Sustainable and Equitable Pensions with Means Testing in Aging Economies

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My research on means-tested pension

1. Sustainable and Equitable Pensions with Means Testing in Aging Economies

2. Facing Demographic Challenges: Pension Cuts or Tax Hikes (MD, 2019)

3. Trade off in Meas-Tested Pension Design (JEDC, 2014)

co-authored with George Kudrna and Alan Woodland

Demographic Transition

- Demographic transition:
  - decreased birth rate: high to low fertility rate
  - decreased death rate: longer life expectancy
- Population aging:
  - later stage of demographic transition
  - increase in proportion of older people in economy

FERTILITY RATE: AUSTRALIA

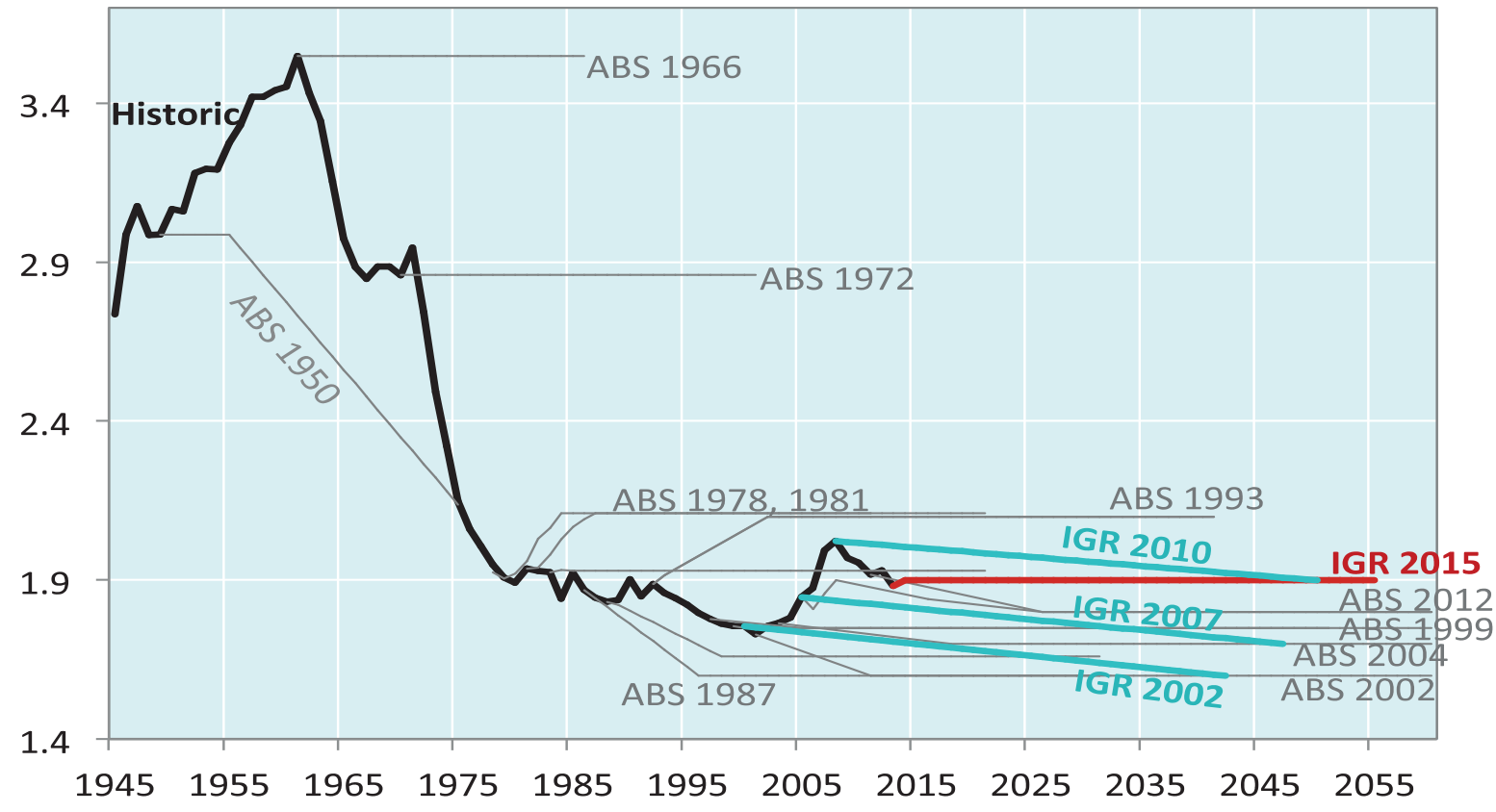


FIGURE: CEPAR(2015)

LIFE EXPECTANCY - MALE: AUSTRALIA

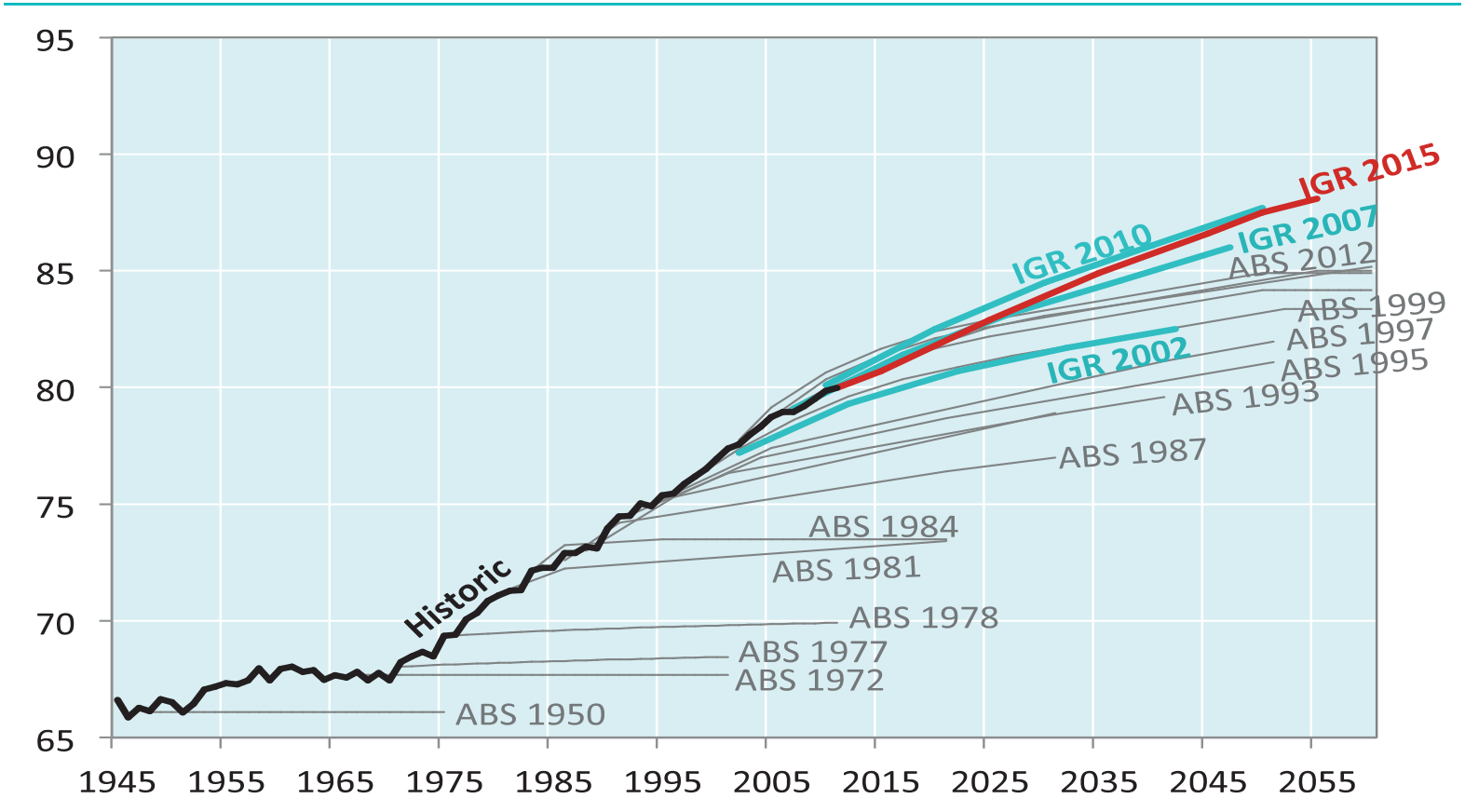


FIGURE: CEPAR(2015)

LIFE EXPECTANCY - FEMALE: AUSTRALIA

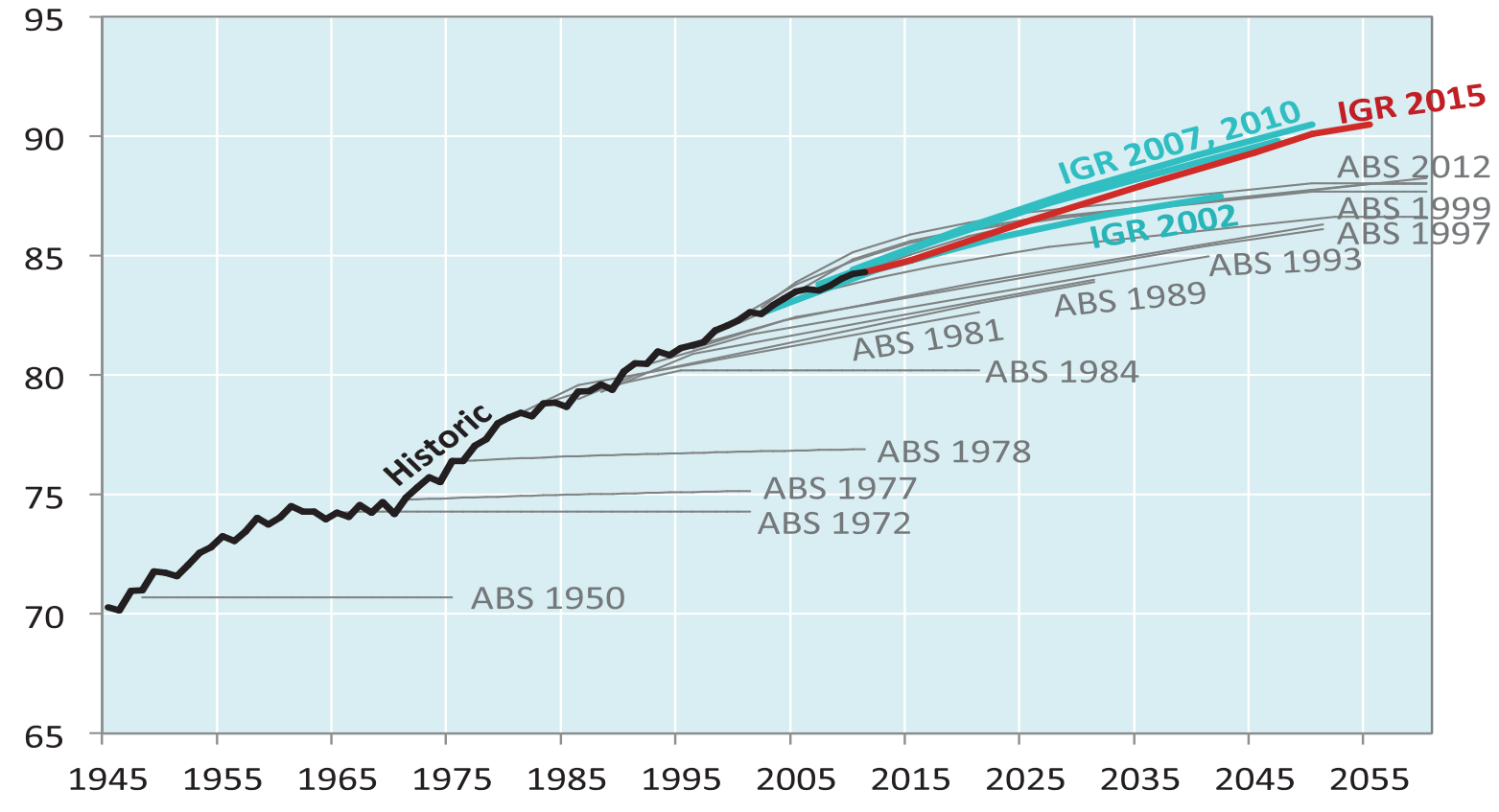


FIGURE: CEPAR(2015)

Aged Dependency Ratio: Australia

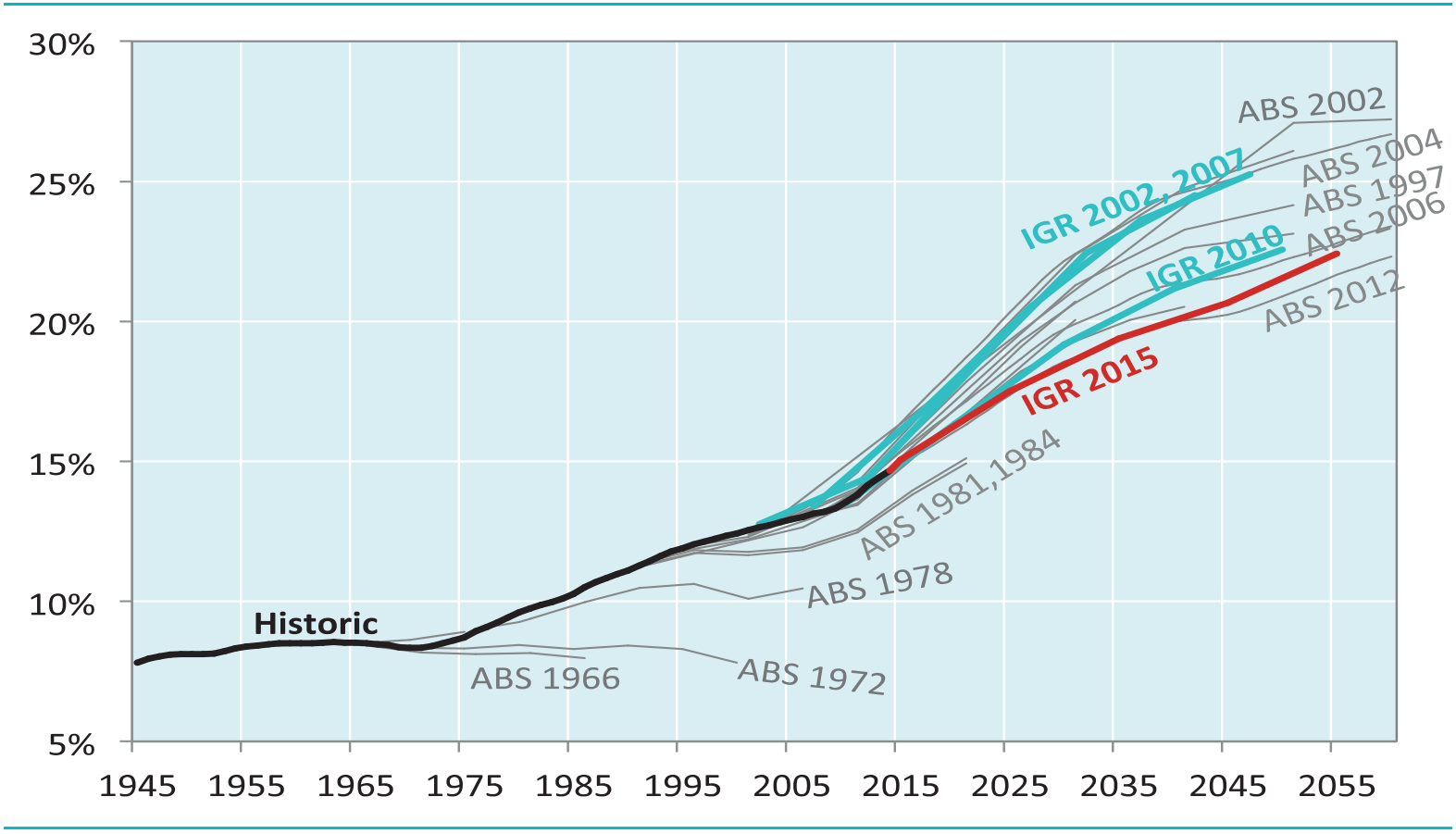


Figure: CEPAR(2015)

Life Expectancy Gap: Australia

Source: Adapted from Clarke and Leigh (2011)

Figure: Clarke and Leigh (2011)

Population Aging in Advanced Economies

- Australia $=>$ support ratio ($\frac{20-64}{65+}$) to decline to **2.4** in 2050 from 4 in 2015 (United Nations, 2015)
- OECD28 countries (average) $=>$ support ratio to decline to **2.1** in 2050 from 3.6 in 2015 (United Nations, 2015)

Population Aging: Global Phenomena

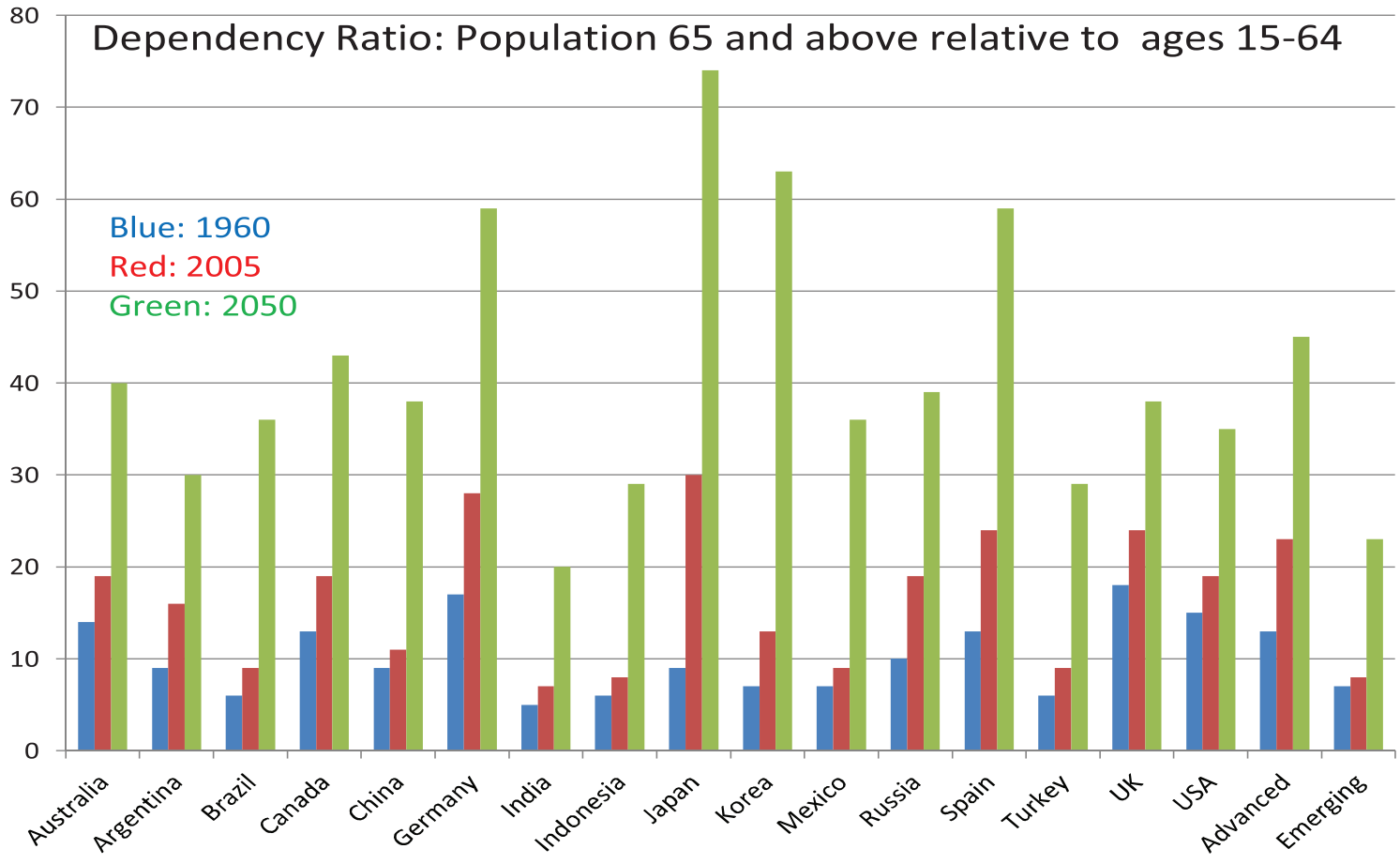


Figure: Changes in Dependency Ratio by IMF(2010)

Implications for Pension Systems

- Fiscal sustainability
  - Australia $=>$ spending on public pensions at **4.9%** of GDP in 2050, compared to 3.6% in 2015 (OECD, 2013)
  - OECD28 countries (average) $=>$ spending on public pensions at **11.7%** of GDP in 2050, compared to 9.5% in 2015 (OECD, 2013)

- Equity issue
  - Due to widening life-expectancy gaps between high and low skilled groups of individuals.

Aging and Government Spending

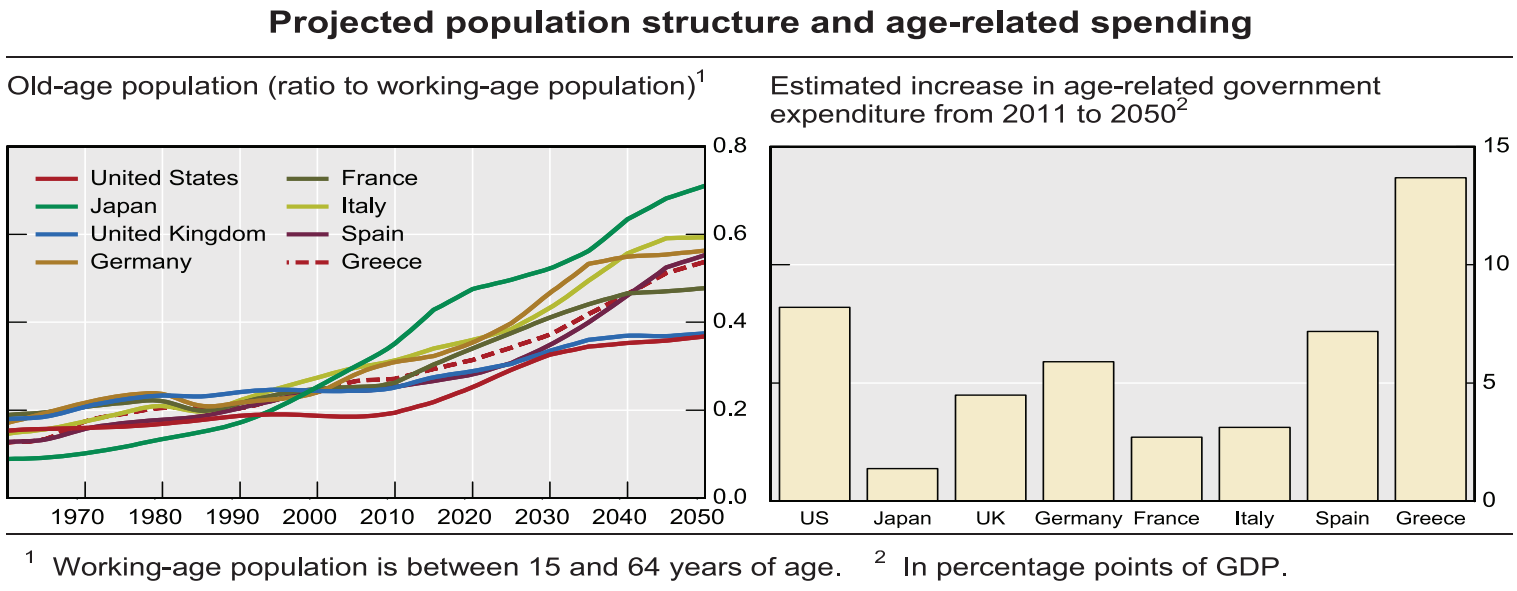


Figure: Fiscal Costs of Aged Related Spending (Cecchetti et al (2010))

Government Debts in Advanced Economies

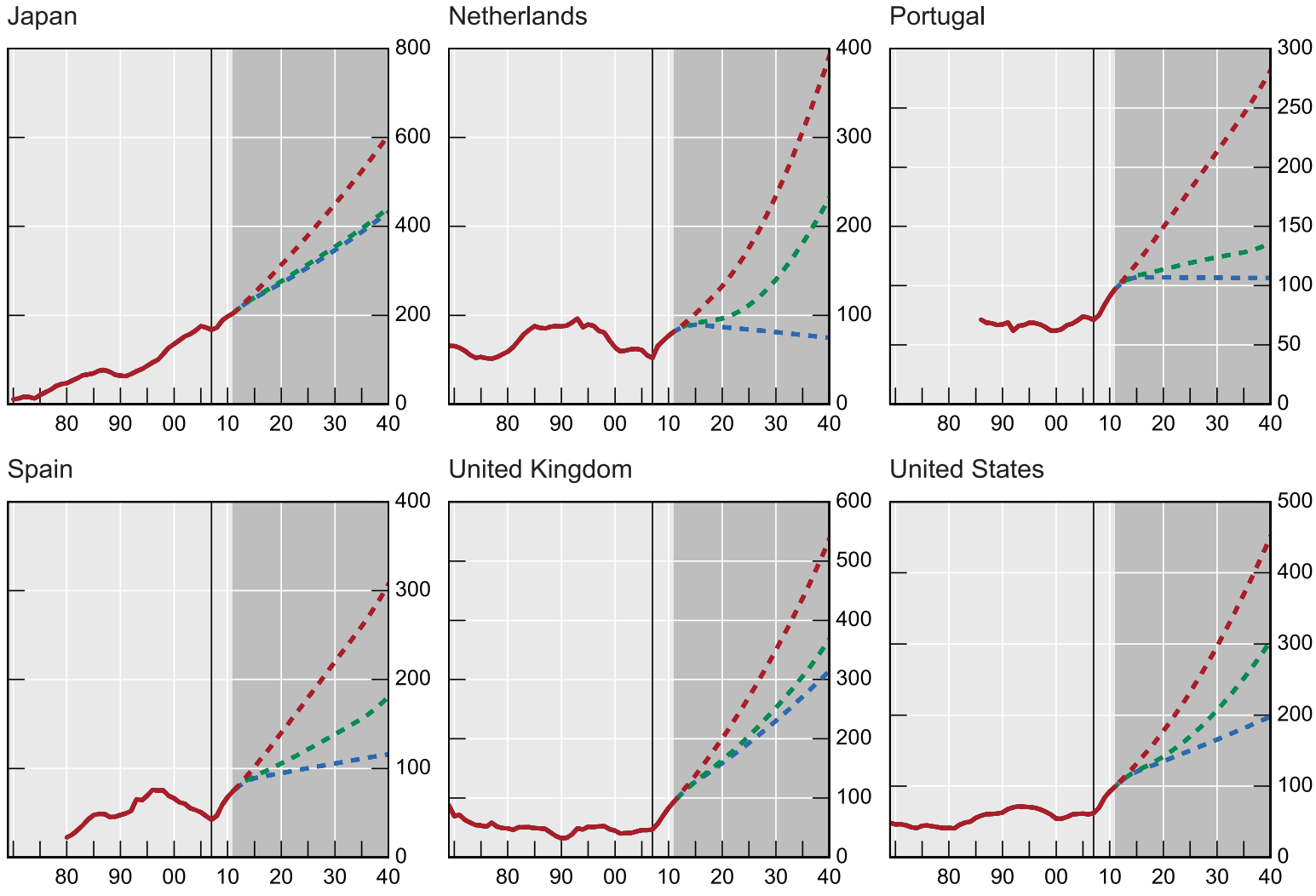


Figure: Government Debt-to-GDP Projection by Cecchetti et al (2010)

Demographic and Fiscal Challenges

- Pension systems in advanced economies:
  - Unfunded and not sustainable due to aging
- Why?
  - Pay-as-you-go (PAYG) principle: Defined benefits, universal coverage
  - A static design that has no automatic mechanism to adapt to aging population

Pension reforms

- Structural reforms
  - that change the basic structure of existing pension systems
  - very difficult

- Parametric reforms
  - *(i)* Fiscal sustainability
    - Reductions in benefit levels or pension formulae, lowering benefit indexation, increasing access ages, increasing payroll taxes
  - *(ii)* Adequacy and equity of pensions
    - Increasing coverage and benefit levels, changes to pension entitlements and benefit formulae

- Questions:
  - Is it enough????
  - Is there any better design of a pension system?

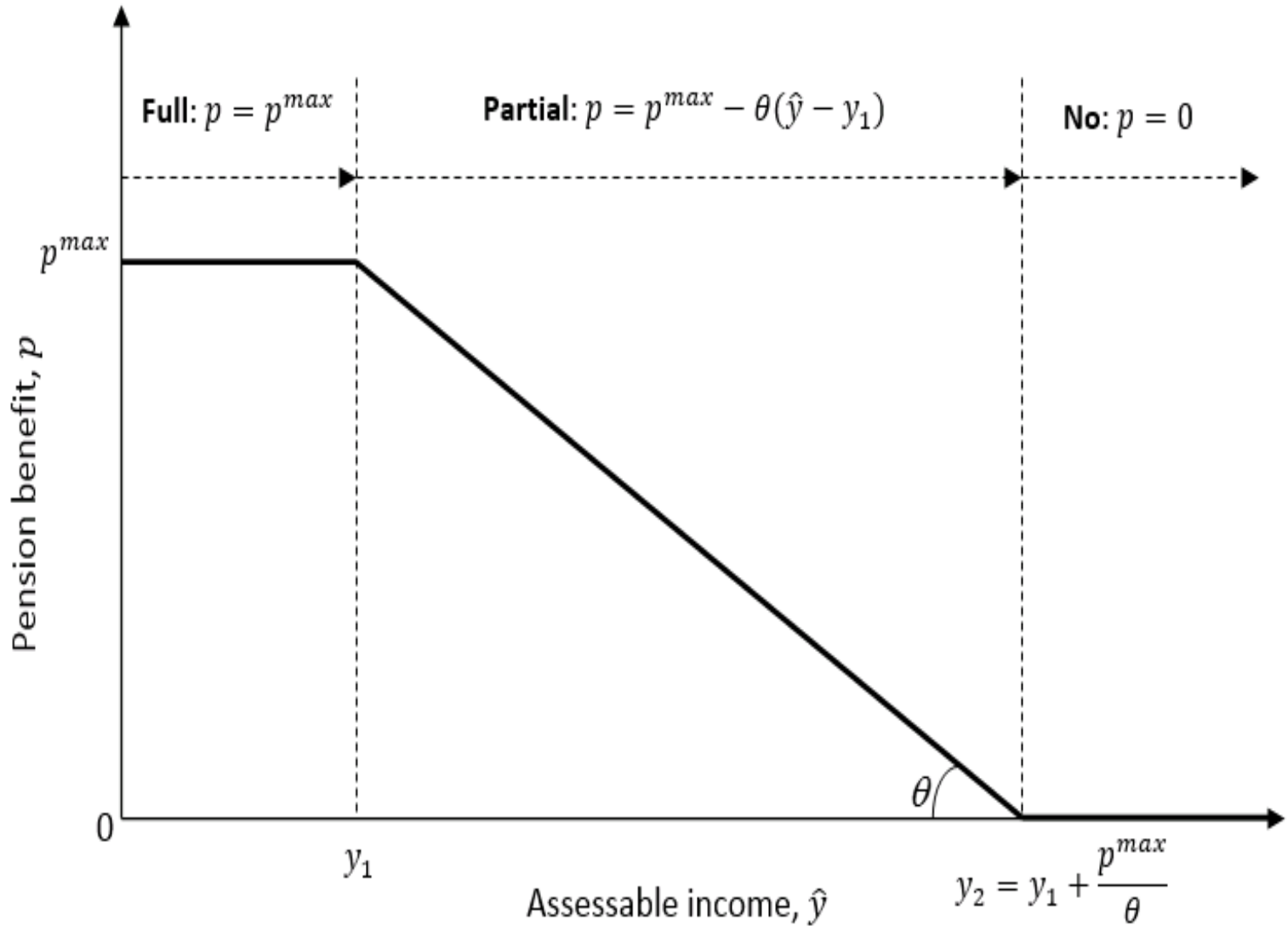
This Paper

- Motivated by the pension system in Australia:
  - means-tested, non-contributory, and funded from general tax revenues
  - non-PAYG, non-universal
- Explore a dynamic design of a pension system
  - an automatic adjustment mechanism to respond to population aging
- Modeling tools
  - dynamic general equilibrium, overlapping generations model

Australia: Age pension

- Funding: Non-contributory, tax financed
- Eligibility criteria: Residency (10 years), Access age (65, moving to 67), Means testing (income and assets tests)
- Benefits: Maximum single rate at 28% of average f/t male earnings (≈$21,500 p/a in 2014), 40% for couples
- Means testing: Affluence tested, not targeted at destitution
  - 50% full pension, 28% part pension, 22% get nothing
  - Income test binding for almost 70% of part pensioners
- Pension expenditure: Low costs at 2.93% of GDP in 2014

AUSTRALIA: MEANS-TESTING RULE



Automatic Adjustment Mechanism

- Income and asset tests create a link between pension payments and economic status
- This results in two automatic adjustment devices that automatically adapt the pension system to population aging.
- Life-cycle behavioral responses to aging
  - Lower fertility rate and higher life expectancy encourage rational individuals to work and save more
  - High skill individuals who live relatively longer response relatively stronger
- How?
  - More income and asset lead to less pension benefits in old ages (Fiscal stablization device)
  - High income agents received less or no pension (Redistributive device)

Main Findings

- This mechanism plays an important role
- More pronounced aging scenarios further strengthen the role of this mechanism
- A well-designed means test rule can create a sufficiently strong automatic mechanism to keep public pensions sustainable and equitable
- It is feasible to devise a pension reform that better adapts a means-tested pension system to more pronounced demographic trends, but does not lower the welfare of current and future individuals of all ages and income

Outline

- Methodology: Dynamic general equilibrium model
- Calibration & data comparison
- Experiments & results
- Conclusions

The model: Key features

- Type: Dynamic general equilibrium with overlapping generations
- Sectors: Household, firm, government and foreign sectors
- Markets: Labour, capital and goods markets
- Market structure: Small open economy

Household sector: Key features

- Structure: Overlapping generations (aged 20 to 100 years) of 5 skilled types (i.e. income quintiles) in every time period
- Lifespan: Households to become economically active at age 20, face random survival and live at most to age 100
- Endowments: Time endowment; age- and skill-dependent survival probabilities and earnings abilities; skill-dependent transfers
- Optimization problem: Decide on sequences of consumption/saving and leisure/labor (and when to retire) to maximize lifetime utility subject to budget constraint

Household sector: Demographics

- Stationary demographic structure with size of i-type cohort at age j given by

$$pop_j^i = \frac{s_j^i}{(1+n)^{j-1}}$$

where, n : population growth rate, $s_j^i = \prod_{z=1}^{j} \pi_z^i$:

income-specific (unconditional) survival rates, π_j^i : conditional survival probabilities.

- Total population then given by

$$P = \sum_{i \in I} \omega_{j \in J}^i pop_j^i$$

where ω^i : intra-generational shares (0.2 for each quintile).

HOUSEHOLDS AND GENERATIONS

Time (t)	*1*	*2*	*3*	*4*	...	*t*	...	*100*	...	*T*	...	...
Generations												
-100	**100**											
-99	**99**	100										
-98	**98**	99	100									
...	**...**	...										
...	**...**	...				100						
-66	**66**	67	68	...	...	99	100					
-65	**65**	66	67	...		98	99	100				
...	**...**	...										
-a	**...**	...										
...		....										
-22	**22**	23	24	...					...	100		
-21	**21**	**22**	**23**	**...**		**a**	**...**	**...**	**...**	**99**	**100**	
...	**...**	...	...	...								
...	**...**	...	...	...								
-2	**2**	3	4	...								
-1	**1**	2	3	...								
0	**0**	1	2	...	20	21	...	...		...	...	100
+1		0	1	2	...	...	...	...		...	...	...
+2			0	1	...	...	...	...		...	...	...
...						...	...	...		...	...	...
+t						0	1	2	...	...	...	...

Household sector: Lifetime utility

- Households of each skill type i assumed to choose consumption, c, and leisure, l, at age j to maximize expected lifetime utility

$$U^i = E\left[\sum_{j=1}^{J}\left(\prod_{z=1}^{j}\pi_z^i\right)\beta^{j-1}\frac{\left[\left(c_j^i\right)^{\rho}\left(l_j^i\right)^{1-\rho}\right]^{\left(1-\frac{1}{\gamma}\right)}}{1-\frac{1}{\gamma}}\right], \quad (1)$$

where

π_j^i : conditional survival probabilities with $\pi_{j=1}^i = 1$
β : subjective discount factor
γ : intertemporal elasticity of substitution
ρ : share parameter for leisure

Household sector: Budget constraint

- Expected lifetime utility in (1) to be maximized subject to per-period budget constraint

$$\begin{aligned} a^i_j - a^i_{j-1} &= r \cdot a^i_{j-1} + le^i_j + ap^i_{j\geq 65} + sp^i_{j\geq 60} \\ &\quad + st^i_{j<65} + \widehat{b}^i_{45<j<65} - c^i_j - tax^i_j, \end{aligned} \tag{2}$$

where

a^i_j : private assets	$r \cdot a^i_{j-1}$: investment income
ap^i_j : age pension	sp^i_j : superannuation payouts
$\widehat{b}^i_j$: bequest payment	$le^i_j = we^i_j(1 - l^i_j)$: labour earnings
st^i_j : social transfers	$tax^i_j = t(y^i_j) + \tau^c c^i_j$: household taxes

- Aggregates: e.g., $C = \sum_{i \in I} \omega^i_{j \in J} c^i_j \cdot pop^i_j$.
- ▸ Age pension

Modeling age pension

- Age pension paid to households $j \geq 65$ and subject to income test:

$$ap_j^i = \max\left\{\min\left\{p^{\max}, p^{\max} - \theta\left(\widehat{y}_j^i - \underline{y}\right)\right\}, 0\right\},$$

where $\widehat{y}_j^i$: assessable income; $p^{\max}$: maximum pension; θ : taper rate; $\underline{y}$: income threshold.

Rest of the model

- Production sector - perfectly competitive, profit maximizing firms that demand capital and labour to produce single output
- Government - taxing household's income, superannuation & consumption to pay for its general expenditure & transfer payments
- Foreign sector - small open economy setup with exogenous and constant domestic interest rate
- Market clearing - labour, capital and goods markets must clear in every period

Calibration: Assumptions & parameter values

- Model economy assumed to be in a steady state - calibrated to key macro & fiscal data in 2013-14
- Household utility & production technology of Cobb-Douglas forms, with parameters values being standard in related literature
  - Some parameters taken from literature (e.g. $\gamma = 0.5$) and some calibrated to replicate observed macro data (e.g. $\beta = 0.982$)
- Policy settings & values of policy parameters (e.g. age pension & tax policy settings) as of 2013-14
- Demographic structure assumed to be stationary with
  - population growth rate ($n = 1.6\%$) as from 2013 to 2014; survival rates for third (middle) quintile ($\pi_j^{i=3}$) derived from ABS 2012-14 life tables (average for men & women)

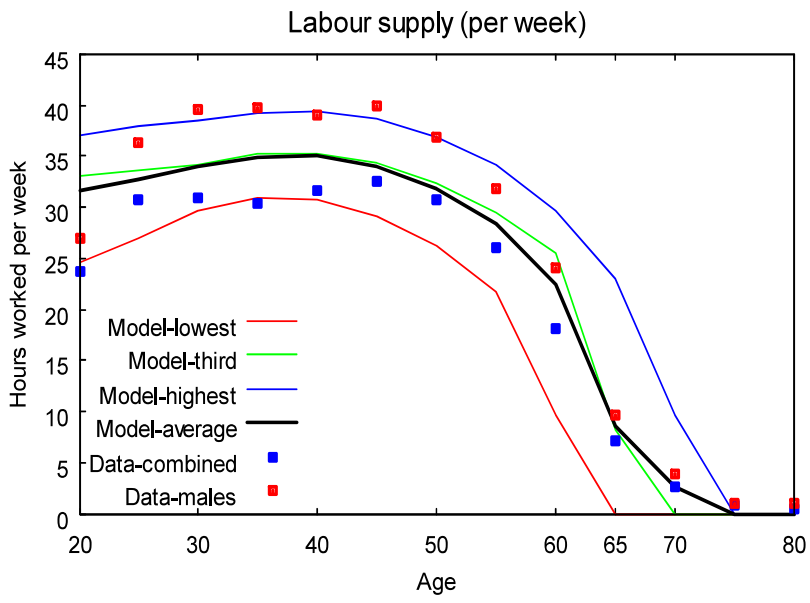
Calibration: Intra-cohort heterogeneity

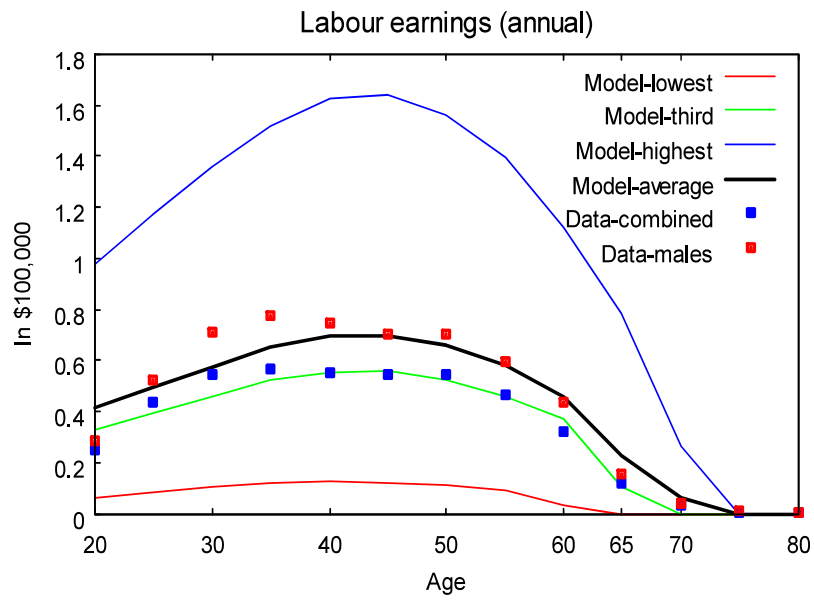
- Five household income types (i-type quintiles) assumed to differ by
  - Earnings ability (e_j^i) based on estimated age wage function (Reilly et al., 2005) and income distribution parameter (ABS, 2012)
  - Social transfer (st_j^i) paid to households in the lowest to fourth quintile aged $j < 65$ and derived from ABS (2012)
  - Survival probabilities (π_j^i) where ABS 2012-14 life tables being used to derive $\pi_j^{i=3}$, with $\pi_j^{i\neq 3}$ being adjusted to replicate life expectancy gaps (by income) estimated by Clarke & Leigh (2011)

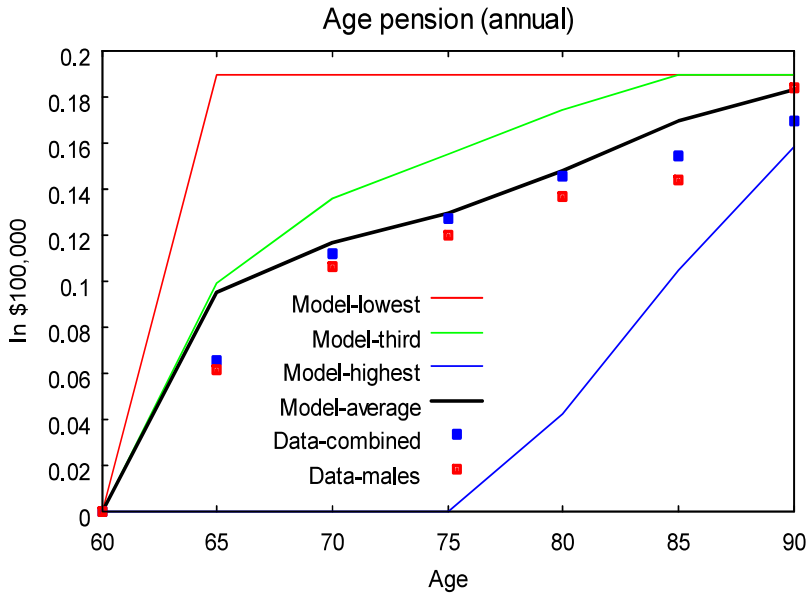
Solving benchmark economy

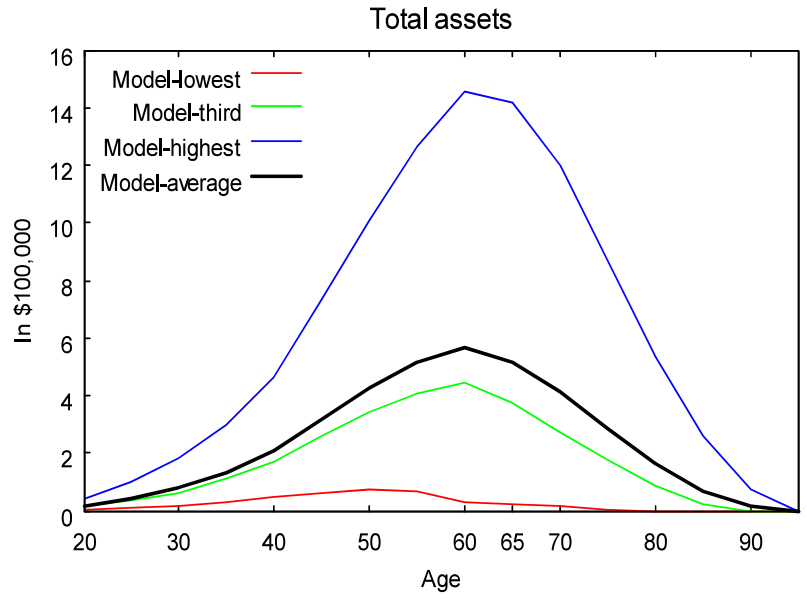
- Benchmark solution obtained by numerically solving the model for initial steady state equilibrium in GAMS software
- Gauss-Seidel iterative method used, which involves
  - choosing initial guesses for some variables and then updating them by iterating between production, household and government sectors until convergence
- Comparison of model-generated results with both lifecycle and aggregate data

Model performance: Life cycle data









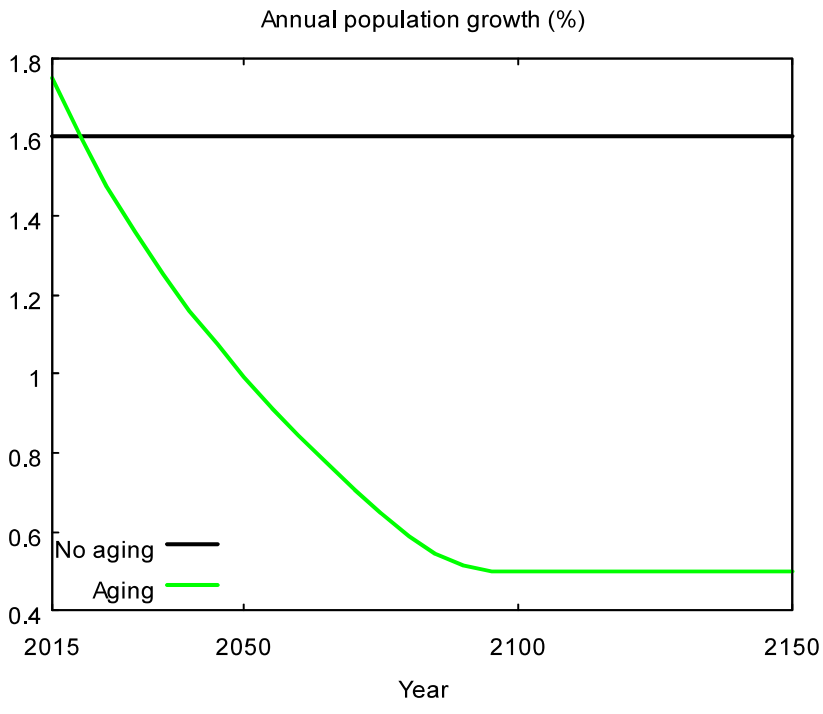
Model performance: Macro & income data

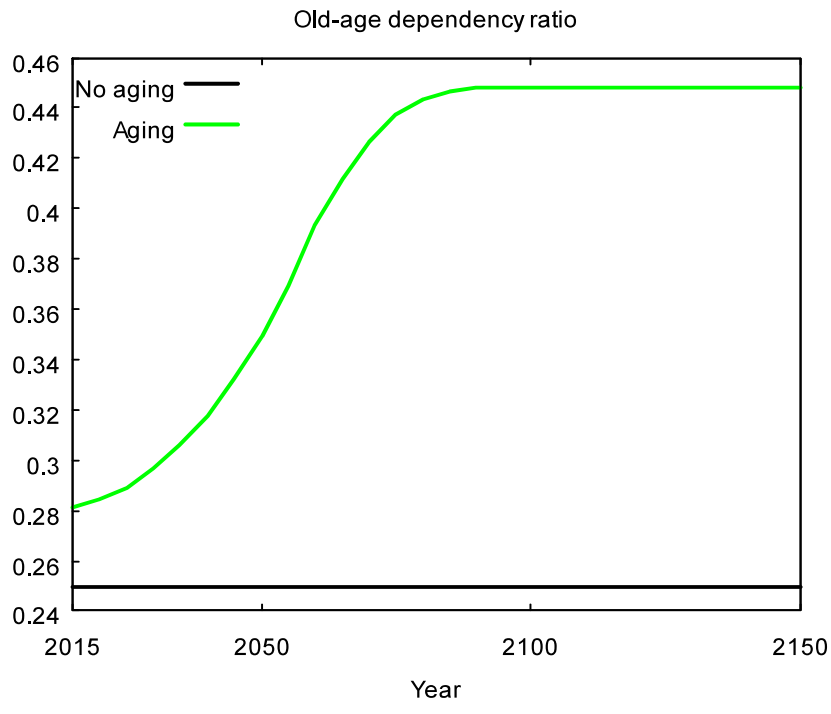
Variable	Benchmark model	Australia 2013-14
Expenditures on GDP (% of GDP)		
Private consumption	55.50	54.61
Investment	27.90	27.60
Government consumption	15.08	17.95
Trade balance	1.51	-0.29
Calibration targets		
Capital-output ratio	3.10	3.10
Investment-capital ratio	0.09	0.09
Foreign assets-capital ratio	-0.18	-0.18
Average hours worked	0.33	0.33
Net income shares (%)		
Lowest quintile	6.1	7.5
Second quintile	11.5	12.3
Third quintile	17.9	16.9
Fourth quintile	24.3	22.4
Highest quintile	40.2	40.8
Gini coefficient (in net income)	0.36	0.33

Applications of the Model

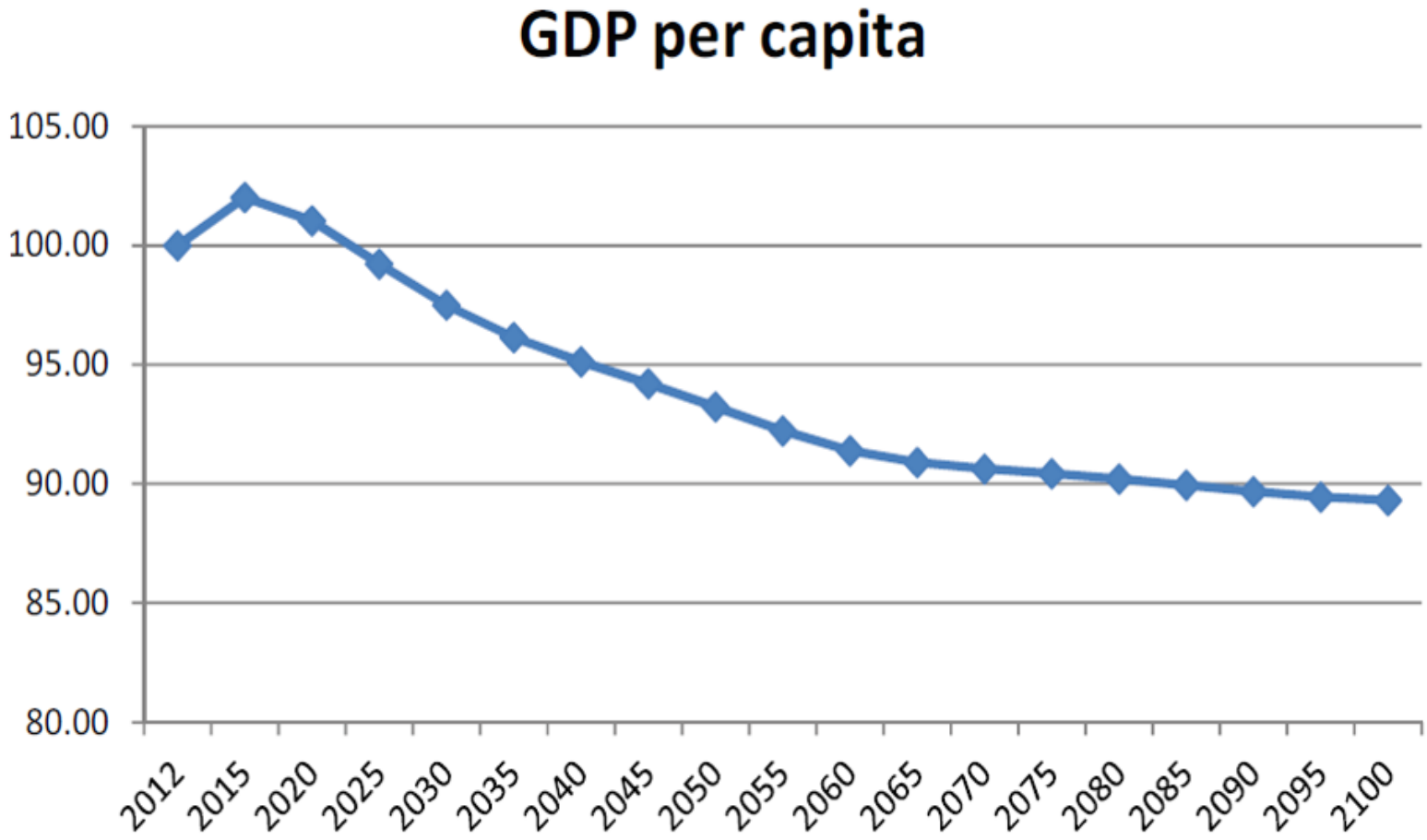
- Study the macroeconomic and welfare effects of population aging
- Assess the implications of population aging for government budget
- Evaluate the effects of fiscal policy reforms in response to population aging

Demographic Transition

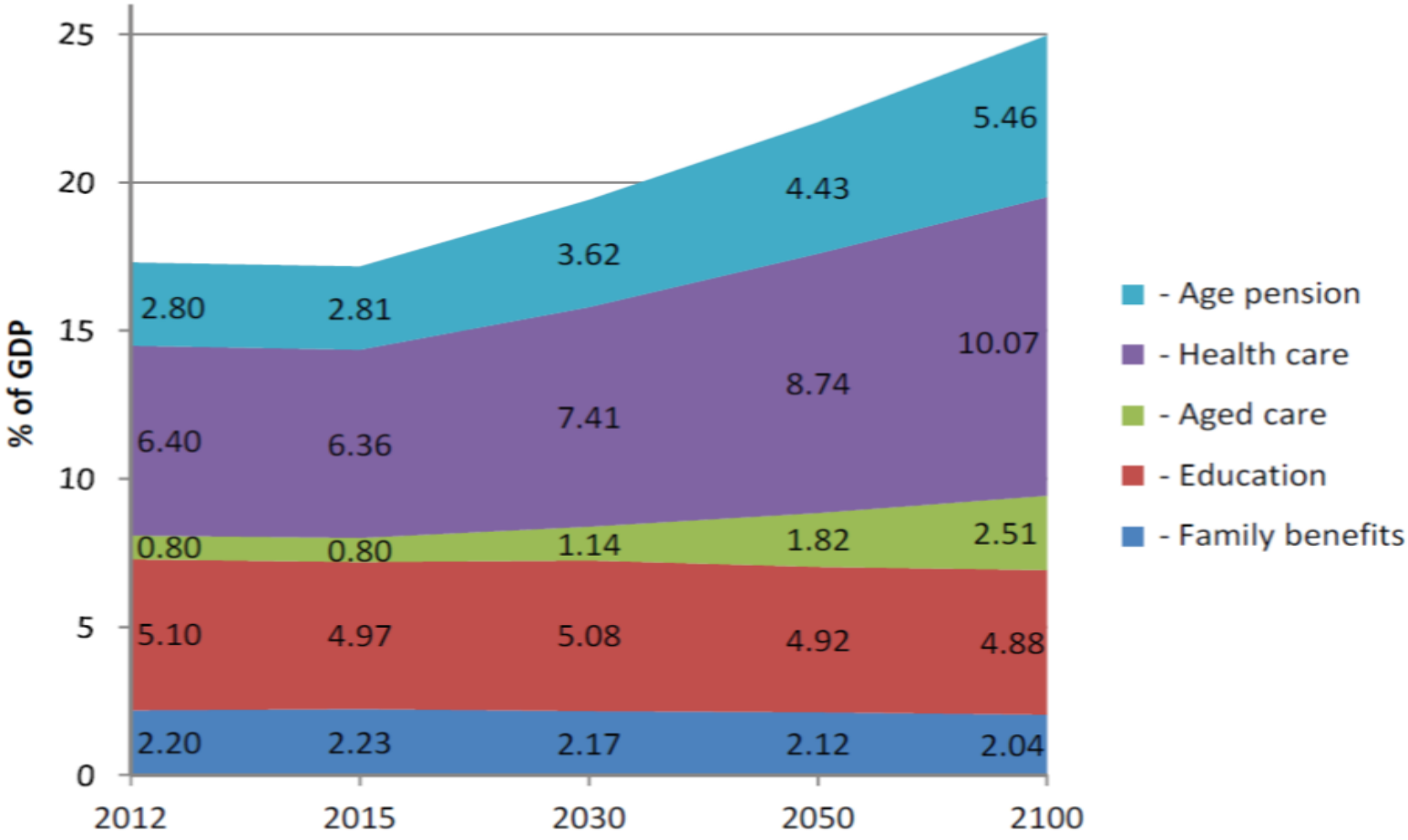




Aging and Macroeconomic Effect



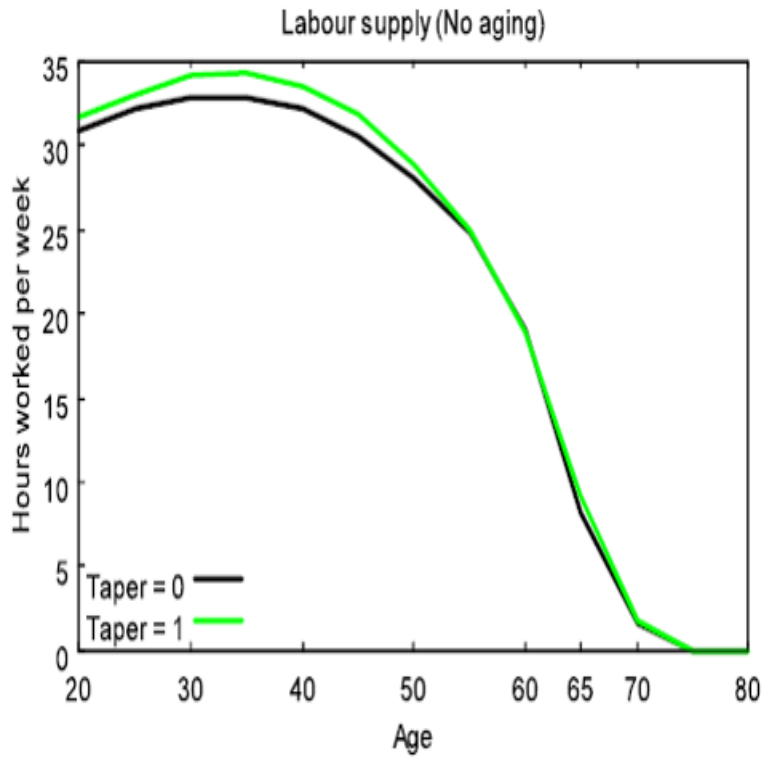
Aging and Fiscal Effect

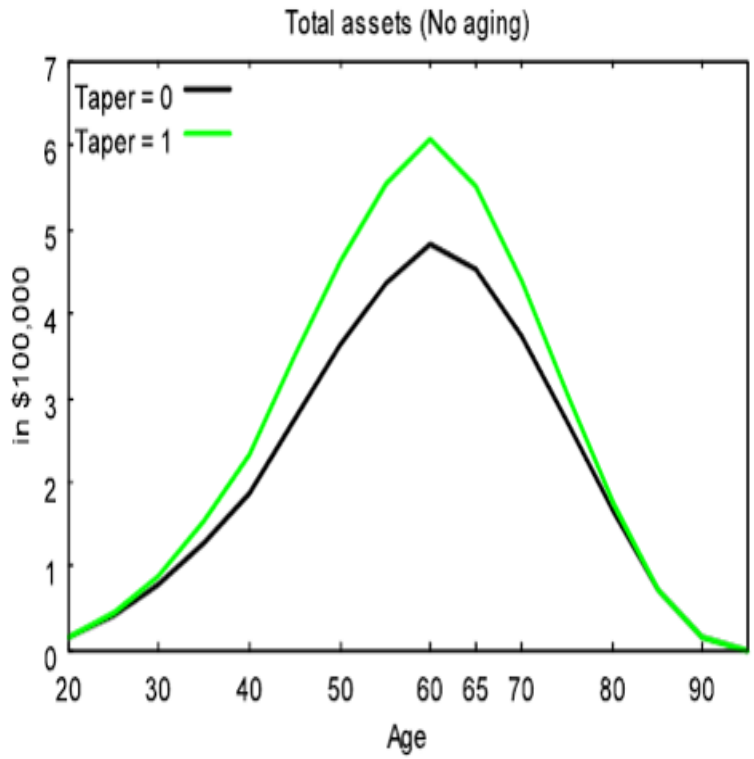


Experiments

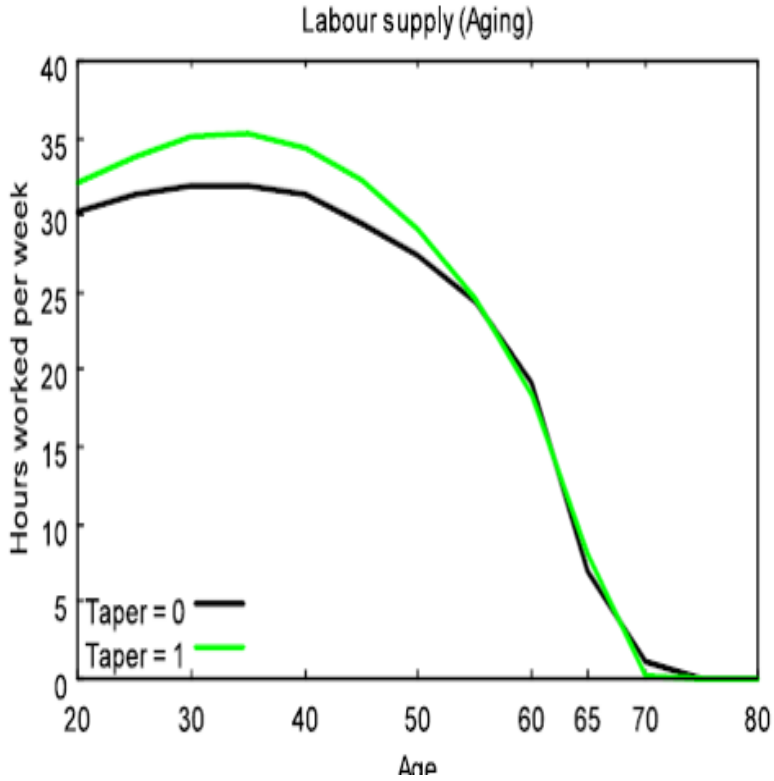
- This paper focus on the role of means testing in mitigating the fiscal effect of aging
- Focus on two designs (θ)
  - *(i)* Universal pension system with $\theta = 0$
  - *(ii)* Strict means-tested system with $\theta = 1$
- A range of demographic scenarios considered (In this talk, focus on two scenarios)
  - *(a)* No population aging generating old-age dependency ratio of 0.25
    - Same (existing) n & π_j^i as in benchmark model
  - *(b)* Population aging generating old-age dependency ratio of 0.45
    - Reduced n & increased π_j^i (for 2060 from ABS, 2013) & increased life expectancy gaps

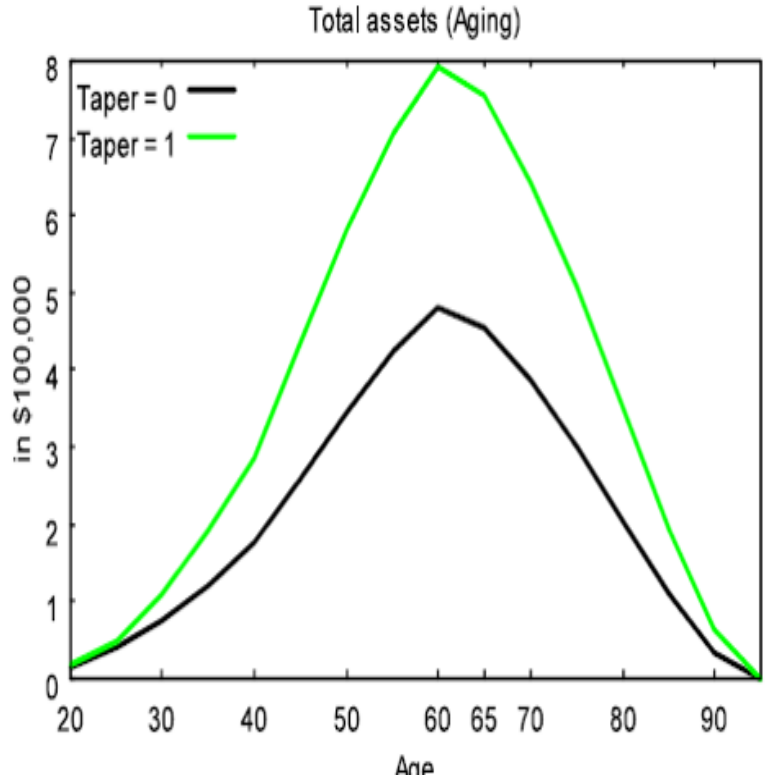
Aging and lifecycle Behavioral Responses I



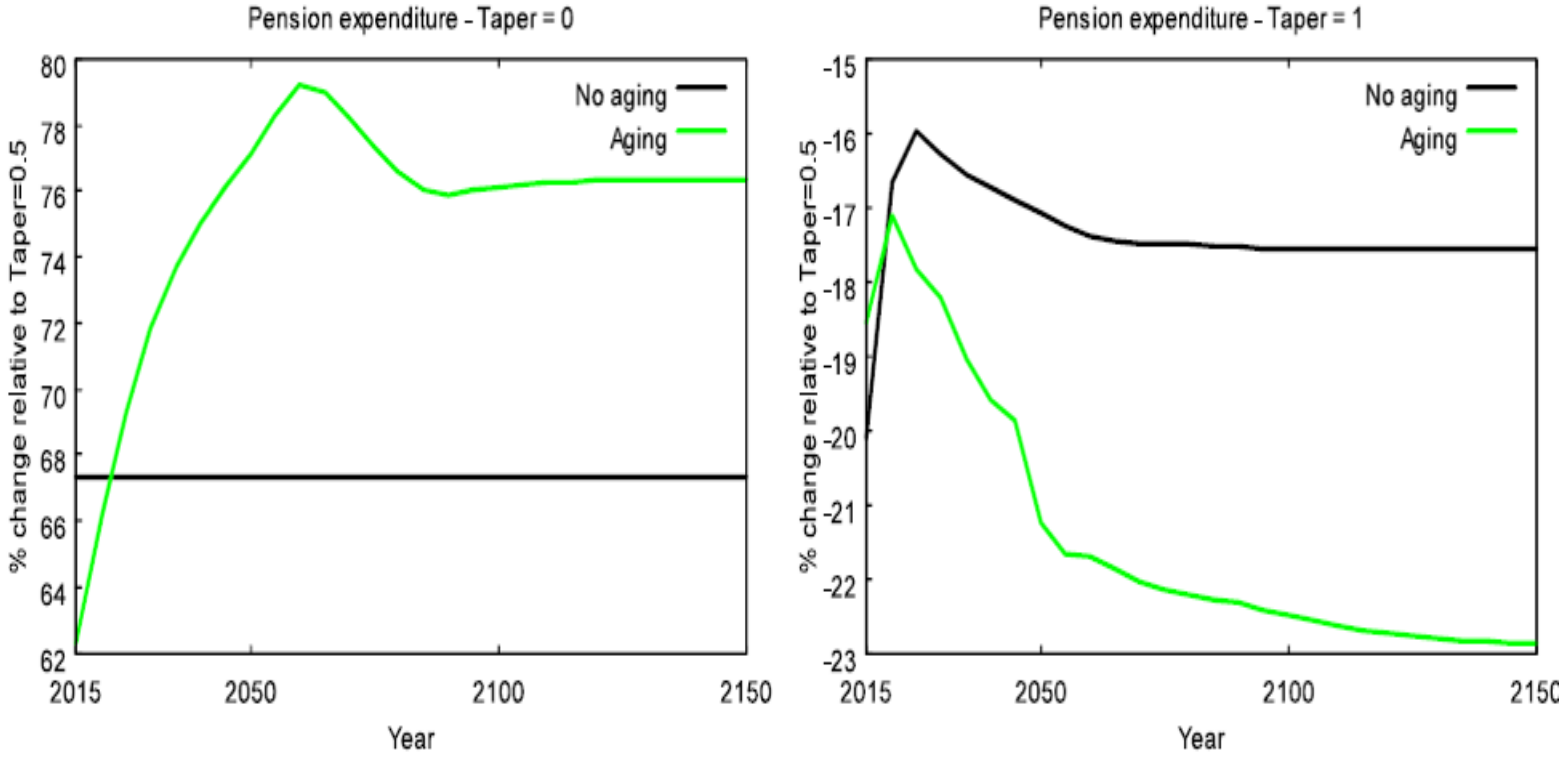


Aging and lifecycle Behavioral Responses II



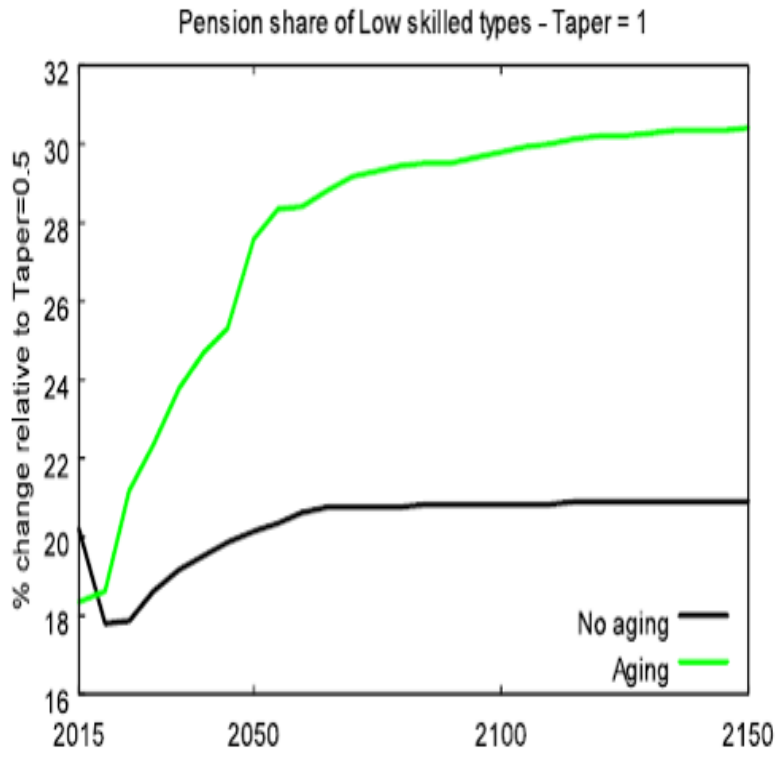


FISCAL SUSTAINABILITY I

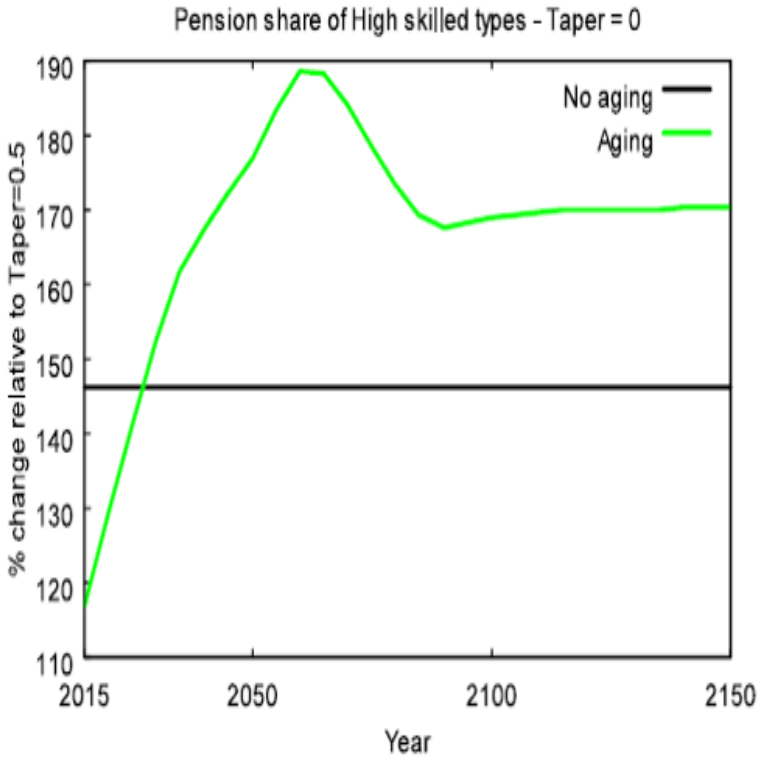


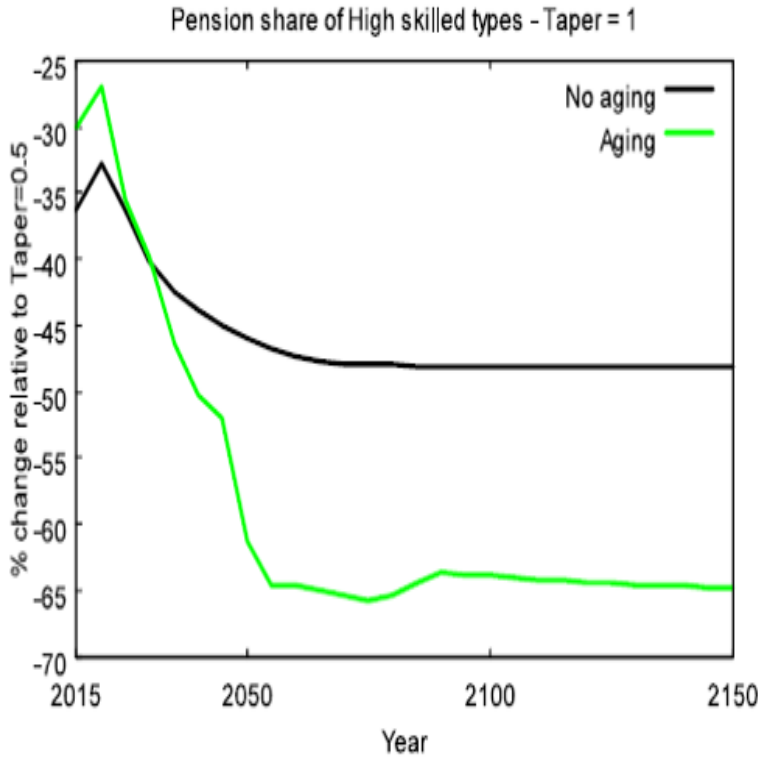
EQUITY I


Pension share of Low skilled types - Taper = 0
% change relative to Taper=0.5
-36
-37
-38
-39
-40
-41
-42
2015
2050
2100
2150
No aging
Aging

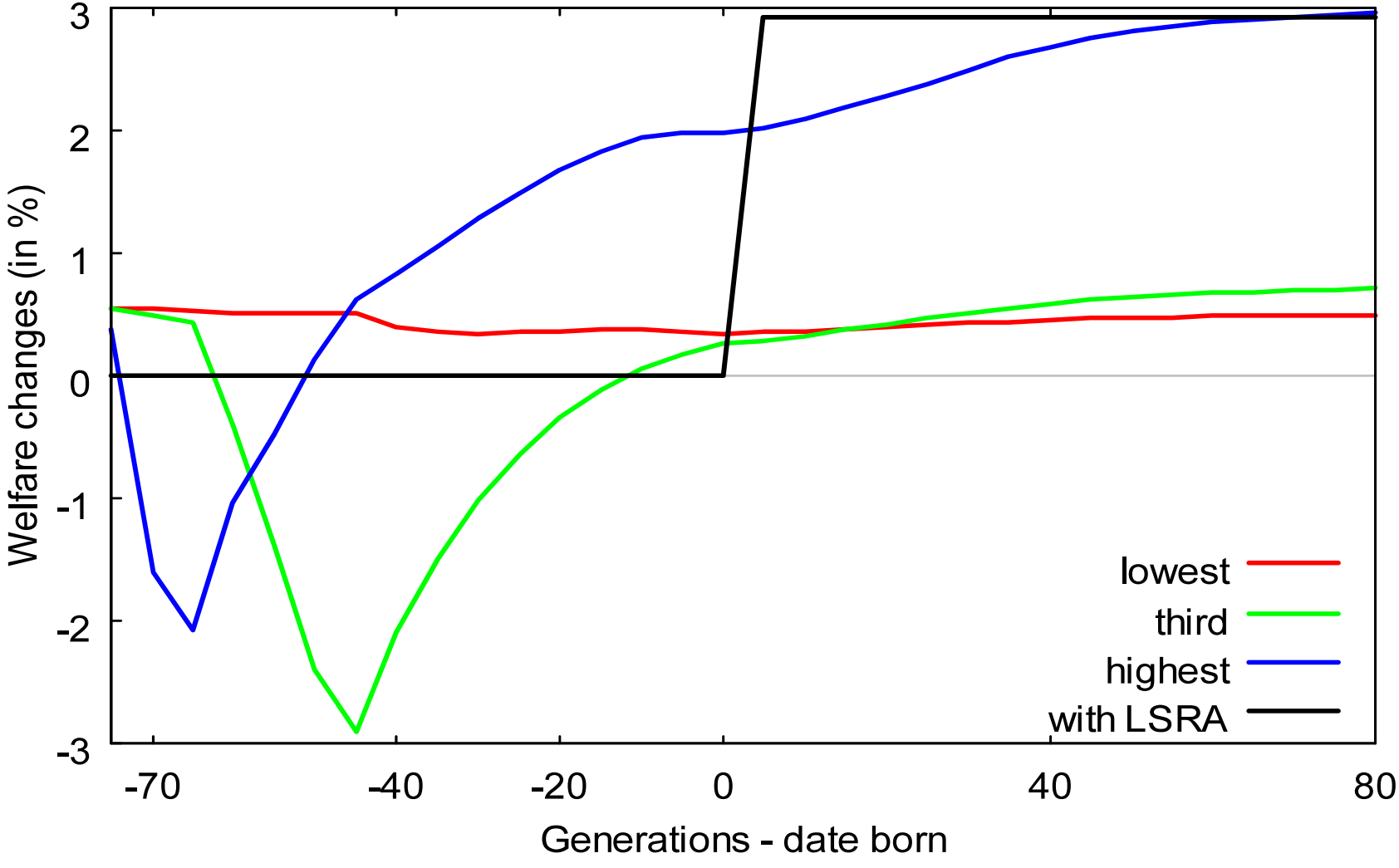

Pension share of Low skilled types - Taper = 1
% change relative to Taper=0.5
32
30
28
26
24
22
20
18
16
2015
2050
2100
2150
No aging
Aging

EQUITY II


Pension share of High skilled types - Taper = 0
% change relative to Taper=0.5
Year
No aging
Aging
190
180
170
160
150
140
130
120
110
2015
2050
2100
2150


Pension share of High skilled types - Taper = 1
% change relative to Taper=0.5
Year
No aging
Aging
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
2015
2050
2100
2150

Pareto Pension Reform



Conclusion

- Means testing rule creates a built-in mechanism that automatically adapt the pension system to population aging
- This improves fiscal sustainability and progressivity of the pension system
- A good design of means testing rule could keep the pension system fiscally sustainable and equitable