Fertility and Family Labor Supply

WORK IN PROGRESS

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Motivation

Understanding labor supply wage responses is key for policy design.

- **Human capital important** determinant of labour supply
  elasticities (Imai and Keane, 2004; Keane and Wasi, 2016)

- **Fertility likely important for human capital accumulation**
  (e.g. Francesconi, 2002)
    - Market-work less desirable when children are present
    - Labor income tax reforms might affect labor supply *and* fertility
    - Fertility adjustments affect labor market responses to tax
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- Existing research tend to focus on labor supply of **either men or women**.
    - Many working-age individuals live in **couples**

Research Agenda and Preliminary Results

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   - Fertility (endogenous number and timing)
   - Wealth accumulation

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   - labor supply and human capital accumulation of both household members
   - Fertility (endogenous number and timing)
   - Wealth accumulation
   - Simulations suggest that fertility adjustments to wage-changes are important for understanding labor supply responses

Related Literature (short)

- There is a vast body of literature

- Some main papers are
  - **Human capital accumulation (learning by doing):** Imai and Keane (2004); Keane and Wasi (2016)
  - ***Female* labor supply and fertility:** Hotz and Miller (1988); Francesconi (2002); Adda, Dustmann and Stevens (2017); Eckstein, Keane and Lifshitz (2019)
    (latter has both male and female labor supply. But no savings.)

Outline

Data and Sample Selection

- **Use several Danish registers for 2003–2017**
  - Linking household members (married and cohabitating)
  - Information on income, fertility, wealth etc.

- **Restrict attention to individuals who are**
  - not registered as mainly self-employed or students
  - aged 25–40 in 2007 and 2008 (for reduced form)

- **Marginal tax rates**
  - Detailed tax simulator: Computing marginal tax rates from small increases in income
  - Compute tax instruments, τ_{it-k}: mechanical tax change induced by tax reforms

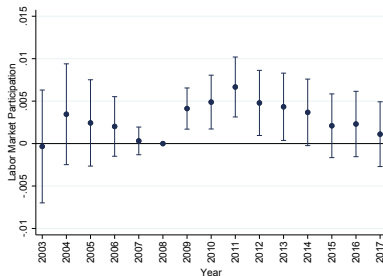# Identification Strategy: Danish 2009/10 Tax Reform
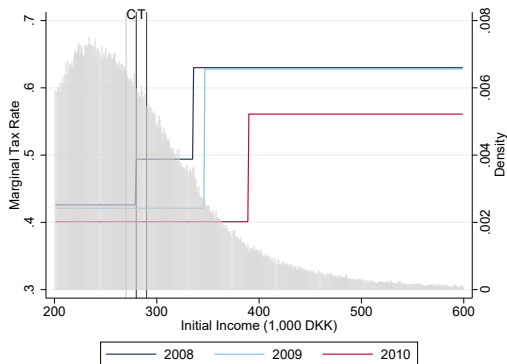
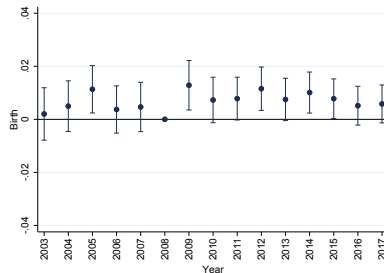Control: $T_i = 0$ if $\bar{Y}_{i,2007:2008} \in [270; 280]$
Treatment: $T_i = 1$ if $\bar{Y}_{i,2007:2008} \in (280; 290]$

- *likely* 6 pp additional reduction in marginal tax rate
  ~14% increase in net-of-tax wage (mechanical)
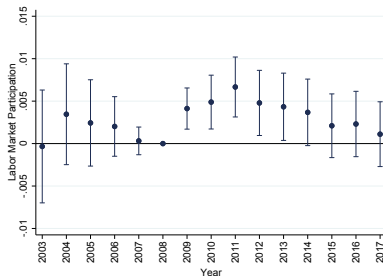
Reduce Form Estimation Results
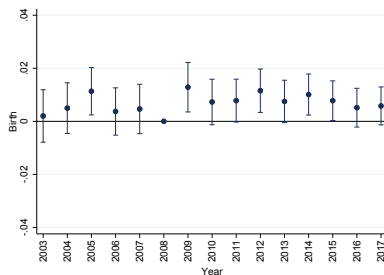

(a) Labour market participation.

(b) Fertility.

Reduce Form Estimation Results

(c) Labour market participation.

(d) Fertility.

- Birth probability is ~1.5 pp higher (baseline is 15%)
  → **wage-elasticity** is thus $10/14 = 0.74$ (95% CI [0.15;1.13])

Outline

States and Controls (couples)

- State variables:
    - $K_{w,t}$: Human capital, women
    - $K_{m,t}$: Human capital, men
    - A_{t-1}: Wealth (end-of-period)
    - n_t: Number of children
    - o_t : Age of youngest child

- Choice variables:
    - C_t: Consumption
    - e_t : Fertility effort
    - $l_{w,t}$: Labor supply, women
    - $l_{m,t}$: Labor supply, men

Labor Supply

- Endogenous labor supply of men and women, $j \in \{m, w\}$:
  - Not working, $l_{j,t} = 0$
  - Part time, $l_{j,t} = 0.75$
  - Full time, $l_{j,t} = 1$

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- Human capital accumulation

$$K_{j,t+1} = [(1-\delta)K_{j,t} + l_{j,t}]\epsilon_{j,t+1}$$

where $\epsilon_{j,t+1}$ is an iid log-normal mean-one shock.

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- Labor income is

$$Y_{j,t} = w_{j,t}l_{j,t}$$

  where wages are

$$\log w_{j,t} = \gamma_{j,0} + \gamma_{j,1}K_{j,t}$$

Fertility

- Couples chose **fertility effort**, $e_t \in \{0, 1\}$ each period
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Fertility

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- Imperfect control
  Childbirth next period with probability

$$\wp_t(e_t) = \begin{cases} \overline{\wp}_t & \text{if } e_t = 1 \\ \overline{\wp}_t \underline{\wp} & \text{else} \end{cases}$$

  $\overline{\wp}_t < 1$: biological fecundity (declining in age)
  $\underline{\wp} > 0$: unintended pregnancies

- Children move out stochastically

Institutional environment

- Partnership dissolution is random and absorbing
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- Parsimonious versions of the Danish institutions (2010 rules)
    - Labor income tax system
    - Unemployment transfers [fixed amount in model]
    - Child care costs
    - Child benefits
    - Parental leave benefits [mother takes all in model]

Preferences

- Household preferences are (unitarian)

$$U(C_t, n_t, o_t, l_{w,t}, l_{m,t}) = \lambda u_w(\cdot) + (1 - \lambda) u_m(\cdot)$$

- Individual preferences are

$$
\begin{aligned}
u_j(C_t, n_t, o_t, l_{j,t}) = {} & \frac{(C_t / \nu(n_t))^{1-\rho}}{1 - \rho} \\
& + \sum_{i=1}^{\overline{n}} \omega_i \mathbf{1}(n_t \geq i) \\
& + q(l_{j,t}, n_t, o_t)
\end{aligned}
$$

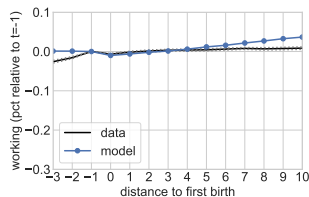with flexible interaction between labor supply and children in $q()$.

Estimation: two steps

1. **Calibrate** a set of parameters, γ. E.g.
   $\beta = 0.97$ and $\rho = 1.5$
   - Investigate the **sensitivity** to calibrated parameters
     (Jørgensen, forthcoming)

2. **Estimate** the remaining parameters, θ. E.g.
   value of children, $\omega_1, \omega_2, \omega_3$ and value of leisure, $q(\cdot)$
   - Simulated Method of Moments, using data from 2010
     (post-reform)
   - Investigate the "**informativeness**" of estimation moments
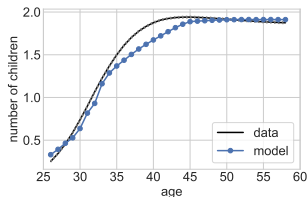   (Honoré, Jørgensen and de Paula, 2020)

Model Fit [selected]
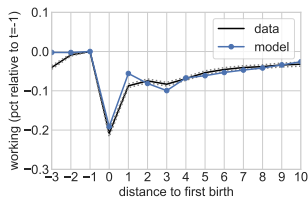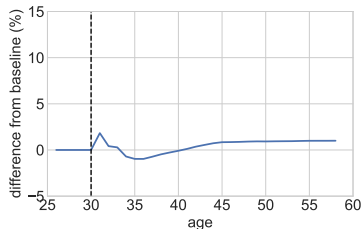

(e) Share Working, Women.   (f) Share Working, Men.

(g) Number of Children.

Model Validation [selected]

- Unanticipated 5% permanent wage increase, women at age 30

(h) Number of children.

- In line with our own reduced form results
  - Immediate increase in the probability of birth of ~5% and thus elasticity of around ~1
  - only minor effects on completed fertility

Importance of Fertility for Labor Supply

We simulate 2 versions of the model:

1. **baseline**, with endogenous fertility
2. **exogenous fertility**, where couples cannot choose fertility
   - expect children to arrive probabilistically
     based on realized fertility from the baseline model
   - The realized fertility (when simulating) is fixed at the baseline
     simulation
     $\rightarrow$ Exactly the same realized fertility in the two models

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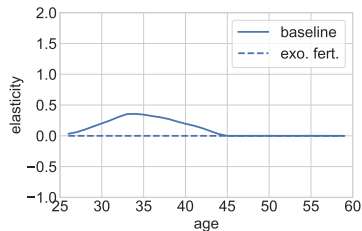 $\rightarrow$ Exactly the same realized fertility in the two models

Introduce a 5% permanent (unanticipated) increase in women's
wage rate *in both models*.

- Compare elasticities of
  - average life-cycle working hours
  - completed fertility (number of children at age 50)

Importance of Fertility for Labor Supply [**preliminary**]
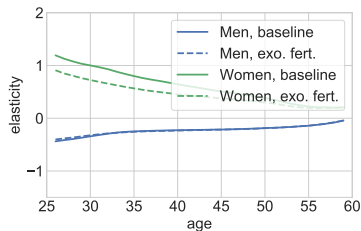
(i) Hours.   (j) Number of children.

- Fertility responses clearly interacts with labor responses
  - Fertility increases, leading to **increased** labor supply responses
  - Driven partly by the **intensive** margin (more children) in the model

Summary

- Fertility and labor supply are inherently interlinked

- Part of wider agenda to model interactions between family choices and labor market choices

- Currently estimating an extended model and checking reduced-form results

All comments, suggestions, relevant literature are very welcome!

You can send me an email at **tjo@econ.ku.dk** and we can **skype**/**zoom**!

References I

ADDA, J., C. DUSTMANN AND K. STEVENS (2017): "The Career Costs of Children," *Journal of Political Economy*, 125(2), 293–337.

ECKSTEIN, Z., M. KEANE AND O. LIFSHITZ (2019): "Career and Family Decisions: Cohorts Born 1935-1975," *Econometrica*, 87, 217–253.

FRANCESCONI, M. (2002): "A Joint Dynamic Model of Fertility and Work of Married Women," *Journal of Labor Economics*, 20(2).

HONORÉ, B. E., T. H. JØRGENSEN AND A. DE PAULA (2020): "The Informativeness of Estimation Moments," *Journal of Applied Econometrics*, 35(7), 797–813.

References II

HOTZ, V. J. AND R. A. MILLER (1988): "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply," *Econometrica*, 56(1), 91–118.

IMAI, S. AND M. P. KEANE (2004): "Intertemporal Labor Supply and Human Capital Accumulation," *International Economic Review*, 45(2), 601–641.

JØRGENSEN, T. H. (forthcoming): "Sensitivity to Calibrated Parameters," *Review of Economics and Statistics*.

KEANE, M. P. AND N. WASI (2016): "Labour Supply: The Roles of Human Capital and The Extensive Margin," *The Economic Journal*, 126(592), 578–617.