Dyanmic General Equilibrim Tax Scoring with Micro Tax Simulations *

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June 2014
(version 14.06.a)
Preliminary and incomplete; please do not cite.

Abstract

This paper ...

keywords: dynamic general equilibrium, taxation, numerical simulation, computational techniques, simulation modeling.

JEL classifications: C63, C68, E62, H24, H25, H68

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1 Introduction

2 Details of the Macro Model

We use a model based heavily on Zodrow and Diamond (2013) which we refer to hereafter as the DZ model.

2.1 Households

Households differ along two dimensions: age and earnings ability, indexed by a and γ. Households enter the model at age $a = 1$ and all die at age $a = T$. In the DZ model $T = 55$ and households enter the labor force at age twenty-three. This implies that all households die at age seventy-eight.

Earnings ability is divided into ten deciles, the top and bottom of which are further subdivided into the top two and bottom two pecent and the remaining eight percent for that decile. This gives us values for $\gamma \in \{\gamma_1, \gamma_2, \ldots, \gamma_{12}\}$.

We therefore have $T \times 12$ different households alive each period. This is 660 for the DZ model.

Lifetime utility is given by the equation below.

$$LU_t(a,\gamma) = \frac{1}{1-1/\sigma_U}\left[\sum_{s=t}^{t+T-a-1}\frac{U_s(a,\gamma)^{1-1/\sigma_U}}{(1+\rho)^{s-t}} + \frac{1}{(1+\rho)^{T-a-1}}\alpha_B(\gamma)B_{t+T-a-1}(a,\gamma)^{1-1/\sigma_U}\right] \tag{2.1}$$

where $LU_t(a,\gamma)$ is total remaining lifetime utility for a household of age a and ability level γ in period t, $U_t(a,\gamma)$ is within-period utility for a household of age a and ability level γ in period t, $B_{t+T-a-1}(a,\gamma)$ is the bequest left by a houshold of age a and ability level γ when it dies in period $t+T-a-1$. σ_U is the intertemporal elasticity of substitution for utility across periods, and rho is the pure rate of time preference.

Within-period utility depends on consumptions of composite goods (CH) and

leisure (LE).

$$U_s(a,\gamma) = \left[\alpha_u^{1/\sigma_u} CH_s(a,\gamma)^{1-1/\sigma_u} + (1-\alpha_u)^{1/\sigma_u} LE_s(a,\gamma)^{1-1/\sigma_u}\right]^{\frac{\sigma_u}{\sigma_u - 1}} \tag{2.2}$$

Composite goods are made up of housing goods (HR) and non-housing goods (CN).

$$CH_s(a,\gamma) = \left[\alpha_H^{1/\sigma_H} CN_s(a,\gamma)^{1-1/\sigma_H} + (1-\alpha_H)^{1/\sigma_H} HR_s(a,\gamma)^{1-1/\sigma_H}\right]^{\frac{\sigma_H}{\sigma_H - 1}} \tag{2.3}$$

Non-housing goods are made up of those produced by the corporate secotor (C) and non-corporate sector (N).

$$CN_s(a,\gamma) = \left[\alpha_N^{1/\sigma_N} [C_s(a,\gamma) - b_s^C(a,\gamma)]^{1-1/\sigma_N} + (1-\alpha_N)^{1/\sigma_N} [N_s(a,\gamma) - b_s^N(a,\gamma)]^{1-1/\sigma_N}\right]^{\frac{\sigma_N}{\sigma_N - 1}} \tag{2.4}$$

Housing goods are made up of owner-occupied housing (H) and rental housing (R).

$$HR_s(a,\gamma) = \left[\alpha_R 1/\sigma_R [H_s(a,\gamma) - b_s^H(a,\gamma)]^{1-1/\sigma_R} + (1-\alpha_R)^{1/\sigma_R} [R_s(a,\gamma) - b_s^R(a,\gamma)]^{1-1/\sigma_R}\right]^{\frac{\sigma_R}{\sigma_R - 1}} \tag{2.5}$$

This completes the description of the household's utility function. There are four fundamental goods consumed: C, N, H and R along with consumption of leisure, LE. The utility parameters are: ρ, σ_U, σ_C, σ_H, σ_N, σ_R, α_B, α_C, α_H, α_N, α_R, $\{b_s^C(a,\gamma_i)\}_{a=1,i=1}^{T,12}$, $\{b_s^N(a,\gamma_i)\}_{a=1,i=1}^{T,12}$, $\{b_s^H(a,\gamma_i)\}_{a=1,i=1}^{T,12}$, $\{b_s^R(a,\gamma_i)\}_{a=1,i=1}^{T,12}$.

The households remaining lifetime budget constraint is given by the equation below.

$$TDW_t(a,\gamma) = TDE_t(a,\gamma) \tag{2.6}$$

where TDW stands for total discretionary wealth and TDE is total discretionary expenditure.

$$TDE_t(a,\gamma) = \sum_{s=1}^{t+T-1-a} \sum_{j\in\{C,N,H,R\}} p_s^j (1+\tau_{vs}^j) j_s D_s \tag{2.7}$$

τ_{vs}^{j} is the value added tax (VAT) on good j in period s.

$$D_s = \begin{cases} \prod_{u=t+1}^{s} \frac{1}{1+r_u} & \text{if } s > t \\ 1 & \text{otherwise} \end{cases} \tag{2.8}$$

$$\tau_{vs}^{j} = \tau_{vs} f_{vs}^{j}; j \in \{C, N, H, R\} \tag{2.9}$$

where f_{vs}^{j} is the proportion of goods in category j subject to the VAT

$$\begin{aligned} TDW_t(a,\gamma) = {} & A_t(a,\gamma)(1+r_t) + TRA_t(a,\gamma)(1+i_t) \\ & + \sum_{s=t}^{t+T-1-a} D_s w_s(a,\gamma)[HT_s(a,\gamma) - LE_s(a,\gamma)] - D_s LIT_s(a,\gamma) - D_s SST_s(a,\gamma) \\ & + \sum_{s=t}^{t+T-1-a} D_s SSB_s(a,\gamma)[1-\tau_{bs}(\gamma)] - D_s RS(\gamma) \\ & + \sum_{s=t}^{t+T-1-a} D_s WD_s(a,\gamma)[1-s_d\tau_{rs}(\gamma)] + D_s TR_s(a,\gamma) + D_s LSR_S(a,\gamma) \end{aligned} \tag{2.10}$$

LIT is the labor income tax, SST is the social security tax, SSB is social security benefits, τ_{bs} is the tax rate on social security benefits is period s, RS is retirement savings which is a constant amount each year the household is not retired, WD is withdrawls from retirement accounts, TR is transfers received, LSR is lump sum rebates received.

$$r_u = i_u(1-\tau_{iu}) \tag{2.11}$$

where τiu is the tax on interest income in period u.

$$TRA_s(a,\gamma) = TDA_s(a,\gamma) + TPA(a,\gamma) \tag{2.12}$$

where TDA is tax-deferred assets and TPA is tax-prepaid assets.

$$WD_s(a,\gamma) = \begin{cases} 0 & \text{if } a \leq R \\ \frac{1}{T+1-a} TRA_s(a,\gamma) & \text{otherwise} \end{cases} \tag{2.13}$$

$$LIT_s(a,\gamma) = \psi_s LIB_s(a,\gamma) + \frac{\chi_s}{2} LIB_s(a,\gamma)^2 \tag{2.14}$$

where LIB is the labor income base, defined below.

$$LIB_s(a,\gamma) = w_s(a,\gamma)[HT_s(a,\gamma) - LE_s(a,\gamma)] - DED_s(a,\gamma) - s_d RS(\gamma) \tag{2.15}$$

2.2 Firms

2.3 Market Clearing

3 Incorporating Feedbacks with Micro Tax Simulations

Follow this algorthim:

- Period 1
  - Use current IRS public use sample.
  - Run the following within-period routine
    - Do the static tax analysis of this sample, save the results
    - Summarize the public use sample by aggregating into bins over age and earnings ability
    - Use this as a starting point for the dynamic macro model
    - Get values for fundamental interest rates and effective wages for next period
- Period 2

  - Age the public use data demographically by one year.
  - Let wages and interest rates rise by the amounts predicted in the macro model.
  - Rerun the within-period routine

- Iterate over periods until end of forecast period is reached.

4 Conclusion

TECHNICAL APPENDICES

References

Zodrow, George R. and John W. Diamond, *Handbook of CGE Modeling - Vol. I*, North Holland,