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Through the consumer lens

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Maturity Transformation is an Oxymoron: Ways to Match Pensions and Long-Term Assets

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*This presentation has been prepared for the Actuaries Institute 2020 All Actuaries Virtual Summit.
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Summary

There can be too much liquidity

...

Super funds
have long
term
liabilities and
short term
assets



Banks have
short term
liabilities
and long
term assets

... but the water fowl benefit

Match assets & liabilities, and address governance

Image taken from
<http://www.dailymail.co.uk/news/article-2170056/Met-Office-warns-lives-risk-issues-highest-level-alert-3ins-rain-fall-overnight-horrendous-downpours.html>

3 propositions, and valuation

- 1 There are long term assets that generate cash flows that would be suitable to fund pensions
- 2 One can design investment instruments (indexed annuity bonds – IABs) to pipe the cash flows from the assets to the pensions
- 3 IABs would address crises in pensions, financial planning and banking
- 4 Valuation and yield projections

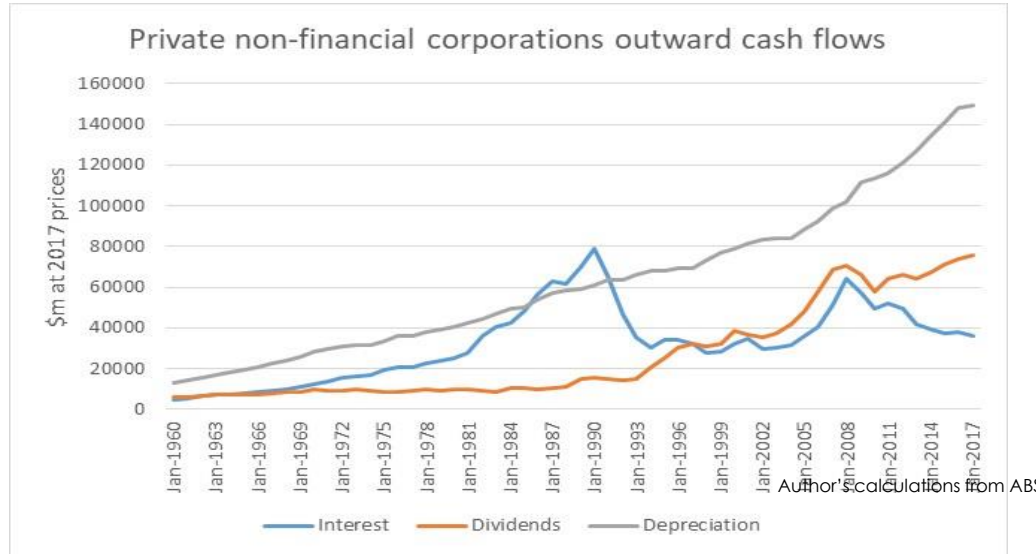
1 There are long term assets that generate *cash flows* that would be suitable to fund pensions

Aside: Depreciation is part of free cash flow

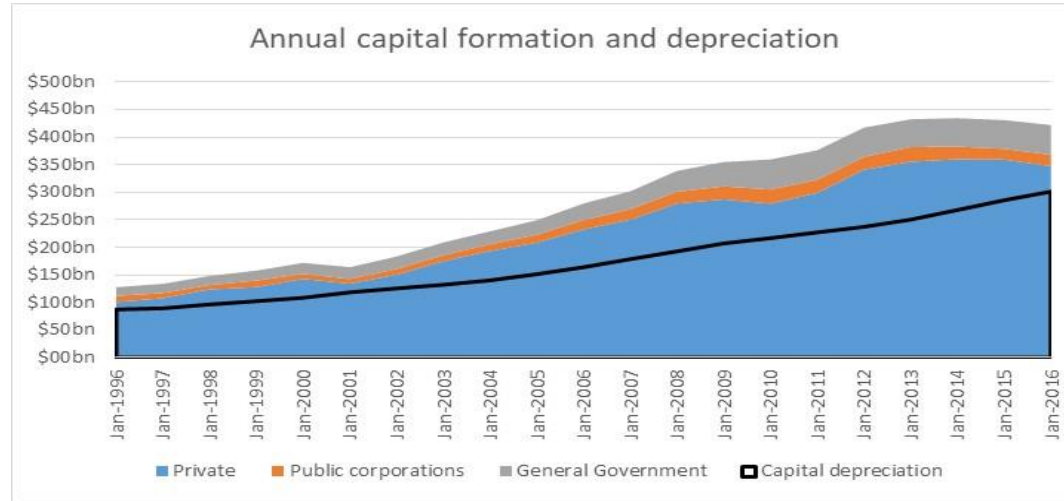
Revenue	1,000,000	Positive cash flow
Costs & expenses	-750,000	Negative cash flow
Cash flow	250,000	Net <i>objective</i> cash flow
Depreciation	-150,000	"Notional" adjustment
Profit	100,000	Notional residue

Depreciation is determined by accountants to "match" the company's income with the expense of capital goods that should be spread over a number of years during which they earn revenue. The choice of depreciation schedule is often based on income tax rules, but there is a genuine underlying economic relationship that depends on the revenue being generated by the assets being depreciated.

Depreciation generates stable cash flows



Depreciation generates huge cash flows



Author's calculations from ABS

- The gap of ~\$150bn needs to be funded by net new saving, which includes superannuation contributions less drawdowns
- Superannuation contributions and investment income are each ~\$100bn, and drawdowns about ~\$60bn

Of the \$300bn, what is depreciated?

Dwelling construction		27%	
Non-dwelling construction		33%	
	Mining		6%
	Manufacturing		3%
	Electricity		5%
	Transport		5%
	Commercial property		3%
Machinery and Equipment		28%	
	Mining		3%
	Manufacturing		4%
	Transport		3%
	Rental property		3%
Computer software		5%	
Other		8%	

Author's calculations from ABS

Rates of depreciation & age of assets

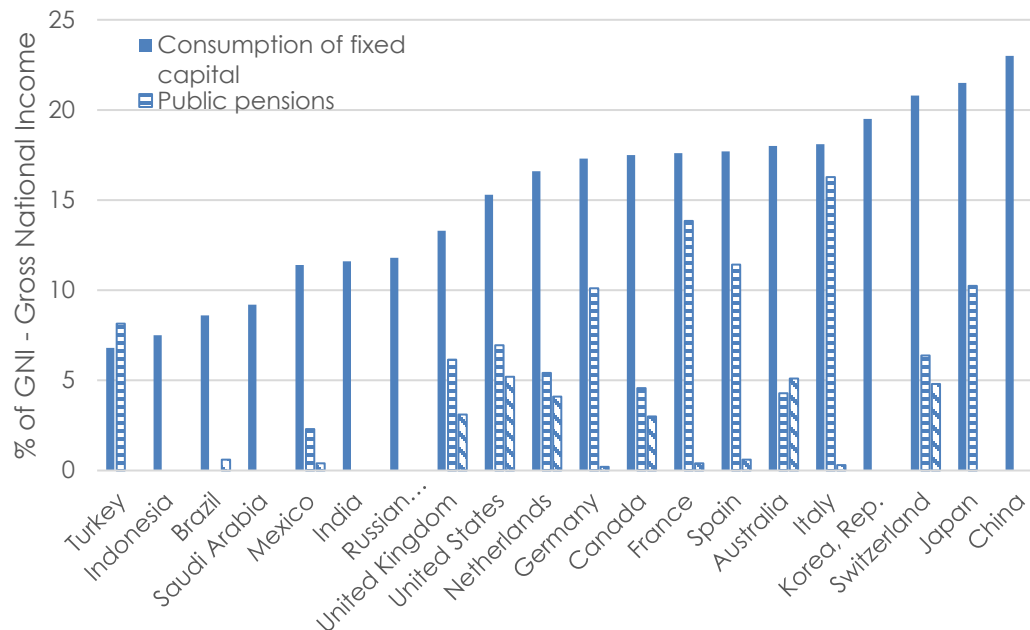
2013	Capital Stock \$ bn	Depreciation \$ bn	Rate of depreciation p.a.	Average age of existing assets
Dwellings	1,687	38	2%	21.3
Other Construction	2,023	72	4%	19.8
Machinery	605	69	11%	8.2
Exploration	64	4	6%	14.7
Other	438	60	14%	
Total	4,817	243	5%	

Capital and depreciation in Australia

Author's calculations from ABS

International comparisons

Consumption of Fixed Capital vs Pensions



Author's calculations from OECD and World Bank data

Proposition 1:

- In Australia, and in other developed countries, there are enough cash flows from depreciation each year to fund pensions.
- The durations are similar:
 - Life expectancy at 65 is similar to the average life of capital investments

2. One can design investment instruments (indexed annuity bonds – IABs) to pipe the cash flows from the assets to the pensions

Design issue 1: Annuities *not* bullet repayments

Annuity bonds – rather than conventional bonds with interest and bullet capital repayments – match the cash flow needs of investors **and** borrowers

Merton, Robert C. and Muralidhar, Arun (2017) Time for Retirement 'SeLFIES'?

(Standard of Living indexed, Forward-starting, Income-only Securities)

Income Stream: Cash Flows for 20 Years



Design issue 2: Link to borrowers' inflation *not* CPI

- The CPI represents an average: both borrower and pensioners face a basis risk
- Pensioners will lose less than borrowers will gain if repayments are linked to borrowers' revenue inflation. e.g.
 - Energy companies to electricity and gas prices
 - Miners to commodity prices (less volatile than profits)
 - Government borrowing to some tax receipts
- Other linkages suggested:
 - National income index (Shiller, 1994)
 - Government revenue (Merton and Muralidhar, 2017)
 - Homeowners' salaries (Asher, 2011)

Design issue 3: Longevity index *not* fixed term

- The term of assets should be, prudently, longer than the term of the annuity
- Adding a longevity contingent increase of a year or two to the term of the IAB is a trivial risk to the borrower – in context
- The benefit to pensioners exceeds the cost to borrowers
- Some assets (property and machines) face declining usefulness that may even match declining survivors of particular cohorts quite closely

Proposition 2

IABs provide appropriate investment instruments for pensioners:

- Match cash flows of investors and borrowers
- Can reduce inflation and longevity risk
- Bottom drawer investments reduce dealing and other costs of institutional investment

3. IABs would address crises in pensions, financial planning and banking

The DB pensions crisis

DB unsustainable because:

- The internal rate of return is based on demography not investment yields
- There are often no backing assets, sometimes leading to benefit accruals not matching contributions (e.g. Australian government DB deficits some 15% of GDP)

OECD (2018) Ageing Societies and the Looming Pension **Crisis**.

The retirement planning crisis

The absence of suitable annuity type products to provide retirement income makes the financial planning problem too hard. Retirees have no way of hedging their retirement risks.

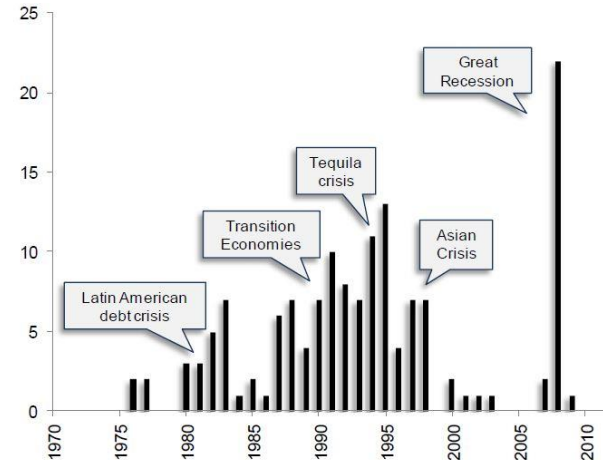
Merton, R.C., 2014. The **Crisis** in Retirement Planning. HBR

Banking crises & financial instability

Minsky (1992):

- Hedge financing where *term and duration matched*
- Speculative financing where interest payments can be met
- Ponzi financing where interest payments are met by price appreciation

The “financial instability hypothesis” that banking inevitably drifts from hedge to speculative finance and at the Minsky moment creates liquidity **crises** ...



So why are there so few IABs?

- *Accounting is too complicated?*
- *No demand?*
- *Banks and investment markets make money from liquidity?*

Bond	Project	State	Maturity Date	Yield to Maturity	Ranking
Praeco	Defence Headquarters	C'th	15/08/2020	CPI+1.93%	Senior secured
Wyuna Water	NSW Water Filtration Plants	NSW	30/03/2022	CPI+2.05%	Senior secured
JEM CCV	Victorian County Court	VIC	15/06/2022	CPI+1.79%	Senior secured
MPC	Melbourne Convention Centre	VIC	31/12/2025	CPI+1.79%	Senior secured
Plenary Justice (SA)	SA Police and Courts	SA	15/06/2030	CPI+2.24%	Senior secured
JEM NSW Schools	NSW Schools	NSW	28/02/2031	CPI+2.35%	Senior secured
Civic Nexus	Southern Cross Station	VIC	15/09/2032	CPI+2.38%	Senior secured
Novacare	Mater Hospital, Newcastle	NSW	15/04/2033	CPI+2.44%	Senior secured
RWH Finance	Royal Women's Hospital	VIC	30/06/2033	CPI+3.10%	Senior secured
MPC	Melbourne Convention Centre	VIC	31/12/2033	CPI+2.43%	Senior secured
JEM Southbank	Southbank Institute of Technology	QLD	28/06/2035	CPI+2.55%	Senior secured
JEM NSW Schools	NSW Schools	NSW	28/11/2035	CPI+2.49%	Senior secured

Source: FIIG Securities

Please note that bonds marked in red above are available to wholesale investors only.

Stiglitz on TIPS

Treasury Inflation Protected Securities (TIPS) faced obstacles to their introduction in 1992.

“Treasury turned to bond traders - their natural clientele - for advice. The experience in England from the perspective of bond traders was that these bonds were a failure; that is, people bought them for their retirement and did not trade them. *Without trades, where were their commissions?* Of course, from the perspective of someone trying to create an instrument to enhance retirement security, this was ideal: we did not want a gambling instrument. The bond traders raised anxiety levels: Would Treasury throw a party to which no one would come?” Stiglitz (1998)

Beneficiaries of the mismatch

Investment managers and asset consultants

- advice on asset allocation and price of liquid assets

Stock exchanges, stockbrokers, custodians

- more trading, administration

Commercial banks

- Inappropriate short term lending
- Managing cash flows for bullet payments

Finance directors

- Manage complex internal treasury cash flows

Proposition 3:

The 3 crises in financial markets (DB, DC & liquidity) arise because of the absence of appropriate instruments, which in turn is related to governance failures and perverse incentives

Conclusion

Almost all the experts are conflicted

Trustees need to take control:

- Bring investment management in-house and eliminate conflict of interests
 - Disintermediate expensive merchant banks by interacting directly with borrowers
 - Fund investment research directly
- Develop a market in IABs
- Offer them to members to fund their retirement

4. Valuation and yield projections

Valuation of IABs

Term of n years

Annual cashflows $C_1, C_2, \dots, C_n$

Actuarial valuation / present value

$$PV = C_1 \times DF_1 + \dots + C_n \times DF_n$$

where DF_k = k -year discount factor

Valuation of IABs

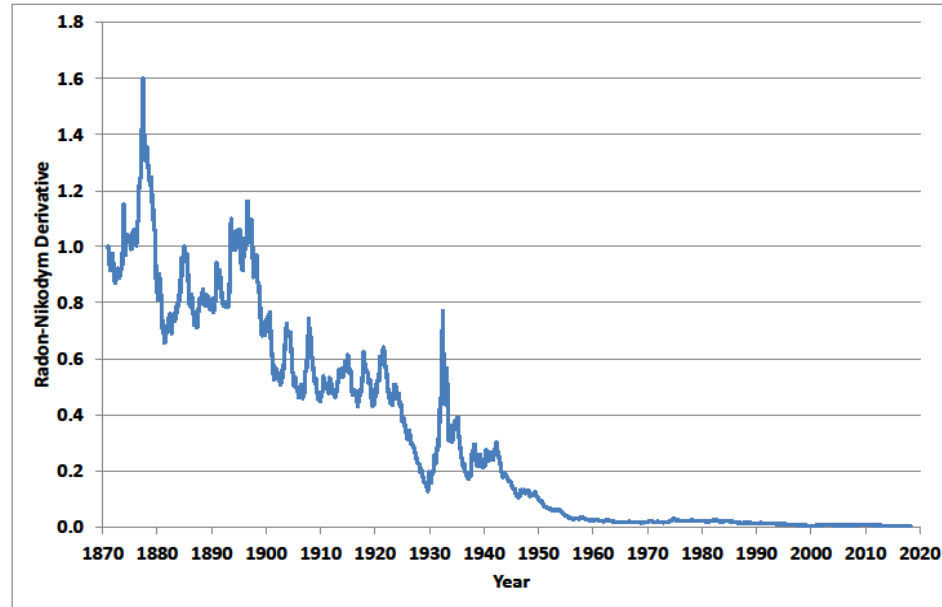
Actuarial valuation - based on discount rate
Risk neutral valuation – based on short rate
Real world valuation (benchmark approach)
– based on stochastic discount factor

Equities do not follow geometric Brownian motion

Radon-Nikodym
Derivative

$$\Lambda(t,T) = \check{S}(t) / \check{S}(T)$$

Does not appear to
be a Martingale
i.e. there is arbitrage
in the market



Valuation of Zero-Coupon Bonds

Risk neutral valuation

- absence of arbitrage
- same as assuming equivalent risk neutral probability measure Q

$$D(t,T) = E^Q[B(t)/B(T)] = \exp\{-r(T-t)\}$$

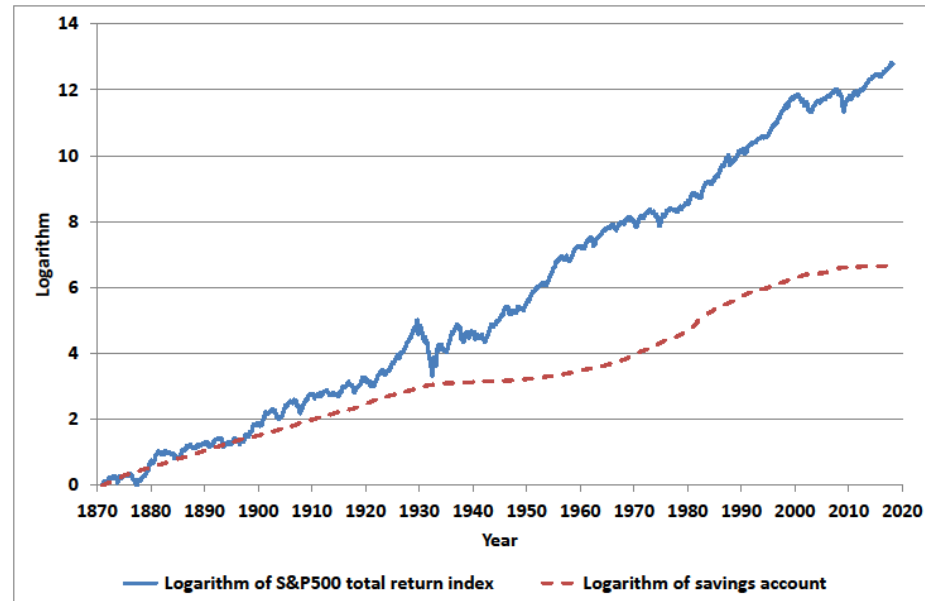
Real world valuation (Platen, 2001)

- absence of *strong* arbitrage
- no assumption regarding equivalent Q measure

$$\begin{aligned} P(t,T) &= E[S(t)/S(T)] = E[B(t)/B(T)] \times E[\check{S}(t)/\check{S}(T)] \\ &= \exp\{-r(T-t)\} \times [1 - \exp(-\frac{1}{2} \check{S}(t) / \{\varphi(T) - \varphi(t)\})] < D(t,T) \end{aligned}$$

Comparison of ZCB and equities

- S&P total return index is a proxy for the growth optimal portfolio (GOP).
- The GOP is used as the numeraire for valuation.
- Stochastic discount factor is proportional to $1/\text{GOP}$.



Comparison of Valuations of ZCBs

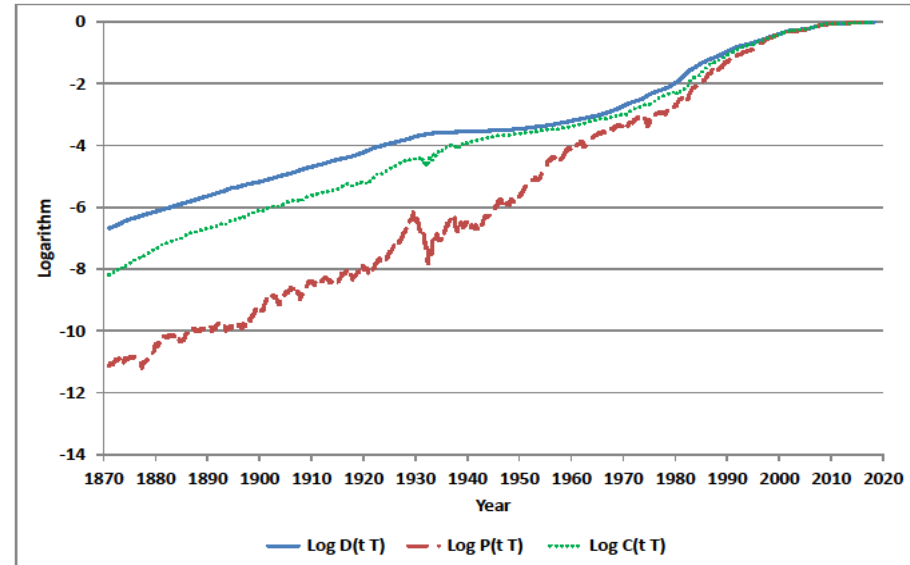
$D(t,T)$ = value of savings bond
(Cash)

$P(t,T)$ = real-world value of ZCB
(Equities moving to cash)

$C(t,T)$ = real world value ZCB
(Corporate bonds moving to cash)

t = valuation date

T = maturity date 2020



Potential Yields

Years to Maturity (1)	AUS Govt BOND Yield (2)	A-rated Corporate Bond Yield (3)	Implied BenchMark Approach Yield (4)	Annuity Value at Corporate Bond Yield (5)	BM Annuity Value (6)
5	0.9%	1.8%	3.4%	\$47,423	\$45,246
10	1.3%	2.4%	5.9%	\$87,956	\$73,813
15	1.3%	2.4%	6.7%	\$124,506	\$92,190
20	1.5%	2.6%	7.2%	\$154,178	\$103,041
25	1.8%	2.9%	7.7%	\$175,853	\$108,529
30	1.9%	3.0%	7.8%	\$195,474	\$112,793

The IAB return between columns 3 and 4

Discussion

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