14 Progressive Tax Changes to Superannuation in a Life Cycle Framework: Australia

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14.1 Introduction

Private pension pillars around the world benefit from concessional tax treatments that aim to increase private retirement incomes and household savings. As shown in table 14.1, most countries tax their private pensions under the "Exempt-Exempt-Taxed" (EET) regime, in which contributions and fund income are exempt from any taxation but benefits are treated as ordinary income and taxed progressively. An alternative approach is the "Taxed-Exempt-Exempt" (TEE) regime, which allows no deductions of contributions from gross income but then applies no further tax. By contrast, the existing tax treatment applied to Australia's superannuation (Australia's term for private pensions) features a flat tax rate on contributions and fund income, with benefits generally tax-free. As the statutory rate of this flat tax on contributions and fund income is 15 percent,[1] the system is concessional for most income earners compared to progressive personal income taxation.[2] The concessions, however, flow largely to high-income earners, as demonstrated by Ingles and Denniss (2009) and Australia's Future Tax Structure (AFTS) (2008, 2010). For instance, AFTS (Australia's Future Tax Structure 2008, 22) estimates that over 37 percent of concessional contributions go to only those Australians whose incomes are in the top 5 percent.

Given concerns regarding the vertical equity of Australia's superannuation tax arrangements, this chapter provides a quantitative analysis of hypothetical replacements of the existing superannuation taxation regime with traditional EET and TEE taxation regimes. Under both reforms, the existing flat tax rates on contributions and fund earnings that are currently paid by superannuation funds are abolished and either the withdrawals or the contributions are treated as ordinary

Table 14.1
Taxation of private pensions in selected countries.

EET				TTE	
EEt[a]	EET	TEE	ETT	tTE	ttE
France	Canada	Hungary	Denmark	New Zealand	Australia
Germany	Finland	Luxembourg	Italy		
Ireland	Greece	United States	Sweden		
Japan	Iceland	(Roth IRA)			
Korea	Netherlands				
Slovakia	Norway				
Spain	Poland				
Turkey	Switzerland				
United Kingdom	United States				
Belgium	Austria				
Portugal	Brazil				
Chile					

Sources: Yoo and de Serres (2004); OECD (2015).
Notes: E=exempt; T=taxed under personal income tax; t=concessional tax or partial exemption.
[a]Partial exemptions apply mainly to lump sums, with income streams often taxed as ordinary income; some countries, such as the United Kingdom, also impose limits on lump-sum payouts.

income and taxed progressively at households' marginal tax rates. The chapter also examines the effects of a variant of the TEE regime recommended by AFTS (Australia's Future Tax Structure 2010, 84–85) that, in addition to the progressive taxation of contributions, includes (1) a flat-rate tax offset such that the majority of taxpayers do not pay more than 15 percent tax on their contributions, and (2) a reduction of the statutory tax on fund earnings to 7.5 percent.

It is well known that under certain conditions the EET and TEE approaches are equivalent; that is, a shift to either the EET or TEE regime would have the same effect on the present value of superannuation tax revenues and the lifetime behavior of utility-maximizing households (Kingston and Piggott 1993; Creedy and Guest 2008a). However, there would be no general equivalence for a pension or tax policy change that would be unanticipated by households and where tax rates would differ over the life cycle (e.g., progressive taxation), some of the aspects incorporated in the modeling herein.

Australia's superannuation and its taxation arrangements underwent many changes over the last decade. Probably the most significant change to superannuation taxation was the abolition of the superannuation benefit tax for people aged 60 years and older, implemented in July 2007. While this change made superannuation taxation simpler, it adversely affected the vertical equity of the system (Bateman and Kingston 2007). The fiscal effects of this reform were examined by the Institute of Actuaries Australia (IAA) (2006) and Davidson and Guest (2007). Both employed microsimulation models that projected low fiscal costs for this benefit tax removal because of already highly preferential tax treatments of superannuation benefits in the prereform system.

Before the 2007 superannuation changes, many retirement income commentators and industry experts called for a move toward a traditional EET regime (Australian Superannuation Fund Association 1998; Doyle, Kingston, and Piggott 1999), and some proposed abolishing the flat tax on contributions (Clare 2006). Horne (2002) applied a microsimulation model to assess the ASFA (Australian Superannuation Fund Association 1998) proposal, with the key finding that it would increase savings and improve vertical equity. The microsimulation study of the shift to the EET regime by Doyle, Kingston, and Piggott (1999) showed only a small net loss in tax revenues, since the revenue loss from abolition of contribution and earnings taxes is partly offset by imposing marginal income tax rates on superannuation benefits. Atkinson, Creedy, and Knox (1999), also using a microsimulation model, found that the traditional EET regime scored better in terms of intragenerational equity and overall progressivity than the concessional TTT regime in Australia at that time.

The theoretical basis for analysis of a policy change to the taxation of private pensions was provided by Creedy and Guest (2008a). Their three-period utility-maximization model studied the behavioral effects of various superannuation tax changes and showed that, for example, abolition of the benefit tax would reduce savings and increase the labor supply. Creedy and Guest (2008b) employed a computable overlapping-generations (OLG) model to examine macroeconomic and welfare impacts of the 2007 abolition of benefit taxation in Australia. Their simulations found that this policy change favors middle-aged and older workers more than younger workers and reduces national savings. To address the "equity" issue, their policy recommendation was to increase marginal tax rates on those with higher incomes. To address the reduced

national savings, their recommendation was to increase public saving through lower transfers.

A large body of international literature has used computable OLG models to examine the economic effects of voluntary, tax-deferred retirement savings accounts (Imrohoroglu, Imrohoroglu, and Joines 1998; Fehr, Habermann, and Kindermann 2008; Nishiyama 2011; Armstrong, Davis, and Ebell 2015). In general, these studies found positive effects on national wealth, capital stock, and long-run welfare, although these effects vary greatly mainly because of different assumptions about government budget-balancing policy instruments. Fehr, Habermann, and Kindermann (2008) assessed not only the effects of tax-deferred or front-loaded accounts taxed under the EET regime but also the implications of tax-exempt or back-loaded accounts taxed under the TEE regime. They showed that increases in national wealth are significantly greater with front-loaded (EET) accounts, which burden old (and benefit young) rich households more than back-loaded (TEE) accounts.

This chapter's quantitative analysis of the superannuation taxation reforms builds on these computable OLG models. It uses an extended version of the small open economy OLG model developed by Kudrna and Woodland (2011a, 2011b), with a more detailed disaggregation of households into income quintiles and gradual withdrawals of superannuation savings in retirement. Compared to Creedy and Guest's (2008b) model, this model includes intragenerational household heterogeneity, life span uncertainty, endogenous retirement, and a richer structure of Australia's fiscal and retirement income systems. While Creedy and Guest (2008b) examined the effects of eliminating the concessional tax rates on contributions, fund earnings, or benefits, this chapter evaluates the effects of replacing these concessional superannuation tax rates with progressive income taxation applied to either benefits or contributions. Compared to Fehr, Habermann, and Kindermann (2008), who assessed the introduction of voluntary tax-favored retirement accounts, this chapter analyzes the reforms to the concessional taxation of already established mandatory superannuation. The chapter's main goal is to assess how these progressive tax reforms to superannuation affect the welfare and net income of households of different income classes (vertical equity) and of different ages (intergenerational equity).

The simulation results indicate that the reforms to superannuation taxation examined improve vertical equity and reduce income inequality, as shown by (1) greater relative gains in welfare and net income shares

for lower-income households and (2) a lower Gini coefficient. These findings provide support for the proposal by ASFA (Australian Superannuation Fund Association 1998) to apply progressive income taxation to superannuation benefits and for the proposals by Australia's Future Tax System (2010) and Ingles and Denniss (2009) to tax the mandatory contributions as ordinary income. The reforms also have important intergenerational implications. Specifically, under the EET taxation regime, older generations suffer from large welfare losses, as their private pensions are now taxed at marginal income tax rates. Compared to the two other taxation reforms, the shift to the EET regime, however, leads to greater long-run welfare gains for all income types because of significant reductions in the assumed budget-balancing consumption tax or income tax rates. The model also shows the reforms' positive long-run effects on domestic assets and reduced public pension expenditures, which are significant especially for the shift toward the EET regime. Similar effects on national wealth were obtained by Fehr, Habermann, and Kindermann (2008) for the introduction of voluntary front-loaded (EET) accounts in Germany.

Section 14.2 provides a technical description of the model. Section 14.3 reports on the calibration of the model and compares the benchmark steady-state equilibrium solutions with Australian data. Section 14.4 presents the simulation results for the three reforms to superannuation taxation, concentrating on equity and macroeconomic implications. Section 14.5 is devoted to a sensitivity analysis of the long-run effects of the reforms on a higher mandatory contribution rate and on an aging demographic. Finally, section 14.6 offers some concluding remarks and suggestions for future research.

14.2 The Model

A computable general equilibrium model with overlapping generations is constructed to analyze the superannuation taxation reforms. The model builds on Kudrna and Woodland (2011a, 2011b) and is extended to (2) include a detailed disaggregation of households into income quintiles based on the ABS (Australian Bureau of Statistics 2007) data and (2) allow for gradual withdrawals of superannuation savings rather than assuming lump-sum payouts.[3]

The model is essentially a small open economy type of Auerbach and Kotlikoff's (1987) OLG model, variants of which have been used

worldwide by many researchers to analyze various tax and pension policy reforms. In Australia, Kulish, Smith, and Kent (2010) used a closed economy model to analyze macroeconomic consequences of population aging, and Creedy and Guest (2008b) applied an open economy model to simulate changes to the superannuation taxation regime. Computable OLG models with stochastic incomes were employed by Tran and Woodland (2014) and by Cho and Sane (2013) to study the effects of policy changes on Australia's means-tested pension. Compared to the aforementioned models, this model specifically includes major aspects of Australia's superannuation, the means-tested Age Pension and progressive income taxation, which, combined with household heterogeneity in both age and income type, is crucial for the analysis of the investigated superannuation tax reforms' distributional effects.

14.2.1 Households

Consider a model economy populated by sequences of cohorts distinguished by age a and income type i. In particular, 70 generations of single-person households aged 21 to 90 years exist at any time t, with each generation consisting of the lowest, second, third, fourth, and highest quintiles. Every year, a new generation aged 21 years enters the model structure and faces random survival with a maximum further life span of 70 years, while the oldest generation, aged 90 years, dies. Random survival is given by conditional survival probabilities denoted by s_a. This benchmark model uses a stationary demographic setup with a constant rate of population growth, n, that together with survival probabilities gives time-invariant cohort shares, $\mu_a = [s_a/(1+n)]\mu_{a-1}$.

Each i-type household beginning economic life at time t is assumed to optimally choose consumption, c, and leisure, l, at each age and when to retire from the workforce to maximize the expected lifetime utility function given by

$$\max_{\{c^i_{t+a-21},\, l^i_{t+a-21}\}} \frac{1}{1-1/\gamma} \sum_{a=21}^{90} S_a \beta^{a-21} u\left(c^i_{t+a-21}, l^i_{t+a-21}\right)^{1-1/\gamma}, \tag{14.1}$$

subject to the within-period budget constraint written as

$$\begin{aligned} A^i_{a,t} = {} & (1+r)A^i_{a-1,t-1} + w_t e^i_a (1-l^i_{a,t}) + AP^i_{a,t} + SB^i_{a,t} \\ & + ST^i_a + B^i_{a,t} - T(y^i_{a,t}) - (1+\tau^c)c^i_{a,t}, \end{aligned} \tag{14.2}$$

where γ is the intertemporal elasticity of substitution, $u(c,l)$ denotes annual utility, with any future utility discounted by the subjective discount factor, β, and the unconditional survival probability, $S_a = \Pi_{j=21}^{a} s_{j-1}$.

In the per-period budget constraint (14.2), $A^i_{a,t}$ denotes the stock of ordinary private assets for type i households at the end of age a and time t, which equals the assets at the beginning of the period, plus the sum of interest income, $rA^i_{a-1,t-1}$, labor earnings, $w_t e^i_a(1-l^i_{a,t})$, Age Pension, $AP^i_{a,t}$, superannuation pension, $SB^i_{a,t}$, social transfer payments, ST^i_a, and bequest receipts, $B^i_{a,t}$, minus the sum of income taxes paid, $T(y^i_{a,t})$, and consumption expenditures, $(1+\tau^c_t)c^i_{a,t}$.[4] Labor earnings are the product of labor supply, $1-l^i_{a,t}$, and the hourly wage, $w_t e^i_a$, where w_t is the market wage rate for a person with unit efficiency and e^i_a is the age- and income-specific earnings ability variable. Labor supply is required to be nonnegative, $1-l^i_{a,t} \geq 0$. Taxable income or income tax base, $y^i_{a,t} = w_t e^i_a(1-l^i_{a,t}) + rA^i_{a-1,t-1} + AP^i_{a,t}$, comprises labor earnings of working agents, investment income, and Age Pension payments. Given the uncertain survival, the assets of persons who die are aggregated within each income type and are assumed to be equally redistributed as accidental bequests, $B^i_{a,t}$, to all surviving i-type persons aged 45–65 years.[5] This means that the bequests received by higher-income types are significantly larger than those received by lower-income types.

Persons are assumed to be born with no wealth and to exhaust all accumulated wealth at the maximum age of 90 years, so that $A^i_{20,t} = A^i_{90,t+70} = 0$.[6] Borrowing constraints are imposed by requiring $A^i_{a,t} \geq 0$ to prevent younger workers from borrowing against their superannuation payouts, as the Superannuation Guarantee legislation prohibits such borrowing.

14.2.2 Private and Public Pensions

Australia has a three-pillar retirement income system: the targeted, publicly provided Age Pension; the mandatory and fully funded Superannuation Guarantee scheme; and other long-term private savings, including housing and voluntary superannuation. The model incorporates the main aspects of the two publicly stipulated pillars—Age Pension and mandatory superannuation. The analysis begins with compulsory superannuation, as the superannuation assets and the incomes they generate affect the Age Pension payments through means testing.

The Superannuation Guarantee currently mandates that employers contribute 9 percent of gross wages into employees' superannuation fund.[7] It is assumed that mandatory contributions are made on behalf

of all workers at the contribution rate, cr, from their gross labor earnings, $w_t e_a^i (1 - l_{a,t}^i)$. These contributions net of the contribution tax, $\tau^s cr$, are added to the stock of superannuation assets, $SA_{a,t}^i$, which earns fund income at the after-tax interest rate, $(1 - \tau^r)r$. Superannuation assets are assumed to be kept in the fund until workers reach age 60. Workers aged 60 and older can draw down their superannuation savings as pensions, $SB_{a,t}^i$, which become part of the per-period budget constraint defined in (14.2). The stock of superannuation assets accumulates in the fund according to

$$SA_{a,t}^i = \left[1 + (1 - \tau^r)r\right] SA_{a-1,t-1}^i + (1 - \tau^s) cr \cdot w_t e_a^i (1 - l_{a,t}^i) - SB_{a,t}^i, \tag{14.3}$$

where τ^r is the effective earnings tax rate and τ^s denotes the statutory contribution tax rate. If eligible workers decide to collect superannuation pensions, $SB_{a,t}^i$, then these pensions are subject to the maximum and minimum withdrawal limits.[8]

The Age Pension, $AP_{a,t}^i$, is paid to single-person households aged 65 and older provided that they satisfy the means test. The means test comprises the income test and the asset test, with the test that results in lower pension payments (i.e., the binding test) applied. The means testing of the Age Pension can be expressed as

$$\begin{aligned} AP_{a,t}^i &= \min\{APi_{a,t}^i,\ APa_{a,t}^i\}, \\ APi_{a,t}^i &= \max\{\min\{p,\ p - \theta(\hat{y}_{a,t}^i - IT)\},\ 0\}, \\ APa_{a,t}^i &= \max\{\min\{p,\ p - \phi[(A_{a,t}^i + SA_{a,t}^i) - AT)]\},\ 0\}, \end{aligned} \tag{14.4}$$

where p is the single rate of the maximum Age Pension, θ is the income taper rate, ϕ represents the annual asset taper (reduction) rate, IT denotes the income threshold, and AT is the asset threshold. The private income assessed under the income test of the Age Pension, $y_{a,t}^i = r(A_{a-1,t-1}^i + SA_{a-1,t-1}^i) + 0.5 \times w_t e_a^i (1 - l_{a,t}^i)$, consists of interest earnings generated from superannuation and non-superannuation assets and half of labor earnings.[9]

14.2.3 The Rest of the Model

In addition to the household and pension sectors, the general equilibrium model includes the production, government, and foreign sectors.

The production sector comprises a single producer that represents a large number of perfectly competitive firms. This representative producer maximizes the present value of all future profits discounted at the world interest rate, r, specified by

$$\max \sum_{t=0}^{\infty} D_t \left[(1-\tau^f)(F(K_t, L_t) - C(I_t, K_t) - I_t - (1+cr) w_t L_t) \right], \tag{14.5}$$

by choosing capital, K_t, labor input, L_t, and net investment, I_t, subject to the (per capita) capital accumulation equation of the form

$$(1+n)K_{t+1} = I_t + (1-\delta)K_t, \tag{14.6}$$

where $D_t = (1+n)^t/(1+r)^t$ accounts for discounting and population growth, τ^f stands for the corporate tax rate, $F(K_t, L_t)$ represents the production of gross output, $C(I_t, K_t)$ gives the adjustment cost function, and the term $(1+cr)w_t L_t$ denotes the total wage bill, which also includes mandatory contributions.

The government is assumed to maintain a balanced budget, which includes pension expenditures, AP_t, social transfers, ST, and public consumption, G, on the expenditure side, and the tax revenues from household income, TR_t^Y, consumption, TR_t^C, superannuation, TR_t^S, and firms' profits, TR_t^F, on the income side. The per capita pension expenditures and tax receipts from households and firms in period t are given by

$$\begin{aligned}
AP_t &= \textstyle\sum_{i=1}^{5} \omega_i \sum_{a=65}^{90} \mu_a \, AP_{a,t}^i, \\
TR_t^Y &= \textstyle\sum_{i=1}^{5} \omega_i \sum_{a=21}^{90} \mu_a \, T(y_{a,t}^i), \\
TR_t^C &= \textstyle\sum_{i=1}^{5} \omega_i \sum_{a=21}^{90} \mu_a \, \tau_t^c \, c_{a,t}^i, \\
TR_t^S &= \textstyle\sum_{i=1}^{5} \omega_i \sum_{a=21}^{60} \mu_a \left[\tau^s \cdot cr \cdot w_t e_a^i (1 - l_{a,t}^i) + \tau^r \cdot rSA_{a-1,t-1}^i \right], \\
TR_t^F &= \tau^f (Y_t - \delta q_t K_t - (1+cr) w_t L_t),
\end{aligned} \tag{14.7}$$

which are the weighted averages of each component across households, with weights given by the intragenerational shares, ω_i, and cohort shares, μ_a.[10] In the per capita corporate tax revenue expression, Y_t is output net of adjustment costs and $\delta q_t K_t$ represents depreciation of the value of the capital stock. The government budget is assumed to be balanced in every time period by adjusting the consumption tax rate, τ_t^c, or through proportional changes to the personal income tax schedule, $T(y_{a,t}^i)$.

The foreign sector is represented by the international budget constraint. The constraint equates capital flows with the current account and can be written in per capita terms as

$$(1+n)FD_{t+1} - FD_t = TB_t - rFD_t, \tag{14.8}$$

where FD_t is per capita net foreign debt at the beginning of time t, TB_t is the trade balance (or net export), and rFD_t represents the interest payments on net foreign debt. The domestic interest rate, r, is exogenous in this small open economy model and is equal to the world interest rate.

The endogenous variables of the model are determined such that all agents optimize their objective functions subject to any constraints and such that all markets clear in every period. The clearing conditions for labor, capital, and output markets are

$$\begin{aligned} L_t &= \sum_{i=1}^{5} \omega_i \sum_{a=21}^{90} e_{a,t}^{i} \left(1 - l_{a,t}^{i}\right) \mu_a , \\ q_t K_t &= \sum_{i=1}^{5} \omega_i \sum_{a=21}^{90} \left(A_{a,t}^{i} + SA_{a,t}^{i}\right) \mu_a - FD_t , \\ Y_t &= \sum_{i=1}^{5} \omega_i \sum_{a=21}^{90} c_{a,t}^{i} \mu_a + I_t + G_t + TB_t , \end{aligned} \tag{14.9}$$

where q_t is the price of capital (i.e., Tobin's q), obtained by solving the firm's profit maximization problem.

14.3 Calibrating the Model

The model is calibrated to the key Australian aggregates averaged over the five-year period ending in June 2010. It assumes a stationary demographic environment with the constant population-growth rate, n, set to the current rate of 1.8 percent per year. The rate of population growth together with the male survival probabilities, s_a, taken from the 2007–2009 life tables (Australian Bureau of Statistics 2010a), generates the existing old-age dependency ratio of 0.2. The intragenerational shares, ω_i, are equal to 0.2 for each income class because of the income quintiles used by the Australian Bureau of Statistics (2007). This section discusses intragenerational differences among households, presents the per-period utility and production functions, and reports the values for the model parameters. It also compares the model-generated solutions with Australian data for some variables.

14.3.1 Income Heterogeneity among Households

The model considers five income types of households in each generation that differ by their exogenously given earnings ability and social transfer payments (which exclude the Age Pension).

The earnings ability (or labor productivity) profile is the potential wage at each age earned with all the time endowment allocated to work.

The approach used by Fehr, Jokisch, and Kotlikoff (2008) is followed to derive these profiles for each of the five income types. Specifically, using the estimated lifetime wage function for men who completed high school from Reilly, Milne, and Zhao (2005) and the income distribution shift parameter, ζ^i, the earnings ability variable, e_a^i, is constructed as

$$e_a^i = \zeta^i \times e^{2.235 + 0.04(a-17) - 0.00067(a-17)^2},$$

where ζ^i is set to 0.26 for the lowest quintile, 0.55 for the second quintile, 1.00 for the third quintile, 1.52 for the fourth quintile, and 2.63 for the highest quintile. These values are the ratios of the private incomes of lower and higher quintiles to the private income of the third quintile, calculated from the Australian Bureau of Statistics (2007, table 7, p. 22). Hence, the earnings ability profile for middle-income households (i.e., those in the third quintile) is taken from Reilly, Milne, and Zhao (2005), and the profiles for lower- and higher-income quintiles are shifted down and up, respectively, to approximate the distribution of private income in Australia.[11]

To account for a changing income distribution over the working years and also to approximate the distribution in gross income, workers are assumed to receive social transfers, denoted by ST_a^i in equation (14.2). These payments, assumed to be constant and received by workers younger than 65 years (except for those in the highest quintile), are calculated as follows. First, the Australian Bureau of Statistics (2007) data are used to derive the share of social transfers in gross income for each eligible quintile. These shares are 0.44 for the lowest quintile, 0.30 for the second quintile, 0.15 for the third quintile, and 0.06 for the fourth quintile. Second, the value of social transfers for eligible households is calculated such that these payments together with the endogenous Age Pension yield the aforementioned shares in their lifetime gross income. These income-specific social transfers have a particularly significant income effect on the labor supply of lower-income households, resulting in labor earnings profiles that are relatively flat for lower-income types compared to those of higher-income types.[12]

14.3.2 Preferences and Technology

The annual utility and production functions and parameter values chosen are standard in the literature. The per-period utility function takes the constant elasticity of substitution (CES) form

$$u(c, l) = \left[c^{(1-1/\rho)} + \alpha l^{(1-1/\rho)}\right]^{1/(1-1/\rho)},$$

where the intratemporal elasticity of substitution, ρ, is set to 0.9 and the value for the leisure distribution parameter, α, is 1.4. The remaining parameters in the lifetime utility (14.1) are the intertemporal elasticity of substitution, $\gamma = 0.4$, and the discount factor, $\beta = 0.99$, with its value chosen to generate the capital output ratio of 3 (Australian Bureau of Statistics 2010b).

The technology is described by the standard CES production function

$$F(K_t, L_t) = \kappa\left[\varepsilon K_t^{(1-1/\sigma)} + (1-\varepsilon)L_t^{(1-1/\sigma)}\right]^{[1/(1-1/\sigma)]},$$

where the technology constant, $\kappa = 0.88$, is calibrated to reproduce the market wage rate that is normalized to 1 in the benchmark steady-state equilibrium. The elasticity of substitution in production, $\sigma = 0.87$, and the capital intensity parameter, $\varepsilon = 0.45$, are calibrated via the producer's first-order conditions to match the interest rate and national account data for factor shares. The exogenous interest rate is set to 4 percent, the same rate used in Creedy and Guest (2008b). Following Fehr (2000), the adjustment cost function is assumed to be quadratic in net investment, given by

$$C(I_t, K_t) = 0.5\psi(I_t/K_t - (n+\delta))^2 K_t.$$

The value for the depreciation rate, δ, which is set to target the investment to capital ratio of 0.09 (Australian Bureau of Statistics 2010b), is 7.2 percent, and the adjustment cost parameter ($\psi = 10$) is taken from Auerbach and Kotlikoff (1987). The model is also calibrated to target the net foreign debt to capital ratio of 0.195, reflecting net foreign ownership of about 19.5 percent of Australia's capital stock (Australian Bureau of Statistics 2010b).

14.3.3 Policy Parameters

Table 14.2 reports the values for taxation and retirement income policy parameters. The values for the Age Pension and superannuation parameters are those applicable in September 2009. The Age Pension eligibility age is 65 years. The consumption tax rate is set to the statutory Goods and Services Tax (GST) rate of 10 percent. The "tax base" parameter is then computed to replicate the average ratio of this tax revenue to gross domestic product (GDP), which was 0.0389 over the five-year period ending in June 2010 (Commonwealth of Australia 2011). The product of the statutory tax rate and the computed tax base parameter

Table 14.2
Values of policy parameters in benchmark steady-state model.

Symbol	Description	Value	Source
$\overline{\tau}^c$	Statutory consumption tax rate (GST)	0.1	Data
τ^f	Statutory corporation tax rate	0.3	Data
v^c	Consumption tax base parameter	0.694	Calibrated[a]
p	Single rate of maximum pension (annual)	A$17,469	Data
IT	Income test threshold (annual)	A$3,976	Data
θ	Asset test threshold	A$307,000	Data
AT	Income reduction (taper) rate	0.5	Data
ϕ	Asset reduction (taper) rate (annual)	0.039	Data
cr	Superannuation contribution rate	0.09	Data
τ^s	Superannuation contribution tax rate	0.15	Data
τ^r	Superannuation earnings tax rate	0.071	Data[b]

[a] The product of this tax base parameter and the statutory Goods and Services Tax (GST) rate of 10 percent gives the effective consumption tax rate of 6.94 percent that appears in the households' budget constraint.
[b] This rate is roughly the value for the effective tax rate on superannuation earnings.

gives the effective tax rate on consumption, $\tau^c = 6.94$ percent. The corporate tax rate is set to the statutory rate of 30 percent, and the government budget is assumed to be balanced with no government debt.

The model incorporates a differentiable approximation function for the Australian progressive personal income tax schedule in 2009–2010. The approximation income tax function of taxable income, $T(y)$, takes the form

$$T(y) = t_5(y) - t_5(yt_1)\exp\left(\sum_{z=1}^{M-1} -(0.1)^z v_z \times \frac{y^z}{z}\right),$$
$$z = 1, \ldots, M-1, t_5(y) = m_5(y - yt_5) + tax_5,$$

where $v_z = (v_1, v_2, v_3, v_4)$ is a parameter vector, M denotes the number of tax brackets ($M = 5$), yt_1 and yt_5 are the lowest and highest tax thresholds ($yt_1 = 0$ and $yt_5 = 180$, expressed in A$1,000),[13] m_5 is the top marginal tax rate ($m_5 = 0.45$), and tax_5 is the tax payable at the highest threshold ($t = 54.55$, expressed in A$1,000). The parameter vector $v_z = (v_1, v_2, v_3, v_4)$ is estimated by nonlinear least squares using the Stata software. A grid of equally spaced incomes in the range [0, 200.5] is constructed, and the corresponding income taxes payable are based on the 2009–2010 Australian tax schedule, with both variables expressed in units of A$1,000. The parameter estimates obtained are $v_z = (0.1446, 0.0160, -0.0049, 0.0003)$.

Note that since the model is assumed to be populated with single-person households, the tax, superannuation, and Age Pension parameters are those applicable to individuals rather than households. While the progressive income tax applies to the individual taxable income and superannuation is accumulated by individuals, the Age Pension policy rules distinguish between higher pension rates for single pensioners and lower pension rates for couples. As the proportion of pensioners in the 65–69 age group receiving the couples rate of the maximum pension is around 60 percent (and then declines to less than 30 percent for those aged 80 and older), the model somewhat overestimates average pension payments in the early years of receiving the Age Pension. The model also somewhat overestimates income tax receipts from lower-income and middle-aged households, as it abstracts from any income tax offsets and tax benefits to families with children that are means tested in Australia. However, the choice to model the life cycle behavior of single-person households seems appropriate for the analysis of tax changes to superannuation that is accumulated by individuals (and not by households). In addition, the single-person household model is standard in the related literature (Altig et al. 2001; Creedy and Guest 2008b; Fehr, Habermann, and Kindermann 2008; Tran and Woodland 2014; Armstrong, Davis, and Ebell 2015).[14]

14.3.4 Computation and Benchmark Steady-State Solution

After specifying the parameter values, the GAMS software is used to compute the solutions for the benchmark steady-state and transition path equilibria. The algorithm applies the iterative Gauss-Seidel computational method suggested by Auerbach and Kotlikoff (1987). The steps carried out to solve for the steady states and the transition paths are listed in Kudrna and Woodland (2011a). This section briefly outlines how to deal with the nonconvexity of the household budget set caused by the Age Pension means test. It follows Altig et al. (2001) to handle the kinked household budget constraints and identifies households that choose to locate at the kinks in particular periods by evaluating their income assessable under the pension income test. If their assessable income is close to the income threshold of the pension income test, this income is set exactly to that threshold. Doing so puts such households at exactly the kinks in each period in which being at a kink is optimal.

Table 14.3 shows the results for the key macroeconomic ratios and household net income variables generated by the benchmark steady-

Table 14.3
Benchmark model and Australian data comparison.

Variable	Benchmark model	Australia[a]
Expenditures on GDP (percentage of GDP)		
Private consumption	56.12	56.22
Investment	27.01	27.38
Government consumption	15.58	17.88
Trade balance	1.29	–1.3
Government indicators (percentage of GDP)		
Age Pension expenditure	2.89	2.7
Personal income taxes	12.31	11.49
Corporation taxes	5.08	5.27
Consumption taxes (GST revenue)	3.89	3.89
Superannuation taxes	1.05	0.8
Targeted calibration ratios		
Capital to output (*K/Y*)	3	3
Investment to capital (*I/K*)	0.09	0.09
Foreign debt to capital (*FD/K*)	0.195	0.195
Net income share		
Lowest quintile	0.069	0.075
Second quintile	0.121	0.125
Third quintile	0.184	0.171
Fourth quintile	0.243	0.229
Highest quintile	0.384	0.401
Gini coefficient	0.336	0.326

Source: Authors' simulations; Commonwealth of Australia (2011); Australian Bureau of Statistics (2010b, 2011).
[a] These are five-year averages over the period ending in June 2010.

state solution of the model and provides a comparison with the actual data. The distribution of net incomes across household quintiles and the Gini coefficient match the actual data very closely. The comparison of model-generated and actual macroeconomic indicators also indicates that the model replicates the Australian economy fairly well. The components of domestic aggregate demand are close to their actual values expressed as a percentage of GDP. The exception is the trade balance; its positive value is implied by the calibration target for the net foreign debt to capital ratio. Similar conclusions can be drawn for the government indicators displayed, apart from government revenues from

the superannuation taxes. The difference between the model-generated and actual revenues from the superannuation tax is caused by the full maturity of the superannuation system assumed in the model.[15]

14.4 Dynamic Simulations of Superannuation Tax Reforms

This section numerically evaluates three hypothetical reforms to superannuation taxation: (1) a shift to an EET taxation regime, (2) a shift to a TEE taxation regime, and (3) implementation of the AFTS proposal.

Under the shift to the EET regime, the existing concessional tax rates on superannuation contributions and fund earnings paid by the superannuation fund are abolished, with the superannuation withdrawals added to ordinary taxable income and taxed progressively at marginal income tax rates. The second reform—the shift to the TEE regime—also eliminates the existing concessional superannuation taxes, but it is the mandatory superannuation contributions that are included in ordinary taxable income and taxed progressively at marginal income tax rates. The third reform examined—the AFTS proposal—follows the TEE regime by treating superannuation contributions as ordinary taxable income. In addition, the proposal includes a 15 percent tax offset to contributions for all households and a reduction of the statutory tax on fund earnings to 7.5 percent.[16]

These reforms are expected to have implications for the government budget. As mentioned, adjustments are made to either the consumption tax or income tax rate to maintain a balanced government budget. Specifically, the consumption tax rate is adjusted under the consumption tax adjustments, and proportional changes are made to the progressive income tax schedule (thus proportionally raising or lowering average and marginal income tax rates) under the income tax adjustments.

The following discussion of the simulation results concentrates on the equity and macroeconomic implications of the three superannuation tax reforms. An overview of the key results is presented first, after which the results are discussed in more detail.

14.4.1 Overview

All three examined reforms to superannuation taxation basically consist of two parts. The first part is to abolish the concessional 15 percent tax rate on mandatory contributions and either fully eliminate the effective fund earnings tax of 7.1 percent for the EET and TEE regimes or partially eliminate this tax for the AFTS proposal. These changes greatly

favor the superannuation assets that households can draw down from the age of 60 onward. The resulting increases in national wealth, saving, and interest incomes upon reaching the eligibility age of 60 for the Age Pension mean that the income and/or asset tests become more binding for potential Age Pension recipients and hence that government expenditures on the Age Pension decline. In that sense, a substitution occurs between the Age Pension and superannuation as retirement income supports, which is especially significant under the shift toward the EET taxation regime.[17]

The second part of the simulated reforms is to treat either the withdrawals (for the EET regime) or the contributions (for the TEE regime and the AFTS proposal) as ordinary taxable income. Consequently, the average income tax base increases, thus generating larger revenues from income taxation and allowing for budget-balancing reductions in the consumption tax rate or average income tax rate.[18] Under the EET regime, the budget-balancing tax instruments are lower over the entire transition path because of the increased labor supply of younger cohorts, yielding positive effects on their ordinary non-superannuation assets. The decrease in the consumption tax or income tax rate is shown to be only temporary for the two other taxation reforms, with the refundable superannuation tax offset paid under the AFTS proposal implying higher budget-balancing tax rates relative to those under the TEE reform.

The progressive income tax treatment of superannuation benefits or contributions is behind improvements in vertical (or intragenerational) equity and reductions in income inequality, which are demonstrated by greater gains (or smaller losses) in welfare and net income shares for lower-income households and lower values of the Gini coefficient. In terms of intergenerational implications, older generations experience significant welfare losses under the EET regime, as their superannuation pensions are taxed at marginal income tax rates. This contrasts with higher welfare losses or only small welfare gains and losses under the TEE regime and the AFTS proposal, respectively, for older cohorts, who are affected only indirectly through the budget-balancing tax changes. In the long run, however, the shift to the EET regime generates larger average welfare compared to the other policy reforms.

14.4.2 Equity Effects

To examine the equity effects of the superannuation taxation reforms, the analysis uses the concepts of equivalent variation, net income shares for household quintiles, and the Gini coefficient calculated using net

incomes. The first equity measure—equivalent variation—provides the distributional welfare effects across the five income types of households (i.e., measuring the effects on vertical equity) and across different generations (i.e., measuring the effects on intergenerational equity). In particular, equivalent variation for the given generation measures the percentage increase or reduction in this generation's wealth, which brings about a proportional increase or reduction in consumption and leisure in each year of remaining life needed in the benchmark scenario to produce the realized remaining lifetime utility in the reform scenario (Auerbach and Kotlikoff 1987, 87).[19]

The distributional welfare effects of the superannuation taxation reforms examined are reported in table 14.4. These effects are presented as percentage changes in remaining utility for generations of different ages at the time of the reform and for three income types of households, assuming either consumption tax or income tax adjustments to balance the government budget.[20,21]

Two main observations can be drawn for the intragenerational implications. First, under the consumption tax adjustments, the key result is that all three reforms improve intragenerational or vertical equity, depicted by larger or smaller gains or losses in welfare for lower-income types of households relative to those for higher-income households. For instance, the shift to the EET taxation regime generates a welfare loss of 0.89 percent for lower-income households where the person is age 80 at the time of the reform, but the welfare loss for higher-income types of the same age is 5.52 percent. In the long run, lower-income households gain in welfare by about 0.49 percent, compared to a 0.27 percent gain for higher-income types. Under the shift to the TEE regime, future-born generations of lower-income quintiles gain in welfare by 0.22 percent, while higher-income types attain a welfare loss of about 0.18 percent. These improvements in vertical equity result from the progressive taxation of the benefits or the contributions, and this outweighs the elimination of the concessional tax on fund earnings, which favors higher-income types.

Second, the choice of budget-balancing tax instruments also has intragenerational implications. In particular, reduced budget-balancing income tax rates are more beneficial for welfare of higher-income types and increased rates less so, while reduced budget-balancing consumption taxes are more beneficial for welfare of lower-income types and increased rates less so. For example, under the shift to the EET regime with reduced income tax rates, the long-run welfare gain for higher-

Table 14.4
Welfare implications of superannuation tax reforms
(percentage changes in welfare from initial steady-state solution).

	Consumption tax adjustments				Income tax adjustments			
Age in 2010	Lower income[a]	Middle income[b]	Higher income[c]	Average welfare[d]	Lower income[a]	Middle income[b]	Higher income[c]	Average welfare[d]
Shift to the EET taxation regime								
80	–0.890	–3.036	–5.519	–3.171	–1.009	–3.083	–5.450	–3.200
40	0.048	–0.330	–0.845	–0.385	–0.107	–0.362	–0.692	–0.392
20	0.405	0.310	0.141	0.280	0.266	0.289	0.301	0.285
–80	0.492	0.408	0.267	0.385	0.375	0.444	0.529	0.451
Shift to the TEE taxation regime								
80	0.228	0.220	0.213	0.220	0.114	0.068	0.037	0.074
40	0.339	0.161	0.005	0.170	0.259	0.166	0.119	0.185
20	0.317	0.101	–0.101	0.107	0.264	0.108	–0.010	0.123
–80	0.216	0.003	–0.175	0.017	0.226	0.000	–0.195	0.012
Shift to the AFTS proposal								
80	–0.039	–0.117	–0.160	–0.103	–0.036	–0.118	–0.164	–0.103
60	–0.184	–0.343	–0.506	–0.344	–0.161	–0.309	–0.465	–0.312
20	0.315	0.125	–0.045	0.133	0.365	0.136	–0.092	0.137
–80	0.248	0.059	–0.090	0.075	0.325	0.032	–0.259	0.033

Notes: Standard equivalent variation measures in percent.
[a] Average value for lowest and second quintiles.
[b] Value for third quintile.
[c] Average value for fourth and highest quintiles.
[d] Average value across all income quintiles.

income types is 0.53 percent, compared to the gain of 0.27 percent for higher-income types under the consumption tax adjustments with the reduced consumption tax rate. On the other hand, the long-run welfare gain for lower-income types under the AFTS proposal with increased income tax rates is 0.36 percent, compared to the long-run gain of 0.25 percent for these income types under the AFTS proposal with the increased consumption tax rate.

Table 14.4 also shows large differences in intergenerational equity implications among the superannuation taxation reforms. Under the EET taxation regime, older generations receiving (or close to the age of receiving) the superannuation benefits experience welfare losses, with the average welfare loss for generations aged 80 years at the time of the reforms being 3.18 percent (or 3.20 percent with income tax adjustments). In contrast, future-born generations gain in welfare, with a long-run welfare gain of 0.39 percent (or 0.45 percent with income tax adjustments). The long-run gains indicate that the resulting decreases in budget-balancing consumption or income tax rates and significantly larger assets offset the negative effects of increased marginal income tax rates applied to superannuation withdrawals. On the contrary, the shift to the TEE regime increases older generations' welfare because of initially reduced consumption or income tax rates. In the long term, the average welfare gain is smaller under this policy because of lower welfare for higher-income households, who bear most of the burden of the progressive income tax applied to their superannuation contributions.[22]

The two other equity measures for which results are provided are the net income shares for five household types and the Gini coefficient. The percentage changes in net income shares and in the Gini coefficient are presented in table 14.5. Similar to the distributional welfare implications, all three reforms increase net income shares for lower- income types and reduce them for higher-income types, thus reducing the Gini coefficient. Under the shift to the EET regime, the Gini coefficient falls by 0.94 percent (or by 0.48 percent with income tax adjustments) upon impact and by 1.13 percent (or by 0.69 percent with income tax adjustments) in the long run. The improvements in vertical equity during the transition path result from the transitional increases in the net income shares for lower-income types. The opposite transitional effects on vertical equity result from the shift to the TEE regime and also from adopting the AFTS proposal with consumption tax adjustments, with the decreases in the Gini coefficient being larger in the short term than in

Table 14.5
Effects of superannuation tax reforms on income shares and Gini coefficient
(percentage changes in net income shares and Gini coefficient from initial steady-state solution).

	Consumption tax adjustments				Income tax adjustments			
Period	Lower income[a]	Middle income[b]	Higher income[c]	Gini coefficient	Lower income[a]	Middle income[b]	Higher income[c]	Gini coefficient
Shift to the EET taxation regime								
2010	0.855	0.220	–0.365	–0.935	0.400	0.118	–0.216	–0.482
2015	0.926	0.193	–0.347	–0.936	0.480	0.091	–0.202	–0.485
2030	1.174	0.462	–0.433	–1.308	0.967	0.404	–0.367	–1.081
Long run	1.007	0.414	–0.370	–1.126	0.601	0.306	–0.245	–0.686
Shift to the TEE taxation regime								
2010	2.128	0.187	–0.652	–1.899	1.710	0.120	–0.517	–1.504
2015	2.156	0.145	–0.638	–1.908	1.792	0.098	–0.524	–1.569
2030	1.865	–0.026	–0.473	–1.618	1.893	–0.013	–0.474	–1.673
Long run	1.717	–0.042	–0.456	–1.390	1.743	–0.041	–0.464	–1.412
Shift to the AFTS proposal								
2010	1.686	0.066	–0.508	–1.431	1.530	0.023	–0.456	–1.266
2015	1.713	0.049	–0.501	–1.457	1.607	0.017	–0.466	–1.341
2030	1.690	–0.015	–0.443	–1.451	1.853	–0.019	–0.488	–1.583
Long run	1.455	–0.096	–0.379	–1.133	1.664	–0.085	–0.440	–1.311

[a] Average value for lowest and second quintiles.
[b] Value for third quintile.
[c] Average value for fourth and highest income quintiles.

the long run. For example, under the TEE regime, the Gini coefficient falls by about 1.9 percent (or by 1.5 percent with income tax adjustments) upon impact and by 1.39 percent (or by 1.41 percent with income tax adjustments) in the long run.

14.4.3 Macroeconomic Effects

Macroeconomic or aggregate variables are obtained as weighted averages of optimal household behavior, where the weights are the constant cohort and income type shares. The macroeconomic effects of the superannuation tax reforms are displayed in table 14.6 as percentage changes in the selected per capita variables in the selected years of the transition from the benchmark steady-state solution. Note that the reforms are assumed to be implemented in 2010, with the results for that year depicting the immediate effect of the reforms. The results for 2030 and the long-run effects of the policy reforms are also presented. The discussion of the macroeconomic results concentrates on the implications for asset accumulation and capital, the goods market, the labor market, and the main government indicators.

Removal of the superannuation contribution tax rate, combined with full elimination (under both the EET and TEE regimes) or partial elimination (under the AFTS proposal) of the fund earnings tax implies larger superannuation assets, which generate the reported increases in total domestic assets. The magnitude of these increases, however, differs greatly among the three reforms. Similar differences in the effects on national wealth arising from the introduction of voluntary front- and back-loaded retirement accounts were derived by Fehr, Habermann, and Kindermann (2008). Under the EET regime, the long-run increase in total wealth is 21.78 percent (or 24.84 percent with income tax adjustments), which results from greater superannuation assets and also from increased private non-superannuation assets. Increased private assets are the result of lower consumption expenditures and an initially higher labor supply. As for the TEE regime and the AFTS proposal, the increases in total domestic assets are moderated by decreases in private assets, which are affected by higher income taxes faced by younger generations.[23] While the total wealth increases, the effects of the superannuation taxation reforms on the capital stock per capita (not displayed) are negative. In the short and medium terms, the capital stock decreases are caused by lower capital prices (not displayed), but in the long term these negative effects are entirely driven by lower labor input. Hence, the increases in household savings are not invested in the

Table 14.6
Macroeconomic implications of superannuation tax reforms
(percentage changes in selected per capita variables from initial steady-state solution).

	Consumption tax adjustments			Income tax adjustments		
Variable	EET	TEE	AFTS	EET	TEE	AFTS
Domestic assets						
2010	0.00	0.00	0.00	0.00	0.00	0.00
2030	19.05	3.03	3.64	20.82	4.10	3.09
Long run	21.79	4.37	4.85	24.84	4.16	3.00
Labor supply						
2010	1.92	–0.53	–0.11	2.98	0.39	0.18
2030	–1.81	–0.81	–0.63	–1.54	–0.94	–1.09
Long run	–2.24	–1.10	–0.84	–1.76	–1.14	–1.15
Output (GDP)						
2010	1.17	–0.33	–0.06	1.81	0.24	0.11
2030	–1.72	–0.81	–0.61	–1.41	–0.91	–1.03
Long run	–2.24	–1.10	–0.84	–1.76	–1.14	–1.15
Gross national product (GNP)						
2010	1.17	–0.28	–0.04	1.77	0.25	0.14
2030	0.37	–0.41	–0.18	0.81	–0.39	–0.61
Long run	0.16	–0.56	–0.28	0.89	–0.62	–0.74
Consumption						
2010	–3.64	–0.48	–0.44	–3.55	–0.46	–0.43
2030	–1.23	–1.15	–0.83	–0.67	–0.96	–1.09
Long run	–0.57	–0.89	–0.54	0.29	–0.96	–1.08
Pension expenditure						
2010	0.63	0.02	0.03	0.57	0.01	0.04
2030	–2.84	–0.49	0.01	–3.15	–0.61	0.09
Long run	–4.52	–0.93	–0.67	–5.11	–0.89	–0.29
Income tax revenue						
2010	13.67	12.33	6.90	8.19	8.39	6.19
2030	11.30	9.32	4.44	8.58	9.00	6.76
Long run	12.16	8.77	3.90	7.98	9.11	6.69
Tax rate[a]						
2010	–16.43	–11.14	–1.66	–5.63	–4.26	–0.88
2030	–7.63	–0.84	6.45	–3.12	–0.34	2.80
Long run	–11.33	0.93	7.55	–4.85	0.40	3.29

[a] These are percentage changes in either the consumption tax rate or income tax imposed on taxable income that includes superannuation benefits (the EET regime) or contributions (the TEE regime and AFTS proposal).

domestic capital stock but instead are exported abroad, leading to substantial reductions in net foreign debt.

The policy changes to superannuation taxation examined have significant implications for household labor supply. As shown in table 14.6, the effects of the TEE regime and the AFTS proposal on per capita labor supply are negative over the entire transition path. The lower average labor supply results from reduced working hours of middle-aged and older working households that face increased income tax rates as contributions are now subject to progressive income taxation. The relatively more favorable outcome for per capita labor supply arising from the AFTS proposal is caused by the uniform 15 percent tax offset to superannuation contributions, which effectively reduces income tax rates (relative to the rates under the TEE regime). On the other hand, the shift to the EET regime leads initially to a higher per capita labor supply, which in 2010 increased by 1.92 percent with consumption tax adjustments or by 2.98 percent with income tax adjustments. This is because the current middle-aged and older working households supply more labor to boost their superannuation savings. In the succeeding years of the transition, the increases in average labor supply disappear, with the average labor supply falling by 2.24 percent (or by 1.76 percent with income tax adjustments) in the long term, mainly because of the dominating income effect of significantly larger asset holdings.[24]

Output (or GDP) is produced using the capital stock and labor supply, so the effects of the reforms on output follow the changes in these two inputs to production. Table 14.5 indicates that only under the shift to the EET regime in the short and medium terms does output increase, because of a higher average labor supply. The effects on national income (or gross national product, GNP), which equals output less the interest payments on foreign debt, are more favorable because of lower foreign debt. In fact, the national income is higher over the entire transition and in the long term as a result of the shift to the EET regime. The largest component of output is consumption, which is measured in per capita terms, as are all the other macroeconomic variables. As shown, all three reforms have negative effects on per capita consumption. Under the EET regime, average consumption decreases significantly, by about 3.6 percent upon impact, caused by lower consumption for the current elderly, who now have their superannuation benefits taxed as ordinary income. However, per capita consumption improves during the transition because of greater accumulated assets. By contrast, the shift to the TEE regime and the AFTS proposal generate relatively higher consumption in the short run than

in the long run, driven mainly by the budget-balancing changes in the consumption tax or income tax rates over the course of the transition.[25]

The simulation results also show that all three reforms reduce the elderly's reliance on the publicly provided Age Pension. This is because larger accumulated assets and asset incomes in retirement imply reduced Age Pension benefits because the means test is more strictly binding. The decline in Age Pension expenditures is especially significant for the shift to the EET regime, generating a long-run fall in pension costs of 4.52 percent with consumption tax adjustments or 5.11 percent with income tax adjustments. As expected, the receipts from the income tax increase under all three reforms, as either benefits or contributions are treated as ordinary taxable income. Assuming consumption tax rate adjustments to balance the government budget, the effects on income tax receipts are quite similar for both the EET and TEE regimes in the short run, but during the transition the shift to the TEE regime leads to greater decreases in income tax revenues. This is caused by the higher income tax rates faced by middle-age households, which lower their labor supply, private assets, and asset income. In the short run, the consumption tax rate declines under all three reforms examined. However, relative to the immediate effects, the consumption tax rate increases, and is 0.93 percent and 7.55 percent higher for the TEE regime and the AFTS proposal, respectively. These increases are caused partly by declining intakes from personal income taxation, corporate taxation (which largely follows the effects on per capita output), and declining average consumption, which affects overall consumption tax revenues. The relatively higher consumption taxes or income taxes for the AFTS proposal result from the uniform 15 percent contribution tax offset.

14.5 Sensitivity Analysis

To investigate the sensitivity of the results, the model now considers the long-run effects of the three superannuation taxation reforms under two alternative assumptions. The first alteration involves a higher 12 percent mandatory superannuation contribution rate; the second modification accounts for a more aged demographic environment.[26]

14.5.1 Higher Superannuation Contributions

In 2010, the Australian government announced that the mandatory contribution (or Superannuation Guarantee) rate would be gradually increased, reaching 12 percent of gross wages by July 2019. The

macroeconomic and welfare effects of the gradual increases in the Superannuation Guarantee rate were examined by Kudrna and Woodland (2013). Long-run effects similar to those in Kudrna and Woodland (2013) are reported in the column "ttE" of table 14.7, which shows the long-run percentage changes of the increased Superannuation Guarantee rate with the existing concessional tax rates on superannuation contributions and fund earnings. The policy change increases superannuation assets; the resulting increases in total assets and interest income upon reaching pension eligibility age reduce overall reliance on the Age Pension support in retirement. Although the government's pension expenditures fall as a result of the increased Superannuation Guarantee rate, income tax revenues decrease (because of lower labor earnings) and have to be compensated by an increase in the consumption tax rate, or alternatively by an increase in the average income tax rate. In terms of the welfare effects, the increased Superannuation Guarantee rate increases the welfare of higher-income types, whereas lower-income types with no preferential tax treatment of their superannuation suffer welfare losses because of a reduced wage rate and increased consumption tax or income tax rates that compensate for higher superannuation tax concessions.

The long-run effects of the superannuation taxation reforms with the 12 percent Superannuation Guarantee rate are reported in table 14.7 as percentage changes in the selected variables from the new (long-run) steady-state solution with the higher contribution rate. A comparison with the long-run effects of the superannuation taxation reforms under the lower 9 percent Superannuation Guarantee rate presented in section 14.4 reveals that the long-run effects presented here, although different quantitatively, are broadly the same qualitatively, with the same direction of change in most macroeconomic and welfare variables. That is, the examined superannuation taxation reforms with the higher 12 percent Superannuation Guarantee rate continue to yield greater domestic assets, lower pension expenditures, improved intragenerational equity, and reduced income inequality. The only exception occurs for the shift to the EET regime with income tax adjustments, where the long-run welfare gains are greater for higher-income types compared to the gains for lower-income types (i.e., vertical equity worsens). This is because of the budget-balancing reduction in income tax rates, which favors higher-income types. The larger long-run increases in domestic assets compared to those reported in section 14.4 result from smaller superannuation offsets (i.e., reductions in ordinary non-superannuation assets).

Table 14.7
Long-run effects of superannuation tax reforms with 12% Superannuation Guarantee rate
(percentage changes in selected variables from new steady-state solution with 12% Superannuation Guarantee rate).

	Consumption tax adjustments				Income tax adjustments			
Variable	ttE[a]	EET	TEE	AFTS	ttE[a]	EET	TEE	AFTS
Macro implications								
Domestic assets	9.90	23.48	12.76	10.41	7.59	26.99	14.12	11.00
Labor supply	–0.15	–2.43	–2.23	–1.56	–0.52	–1.69	–2.42	–2.24
Consumption	0.77	–0.40	–1.29	–0.74	0.11	0.78	–1.40	–1.51
Pension expenditure	–2.44	–5.43	–2.41	–1.47	–2.02	–5.51	–2.25	–1.29
Income tax revenue	–6.14	17.87	13.11	6.18	–2.79	10.52	12.31	9.19
Tax rate[b]	8.94	–12.07	0.75	7.55	4.55	–7.85	–0.82	3.06
Welfare effects								
Lower income[c]	–0.14	0.72	0.35	0.36	–0.05	0.49	0.31	0.45
Middle income[d]	0.08	0.55	0.09	0.14	0.06	0.50	0.06	0.12
Higher income[e]	0.37	0.36	–0.20	–0.08	0.17	0.72	–0.21	–0.28
Average welfare[f]	0.11	0.54	0.08	0.14	0.06	0.58	0.05	0.09
Income shares								
Lower income[c]	–0.53	1.45	1.96	1.58	–0.25	0.88	1.93	1.83
Middle income[d]	–0.35	0.53	–0.01	–0.11	–0.32	0.30	–0.01	–0.05
Higher income[e]	0.34	–0.51	–0.56	–0.43	0.26	–0.29	–0.54	–0.52
Gini coefficient	0.54	–1.53	–1.55	–1.16	0.28	–0.92	–1.54	–1.42

[a] Long-run results for increased contributions with existing concessional tax rates on contributions and earnings.
[b] Percentage changes either to consumption tax rate or income tax rate.
[c] Average value for lowest and second quintiles.
[d] Value for third quintile.
[e] Average value for fourth and highest quintiles.
[f] Average value across all income quintiles.

As mentioned, the increased Superannuation Guarantee rate results in larger superannuation savings, which offset (displace) other savings. Additional increases in the superannuation assets arising from the superannuation taxation reforms then lead to smaller superannuation offsets and thus larger increases in total assets compared to those with the 9 percent Superannuation Guarantee rate.

14.5.2 Aging Demographic

To examine the long-run effects of the superannuation taxation reforms in an aging environment, the medium population projections by the Productivity Commission (2013) are used. In particular, the model uses their age-specific survival rates in 2050 and calculates the annual rate of population growth to generate an old-age dependency ratio of 0.38, taken from their projections for 2050. The long-run steady-state effects of this aging demographic with increased longevity and reduced population growth are presented in the column "ttE" of table 14.8, which shows the percentage changes in selected variables in the new steady state with aging (but with the existing superannuation tax treatment) from the initial steady state in 2010.

Similar to the results of Kudrna, Tran, and Woodland (2015), the results show increased domestic assets (because of increased longevity and the proportion of older households with large asset holdings), reduced labor supply (because of a reduced proportion of working-age population), and significant increases in either consumption tax or income tax rates needed to fund higher Age Pension expenditures. The welfare effects of population aging are negative across all income types because of the increased tax rates. However, income inequality declines—as measured by the impacts on income shares and on the Gini coefficient. In the simulation herein, where increased pension expenditures are financed by tax hikes, income inequality falls, partly because the higher tax rates more negatively affect those households with higher incomes and partly because of a more binding pension means test for higher-income households, which accumulate more assets as a result of increased longevity.

The results for the three superannuation taxation reforms are presented in table 14.8 as percentage changes in the selected macroeconomic and welfare variables between the two new steady states (one with the tax reform and aging demographic and the other with the aging demographic only). As reported for the effects of the tax reforms with the 12 percent contribution rate, the macroeconomic implications

Table 14.8
Long-run effects of superannuation tax reforms with aging demographic
(percentage changes in selected variables in long-run steady state with aging demographic).

	Consumption tax adjustments				Income tax adjustments			
Variable	ttE[a]	EET	TEE	AFTS	ttE[a]	EET	TEE	AFTS
Macro implications								
Domestic assets	41.45	19.59	0.38	1.45	14.46	44.81	5.01	4.34
Labor supply	–9.68	–2.27	–0.52	–0.46	–11.44	–0.64	–1.99	–1.64
Consumption	–0.94	1.52	–0.49	–0.20	–6.85	7.10	–1.36	–1.09
Pension expenditure	53.77	–6.39	–1.30	–0.86	60.44	–8.71	–1.11	–0.65
Income tax revenue	–2.70	22.16	6.71	2.66	18.02	2.18	7.13	4.50
Tax rate[b]	52.18	–32.69	2.78	4.07	32.16	–22.69	–0.19	0.43
Welfare effects								
Lower income[c]	–4.90	1.34	0.12	0.25	–4.66	1.03	0.16	0.31
Middle income[d]	–5.23	1.18	–0.08	0.07	–5.83	1.74	–0.11	0.02
Higher income[e]	–5.25	0.97	–0.24	–0.08	–7.09	2.72	–0.48	–0.34
Average welfare[f]	–5.11	1.16	–0.06	0.08	–5.87	1.85	–0.15	–0.01
Income shares								
Lower income[c]	1.68	0.92	1.03	0.96	4.14	–1.33	1.22	1.11
Middle income[d]	–0.84	0.46	–0.22	–0.14	–0.42	0.30	–0.02	–0.11
Higher income[e]	–0.23	–0.30	–0.17	–0.22	–0.98	0.28	–0.38	–0.33
Gini coefficient	–0.74	–1.29	–0.88	–0.80	–3.15	1.12	–1.01	–0.87

[a] Long-run results for an aging economy with existing concessional tax rates on contributions and earnings.
[b] Percentage changes either to consumption tax rate or income tax rate.
[c] Average value for lowest and second quintiles.
[d] Value for third quintile.
[e] Average value for fourth and highest quintiles.
[f] Average value across all income quintiles.

in this aging economy are also broadly the same qualitatively as those derived in section 14.4. The magnitude of the change in some macroeconomic variables, however, differs greatly between the two demographic assumptions. For instance, the reductions in either consumption tax or income tax rates in this aging environment are significantly larger under the shift to the EET regime. This is simply a result of comparing the results of this tax reform with the new higher-aging steady state, which requires significantly higher tax rates to fund the increased pension expenditure. Table 14.8 also indicates that vertical equity—measured by the long-run effects on welfare and income inequality—improves under all the superannuation tax reforms in this higher-aging environment, except for the shift to the EET regime with the progressive income tax adjustments. As discussed, this reform allows for a large income tax cut that favors higher-income households, generating relatively larger welfare gains and net income shares compared to those of lower-income households.

14.6 Conclusions

This chapter examined three progressive tax reforms to superannuation (i.e., private pensions) by using a computable OLG model that incorporates essential features of Australia's retirement income and taxation policy settings. These hypothetical reforms are: (1) a shift to an EET taxation regime, (2) a shift to a TEE regime, and (3) adoption of the AFTS proposal on the taxation of superannuation. The first two reforms comprise replacement of the existing concessional superannuation taxation with the taxation regimes commonly applied to private pensions in other countries, where either benefits or contributions are treated as ordinary income and taxed progressively. The third reform is a variant of the shift to the TEE regime but also includes a 15 percent refundable contribution tax offset and a halving (but not full elimination) of the effective tax rate on investment earnings by the superannuation fund.

The major objective of the chapter was to assess whether, and to what extent, the reforms would improve vertical equity of the superannuation system, which currently provides tax concessions mainly to wealthy households, with lower-income households deriving little or no benefit (Australia's Future Tax System 2010). The simulation results indicate that all three reforms generate positive effects on vertical equity in the short, medium, and long terms, supporting proposals to impose

progressive income taxes on either superannuation contributions or benefits (Australian Superannuation Fund Association 1998; Ingles and Denniss 2009; Australia's Future Tax System 2010). The welfare gains are greater and losses smaller for lower-income households relative to those experienced by higher-income households. The net income shares for lower-income households also improve, while the shares for higher-income households are smaller. The Gini coefficient declines under all the reforms examined. To rank the reforms in relation to their impact on the Gini coefficient, the most effective reform for reducing income inequality—which has been steadily increasing in Australia, with the current Gini coefficient up by 10 percent since the 1990s (Australian Bureau of Statistics 2011)—is the TEE regime, followed by the AFTS proposal and the EET regime.

The chapter also examined the intergenerational implications of the reforms and showed that the effects obtained from the shift to the EET taxation regime differ greatly from those caused by the TEE regime and the AFTS proposal. Under the shift to the EET regime, older generations suffer from large welfare losses, as their private pensions are now taxed at potentially higher marginal tax rates under progressive income taxation. However, future generations gain more in welfare under the EET regime than under the two other tax reforms, because of significantly higher income tax revenue, which allows lower tax rates. The macroeconomic implications are that removal of the existing concessional taxes on mandatory contributions and fund earnings generates larger superannuation assets, household savings, and overall domestic assets. The increased assets and asset incomes in retirement are assessed under the Age Pension means test, reducing average Age Pension payments and overall pension expenditures by the government. Therefore, the reforms (especially the shift to the EET regime) increase self-funding for retirement and reduce reliance on the public pension for many pensioners. Most of these macroeconomic and welfare effects are robust to modifications of the model to account for a higher mandatory superannuation contribution rate and a more aged population.

While the simulated impacts of the investigated changes to the taxation of superannuation are in accordance with economic intuition, they vary in numerical size and importance. Broadly, the implications of the superannuation tax reforms are relatively small for macroeconomic variables such as output, labor supply, and inequality as measured by the Gini coefficient. On the other hand, they are much larger quantitatively

for other variables such as assets, tax revenues, Age Pension expenditures, and the budget-balancing tax rates. This is especially true under the policy change that replaces the current superannuation taxation arrangements with the EET taxation regime.

Any modeling analysis like that employed here is subject to limitations. First, the simulation of the superannuation tax reforms is undertaken in the environment of an assumed fully mature superannuation system, while the existing system is still in a transition toward maturity. Accordingly, if the current values for superannuation assets and superannuation tax revenues were targeted in the benchmark model, the effects generated by the reform would change to some extent from those presented here. For example, eliminating the concessional superannuation tax rates would require smaller increases in other taxes. Similarly, the shift to the EET regime is likely to lead in the short run to smaller increases in income tax revenues than those presented, as the actual superannuation balances are not as large as those predicted by the model. Second, the choice by households to make voluntary superannuation contributions was not modeled. Although aggregate voluntary contributions to superannuation are quite small compared to mandatory contributions, higher-income and older individuals make more significant voluntary contributions, and their voluntary choice of contributions is likely to be impacted by the superannuation tax reforms examined. Third, the present model abstracts from uncertainty for households regarding labor productivity over the life cycle and from precautionary savings during the working years. These extensions are left for future research.

Notes

We would like to thank Viktor Steiner, Robert Holzmann, and participants of the CEPAR-CESifo workshops on "Taxation of Pensions" in Sydney and in Munich for comments and feedback. This research was supported by the Australian Research Council Centre of Excellence in Population Ageing Research (CEPAR) under grant CE110001029.

1. Note that the effective fund earnings tax rate is about 7.1 percent, which is because of imputation credits on dividend income and the capital gains tax discount (Yoo and de Serres 2004).

2. The Australian personal income taxation system is progressive, with five tax brackets. In the financial year of 2009–10, the marginal tax rates range from zero to 45 percent (excluding the Medicare Levy).

3. Phased withdrawals of superannuation savings are assumed in the model because in 2009 the value of superannuation benefits paid as phased withdrawals exceeded for the first time the value of lump sums received (Bateman and Piggott 2011).

4. The social transfer payments are assumed to be paid to persons in the lowest to the fourth income quintiles aged younger than 65 years (see section 14.3 for details).

5. The bequest range of 46–64 years reflects intergenerational transfers from parents to children, as childbearing occurs largely between 25 and 35 years of age and the probability of death is particularly high in the 80+ age group.

6. The model abstracts from planned bequests, based on Gokhale et al. (2001), who documented a number of studies that found strong empirical evidence against intergenerational altruism.

7. The initial decision by the Australian government was to increase the rate to 12 percent by July 2019, but this was delayed by a subsequent government to 2025.

8. The maximum limit of 10 percent of the superannuation balance applies only to working households. The minimum limits are age based. These limits are 4 percent of the balance for persons younger than 65, 5 percent for those aged 65–74, 6 percent for those 75–79, 7 percent for those 80–84, 9 percent for those 85–89, and 11 percent for those 90 years old.

9. The model closely follows the pension means-testing rules in relation to assessing the superannuation assets at retirement (Department of Families, Community Services and Indigenous Affairs 2009). The superannuation assets that pensioners hold are assessed in full under the asset test of the Age Pension; the interest earnings generated by superannuation assets (similar to income generated by non-superannuation assets) are subject to the income test of the Age Pension, reflecting the means-testing rules applied to short-term income streams.

10. Government consumption and social transfers are assumed to be constant, with per capita social transfers equal to $ST = \Sigma_{i=1}^{4} \omega_i \, \Sigma_{a=21}^{64} \mu_a \, ST_a^i$.

11. The earnings ability for each income class after age 65 is also assumed to decline at a constant rate to reach zero at age 90, as Reilly, Milne, and Zhao (2005) considered only workers aged 15–65 years.

12. The effects of the superannuation tax reforms are also analyzed using alternative labor productivity profiles that differ not only in their level but also in their shape among the five income types (see section 14.5 for more details).

13. All figures are in Australian dollars unless otherwise specified.

14. Similar to the models in the articles listed, the behavior of self-employed workers (i.e., entrepreneurs) is not explicitly modeled. Although they are not required to contribute toward their superannuation, they are encouraged to do so through generous tax concessions. Importantly, self-employed workers account for only about 8 percent of the Australian workforce. It is also very likely that at some stage during their working years, those reported as self-employed workers were (or will be) employed and accumulated (will accumulate) superannuation through employers' mandatory contributions.

15. Note that compulsory superannuation (i.e., Superannuation Guarantee) was introduced in 1992 with initial 3 percent contributions, which were gradually increased to the existing rate of 9 percent in 2002. The model assumption of the 9 percent mandatory contributions paid to workers over their whole working life also generates higher ratios of superannuation assets to GDP and to total assets. Thus, the superannuation tax reforms are examined in the environment of a fully mature superannuation system.

16. The effective fund income tax rate is reduced from 7.1 percent to 3.55 percent under this policy change.

17. The policy simulations of eliminating concessional tax rates on either contributions, fund earnings, or benefits by Creedy and Guest (2008b) assume universal Age Pension benefits and thus are incapable of capturing the effects of a superannuation tax policy on the publicly provided Age Pension.

18. The income tax base (i.e., taxable income) increases for older households under the EET regime and for younger and middle-aged households under the two other reforms. These households then face higher average and marginal income tax rates. The budget-balancing reduction or increase under the income tax adjustments is made to these increased income tax rates.

19. The welfare effect for an *i*-type household of generation aged *a* at the time of the superannuation tax reform is calculated as $W_g^i = \left[\left(\hat{U}_g^i / \bar{U}_g^i\right)^{1/(1-1/\gamma)}\right] - 1] \times 100,$ where $\hat{U}_g^i$ is the value of the remaining lifetime utility after the reform and $\bar{U}_g^i$ is the value of the remaining lifetime utility in the benchmark scenario.

20. The youngest generation at the time of the reforms is aged 21, which is the assumed entry age in the model. All the generations aged 20 and younger are those born in the succeeding transitional years. The results for the generation of those aged −80 in year 2010 (i.e., the generation born in 2090) approximate the long-run welfare effects.

21. The model assumes five income types of households. The welfare effects on lower-income, middle-income, and higher-income households in table 14.4 are presented as the average effect for the lowest and second quintiles, the effect on the third quintile, and the average effect for the fourth and highest quintiles, respectively.

22. Similar intergenerational welfare effects were obtained by Fehr, Habermann, and Kindermann (2008) for the policy introducing voluntary front-loaded and back-loaded accounts. The differences in their results between the two types of tax-preferred accounts come mainly from the general equilibrium effects on the assumed budget-balancing policy instrument rather than from direct effects on households from the taxation applied to these voluntary accounts.

23. Recall that borrowing constraints are imposed on all households so they cannot borrow against their superannuation assets. Removing the borrowing constraints would generate a larger superannuation offset (i.e., reduction in private non-superannuation assets) and smaller increases in total wealth for all three reforms examined. Creedy and Guest (2008b) allowed for borrowing, which partly explains the lower savings generated by their policy simulation of removing the concessional tax rate on benefits.

24. The wage rate (not displayed) is unchanged in the long run in this small open economy model, but during the transition it moves in the opposite direction from the changes in average labor supply.

25. The effects on the other components of aggregate demand are not displayed. In brief, government or public consumption is kept constant over the entire transition, and the policy effects on investment demand are similar to those in the capital stock. The external demand or net export balances output supply with domestic demand, and under all three reforms it decreases in the long run as output falls more than domestic demand.

26. To evaluate the sensitivity of the results to a relaxation of the assumption that the productivity profiles for the five income types of households have the same shape, dif-

fering only in level, the long-run effects of the superannuation tax reforms are also examined, using alternative labor productivity profiles. These alternative profiles assume different years of schooling among the income types. In particular, the third quintile is assumed to have the same number of years of schooling as in the benchmark model (12 years), but the two lower-income types have only 10 years of schooling and the two higher-income types have 15 years of schooling. This assumption generates labor productivity profiles, e_a^i, that are relatively flat for the two low-income types and relatively steep for the two high-income types. Given that the results are not significantly different from those presented in section 14.4, they are not reported here. Results are available from the authors upon request.

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