



Financial Innovation for an Aging World

Olivia S. Mitchell, John Piggott,
Michael Sherris, and Shaun Yow

Introduction

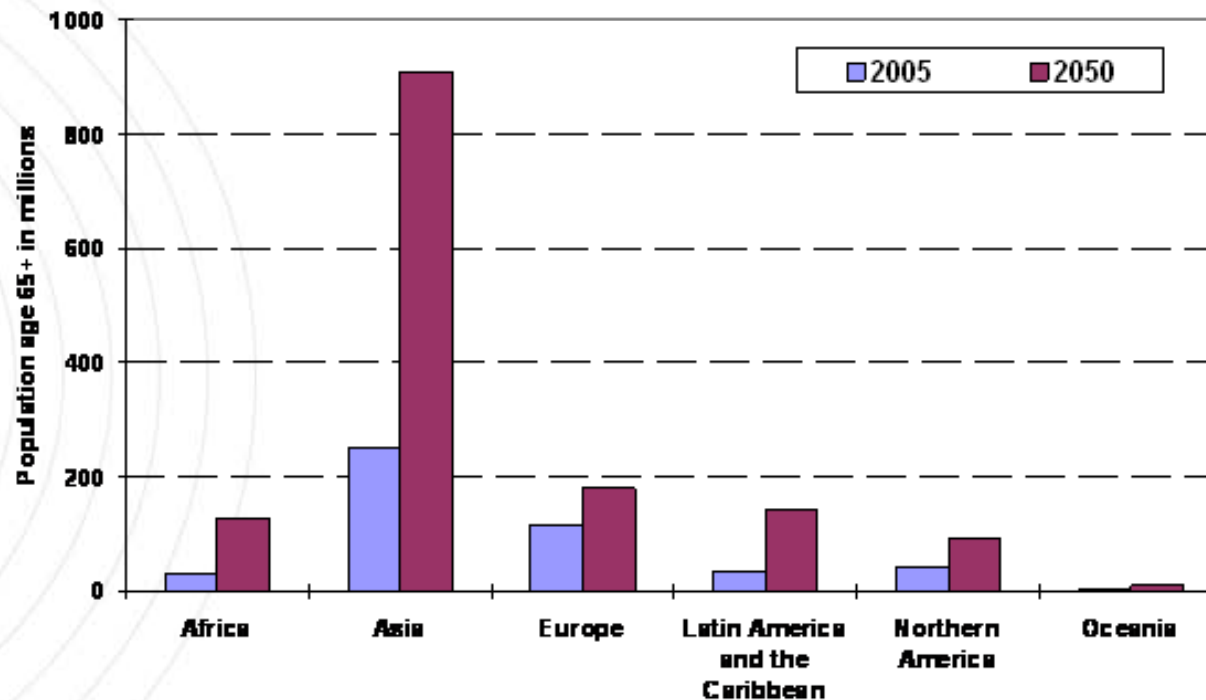
- Global aging and impact on financial, housing and insurance markets
- Financial market innovations to manage demographic change
- Paper prepared for G-20 Workshop on Demography and Financial Markets, Sydney, 23-25 July 2006 and appears in Demography and Financial Markets, RBA, 2006, p299-336.

Demographic Transition

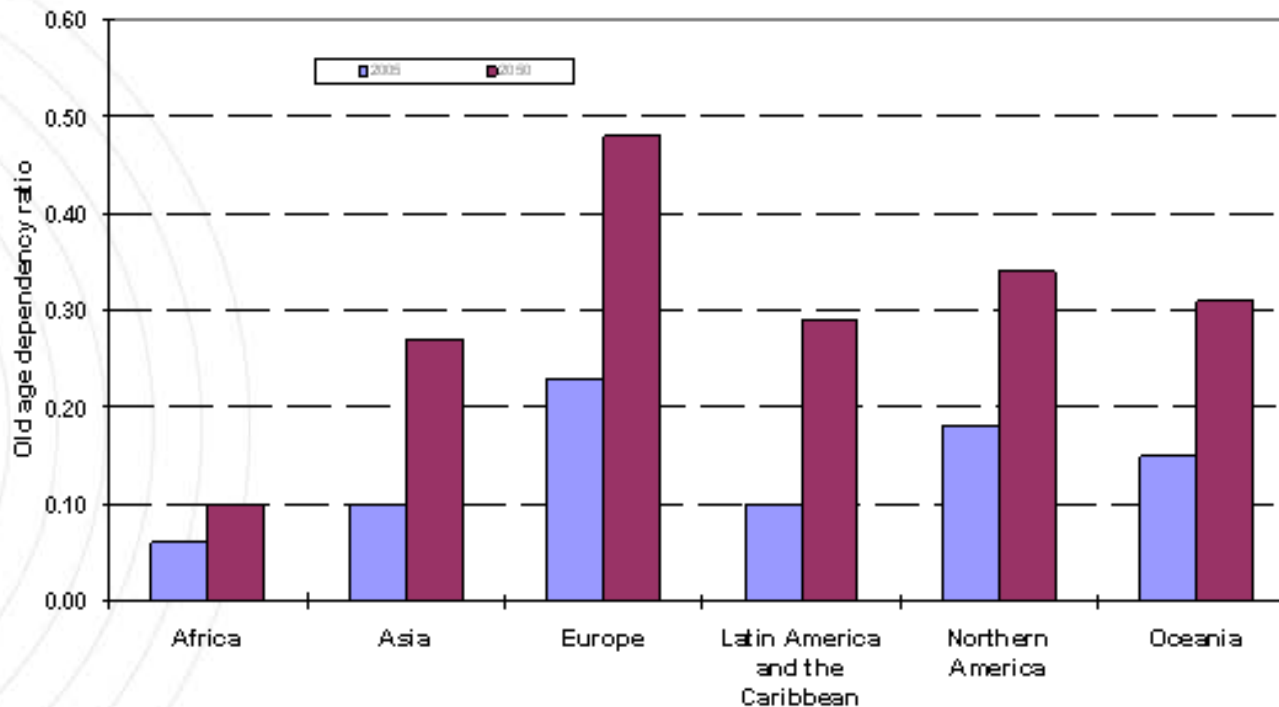
- Aging populations
 - Increases in longevity
 - Declines in fertility
- Varies from country to country – most dramatic impact is in Asia (Japan, China) but low fertility impact in Europe
- Retirement of baby boomers

Population Over Age 65 (millions)

Source: Authors' calculation based on data from United Nations 2006 <http://esa.un.org/unpp>



Old-age Dependency Ratio (Persons age 65+ / 15-64)

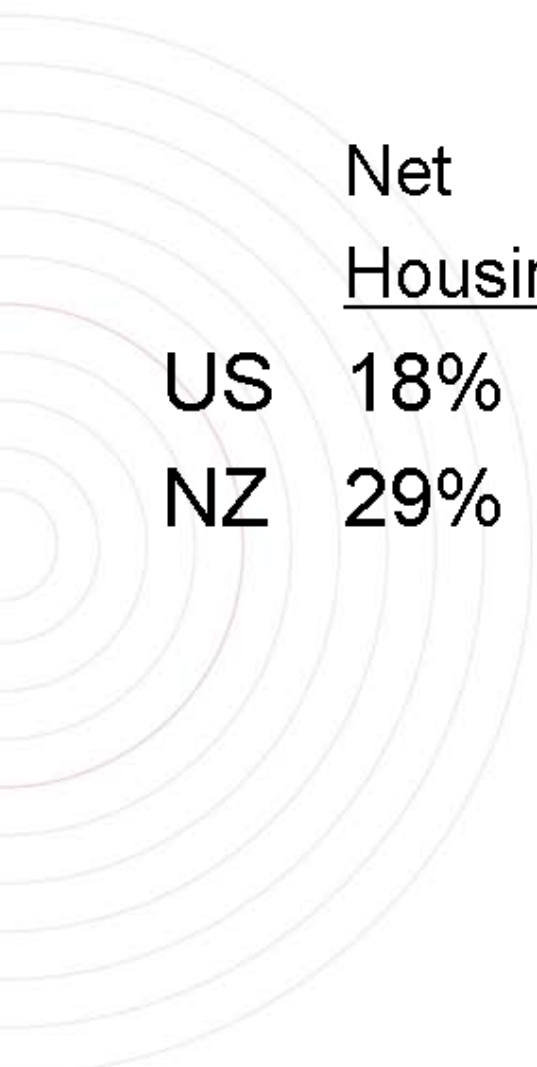


Financial Markets

- Financial and housing wealth a major source of retirement wealth (typical US household about 40%)
- Social security very significant component (typical US household also about 40%)
- Predictions of “asset market meltdowns” as retirement savings drive asset market booms followed by market collapse from retirement dissavings (sale of financial and housing assets to smaller cohort)

Pre-retirement Wealth: US and New Zealand

Source: Moore and Mitchell (2000); Scobie and Gibson (2003)



	<u>Net Housing</u>	<u>Net Financial</u>	<u>Social Security</u>	<u>Pension</u>
US	18%	20%	41%	20%
NZ	29%	14%	48%	0%

Capital Markets

- Theoretical models imply some impact but relatively small especially when allowance made for international capital flows (OLG models)
- Empirical studies (mostly US data) provide weak evidence of relationship between demographic variables and asset prices/returns
- Poterba (2001, 2004), Abel (2001), Brooks (2002, 2003, 2006), Geanakopulos, Magill and Quinzii (2002, 2004), Siegel (2005)

Capital Markets – Theoretical Models

- Poterba (2001) – the asset “market meltdown”

$$p * K = N_y * s$$

where p = price per unit of capital

K = supply of capital

N_y = no. of young workers

s = savings rate

- Real-world conditions
 - Heterogeneous savings,
 - Capital is not fixed,
 - International capital flows, and
 - Productivity changes.

Capital Markets – Theoretical Models (OLG)

- Abel (2001)
 - Variable capital supply and a bequest motive.
 - Bequest does not attenuate the market meltdown.
- Geanakoplos et al. (2002)
 - Dependency by young and retirees.
 - Stock market peaks and troughs are amplified by ageing cycles.
- Brooks (2003) and Siegel (2005)
 - International flows of capital.
 - Ageing countries will export capital to younger countries and attenuate the fall in asset prices.
 - Productivity is critical to capital markets.

Capital Markets – Empirical Studies

- Poterba (2004)

$$RETURNS_t = \alpha + \beta * (PROJECTED ASSET DEMAND)_t + \varepsilon_t$$

- Baby boomers don't draw down all their wealth in retirement.

- Geanakoplos et al. (2002)

$$RETURNS_t = \alpha + \beta * MY_t + \varepsilon_t$$

- MY ratio: the ratio of middle-aged to young persons
- MY ratio is positively correlated to returns explaining 14% of the variability.
- Immigration does not significantly change results.

- Weak empirical evidence (mainly U.S.) indicates that asset returns will fall slightly as populations age.

Housing Markets

- Impact of downsizing in retirement
- Significant impact possible if housing markets are inefficient
- Empirical studies indicate a relationship between housing demand and prices resulting in a future decline if housing demand is reduced
- Mankiw and Weil (1989), Poterba (2001), Green and Hendershott (1996), Holland (1991)

Housing Markets – Empirical Studies

■ Mankiw and Weil (1989)

$$\log P_t = \alpha + \beta_1 t + \beta_2 \log D_t + \beta_3 \rho_t + \varepsilon_t$$

where $t = \text{time trend}$

$P_t = \text{price of housing}$

$D_t = \text{housing demand}$

$\rho_t = \text{error correction term}$

- A 3% projected decline in housing demand produces a 47% fall in housing prices by 2007. (Now unlikely to come true)

■ Hendershott (1991) and Holland (1991)

- Omitted variable bias.
- Including rent, interest rates, inflation, and labour force participation rates reduces the significance of age-demand.

Insurance Markets

- Longevity risk and life annuity markets
- Self annuitization and mortality risk pooling (phased withdrawals)
- Impact of mortality risk and recent focus on stochastic mortality models
- Issues with natural hedging of life versus annuity products
- Health shocks and LTC products

Financial Market Innovations

- Retail and wholesale financial products
 - life annuities,
 - long-term care benefits,
 - reverse mortgages,
 - inflation-protected assets,
 - derivative contracts on residential property price indices,
 - mortality swaps and
 - securitization of longevity risk

Wealth Decumulation – Retail Market

- DC plans and guarantees (costly option to provide DB or DC option)
- Reverse mortgages (issues with product design and guarantees)
- Inflation risk (lack of indexed securities and annuities)
- Deferred annuity products with guaranteed minimum payments (fees and charges)

Wealth Decumulation – Institutional Market

- Bulk annuity providers in UK (100 to 120 bp)
- Swiss Re mortality linked bond - Vita I 2003 135 bp and Vita II 2005 (90 to 150 bp)
- EIB/BNP bond for longevity risk (20 bp)
- Developments in reinsurance and securitization
- Credit Suisse Longevity Index
- www.mortalityrisk.org

Mortality & Longevity Bond

Source: Creighton, Jin, Piggott, and Valdez (2005)

	Swiss Re Mortality Bond	BNP Paribas / EIB Survivor Bond
Issuer	The Swiss Re (Dec 2003)	European Investment Bank (EIB) (Nov 2004)
Cash Flow Structure	3-year Catastrophe Bond Structure	25-year Group Term Life Annuity
Calculation Agency	The Swiss Re	BNP Paribas
Index	weighted average population mortality in US, UK, France, Italy and Switzerland in 2003 to 2006	Based on publicly available ONS data of English and Welsh mortality for a cohort of males aged 65 in 2003
Reinsurer	N.A.	Partner Re
Principal	\$400 million	Nil
Coupon	LIBOR plus 1.35%	Linked to Cumulative Survival Rate (i.e. proportion of survivors) in the cohort
Risk Type	Extremely high group mortality risk over next 3 years	Cumulative aggregate longevity risk over next 25 years
Risk Transfer	From issuer to bond holder(s)	From bond holder(s) to issuer/reinsurer
Market Yield	LIBOR plus 135 bps initially	LIBOR less 35 bps
Market Response	Over-subscribed; reduced yield	Undersubscribed; No further issues

Conclusions

- Aging has implications for capital, housing and insurance markets and particularly for product developments in retail and wholesale, financial and insurance markets
- Some issues
 - Impact of downsizing on housing markets and reverse mortgage product design
 - House price and mortality index financial products for trading and hedging risks
 - Mortality securitization and mortality risk modelling for accessing financial market risk capital