General Equilbrium Policy Analysis

Lecture 7

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Outline

Homework 3 (1/2)

Ex. 7 - **Fiscal devaluation**:

- labor tax more distortive than consumption tax (look at effective tax rates) $L \uparrow$, $C \uparrow$
- because positive jump in $C \rightarrow$ net exports (trade balance) $\downarrow$, which recovers over time as Y increases slowly
- $TB_T > TB_0$ is a robust outcome for different ρ (but ρ has effect on magnitude of change in net export position)

Homework 3 (2/2)

Ex. 8 - **Debt-rule and Ricardian equivalence**:

- available as code `Blanchard_government_debt`
- gain today vs. pain tomorrow is anticipated (Ricardian equivalence)
- only in last case (100 years) the result is broken (in the first periods) $\rightarrow$ outcome of the OLG structure (old generations do not care about the burden on the young generation, in this setting)

Outline

Some principle comments 1/2

- The **lack of stochastic** model components makes **calibration easier**.
- Use block recursion of the model to **first calibrate demography** and then the rest.
- Set the calibration up as a **proper optimization or root finding problem** to be solved numerically (no trial and error approach!).
  - more targets than parameters $\rightarrow$ optimization
  - same number of targets and parameters $\rightarrow$ root finding
- Differentiate between **parameters to match first moments** in the data and **behavioral parameters**.
  - start with former: either **match directly observed parameters** or set them in order to **indirectly match another calibration target** e.g. r_0 is the observed interest rate vs. β is set to replicate the trade balance.
  - then set latter: e.g. elasticities, capital-adjustment cost parameters, etc. (relevant for 'shock' behavior of the model)

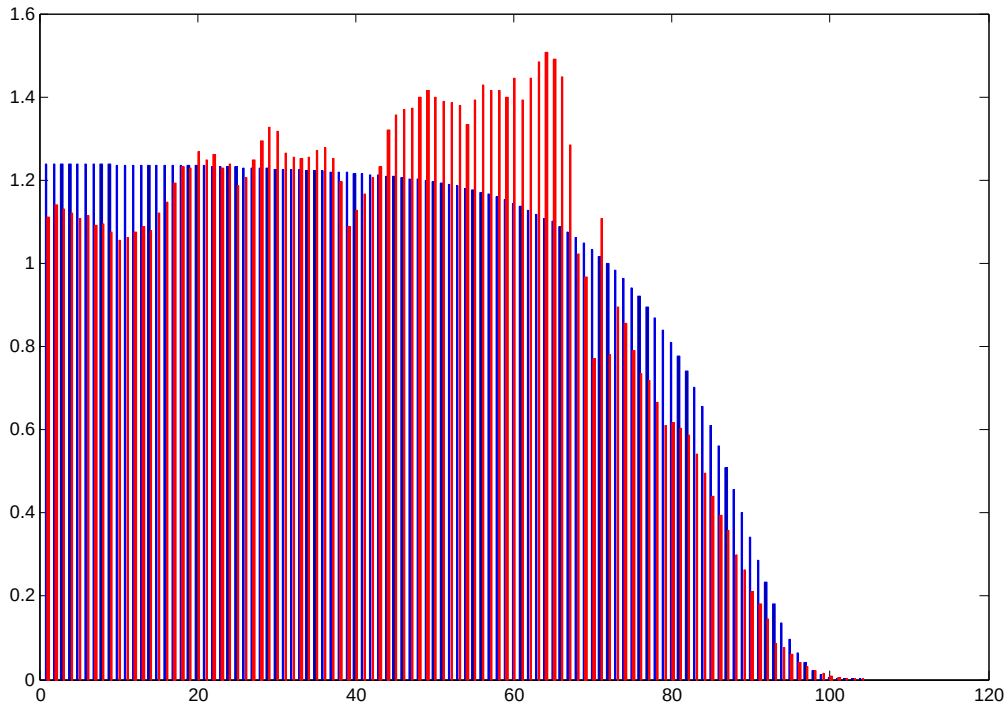
Some principle comments 2/2

- Choose a **calibration year** (trade off availability vs. 'up-to-dateness' of data)
- You may want to **eliminate business cycle influence** on the calibration (e.g. take average over several years) if model is meant for simulating **long-run structural reforms**
- Choice of calibration target often comes with a trade off: getting **individual behavior** right vs. getting **aggregate accounting** right
  - The problem is often related to the **out of steady state nature** of the observed data or **simplistic modeling**, e.g.
  - individual savings behavior vs. foreign asset positions
  - life-expectancy vs. population structure
  - individual tax burden (at the margin) vs. aggregate revenue figures

Look at summary table in manuscript.

Demography 1/2

Problem: observed population structure is not stationary. Dependency ratio: 24 % (data 2010) vs 29 % (model SS).



Example: Actual population structure 2010 vs. stationary structure based on 2010 mortality rates (for Finland). See `demo_fin`.

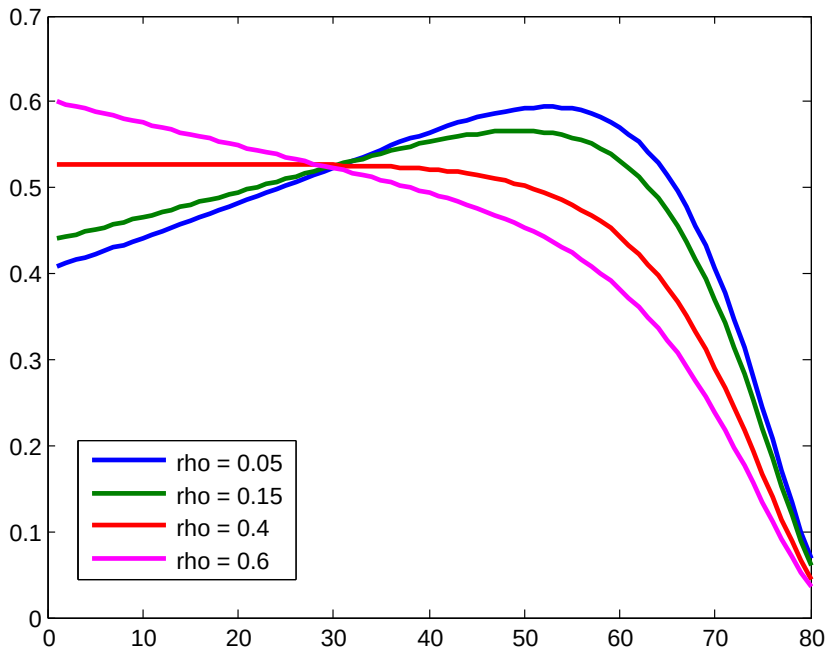
Demography 2/2

3 **options** to improve the demographic fit of the model (i.e. match life-expectancy and population structure)

- **Compromise**: Increase observed mortality rates in order to balance mismatch between both targets.
- **Pseudo-migration**: Calibrate model with counter-factual migration flows in order to match population structure. Replace migration flows once the simulation is run with observed values. (See migration extension later).
- **Start simulation earlier**: Choose an earlier year, e.g. 1950 as start of the simulation of demographic shock. Hence, population in 2014 is in demographic transition in the model. Run actual reform as unanticipated shock in e.g. 2014. Cleanest option but hard to match 2014 targets.

Consumption and Asset Profiles 1/2

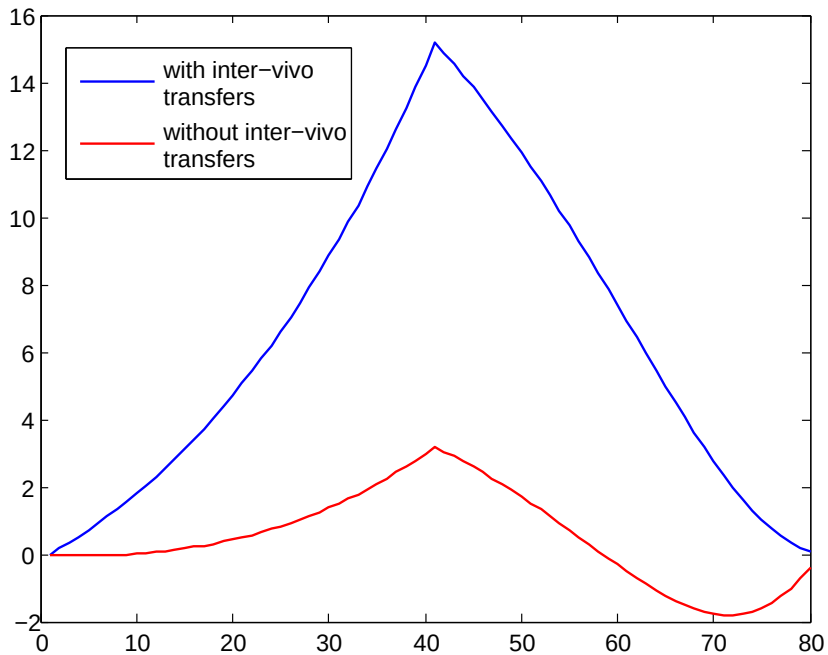
Empirical **consumption-age profile** is hump-shaped. Without finance-constrained households, how can this be replicated?



For given mortality rates the right ratio of interest (in figure: 4 %) and **discount rate** is crucial.

Consumption and Asset Profiles 2/2

The shape of the **asset-age profile** can be changed by assuming **inter-vivo transfers** from older to younger households.



Note: The assumption on the **distribution of accidental bequests** will also affect the shape.

Accounting

Do **strict accounting** while implementing your model. (a) Gives a valuable **overview for calibration** and (b) in order to **detect accounting errors**. Use function `writecalib2latex`.

Table: Household Sector

Expenditure			Income
Private Consumption	50.000	Wages	60.000
Households PAYG contr.	6.000	Publ. transfers to households	-40.115
Income tax workers	2.700	PAYG Pensions	23.626
Income tax retirees	1.181	Non-part. benefits	10.602
Consumption taxes	10.000	Dividends	4.846
Accid. bequests given	13.065	Accid. bequests rec.	13.065
Intervivo trans. given	13.834	Intervivo trans. rec.	13.834
Private savings	6.553	Private interest earnings	17.475
Total	103.334	Total	103.334

Data Sources

Some **useful data sources** for calibrating the presented models:

- Eurostat: national accounts (macro aggregates), government statistics, population structure, life tables (mortality rates), population forecasts, LFS summary statistics (labor market), SES and SILC main findings
- OECD: Revenue Statistics, LFS by sex and age (labor market), Taxing Wages,...
- Summary statistics and papers related to LFS, EU-SILC, HFCS
- National statistics offices
- Other applied papers (e.g. elasticities, etc.)

LFS ... Labour Force Survey
HFCS ... Household Finance and Consumption Survey
SILC ... Statistics on Income an Living Conditions
SES ... Structure of Earnings Survey

Outline

Final Project: Ex. 12 - 14

Short policy advice (background) paper on '**long-term public financing** and **aging**'. **Three tasks** (again in groups of 2-3):

1. Calibrate `AuerbachKotlikoff` or `AuerbachKotlikoff_earnings_link` to **an EU country of your choice** (except Finland). Explain and document.
2. Simulate **demographic change** based on available population forecasts. Explain and interpret.
3. Simulate **3 refoms on top**. (a) a cut in pension benefits, (b) a rise in contribution rates, (c) a rise in retirement age. Explain, compare and interpret.

Time resources are limited (no need to work directly with micro data). Do to best of your knowledge. Be creative. You are free to set your own focus. Please coordinate and choose different countries.
Deadline: June 7th.

Outline

Finance-constrained households

- Strong empirical support for finance-constraints. Empirical consumption behavior **between extreme cases**: hand-to-mouth consumption and permanent income hypothesis.
- Assume that a **share of the households cannot save** at all, i.e. $A_t^{C,a} = 0, \ \forall a, t$, i.e. they do not invest in firm, etc. They have a tight relationship between per-period income and per-period consumption.
- The other share of the households works like before.
- The **share parameter** governs the **compromise** between both extreme cases.

Migration 1/2

- Simplifying assumption: assume that migration occurs vis-a-vis an completely **identical country**.
- Migration 'shocks' are **exogenous** (i.e. for private reasons).
- Hence, they **do not show up** in the households' optimization problems.
- Immigrants /emigrants bring / take assets with them. The corresponding pension rights are converted into **intergovernmental transfers** in order to reimburse.
- Native and foreign workers are **indistinguishable**, i.e. perfect substitutes in production.

$$N^0_{t+1} = NB_{t+1}$$
$$N^{a+1}_{t+1} = \gamma^a_{t+1} N^a_t + Mig^{a+1}_{t+1}, \quad \gamma^A_t = 0 \ \forall t.$$

Migration 2/2

If native and foreign workers are **not supposed to be indistinguishable**. We have to **separately keep track** of them $\rightarrow$ **Twice** as many household problems.

- They **do not have to** be perfect **substitutes** in production.
- They can have **different** productivity, hours supply, participation, mortality **profiles**, etc. from the natives.
- **Necessary assumption**: emigrating natives leave with average assets within their age group, immigrating foreigners bring same assets as average foreigner already residing in the domestic country.

Skill Choice 1/3

Assume we have S **skill class** index with s **S times** as many household problems.

- The skill class is chosen **at the beginning of life**.
- Once chose they **cannot switch** anymore.

$$N_{t+1}^{0,s} = NB_{t+1}^{s}$$
$$N_{t+1}^{a+1,s} = \gamma_{t+1}^{a,s} N_t^{a,s}, \quad \gamma_t^{A,s} = 0 \ \forall t.$$

- On the household side the model is solved like for S different populations.
- Aggregate production can feature different forms of **substitability** or **complementarity** between skill classes.

Skill Choice 2/3

How does the **skill choice** at the beginning of life work?

- Individuals have different (inverse) **learning ability** $v \sim \Gamma(\cdot)$.
- At the beginning of life they face **education costs** (in terms of disutility) $c^s(v)$ to attain a specific skill (there can also economic costs of **foregone income** reflected in $V^{0,s}$) with the following assumptions

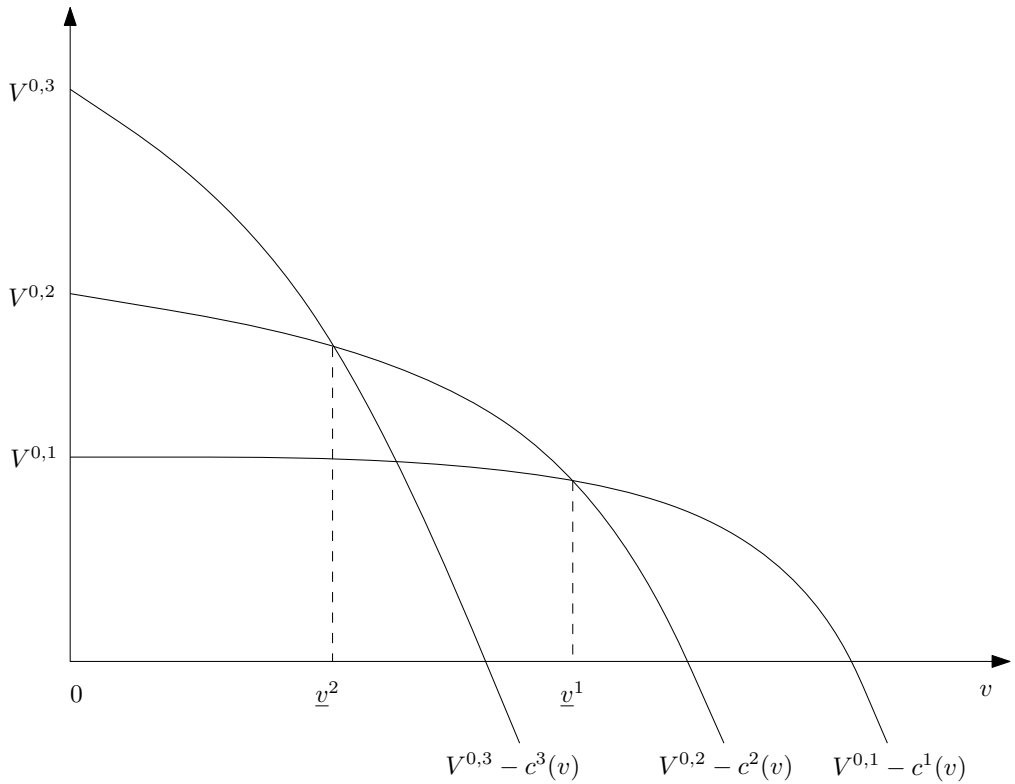
$$\frac{\partial c^s(v)}{\partial v} > \frac{\partial c^{s-1}(v)}{\partial v} > 0 \quad \forall s \in \{2,3,..S\} \qquad \text{and} \qquad c^s(0) = 0 \quad \forall s,$$

$$V_t^{0,s} - c^s(\underline{v}_t^{s-1}) = V_t^{0,s-1} - c^{s-1}(\underline{v}_t^{s-1}) \quad \forall s \in \{2,3,..S\},$$

pins down the **indifference level** $\underline{v}_t^{s-1}$.

$$N_t^{0,s} = N_t^0 \times \begin{cases} 1 - \Gamma\left(\underline{v}_t^1\right) & : s = 1, \\ \Gamma\left(\underline{v}_t^{s+1}\right) - \Gamma\left(\underline{v}_t^s\right) & : s \in \{2,3,...,S-1\}, \\ \Gamma\left(\underline{v}_t^S\right) & : s = S. \end{cases}$$

Skill Choice 3/3



Multi-country models

A simple way is to

- Assuming **perfect** goods and capital market integration
- Use front superscript ${}^{j}X$ to denote country $j \in 1, 2, ..., J$
- Countries are 'connected' through a single clearing interest rate, i.e.
- Find r such that $\sum_{j=1}^{J} {}^{j}\zeta^{Y} = 0$
- Models can be solved simultaneously (faster) or sequentially iterating over different guesses of r (more robust and easier to implement)