Unemployment Insurance when the wealth distribution matters

Facundo Piguillem   Hernán Ruffo   Nicholas Trachter

EIEF, UTDT, Federal Reserve Bank of Richmond

EEA-ESEM
August, 2022

Introduction

- Unemployment Insurance (UI) problem in general equilibrium
- Endogenous factor prices
- Search model
  - human capital
  - savings and physical capital
  - firms demand capital and labor

Related literature

- Partial equilibrium:
  - UI as a dynamic contract: Hopenhayn and Nicolini (1997,2009), Shimer and Werning (2008)
  - Sufficient statistics: Baily (1978), Chetty (2006, 2008), Shimer and Werning (2007), Landais (2015)
- General equilibrium
  - Alvarez and Veracierto (1998,2000,2001)
  - Infinitely lived agents: Mukoyama (2010,2013), Popp (2017), Young (2004)

This paper

- Our model: Life cycle + Human capital
  - individuals are born asset poor
  - incentives to borrow at the beginning of the working life
  - incentives to save for retirement
- The model
  - reproduces the distribution of assets of the unemployed
  - moderates the elasticity of capital to UI

This paper: findings

- UI is valuable in GE (4% in consumption equivalent)
- Welfare maximizing UI is close to the policy in the US
- In our baseline model the General equilibrium (GE) and partial equilibrium (PE) analysis provide very similar results whenever K and L respond proportionally to UI
- Absent life cycle effects UI should be (almost) eliminated: (i) very few asset-poor unemployed, (ii) elasticity of savings becomes very high

Outline

1. General equilibrium model
2. Calibration
3. Results in partial and general equilibrium
4. Robustness and extensions
5. Conclusions

The model

Firms

Firms are competitive and solve

$$\max_{K,H} K^{\alpha} H^{1-\alpha} - (r+d)K - wH$$

which provides

$$w = (1-\alpha)\left(\frac{K}{H}\right)^{\alpha}$$
$$r = \alpha\left(\frac{K}{H}\right)^{\alpha-1} - d$$

where d=depreciation, K= aggregate capital, H=aggregate Human Capital

Workers

- At each period t a measure 1 of risk averse agents is born without assets or human capital
- Agents age and they die with probability δ_j (j=age)
- Agents can work until age $j = T$; they retire after T.
- At each $t \leq T$ there are: **employed** and **unemployed** agents
- If employed:
  - choose the proportion of working time (n)
  - they can accumulate human capital through on-the-job learning (with probability $\chi(n)$ human capital increases)
  - they lose their jobs with exogenous probability $1 - \pi_j$
- If unemployed:
  - they can find a job for next period with probability s, at a cost

Income and policies

- **Employed** agents' compensation is proportional to the effective units of labor they provide to the firm, $nh(\kappa)$:

$$wnh(\kappa)(1-\tau)$$

- **Unemployed** receive a government transfer

$$B(\psi)w\bar{n}h(\kappa)(1-\tau)$$

- of a replacement rate B
- dependent on unemployment duration ψ
- The function $B(\psi)$ represents this policy
- average hours $\bar{n}$
- **Retired** receive a pension $P \times w$
- Proportional taxes, τ, balance the budget

Employed worker's problem

- If $j < T$,

$$
\begin{aligned}
V_j^e(a,\kappa) \quad &= \quad \max_{c,a',n} \frac{\left((1-n)^{\omega} c^{1-\omega}\right)^{1-\sigma}}{1-\sigma} + \beta(1-\delta_j) \times V_c \\
s.t. \quad & \\
& c + a' = (1+r)a + wnh(\kappa)(1-\tau) \\
& a' \geq 0 \ , \ \ c \geq 0 \ , \ \ n \in [0,1]
\end{aligned}
$$

- Where

$$
\begin{aligned}
V_c \quad \equiv \quad & \chi(n)\left(\pi_j V_{j+1}^e(a',\kappa+1) + (1-\pi_j)V_{j+1}^u(a',\kappa+1,1)\right) \\
& +(1-\chi(n))\left(\pi_j V_{j+1}^e(a',\kappa) + (1-\pi_j)V_{j+1}^u(a',\kappa,1)\right)
\end{aligned}
$$

  - $n =$ working time
  - $\chi(n)$ probability of going up one step in human capital

Unemployed agent's problem

- If $j < T$,

$$
\begin{aligned}
V_j^u(a,\kappa,\psi) \quad &= \quad \max_{c,a',s} \frac{\left(c^{1-\omega}\right)^{1-\sigma}}{1-\sigma} - \gamma_0 \frac{(1-s)^{1-\gamma_1}}{|1-\gamma_1|} \\
&\quad +\beta(1-\delta_j)\left[sV_{j+1}^e(a',\kappa) + (1-s)V_{j+1}^u(a',\kappa,\psi+1)\right] \\
s.t. \quad & \\
&\quad c + a' = (1+r)a + B(\psi)\bar{n}h(\kappa)w(1-\tau) \\
&\quad a' \geq 0\ ,\ \ c \geq 0, s \in [0,1]
\end{aligned}
$$

- Where
  - $s =$ job-finding probability
  - $\psi =$ duration of unemployment
  - $B_u(\psi) =$ unemployment insurance (replacement ratio)
  - $\bar{n} =$ average number of hours worked in the economy

Retired agent's problem

- If $j > T$,

$$V^R(a) = \max_{c,a'} \frac{\left(c^{1-\omega}\right)^{1-\sigma}}{1-\sigma} + \beta(1-\delta_R)V^R(a')$$

$$s.t.$$

$$c + a' = (1+r)a + Pw$$

$$a' \geq 0 \ , \ c \geq 0$$

- Where
  - P = pension payments
  - δ_R = prob of dying after retirement

Policy functions

- Solution provides policy functions for consumption, c, savings, a', search effort, s, and work effort, n.
- Measures:
  1. employed: $X^e(j, \kappa, a)$
  2. unemployed: $X^u(j, \kappa, a, \psi)$
  3. retired: $X^r(a)$
- Gvmt. budget:

$$
\begin{gathered}
\int\int\int \tau w n_j(a,\kappa) h(\kappa) X_j^e(a,\kappa) d\kappa da dj \\
+ \\
\int\int\int\int \tau w \bar{n} h(\kappa) B(\psi) X_j^u(a,\kappa,\psi) d\kappa da dj d\psi \\
= \\
\int\int\int\int w \bar{n} h(\kappa) B(\psi) X_j^u(a,\kappa,\psi) d\kappa da dj d\psi \\
+ \\
Pw \int X^r(a) da
\end{gathered}
$$

Equilibrium

Given a policy rule $B(\psi)$ and a pension level P, a stationary equilibrium is a tax rate τ, a wage w, an interest rate r and measures $X^R(a)$, $X_j^e(a,\kappa)$, $X_j^u(a,\kappa,\psi)$ $\forall j, a, \kappa, \psi$, such that:

1. agents maximize expected utility,
2. markets clear,
3. the government keeps a balanced budget and,
4. the feasibility constraint is satisfied,

Calibration

Calibration

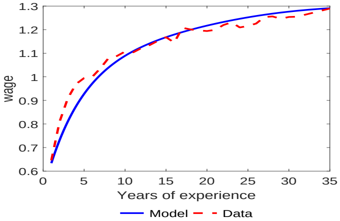
- We set
  - model period to a quarter (12 weeks)
  - years of labor market participation to 43 ($T = 172$)
  - $B(\psi)$ UI system to 50% replacement ratio for 6 months as in the US
  - We set $h(\kappa)$ as a vector of ten positions to reproduce the (controlled) wage-labor experience profile from NLSY 1979 ($\chi \approx 0.088$ if $n \geq 1/6$)
  - We calibrate the search cost function targeting the unemployment rate (6.8%, BLS) and the job-finding elasticity with respect to UI benefits level (-0.32, Landais, 2015)

Calibration

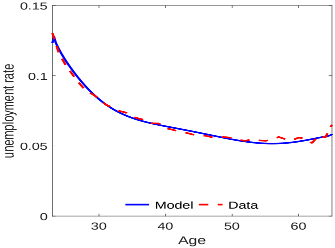
- Pensions to represent a total budget of about 6.8% of GDP
- annual depreciation rate of about 5%
- discount rate to about 1% per period ($\beta = 0.96$ annual) to get $K/Y \approx 2.7$
- Leisure utility $\omega = 0.65$ to match 40.5 hours worked per week
- Risk aversion $\sigma = 3.85$ to get the risk av. coef. of retired at 2
- Separation prob. by age $(1 - \pi_j)$ exogenous (Shimer, 2012)
- the capital share $\alpha = 0.3$
- death probability $\delta(j)$ using Social Security data
- death probability at retirement $\delta_R \approx 0.015$ to match expected lifetime at age 65 (17 years)

Calibrated economy

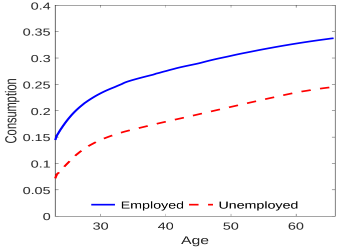
Wage-experience profile



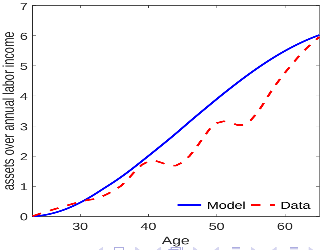
Unemployment rate



Consumption



Assets



Changes in UI

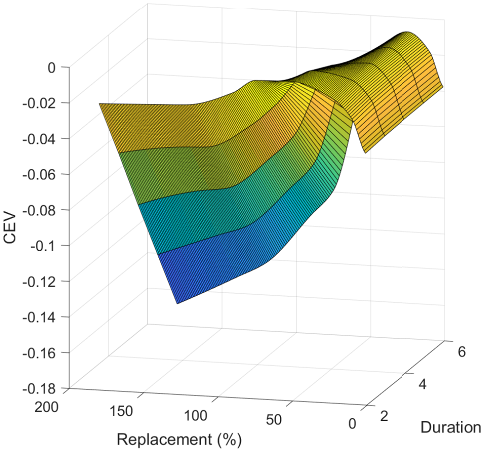
Changes in UI

- Solve the model for a grid of replacement rates and potential durations
  - Partial equilibrium (no changes in factor prices)
  - General equilibrium (changes in factor prices)
- Welfare measure: Consumption Equivalent (CE) considering the welfare of the newborn workers,
  $W_1 = (1 - u_1)V_1^e(a = 0, \kappa = 1) + u_1 V_1^u(a = 0, \kappa = 1, \psi = 1)$
  where $u_1 \sim 0.12$ is the proportion of unemployed workers at the beginning of their working life

Main results

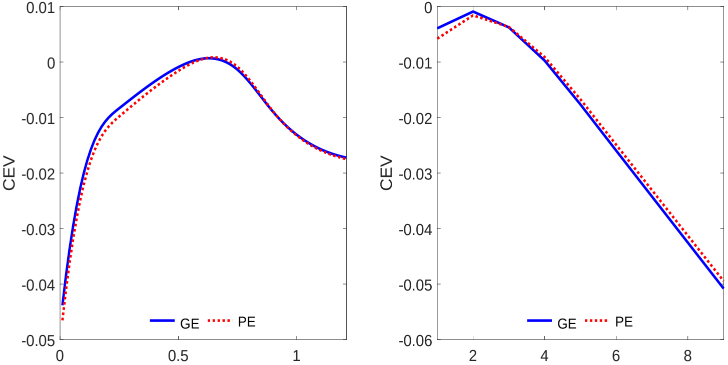
- Optimal UI is close to the current one

Figure: Welfare effects of UI in GE



Main results

Figure: Welfare effects of UI in general and partial equilibrium



(a) Level (PD=2)

(b) Duration ($B = 0.5$)

Changes in GE and PE

- UI has important welfare effects
- The welfare maximizing policy is close to the current one
- GE and PE are almost identical around the optimal policy; the effect of UI on labor is almost proportional to the effect in assets
  - K-L ratio is almost unchanged, generating a very low **GE/price effect** (the effect of price adjustment on welfare)

Extensions

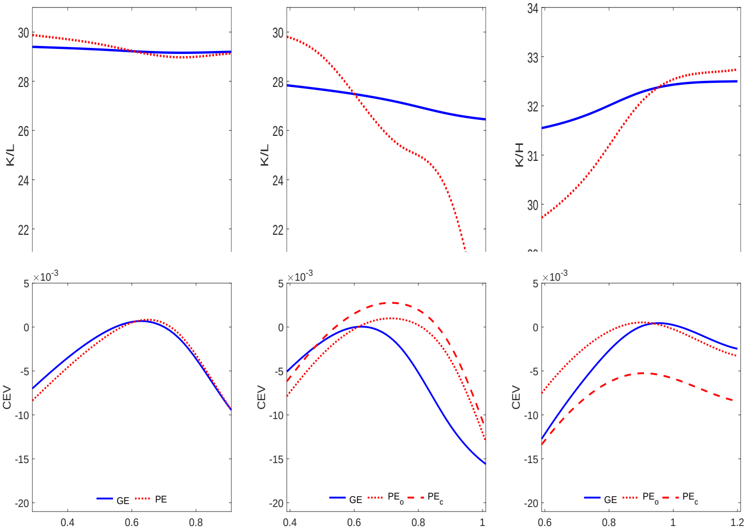
Extensions 1 and 2

- Aim: Highlight the importance of the K-L ratio response
  1. Taxes to capital income (τ_r): more generous UI implies a K/L fall and price effect becomes negative (the GE evaluation will suggest lower UI than the PE)
  2. Lump-sum taxes to be paid at the end of the working life ($\mathcal{T}$): more generous UI increases K/L and price effect is positive (the GE evaluation suggest higher UI than the PE)

- GE welfare effect depends on the K-L ratio response to UI in these extensions
- The way taxes are collected are important for UI in GE

Extensions 1 & 2: the role of capital-labor ratio

Figure: Capital labor ratios and welfare effects of UI in GE and PE (PD=2)



(d) Baseline (e) Capital tax (f) Lump-sum tax

Extension 3

- We explore the role of life cycle effects in our model by eliminating some features:
  1. No human capital accumulation
  2. No other age-dependent variables within labor market years (constant survival, constant separation)
  3. Longer time in the labor market (60 years)
  4. Positive initial assets (from the assets of those that die)
  5. Higher pensions and higher depreciation rate

Extension 3: the role of life cycle effects

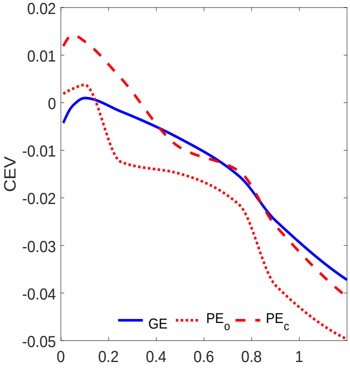
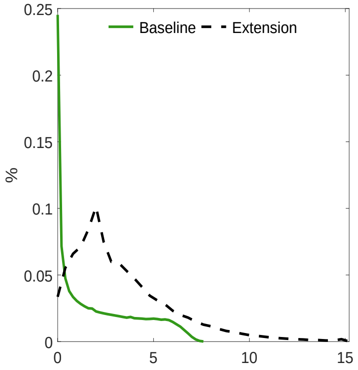


Figure: Welfare effects of UI

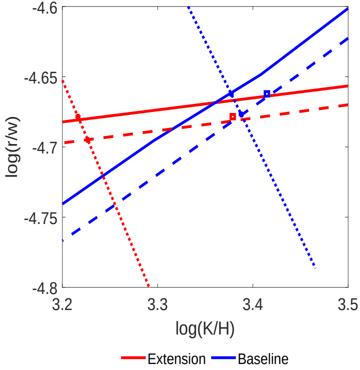
Extension 3: the role of life cycle effects

- Life-cycle effects reproduce the observed distribution of assets and reduce the elasticity of assets to UI

Figure: Welfare effects of UI in general and partial equilibrium



(a) Unemp. distribution of assets



(b) Elasticity of factors

Conclusions

Conclusions

- The analysis of UI in PE is justified if factors adjust proportionally to UI
- UI has relevant welfare gains both in PE and in GE
- GE welfare effect depends on K-L ratio response to UI
- Wealth distribution and assets elasticity are crucial for the analysis of UI
- Life-cycle effects reproduce a wealth distribution and savings elasticity more in line with the data