ch(GNP=GDP)	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7
%ch(Consumption)	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.0	1.1	1.1	1.1	1.1	0.8	1.0	0.9
%ch(Gross Investment)	2.0	1.5	1.2	1.1	0.7	0.5	0.2	0.0	-0.1	0.0	0.0	0.2	0.3	0.3	0.2	0.2	1.3	0.1	0.7
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	-0.39	-0.77	-0.76	-0.76	-0.77	-0.79	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.78	-0.79	-0.79	-0.81	-0.79	-0.79	-0.79	-0.79	-0.81	-0.84	-0.83	-0.83	-0.83	-0.82	-0.82	-0.82	-0.79	-0.80	-0.80
ch(Interest Rate%)	0.09	0.07	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.04	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.03	0.05
%ch(Wage Rate)	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2
ch(Private Wealth/GDP%)	0.0	0.8	1.6	2.4	3.1	3.8	4.5	5.2	5.9	6.6	9.3	10.4	10.5	10.5	10.6	10.5	1.6	5.2	3.4
ch(Gov't Wealth/GDP%)	0.0	-0.4	-0.9	-1.5	-2.1	-2.7	-3.4	-4.1	-4.9	-5.7	-8.8	-9.9	-9.9	-9.9	-9.9	-9.9	-1.0	-4.2	-2.6
ch(Budget Deficit/GDP%)	0.42	0.56	0.63	0.66	0.71	0.74	0.85	0.95	0.95	0.99	0.64	0.28	0.28	0.28	0.28	0.28	0.59	0.90	0.74
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.1	0.1	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	0.2	0.2	0.2
%ch(Labor)	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9
%ch(GNP)	0.8	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.6	0.7
%ch(GDP)	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9
%ch(Consumption)	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	0.9	1.1	1.0
%ch(Gross Dom. Investment)	16.2	-0.2	-0.2	0.9	-0.3	0.2	0.0	0.5	0.9	1.7	1.0	1.3	1.0	1.2	1.2	1.1	3.3	0.7	2.0
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	-0.38	-0.75	-0.75	-0.75	-0.76	-0.79	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.76	-0.77	-0.78	-0.80	-0.79	-0.79	-0.79	-0.80	-0.81	-0.84	-0.83	-0.82	-0.82	-0.82	-0.82	-0.82	-0.78	-0.80	-0.79
ch(Net Foreign Assets/GDP%)	-3.2	-2.7	-2.2	-2.0	-1.7	-1.6	-1.5	-1.5	-1.7	-2.1	-2.9	-3.5	-3.7	-3.7	-3.8	-4.0	-2.4	-1.7	-2.0
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.1	2.8	3.4	4.0	4.6	5.3	5.9	8.2	9.0	9.0	9.0	8.9	8.8	1.4	4.6	3.0
ch(Gov't Wealth/GDP%)	0.0	-0.4	-0.9	-1.5	-2.0	-2.7	-3.3	-4.1	-4.9	-5.7	-8.7	-9.8	-9.8	-9.8	-9.8	-9.8	-1.0	-4.1	-2.5
ch(Budget Deficit/GDP%)	0.39	0.54	0.61	0.64	0.70	0.74	0.85	0.96	0.95	0.99	0.63	0.28	0.28	0.28	0.28	0.28	0.58	0.90	0.74

Table B.9B: Welfare Changes Corresponding to Experiment Shown in Table B.9A
Compensating Variations in Wealth as Percentages of Per-Household Basline GDP
(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.5	-1.8	-4.5	-4.7	-3.6	-2.6	-1.6	-1.0	-2.6	-4.6	-4.6	-4.7	-4.8	-4.8	-4.8
20-40 percentile					-4.4	-5.4	-3.2	-2.4	-1.4	-1.3	-4.2	-6.9	-6.8	-7.0	-7.0	-7.0	-7.0
40-60 percentile					-4.6	-5.6	-2.2	-1.3	-0.7	-1.1	-4.5	-7.2	-7.2	-7.4	-7.4	-7.4	-7.4
60-80 percentile					-4.6	-4.0	0.5	2.1	1.5	-0.3	-4.1	-6.8	-6.8	-7.0	-7.1	-7.1	-7.1
80-90 percentile					-4.0	-1.0	3.4	5.5	4.5	0.6	-3.6	-6.4	-6.4	-6.6	-6.7	-6.7	-6.7
90-95 percentile					-0.7	6.1	7.3	11.1	7.9	2.2	-2.1	-4.9	-4.9	-5.1	-5.2	-5.2	-5.2
95-99 percentile					9.1	23.5	21.6	23.4	16.5	6.0	1.7	-1.3	-1.3	-1.5	-1.6	-1.6	-1.6
99-100 percentile					55.6	125.4	96.3	71.1	47.8	11.8	7.5	4.4	4.4	4.2	4.1	4.1	4.1
Average	-0.2	-0.4	-0.5	-1.8	-3.1	-1.5	0.8	1.9	1.6	-0.2	-3.4	-6.0	-6.0	-6.2	-6.2	-6.2	-6.2
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.7	-2.8	-5.4	-5.4	-3.7	-2.4	-1.3	-0.8	-2.4	-4.4	-4.5	-4.6	-4.6	-4.6	-4.6
20-40 percentile					-5.4	-6.3	-3.4	-2.0	-0.9	-0.9	-3.8	-6.5	-6.6	-6.7	-6.8	-6.8	-6.8
40-60 percentile					-6.0	-6.9	-2.6	-1.1	-0.1	-0.6	-4.0	-6.7	-6.8	-7.0	-7.1	-7.1	-7.1
60-80 percentile					-7.1	-6.5	-0.7	1.8	2.0	0.3	-3.5	-6.2	-6.4	-6.6	-6.6	-6.6	-6.6
80-90 percentile					-7.6	-4.9	1.0	4.5	4.6	1.3	-2.8	-5.7	-5.8	-6.0	-6.1	-6.1	-6.1
90-95 percentile					-5.9	0.0	2.5	8.3	7.4	3.0	-1.4	-4.2	-4.4	-4.6	-4.6	-4.7	-4.7
95-99 percentile					2.7	14.1	13.2	17.9	14.8	6.7	2.0	-0.8	-1.1	-1.3	-1.4	-1.4	-1.4
99-100 percentile					46.4	106.0	76.9	56.7	41.4	12.0	7.2	4.3	4.0	3.8	3.7	3.7	3.7
Average	-0.2	-0.4	-0.7	-2.8	-5.3	-3.9	-0.6	1.4	1.8	0.3	-2.9	-5.5	-5.7	-5.8	-5.9	-5.9	-5.9

Figure B.9: Income Tax Rates Reduced by 10 Percent Proportionally; Lump-Sum Transfers Reduced Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)
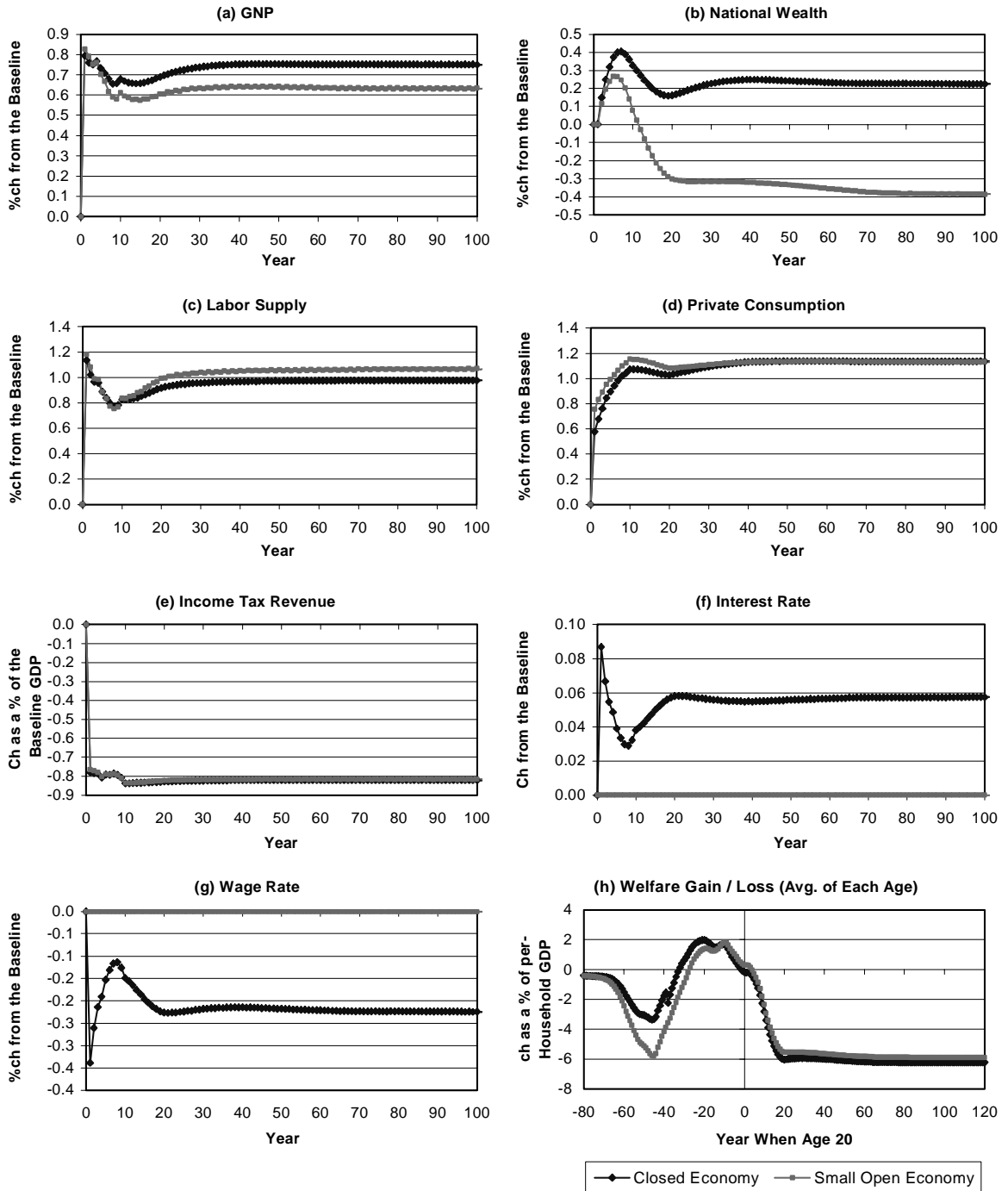
Closed Economy — Small Open Economy

Table B.10A: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

	Year																Average		
	1	2	3	4	5	6	7	8	9	10	15	20	25	30	40	120	01-05	06-10	01-10
(Closed Economy)																			
%ch(National Wealth)	0.0	0.1	0.1	0.2	0.2	0.1	0.1	0.0	-0.1	-0.2	-0.9	-1.9	-2.9	-3.5	-4.1	-4.3	0.1	0.0	0.0
%ch(Labor)	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.7	0.7	0.1	-0.6	-0.4	-0.4	-0.3	-0.3	0.9	0.7	0.8
%ch(GNP=GDP)	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	-0.2	-1.0	-1.2	-1.3	-1.5	-1.5	0.6	0.5	0.6
%ch(Consumption)	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	0.8	0.1	-0.3	-0.5	-0.8	-0.9	0.8	1.1	1.0
%ch(Gross Investment)	1.3	0.8	0.4	0.1	-0.3	-0.6	-1.0	-1.3	-1.5	-1.5	-3.5	-5.2	-4.8	-4.7	-4.5	-4.3	0.4	-1.2	-0.4
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.79	-0.80	-0.80	-0.82	-0.81	-0.81	-0.81	-0.82	-0.83	-0.86	-0.41	0.18	0.18	0.18	0.17	0.13	-0.80	-0.82	-0.81
ch(Interest Rate%)	0.08	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08	0.10	0.19	0.25	0.30	0.32	0.06	0.05	0.06
%ch(Wage Rate)	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.7	-0.9	-1.1	-1.2	-0.2	-0.2	-0.2
ch(Private Wealth/GDP%)	0.0	0.7	1.4	2.0	2.6	3.2	3.7	4.3	4.9	5.5	7.1	5.8	3.2	1.6	0.0	-0.6	1.3	4.3	2.8
ch(Gov't Wealth/GDP%)	0.0	-0.4	-1.0	-1.6	-2.2	-2.9	-3.6	-4.3	-5.2	-6.0	-9.6	-11.1	-11.1	-11.1	-11.1	-11.1	-1.0	-4.4	-2.7
ch(Budget Deficit/GDP%)	0.44	0.58	0.65	0.69	0.74	0.78	0.89	1.00	1.00	1.04	0.77	0.31	0.31	0.31	0.31	0.31	0.62	0.94	0.78
(Small Open Economy)																			
%ch(National Wealth)	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7	-1.8	-3.2	-4.6	-5.6	-6.7	-7.4	0.0	-0.4	-0.2
%ch(Labor)	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.7	0.1	-0.6	-0.2	0.0	0.1	0.2	0.9	0.7	0.8
%ch(GNP)	0.7	0.6	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.3	-0.5	-1.4	-1.5	-1.7	-1.9	-2.1	0.6	0.3	0.5
%ch(GDP)	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.7	0.1	-0.6	-0.2	0.0	0.1	0.2	0.9	0.7	0.8
%ch(Consumption)	0.9	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.0	0.4	0.0	-0.2	-0.6	-0.9	1.1	1.3	1.2
%ch(Gross Dom. Investment)	13.8	-0.4	-0.1	0.6	-0.2	-0.1	0.1	0.3	1.1	1.6	-1.3	-2.9	0.7	0.1	0.1	0.2	2.7	0.6	1.7
ch(Lump-Sum Transfer/GDP%)	-0.25	-0.14	-0.09	-0.10	-0.06	-0.05	0.04	0.11	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	-0.13	0.05	-0.04
ch(Gov't Consumption/GDP%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ch(Income Tax/GDP%)	-0.78	-0.79	-0.80	-0.82	-0.81	-0.82	-0.81	-0.82	-0.83	-0.86	-0.41	0.18	0.15	0.14	0.13	0.12	-0.80	-0.83	-0.81
ch(Net Foreign Assets/GDP%)	-2.8	-2.4	-2.2	-2.3	-2.2	-2.3	-2.5	-2.8	-3.4	-4.0	-5.2	-7.2	-12.2	-15.2	-18.6	-20.9	-2.4	-3.0	-2.7
ch(Private Wealth/GDP%)	0.0	0.5	1.0	1.5	2.0	2.4	2.8	3.2	3.6	4.0	4.7	2.3	-1.6	-4.2	-7.1	-9.2	1.0	3.2	2.1
ch(Gov't Wealth/GDP%)	0.0	-0.4	-1.0	-1.6	-2.2	-2.9	-3.6	-4.3	-5.2	-6.0	-9.6	-11.1	-11.1	-11.1	-11.1	-11.1	-1.0	-4.4	-2.7
ch(Budget Deficit/GDP%)	0.43	0.58	0.65	0.69	0.74	0.79	0.90	1.01	1.00	1.04	0.77	0.31	0.31	0.31	0.31	0.31	0.62	0.95	0.78

Table B.10B: Welfare Changes Corresponding to Experiment Shown in Table B.10A

Compensating Variations in Wealth as Percentages of Per-Household Basline GDP

(The Stochastic OLG Model with Heterogeneous Households, Gamma=2.0, Alpha=0.45, High Labor Supply Elasticity)

The Year When Age 20 (Top) / the Age in Year 1 (Bottom)

	-88	-79	-69	-59	-49	-39	-29	-19	-9	1	11	21	41	61	81	101	120
	109	100	90	80	70	60	50	40	30	20	10	0	-20	-40	-60	-80	-99
(Closed Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.4	0.3	0.5	0.4	1.5	1.4	0.2	-0.4	-0.5	-1.1	-1.8	-1.9	-1.9	-1.9	-1.9
20-40 percentile					0.7	1.1	3.1	3.3	1.2	-0.2	-1.0	-2.6	-3.7	-3.9	-3.8	-3.8	-3.8
40-60 percentile					0.8	2.2	4.9	5.1	2.4	0.2	-1.3	-3.6	-5.0	-5.1	-5.1	-5.0	-5.0
60-80 percentile					1.5	4.7	8.5	8.8	4.9	1.0	-1.7	-4.9	-6.6	-6.7	-6.7	-6.7	-6.7
80-90 percentile					2.9	8.1	12.3	12.6	8.3	1.9	-2.0	-6.3	-8.2	-8.3	-8.3	-8.3	-8.2
90-95 percentile					6.6	16.1	17.0	19.2	11.9	3.6	-1.8	-7.6	-9.8	-9.9	-9.8	-9.8	-9.8
95-99 percentile					17.5	33.9	31.9	33.0	21.4	7.6	-0.1	-9.4	-12.0	-12.0	-11.9	-11.9	-11.8
99-100 percentile					65.7	134.6	105.6	83.8	57.0	13.3	2.4	-11.2	-14.2	-14.1	-14.0	-14.0	-13.9
Average	-0.2	-0.4	-0.4	0.3	2.7	6.0	8.0	8.1	4.6	0.9	-1.2	-4.0	-5.4	-5.5	-5.4	-5.4	-5.4
(Small Open Economy)																	
Temporary Hourly Wage Class																	
0-20 percentile	-0.2	-0.4	-0.5	-0.8	-0.7	-0.6	1.1	1.3	0.3	-0.2	-0.1	-0.5	-1.1	-1.3	-1.3	-1.3	-1.3
20-40 percentile					-0.7	-0.2	2.4	2.9	1.4	0.3	-0.2	-1.2	-2.2	-2.6	-2.7	-2.7	-2.7
40-60 percentile					-1.0	0.3	3.7	4.4	2.6	0.8	-0.3	-1.7	-2.9	-3.3	-3.3	-3.4	-3.3
60-80 percentile					-1.5	0.8	5.6	6.8	4.5	1.6	-0.5	-2.6	-3.8	-4.2	-4.3	-4.3	-4.3
80-90 percentile					-1.6	2.0	7.0	8.7	6.7	2.4	-0.8	-3.6	-5.0	-5.4	-5.5	-5.6	-5.5
90-95 percentile					0.0	5.4	6.7	11.1	8.7	3.8	-0.9	-5.1	-6.5	-7.0	-7.1	-7.1	-7.1
95-99 percentile					8.2	16.2	12.8	17.1	14.1	6.8	-1.0	-8.9	-10.4	-10.9	-11.0	-11.1	-11.1
99-100 percentile					49.9	91.9	56.7	41.4	33.5	10.4	-1.7	-14.2	-15.7	-16.3	-16.5	-16.5	-16.5
Average	-0.2	-0.4	-0.5	-0.8	-0.1	2.1	4.7	5.6	3.8	1.3	-0.4	-2.3	-3.4	-3.8	-3.8	-3.9	-3.9

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Figure B.10: Income Tax Rates Reduced by 10 Percent Proportionally; Income Tax Rates Increased Gradually After 10 Years

(a) GNP

(b) National Wealth

(c) Labor Supply

(d) Private Consumption

(e) Income Tax Revenue

(f) Interest Rate

(g) Wage Rate

(h) Welfare Gain / Loss (Avg. of Each Age)

Closed Economy — Small Open Economy

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