Household Taxation, Convex Earnings, and Occupational Choice

Piotr Denderski & Tim Obermeier (University of Leicester)

Econometric Society European Meeting

August 27, 2024

Motivation

- Macroeconomic literature has emphasised gender differences as an important part of tax policy analysis

- For example, Guner et al. (2012) find that married women account for large fraction of behavioural response to tax reforms

- Occupational choice and differences in hours flexibility across jobs are key components of women's labour supply decisions (Goldin, 2014)

- Some occupations (e.g. business/law) impose high wage penalties when working part-time, whereas others offer a more 'linear' pay schedule (e.g. pharmacists)

- In the long run, tax policy could lead to an additional distortion of earnings through occupational choice and hours-related wage penalties

This paper

- We analyse taxation in a model of household labour supply and occupational choice (based on Erosa et al, 2022)

- High marginal tax rates could discourage individuals from working in the high pay/high hours occupation and lead to lower wages

- Key model features:

  1. **Roy-model** type selection into different occupations

  2. A **non-linear** (convex) earnings/hours schedule which differs by occupation

  3. Home production & **within-household specialisation** (not today)

- We calibrate the model to the US and analyse counterfactual tax policies

Main results

- We study (1) introducing **individual taxation** and (2) **eliminating progressivity** via a flat tax

- We show that tax reforms affect occupational choice through multiple channels:

  - High marginal tax rates **reduce the additional earnings** from entering the high-pay/high-hours occupation

  - But taxation also affects **relative work hours** between occupations, which can have an offsetting effect

- Using our calibrated model, we find that

  1. Tax reforms have a **small effect on occupational choice**: fraction of women working in the high-pay/high-hours occupation goes up by at most 0.7pp

  2. **Endogenous wages** relating to hours flexibility are an **important amplification mechanism**: wage changes account for 15-50% of the elasticity of taxable income

Literature

- Taxation: Heathcote et al. (2017, 2014), Guner et al. (2023, 2012), Holter et al (2019), Mazzocco & Bronson (2022), Mazzocco et al (2007), Gayle & Shephard (2019),

- Gender inequality: Goldin (2014), Erosa et al. (2022), Kleven et al. (2019), Cubas et al. (2022)

Model

- Our model builds on Erosa et al. (2022) and adds non-linear income taxation
- Individual i can work in occupation $j \in \{1, 2\}$
- Key model ingredient: the earnings equation

$$y_i = a_{ij} g_j(h)$$

- Earnings y_i depend on individual specific ability a_{ij} and a partly non-linear function of hours:

$$g_j(h) = \begin{cases} h^{1+\theta_j}, & h < \bar{h} \\ B_j h, & \text{otherwise} \end{cases}$$

- Occupations differ in the convexity in their earnings/hours profile ($\theta_1 > \theta_2$)
- The model is static and outcomes are interpreted as **average life-time outcomes**
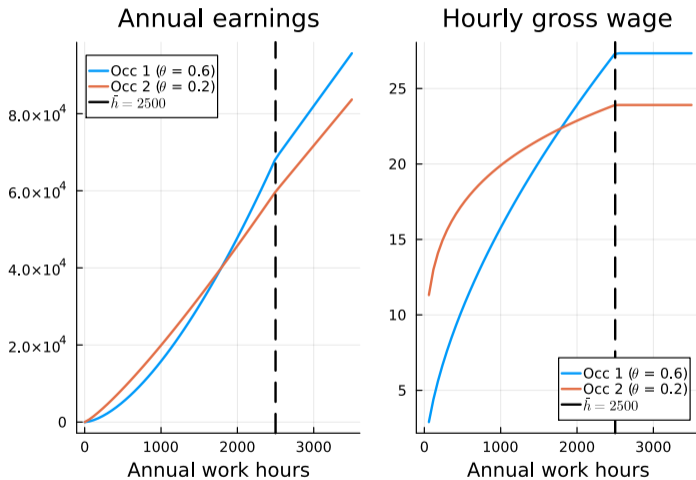
Wages

- Effectively, wages are a function of work hours:

$$w_{ij}(h) = \begin{cases} a_{ij} h^{\theta_j}, & h < \bar{h} \\ a_{ij} \bar{h}^{\theta_j}, & \text{otherwise} \end{cases}$$

- Erosa et al. (2023) calibrate the model using $\theta_1 = 0.6$ and $\theta_2 = 0.2$
- Then, earnings are a convex function in hours and wages are a concave function

Earnings and wages: Illustration

Individuals and households

- Each individual differs in ability in occupation $1/2$ and in their disutility of labour
- Households consist of woman and man and are described by 6D vector:

$$(a_{f1}, a_{f2}, \phi_f, a_{m1}, a_{m2}, \phi_m)$$

- Individuals derive utility from consumption and leisure:

$$u_g(c, h) = \log(c) - \phi_g \frac{(T_g + h)^{1+\gamma}}{1 + \gamma}$$

- T_g captures the time each person spends in home production (exogenous)
- Households maximise the weighted sum of utilities:

$$U = u_f + u_m$$

The distribution of households

- Recall the household characteristics:

$$(a_{f1}, a_{f2}, \phi_f, a_{m1}, a_{m2}, \phi_m)$$

- These are drawn from a 6-dimensional log-normal distribution
- Key parameters:
    - Means of ability in each occupation and of ϕ ($\mu_{a1}, \mu_{a2}, \mu_\phi$)
    - Corresponding variances ($\sigma_{a1}, \sigma_{a2}, \sigma_\phi$)
    - Correlation of ability between sectors (ρ_{a12}), of ability between partners (ρ_{afm}) and of disutility between partners ($\rho_{\phi fm}$)
- Note that distribution is symmetric between genders

The household maximisation problem

- Conditional on occupations j and k, households maximise

$$U_{jk} = \log(c_f) - \phi_f \frac{(T_f + h_f)^{1+\gamma}}{1+\gamma} + \log(c_m) - \phi_m \frac{(T_m + h_m)^{1+\gamma}}{1+\gamma}$$

- Subject to the budget constraint

$$c_f + c_m = y - T(y)$$

- With income:

$$y = w_{fj}(h_f)h_f + w_{mk}(h_m)h_m$$

- And tax function:

$$T(y) = y - \tau_1 y^{\tau_2}$$

- Note that $c_f = c_m$ at the optimal choice, and that **wages depend on hours**

Occupational choice

- Solving the maximisation problem for each combination of occupations, each household has 4 options and chooses the maximum:

$$\max\{U_{11}, U_{12}, U_{21}, U_{22}\}$$

How does taxation influence occupation choice?

- To build intuition, focus on the case of singles
- Singles get utility from consumption $u(c)$ and disutility from work $d(h)$
- They will choose to work in occupation 1 if the following inequality holds:

$$u(c_1^*) - d(h_1^*) > u(c_2^*) - d(h_2^*)$$

- Rearrange:

$$\underbrace{u(c_1^*) - u(c_2^*)}_{\text{Consumption gain}} > \underbrace{d(h_1^*) - d(h_2^*)}_{\text{Leisure cost}}$$

- Working in occupation 1 increases consumption, but also increases disutility of work!

How does taxation influence occupation choice?

- Plug in functional forms:

$$\underbrace{(1 - \textcolor{red}{\tau_2})\left(\log\left[\tau_1\left(a_1 h_1^{*1+\theta_1}\right)\right] - \log\left[\tau_1\left(a_2 h_2^{*1+\theta_2}\right)\right]\right)}_{\text{Consumption gain from occ 1}} > \underbrace{\phi\frac{(T + h_1^*)^{1+\gamma}}{1+\gamma} - \phi\frac{(T + h_2^*)^{1+\gamma}}{1+\gamma}}_{\text{Leisure cost of occ 1}}$$

- Since taxation affects both disposable income and optimal work hours choices, it affects both consumption gain and leisure cost!

How does taxation influence occupation choice? Couples

- For couples, also need to consider cross-effects on hours:

$$\underbrace{2u(c_1^*) - 2u(c_2^*)}_{\text{Consumption gain}} > \underbrace{d^f(h_1^{f*}) - d^f(h_2^{f*})}_{\text{Leisure cost}} + \underbrace{d^m(h_1^{m*}) - d^m(h_2^{m*})}_{\text{Leisure gain of partner}}$$

- Here, h_1^{m*} and h_2^{m*} are the optimal hours choices of the man depending on whether the woman works in occupation 1 and 2 (conditional on men's occupation)

- If woman works in convex occupation, men will have an incentive to reduce their hours and have lower disutility of work

Taking stock

- Tax reforms have multiple effects on the incentive to work in the non-linear occupation
  1. Taxation can reduce the consumption increase from having higher (gross) income $\rightarrow$ reduces incentive to go into non-linear occupation
  2. Taxation can also change the leisure cost, for example by reducing the difference between h_1^* and h_2^*
  3. Changes in h_1^* and h_2^* also have a direct effect on the consumption gain
- Quantitative model is needed to study these effects

Calibration: Exogenously set parameters

- We set $\theta_1 = 0.6$ and $\theta_2 = 0.2$
- Erosa et al. (2022) choose these values based on a literature review of the empirical evidence
- $\hbar = 2500$ and hours are on a grid between $[1, ..., 3500]$ for each person
- To set tax parameters τ_1 and τ_2 we target two values from Heathcote/Storesletten/Violante: avg tax rate of 0.1 at 50k and of 0.2 at 150k

Calibration: Moments

Moment	Data	Model
Share of men working in occ. 1	0.6	0.61
Log of mean hours, men	7.67	7.78
Std of wages in occ. 1, men	0.45	0.55
Std of wages in occ. 2, men	0.47	0.43
Std of hours, men	0.26	0.23
Wage gap between occupations, men	0.37	0.36
Hours correlation in couples	0.43	0.45
Wage correlation in couples	0.02	0.04
Median wage	2.83	2.84

Moments are based on IPUMS-CPS data (1976-2015) from Erosa et al. (2022)

Calibration: Parameters

Parameter	Label	Value
μ_{a1}	Mean ability occ 1	0.4
μ_2	Mean ability occ 2	0.01
μ_ϕ	Mean disutility of labour	1.4
σ_{a1}	Var ability occ 1	0.406
σ_{a2}	Var ability occ 2	0.206
σ_ϕ	Mean ability occ 2	1.068
ρ_{a12}	Corr. ability in occ 1/2	0.035
ρ_{afm}	Corr. ability partners	0.083
ρ_ϕ	Corr. disutility of labour	0.902

Policy experiments

- We consider two main policy experiments
- **Experiment 1:** Introducing individual taxation relative to current US system of income aggregation
- This replaces the budget constraint by

$$c_f + c_m = y_f + y_m - T(y_f) - T(y_m)$$

- **Experiment 2:** Replace current system by flat tax schedule
- Both reforms is revenue-neutral (τ_1 adjusted to keep budget constant)

Main Results 1: Aggregate Outcomes by Gender

Variable	Baseline	Individual Taxation	Flat Tax
Panel A. Women			
Share in occupation 1 (in %)	58.5	+0.7pp	+0.5pp
Annual hours	1909.32	+1.48%	+3.25%
Hourly wage (in $)	19.49	+0.44%	+1.17%
Wage inequality	0.29	-3.15%	-0.47%
Panel B. Men			
Share in occupation 1 (in %)	60.8	+0.1pp	+0.4pp
Annual hours	2390.34	+0.03%	+2.15%
Hourly wage (in $)	21.47	-0.05%	+0.51%
Wage inequality	0.29	-0.83%	-0.31%

Main Results 1: Decomposition of mechanisms

- Recall that decision for woman to work in occupation 1 can be written as:

$$\underbrace{2u(c_1^*) - 2u(c_2^*)}_{\text{Consumption gain}} > \underbrace{d^f(h_1^{f*}) - d^f(h_2^{f*})}_{\text{Leisure cost}} + \underbrace{d^m(h_1^{m*}) - d^m(h_2^{m*})}_{\text{Leisure gain of partner}}$$

- To understand how the tax reforms affect occupational choice, we perform an exercise where we assume that only some of these components change

- For example, what fraction of women would work in occupation 1 if the tax reform only changes the consumption gain, while the leisure components stay identical?

Main Results 1: Decomposition of mechanisms

Label	Individual Taxation	Flat Tax
Panel A. Implied changes in women's occupational choice		
Baseline	58.5	58.5
Change in consumption gain only (in pp)	1.9	1.5
+ Change in leisure cost (in pp)	0.6	0.3
+ Change in partner leisure cost (in pp)	0.7	0.5
Panel B. Further breakdown of change in consumption gain		
Change in cons. gain due to tax only (in pp)	0.7	0.4
Change in cons. gain due to hours (in pp)	1.2	0.8

Wages and the Elasticity of Taxable Income

- To study how much endogenous wages matter quantitatively, we perform the following exercise
- Suppose each individual has values (w_i^0, h_i^0, y_i^0) in the baseline simulation and (w_i^1, h_i^1, y_i^1) in the simulation of the tax reform
- Here, income y_i^k Is defined as $y_i^k = w_i^k h_i^0$
- Then, we construct hypothetical data where we use the **new** work hours but the **old** wages: $(w_i^0, h_i^1, \tilde{y}_i^1)$ (earnings need to be recomputed)
- Using the simulated data, we recompute aggregate statistics
- Interpretation: Are the wage adjustments quantitatively significant?

Main Result 2: Wages and the Elasticity of Taxable Income

Label	Household Income	Income (Women)	Income (Men)
Panel A. Individual Taxation			
Value in baseline (in $1000)	93.89	40.51	53.38
Change in experiment (in pp)	0.18	0.87	-0.34
Fraction of change due to wage changes (in %)	50.44	32.71	15.71
Fraction of change due to occupation changes (in %)	5.56	4.6	0.0
Panel B. Flat Tax			
Value in baseline (in $1000)	93.89	40.51	53.38
Change in experiment (in pp)	3.18	4.04	2.52
Fraction of change due to wage changes (in %)	21.78	25.54	17.2
Fraction of change due to occupation changes (in %)	0.94	0.99	0.79

Main Result 3: Taxation and Gender Gaps

Variable	Baseline	Individual taxation	Flat Tax
Hours gap, non-linear occ (in %)	17.3	-5.09%	-6.59%
Wage gap, non-linear occ (in %)	5.15	-0.97%	-13.2%
Hours gap, linear occ (in %)	39.35	-9.61%	-3.28%
Wage gap, linear occ (in %)	14.32	-8.38%	-3.07%

- Gender wage gaps are partly caused by tax system: for example, introducing individual taxation reduces the wage gap by 8.38%

Conclusion

- We analyse the impacts of household taxation (jointness and progressivity) in a model of occupational choice
- Key findings are that (1) effect of taxation on selection into flexible occupations is relatively small and (2) endogenous wages matter more
- Findings suggest that better understanding the dynamic returns to work hours has important implications for tax policy
- Standard approach with exogenous wages could give misleading predictions