Quantifying Efficient Tax Reform

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Want

- To quantify welfare gains from efficient tax reform

  - Baseline:
    - Positive economy matched to administrative data

  - Reform:
    - Pareto improvements on efficient frontier (full)
    - Optima given set of policy tools (restricted)
Idea in a Picture

- Start with baseline OLG economy:
  - Incomplete markets
  - Heterogeneous households
    - Differ in education levels of members
    - Face productivity, marital, unemployment risks
    - Decide on consumption, saving, hours
  - Technology parameters and tax policies

- Compute remaining lifetime utilities ($v^j$)

- Let’s draw this for 2 households...
Idea in a Picture

• Typical starting point for most analyses
  ○ With constraints on policy instruments
  ○ Do counterfactuals or restricted optimal (“Ramsey”)

• Let’s draw this in the picture
Idea in a Picture
Idea in a Picture

- Not typical starting point for studies in Mirrlees tradition
  - With constraints on information sets
  - Characterize efficient allocations and policy “wedges”

- Let’s draw this in the picture
Idea in a Picture

- This paper quantifies gains from:
  - Full Pareto-improving reform a la Mirrlees
  - Partial Pareto-improving reform a la Ramsey
- Let’s draw this in the picture
Idea in a Picture

Value for Household A, $v^A$

Value for Household B, $v^B$

Efficient Frontier

Pareto Improving

Positive Economy
Idea in a Picture

- Efficient Frontier
- Pareto Improving
- Positive Economy
Our Approach

- Solve equilibrium for positive economy (●)
  - Inputs: fiscal policy and wage processes
  - Outputs: values under current policy
- Solve planner problem next (●)
  - Inputs: values under current policy
  - Outputs: labor and savings wedges and welfare gains
- Use results to inform current policy and reforms (●)
Positive Economy: Some specifics (●)

- Open OLG economy a la Bewley
- Household heterogeneity in:
  - Age
  - Education (observed, permanent)
  - Productivity (private, stochastic)
  - Marital risk
  - Divorce risk (in progress)
  - Unemployment risk (in progress)
- Transfers and taxes on consumption, labor income, assets
Positive Economy: Some specifics ($\bullet$)

- Household problem

$$v^j(a, \epsilon; \Omega) = \max_{c, n, a'} U(c, \ell) + \beta E[v^{j+1}(a', \epsilon'; \Omega)|\epsilon]$$

s.t. $a' = (1 + r)a - T_a(ra) + wen - T_n(j, wen) - (1 + \tau_c)c$

where

- $j =$ age
- $a =$ financial assets
- $\epsilon =$ productivity shock
- $\Omega =$ factor prices and tax policies
- $c =$ consumption
- $n =$ labor supply ($n + \ell = 1$)
Positive Economy: Some specifics (●)

- Firms:
  - Technology: $F(K, N) = K^\alpha N^{1-\alpha}$
  - Prices: $r, w$ set internationally

- Government:
  - Taxes: consumption, incomes, assets
  - Borrows: at home and abroad
Positive Economy: Some specifics (●)

• In equilibrium:

\[ C_t + I_t + G_t + B_{t+1} = F(K_t, N_t) + RB_t \]

\[ \lim_{T \to \infty} \frac{1}{R^{T-1}} (B_T + K_T) \geq 0 \]

• Then use answers as inputs into planner’s problem
Reform Problem: Some specifics (∗)

- Take inputs from positive economy:
  - Parameters for preferences and technologies
  - Wage profiles and shock processes
  - Values under current policy ($v^A, v^B, \ldots$)

- Compute maximum consumption equivalent gain
Planer Problem (Primal)

- Maximize weighted sum of lifetime utilities
- subject to
  - Incentive constraints for every household and history
  - Resource constraints
- But, computationally easier to solve dual problem
Planner Problem (Dual)

• Maximize present value of aggregate resources

• subject to
  
  ○ Incentive constraints for every household and history
  ○ Value delivered exceeds that of positive economy
Planner Problem (Dual)

$$\max \sum_h \pi_0(h) \Pi_0(V^h, -, \epsilon)$$

subject to

- Incentive constraints for all $h$
- $V^h \geq v^h$ for all $h$
Quantitative Deliverables

- Wedges

- Welfare gains
  - Total consumption equivalent
  - Decomposition

- Implied Pareto weights

- Sensitivity to parameter choices

- Insight for restricted policy reforms
Wedges

- Labor wedge:
  \[ \tau_n(\epsilon^j) = 1 - \frac{1}{w} \frac{U_\ell(c(\epsilon^j),\ell(\epsilon^j))}{U_c(c(\epsilon^j),\ell(\epsilon^j))} \]

- Savings wedge:
  \[ \tau_a(\epsilon^j) = 1 - \frac{U_c(c(\epsilon^j),\ell(\epsilon^j))}{\beta RE[U_c(c(\epsilon^j+1),\ell(\epsilon^j+1))|\epsilon^j]} \]
Application to Netherlands
Data from Netherlands

- Merged administrative data, 2006-2014
  - Earnings from tax authority
  - Hours from employer provided data
  - Education from population survey
- National accounts
- Tax schedules

⇒ Big data advantage for estimating elasticities & shocks
Estimation of Wage Processes

- Construct hourly wages $W_{ijt}$ ($j=\text{age}, \ t=\text{time}$)
- Classify degrees:
  - High school or practical (Low)
  - University of applied sciences (Medium)
  - University (High)
- Construct residual wages $\omega_{ijt}$:
  - $\log W_{ijt} = A_t + X_{ijt} + \omega_{ijt}$
  - Estimate AR(1) process for idiosyncratic risk
Marriage and Household Structure

- In period 0, individuals are single
  - Different by education (L,M,H)

- After that, individuals either
  - Form a couple (LL,LM,LH,MM,MH,HH) or
  - Remain single (included with LL,MM,HH)

*Note: Working on adding divorce risk*
Other Key Parameters

• Number of productivity types (50)

• Status quo tax/transfers (NL)

• Preferences:

  1. \( U(c, \ell) = \gamma \log c + \kappa n^\rho \)

  2. \( U(c, \ell) = \gamma \log c + (1 - \gamma) \log \ell \)

  with different labor elasticities (0.5 vs 3)
Results
Labor Wedges

![Graph showing labor wedges over age](image)

- HH
- MH
- MM
- LH
- LM
- LL

Age

Labor wedge (%)
Increasing with wage variance as planner trades off increasing distortions with more insurance.

Increasing with age since the opportunity to promise future payoffs decreases.
With Log preferences, initial slopes are steeper, but peak values similar.
What We Learn

- Wedges are suggestive of
  - Informational frictions
  - Insurance needs

- But,
  - Average wedges are not taxes
  - Averages mask significant variation
Labor Wedges for LL, HH

Note: 25th and 75th percentiles shown
Labor Wedges for LL, HH

With Log preferences, the variance is greater

Note: 25^{th} and 75^{th} percentiles shown
Welfare, (●) vs (●)

- Consumption equivalent gain of 15% for future cohorts
- Large but maybe not surprising given:
  - Tax rates in NL over 40%
  - Average tax wedges of planner in 6% to 21% range
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- What are the implied Pareto weights?
Implied Pareto Weights

• Recall: could also have solved:
  - $\max \sum_i \pi_i \omega_i V^i$
  - subject to incentive and incentive constraints

Note: $\omega_i > 1 \Rightarrow$ overweight $i$ relative to population share
Implied Pareto Weights

- Recall: could also have solved:
  - $\max \sum_i \pi_i \omega_i V^i$
  - subject to incentive and incentive constraints

- What are the implied $\omega_i$’s for L,M,H?
## Pareto Weights and Welfare Gains

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<th>Equal Gains</th>
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<th>Equal Weights</th>
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<tbody>
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$^\dagger$ Utilitarian planner with $V^H \geq V^M \geq V^L$
Pareto Weights and Welfare Gains

- With log preferences
  - Essentially same consumption equivalent gain (16%)
  - Essentially same implied Pareto weights
  - All gain with equal weights (but 0.05 for high)

- But, surprisingly close given labor elasticities of 0.5 vs 3
Comparing Allocations, ($\bullet$) vs ($\cdot$)

- Consumption: level $\uparrow$ and variance $\downarrow$ for all groups
- Leisure: level $\downarrow$ and variance $\uparrow$ for all groups
- Intuition from simple static model:
  - No insurance: $c$ varies, $\ell$ constant
  - Full insurance: $c$ constant, $\ell$ varies
- What about magnitudes?
A Look Under the Hood: Group LL

Levels of Consumption

Levels of Leisure

Variances of Log Consumption

Variances of Log Leisure
A Look Under the Hood: Group LL
A Look Under the Hood: Group LL

With log preferences, planner chooses much higher initial levels and variances.
Informing Counterfactuals (●)

- Value for Household B, $v^B$
- Value for Household A, $v^A$
- Efficient Frontier
- Positive Economy
- Restricted Optimal
- Pareto Improving
Informing Counterfactuals (*)

- Results of planner problem suggest large gains to
  - Lower average marginal tax rates
  - Early life transfers
  - Income-tested transfers

*Note*: our results on restricted gains still tentative
Points to certain:
  - Early life transfers
  - Income-tested transfers
Summary

- Ultimate deliverables of project:
  - Estimates of gains for efficient reform
    - for any age in steady state
    - along the transition path
  - Identification of sources of gains
  - Ideas for new policy instruments
  - Prototype for future analyses

- Stay tuned...