Generational Wealth Accounts

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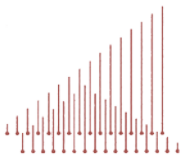
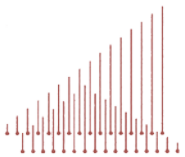


Outline

- Background
  - Conceptual understanding of generational economy
  - Policy issues
  - Accounting: Balance sheets and income statements
  - The economics of discounting
- Generational Wealth Accounts
  - NTA flow equation at each age
  - Inter-temporal budget constraints (public, private) quantify aggregate flows to and from the unborn
- Some examples to assist interpretation
- Focus here is on portfolio composition of resources and uses, and implications for aggregate sustainability
  - Four European countries are compared: UK, Slovenia, Spain, Austria

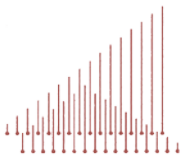
Background (I)

- Understanding the generational economy
  - Generational distribution of resources (and equity)
  - Inter-generational risk-sharing (at an aggregate level)
  - Role played by the public and private sectors
- Inter-generational equity is a major policy issue
  - Population ageing and the welfare state
  - Effect on composition and level of wealth and physical and human capital
  - Effect on household structure
- Comprehensive understanding of household portfolios, including transfer wealth
- BUT: work is held back by absence of a comprehensive measure of generational welfare
  - Lee arrows (Lee and Miller 1994) assume steady state, golden rule, constant profiles
  - Trying to generalise the approach to examine sustainability



Background (II)

- Accounting
  - Two parts to accounting systems
    - Balance sheets provide a fair picture of the stock of resources (double-entry accounting systems count two stocks: Assets and liabilities, resources and uses)
    - Income statements estimate flows of resources (and link the two)
  - Generally, income statements link successive balance sheets, so with an infinite series of income statements, you can create a balance sheet
- Examples
  - Bank statements
  - Financial accounting
  - Government accounting



Background (III)

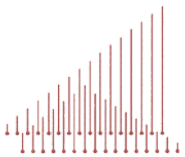
- In principle, NTAs allow construction of a set of generational-specific balance sheets
  - Given a set of future flows by and to each generation over its future life, a corresponding measure of stocks can be derived
  - Transversality conditions allow flows to and from the unborn to be measured
  - In the case of public-sector accounting, this is called Generational Accounting
  - NTA allows a generalisation to what we have called GWA
- But you need to:
  - Project future resource flows for each cohort in each future year
  - Discount these back to the present
  - (Failure to discount results in absurd conclusions)

Background (IV)

- Economics of discounting
  - Justifications for discounting
    - Subjective rate of time preference (problematic across generations)
    - Changes in expected levels of consumption (seems selfish?)
    - Risk and uncertainty
  - Choice of discount rate allows risk to be shifted between generations in subtle ways
    - High discount rate applied to outflows: Shifts risks to future generations
    - Low discount rate applied to outflows: Shifts risks to current generations
  - In a financial sense, baseline discount rate for a risk-free cash flow is a ‘risk-free’ rate
    - Generally taken as the rate of return on a portfolio of risk-free government bonds
    - (Remember, government can spread risks across the entire economy, through tax collection, and across different generations, through borrowing and investing)
    - Focus on rate of return of a portfolio of bequeathable, risk-free assets (government bonds) allows us to abstract from generational issues
  - But there is no clear guidance on correct way to adjust for risk, especially inter-generationally

Generational Wealth Accounts

- Similar approach to Lee and Sambt (2015), although independent(!)
- Use GA principles to calculate public and private transfer wealth and implicit transfers to and from the unborn in the presence of inter-temporal budget constraints of government and private sector
- Public transfer wealth: Generational account of Auerbach, Kotlikoff, and Gokhale (1991)
- Private transfer wealth: Use NTA profiles, balanced to population projections, discounted



Using NTA flow equation

- We used the NTA flow equation for each generation at each point in future to obtain a balancing equation

$$y^{l}_{k,t} - c_{k,t} = (\tau^{g,-}_{k,t} - \tau^{g,+}_{k,t}) + (\tau^{p,-}_{k,t} - \tau^{p,+}_{k,t}) - y^{a}_{k,t} + b_{k,t}$$

- Lump all flows not included in income, consumption, or public and private transfers (excluding bequests) into a balancing item, called savings (including bequests) in NTA
  - In effect, cohorts are assumed to borrow from, or add to, a pool of resources in order to sustain their consumption plans, conditional on their labour income, public and private transfers
- Discount these to the present over remaining life time for each generation
  - We assume a real discount rate of 2% p.a., slightly higher than historical average real government bond yields in western countries

Using inter-temporal budget constraints

- Three inter-temporal budget constraints allow the transfers between the living and the unborn to be quantified
  - We cannot quantify total resources/uses of the unborn, as there are (hopefully) an infinite number of them
- Public sector
  - Unborn generations must inherit the government debt and take account of it in their decisions
- Private sector
  - Total private transfers must equal zero
- Overall
  - Total residual items must sum to zero

Some examples

- Before we get to the ‘real’ GWAs, useful to examine some simple examples
  - We have been struggling with interpretation: Generated a series of simple economies of increasing complexity and calculated GWA’s for them as an aid to understanding
- Population
  - Steady-state, n=g=0
  - Very simple structure
- Consumers
  - Constant labour income, followed by retirement
  - Pure life-cycle savers, level consumption
  - (Rate of subjective discount = r+q(x))
- Economy
  - Steady-growth path, golden rule (Lee, 1994)

x	l(x)	yl
0	1000	1
1	900	1
2	800	1
3	700	1
4	600	1
5	500	0
6	400	0
7	300	0
8	200	0
9	100	0
10	0	

Ex 1: r=0, no government, perfect annuity markets

- Economy
  - r=0
  - Perfect annuity markets (or alternatively, all capital bequeathed to members of the same cohort)
- Individual behaviour
  - Level annual consumption = 0.7272…
- Aggregate economy
  - YL = 4000, C = 4000,
  - K = 5000
  - (Samuelson sense of capital)
- Conclusions in steady state
  - Agents trade claims on wages
  - Life-cycle portfolio composition
  - Zero balances in final column
    => Each generation 'self suff'

	Resources			Uses	Balance
Age	YL	K	Total	C	
0	4000	0	4000	4000	0
1	3000	273	3273	3273	0
2	2100	518	2618	2618	0
3	1300	736	2036	2036	0
4	600	927	1527	1527	0
5	0	1091	1091	1091	0
6	0	727	727	727	0
7	0	436	436	436	0
8	0	218	218	218	0
9	0	73	73	73	0
All	11000	5000	16000	16000	

Ex 2: r=0.2, no government, perfect annuity markets

- Individual behaviour
  - Level p.c. annual consumption = 0.86095…
  - (Higher consumption reflects capital income, need higher subjective discount rate to generate level consumption)
- Aggregate economy
  - YL = 4000, YK = 735, C = 4735,
  - K = 4411
- Conclusions in steady state
  - Higher C => Lower K in SS
  - Life-cycle portfolio composition
  - Higher r => Lower EDPV(YL)
  - Zero balances in final column
    => Each generation 'self suff'

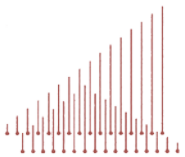
	Resources			Uses	Balance
Age	YL	A	Total	C	
0	3000	0	3000	3000	0
1	2400	167	2567	2567	0
2	1800	350	2150	2150	0
3	1200	554	1754	1754	0
4	600	782	1382	1382	0
5	0	1038	1038	1038	0
6	0	729	729	729	0
7	0	462	462	462	0
8	0	244	244	244	0
9	0	86	86	86	0
All	9000	4411	13411	13411	0

Ex 3: r=0.2, government, perfect annuity markets

- Government
  - Creates a PAYG pension system
  - Imposes a 10% payroll tax, runs balanced budget, so can pay 0.2666 to each ‘retiree’
- Individual behaviour
  - Presence of PAYG system leads to lower savings, capital accumulation
  - Lower capital income leads to lower per capita consumption (0.8119 vs 0.8610)
- Aggregate economy
  - YL = 4000, YK = 466, TGO = 400, TGI = 400, K = 2794, C = 4466
- Conclusions in steady state
  - Lower savings => Lower capital accumulation in SS, lower YK
  - PAYG system introduces ‘trade’ with the unborn (and the dead)
  - Each generation still ‘self sufficient’, but in SS an implicit debt of 854 is passed on to the unborn (and an asset is received from the already dead)

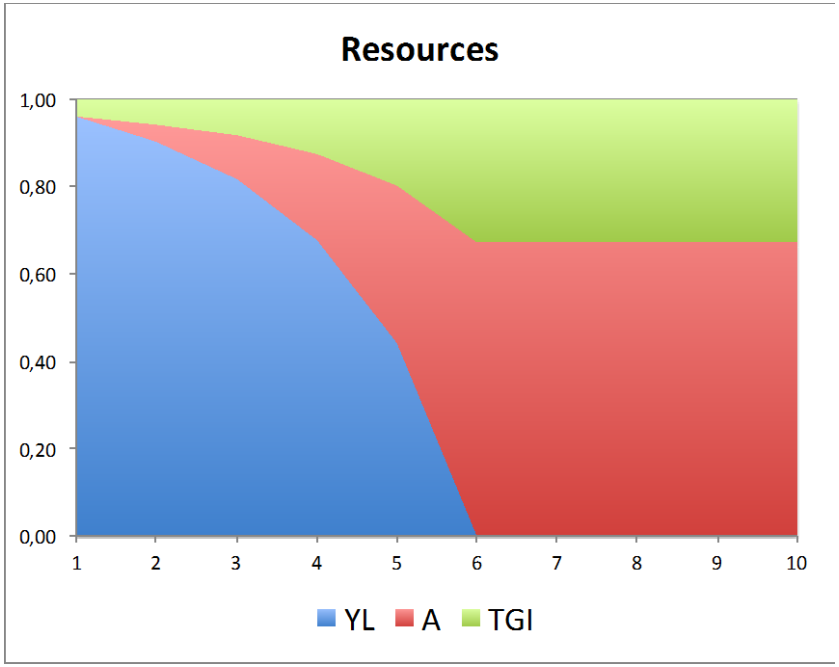
Ex 3: r=0.2, government, perfect annuity markets

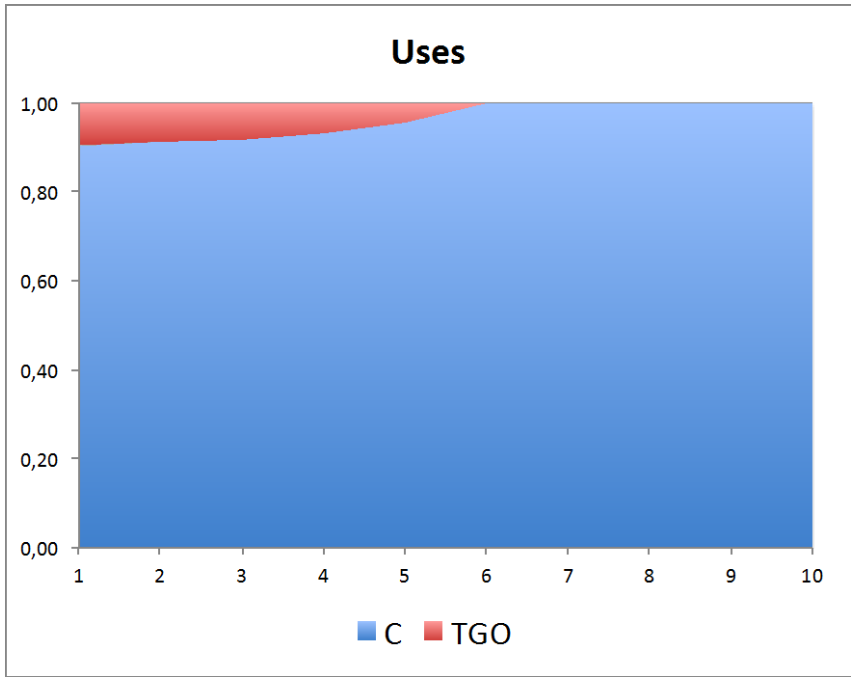
	Resources				Uses			Balance
Age	YL	A	TGI	Total	C	TGO	Total	
0	3000	0	129	3129	2829	300	3129	0
1	2400	106	155	2661	2421	240	2661	0
2	1800	222	186	2208	2028	180	2208	0
3	1200	351	223	1774	1654	120	1774	0
4	600	495	268	1363	1303	60	1363	0
5	0	657	322	979	979	0	979	0
6	0	462	226	688	688	0	688	0
7	0	292	143	435	435	0	435	0
8	0	154	76	230	230	0	230	0
9	0	55	27	81	81	0	81	0
Unborn						854		
All		2794	1754			1754		



Ex 3: r=0.2, government, perfect annuity markets

- Portfolio composition of resources and uses
  - Resources comprise a changing proportion of YL, A, TGI
  - Uses comprise C and TGO





Ex 4: r=0.2, government, perfect annuity markets, a bequest

- Same as example 3, but we introduce a bequest
  - The individuals who die at age 5 give a bequest of 100 to those who are alive at age 1, every year into the future (unnatural, but keeps it easy)
  - All other bequests are to members of the same cohort, as before (or perfect annuity markets)
- Individual behavior
  - Bequest leads to higher peer capita consumption (0.8243 vs. 0.8119)
- Aggregate economy
  - YL = 4000, YK = 534, TGO = 400, TGI = 400, K = 3202, C = 4534
- Conclusions in steady state
  - Although savings are lower, capital is spent less quickly
  - Because K is around for longer, it accumulates, leading to higher K and YK, raising consumption
  - Each generation is no longer ‘self sufficient’, before bequests
  - Younger generations consume ‘too much’, older generations consume ‘too little’, in anticipation of receiving or making the bequest
  - Two forms of trading with the unborn: Government AND bequests

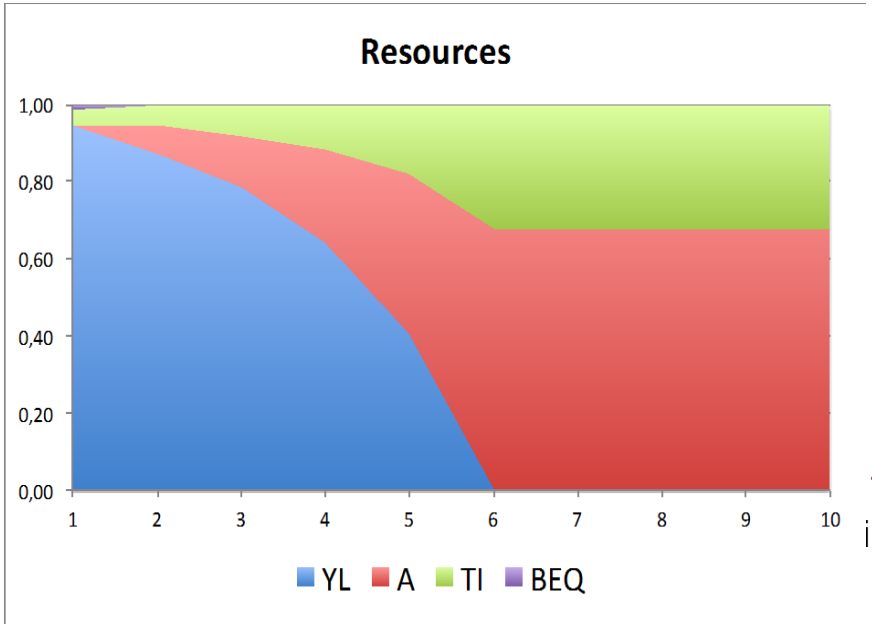
Ex 4: r=0.2, government, perfect annuity markets, a bequest

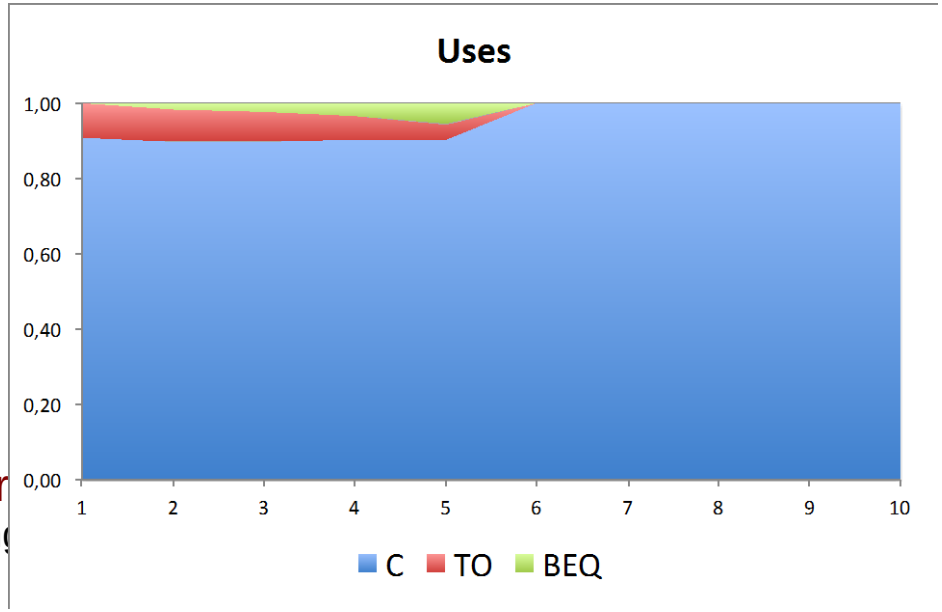
	Resources					Uses				Balance
Age	YL	A	TGI	BQI	Total	C	TGO	BQO	Total	
0	3000	0	129	43	3172	2872	300	0	3172	0
1	2400	191	155	0	2746	2458	240	48	2746	0
2	1800	311	186	0	2297	2059	180	58	2297	0
3	1200	446	223	0	1869	1679	120	69	1868	0
4	600	598	268	0	1466	1323	60	83	1466	0
5	0	672	322	0	994	994	0	0	994	0
6	0	472	226	0	698	698	0	0	698	0
7	0	299	143	0	442	442	0	0	442	0
8	0	158	76	0	234	234	0	0	234	0
9	0	56	27	0	82	82	0	0	82	0
Unborn				215			854	0		
All		3202	1754	258			1754	258		

- The living pass down a public-sector liability, but also a bequest asset to the unborn

Ex 4: r=0.2, government, perfect annuity markets, a bequest

- Portfolio composition of resources and uses
  - Resources comprise a changing proportion of YL, A, TGI and BQI
  - Uses comprise C, TGO and BQO





Example GWAs for the UK

- Highly preliminary results
  - Many strong assumptions (constant per capita profiles, no already legislated changes put into effect, no policy changes)
  - Constant r = 5% per annum; g = 2% per annum
  - No treatment of ROW, some public-sector pension liabilities and other public sector assets ignored, which national balance sheet etc., etc., etc.
  - Population projections as per Eurostat up to 2080, our own ad-hoc method up to 2120 (when all those currently alive will be dead)

GWA 2007 (before crisis)

Aggregate Resources and Uses by Age Group, £Mn, 2012 Prices

		Resources							Uses					
	Population Mllns	Labour Income	Market Assets	Govt. Transfers	Priv. Transfers	Bequests	*Funding Gap*	Total	Govt. Consump.	Priv. Consump.	Govt. Transfers	Priv. Transfers	Bequests	Total
75-90	4,333,400	4	1,040	901	69	-	-	2,013	519	537	284	101	572	2,013
65-74	6,182,400	61	1,663	1,425	210	-	-	3,360	754	1,086	576	233	712	3,360
55-64	7,479,700	835	2,862	2,337	480	-	-	6,514	1,220	2,324	1,382	492	1,095	6,514
45-54	8,962,600	2,690	2,175	2,769	590	79	-	8,303	1,476	3,427	2,337	858	205	8,303
35-44	8,428,200	5,013	1,423	3,413	698	834	-	11,381	1,763	4,594	3,405	1,619	-	11,381
25-34	8,114,600	6,031	498	3,243	673	1,373	-	11,818	1,641	4,735	3,620	1,822	-	11,818
15-24	7,718,700	6,798	105	3,615	974	299	*1,465*	13,255	1,945	5,488	3,928	1,894	-	13,255
0-14	7,016,300	7,297	-	4,566	2,160	-	*2,002*	16,026	2,768	6,845	4,395	2,018	-	16,026
Unborn					3,182						2,341			
All		28,730	9,766	22,268	9,037	2,585	*3,467*		12,086	29,036	22,268	9,037	2,585	
Debt/ Shortfall							*-3,467*				654			

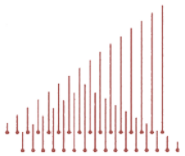
- Assuming constant profiles going forward, we assume 2% real growth rate in aggregates and discount back at a real interest rate of 4%

GWA 2012 (after crisis)

Aggregate Resources and Uses by Age Group, £Mn, 2012 Prices

		Resources							Uses					
	Population Mlns	Labour Income	Market Assets	Govt. Transfers	Priv. Transfers	Bequests	*Funding Gap*	Total	Govt. Consump.	Priv. Consump.	Govt. Transfers	Priv. Transfers	Bequests	Total
75-90	4,522,700	8	1,181	972	85	-	-	2,247	531	601	245	118	753	2,247
65-74	6,969,400	94	2,148	1,695	272	-	-	4,209	850	1,336	595	293	1,134	4,209
55-64	7,920,000	858	2,873	2,366	504	-	-	6,601	1,180	2,342	1,222	510	1,347	6,601
45-54	9,253,100	3,012	2,398	3,072	714	9	-	9,205	1,563	3,654	2,379	1,015	594	9,205
35-44	8,276,100	4,525	1,091	3,172	749	528	-	10,065	1,558	4,043	2,930	1,534	-	10,065
25-34	8,650,200	5,944	472	3,485	822	970	-	11,692	1,658	4,677	3,417	1,941	-	11,692
15-24	7,502,800	6,160	71	3,632	1,012	1,297	-	12,172	1,837	5,030	3,438	1,868	-	12,172
0-14	7,637,500	6,768	-	4,669	2,211	1,024	*483*	15,155	2,683	6,467	3,970	2,035	-	15,155
Unborn					2,944						4,866			
All		27,369	10,234	23,062	9,314	3,828	*483*		11,859	28,150	23,062	9,314	3,828	
Debt/ Shortfall							*- 483*				1,353			

- Comparing the GWA 2007 with GWA 2012 shows the impact of crisis on unborns



Conclusions

- GWA's provide a different perspective on NTA flows
  - Measure trades with the unborn and implications of current flows, under strong assumptions, for future generations and sustainability
- Private-sector transfers to the unborn are large and economically significant in magnitude
  - Both bequests and inter-vivos transfers appear important
- These serve to offset public-sector implicit debt transfers
- Analysis of portfolio structure and risk transfer inside economies is significantly incomplete without consideration of transfers
- Sustainability looks to be a problem in the UK for younger generations
- Bequests and public-sector implicit debt transfer risk between generations