Empirical public economics, part I

Thor O. Thoresen, room 1125, Friday 10-11

Reading

- Thor O. Thoresen & Trine E. Vattø (2015). Validation of the Discrete Choice Labor Supply Model by Methods of the New Tax Responsiveness Literature. Revised version of Discussion Papers no 738, SSB.

Ambition of lecture

- Provide information on
  - Methods to derive information about people's responsiveness to changes in tax
  - The responsiveness of tax-payers in Norway
  - Norwegian institutional setting
    - Norwegian tax system

Three classic criteria for evaluating tax systems

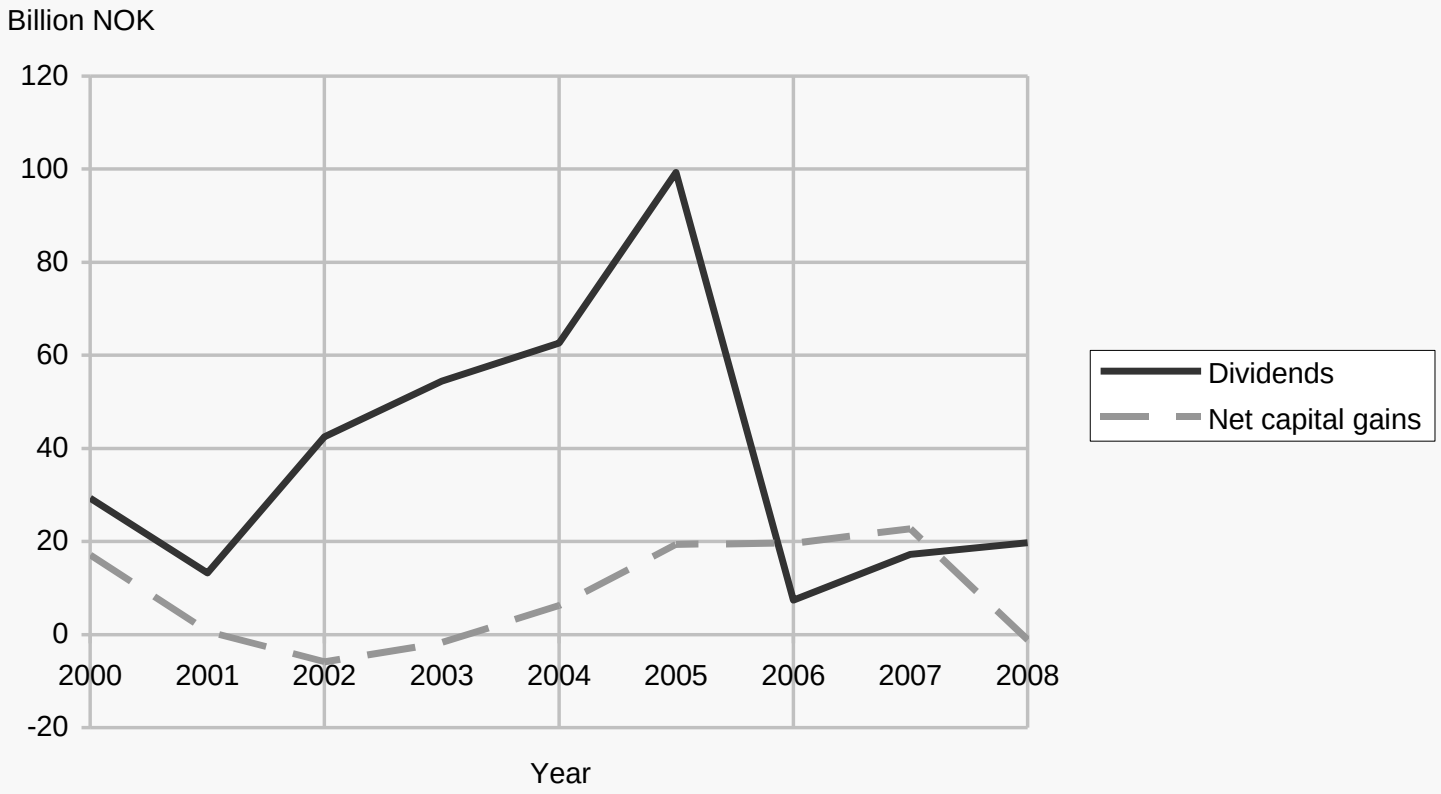
- Efficiency, the focus in this lecture
- Equity, the focus in ”Empirical public economics, part II”
- Simplicity

Joel Slemrod's behavioral hierarchy

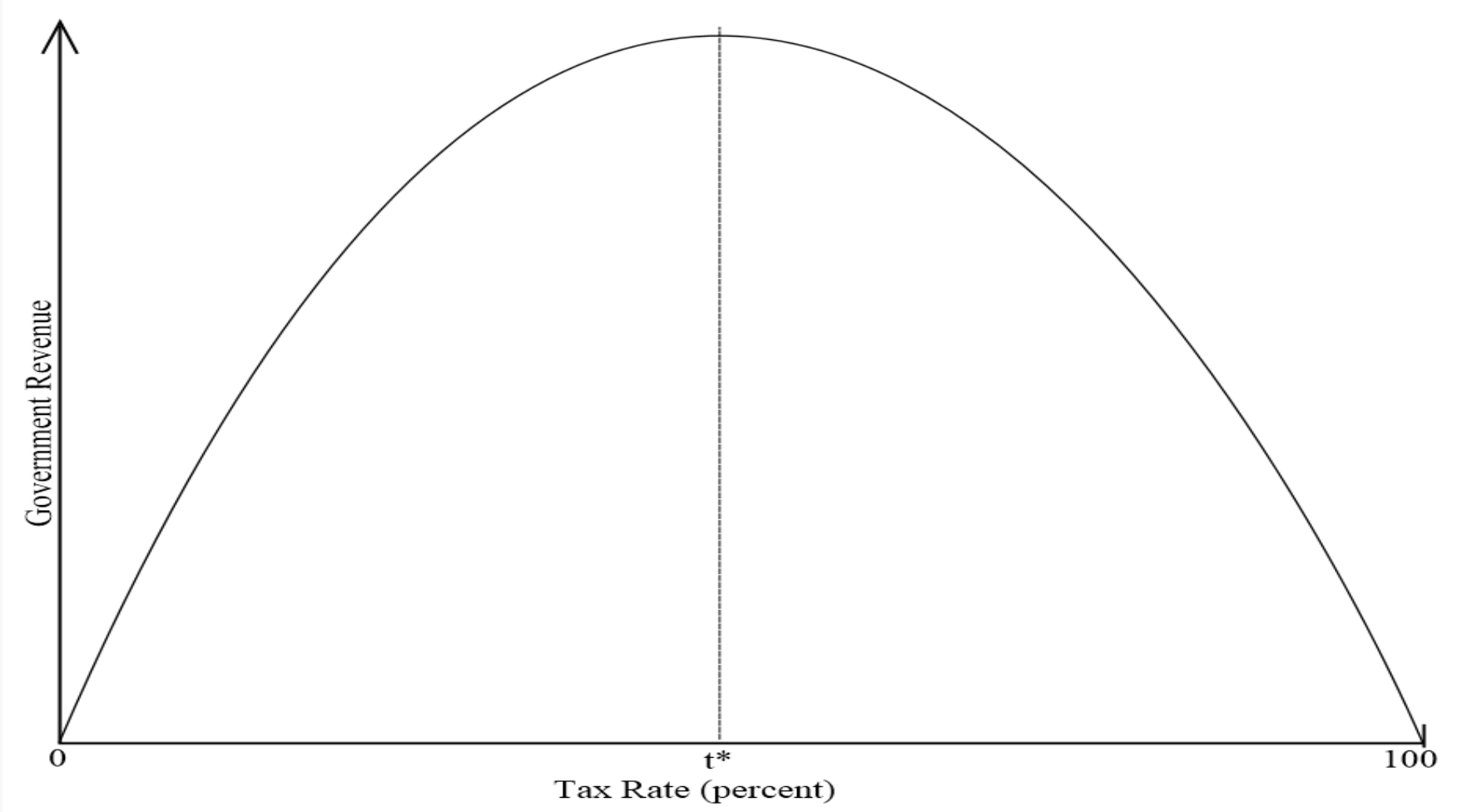
- Effects on labour supply, saving and investments (real effects) are smaller than many other effects
- Timing effects and income shifting effects are larger

Example of timing effect

- Taxation of dividends in 2006



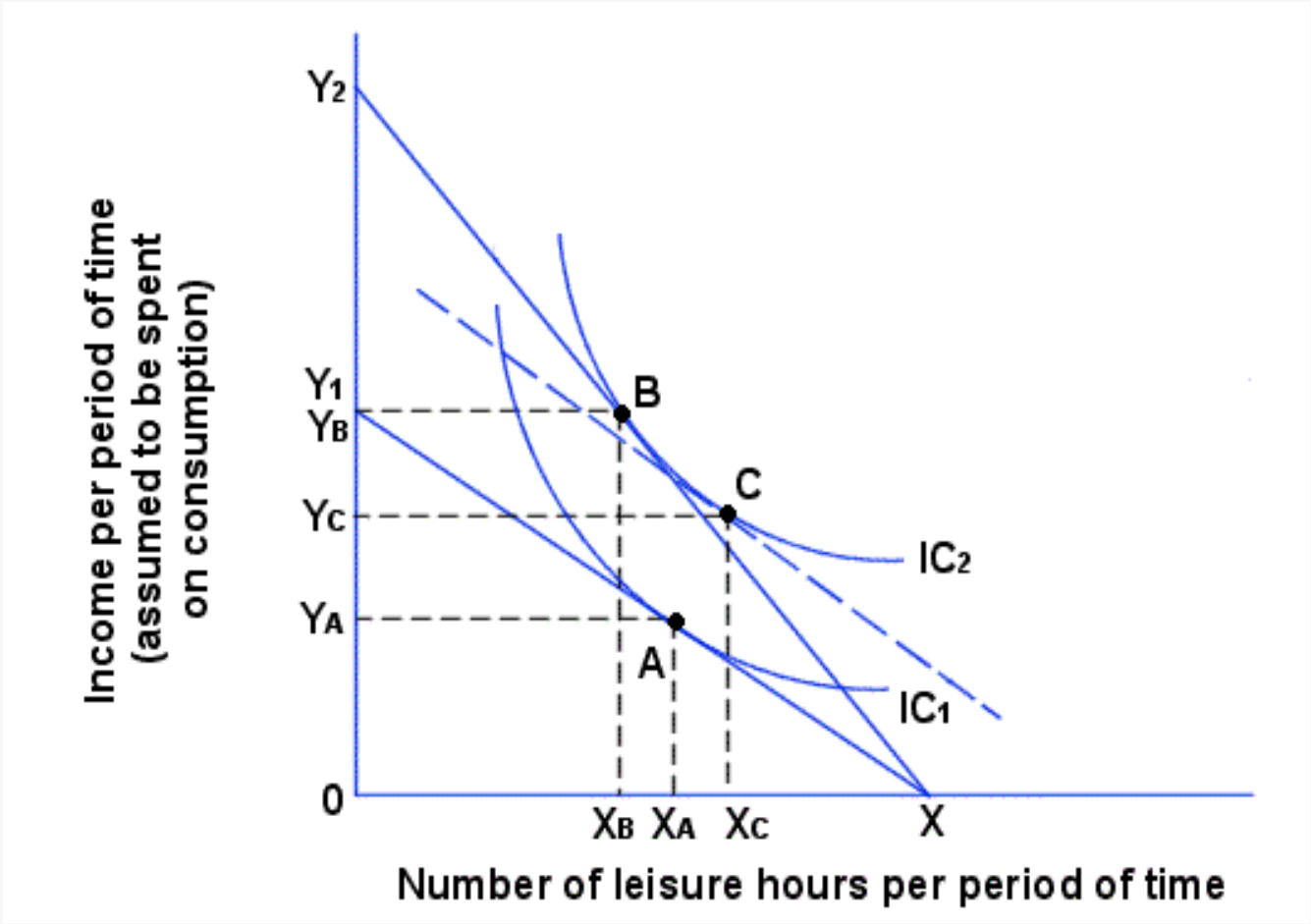
Tax, labor supply and tax revenue: the Laffer curve



Two main approaches to obtain information about responses in the short-run

- Structural approach
  - Estimation of discrete choice labor supply model on cross-sectional data
  - Closely connected to economic theory
  - Useful for simulation of effects of tax changes
- Quasi-experimental approach
  - Using data before and after a reform to obtain information
  - Reduced form estimation

The effect of wage increase



Slutsky equation: uncompensated effect, compensated effect and income effect

$$\eta_{h,w}^{M} = \eta_{h,w}^{H} + \eta_{h,y}$$

$$\eta_{h,w}^{H} = \frac{w}{h}\frac{\partial h^{H}}{\partial w} > 0$$

$$\eta_{h,y} = w\frac{\partial h}{\partial y} \leq 0$$

First approach: utilizing direct observations of income growth over a reform period

- Key concepts
  - Taxable income
  - Net-of-tax rate (1-marginal tax rate)
- Observe income before and after a fundamental change in tax, as a tax reform
- See if the income growth varies according to the change in the net-of-tax rate
- Using methods of the «experimental literature» or the «treatment literature»

Martin Feldstein's analysis of the US tax reform of 1986

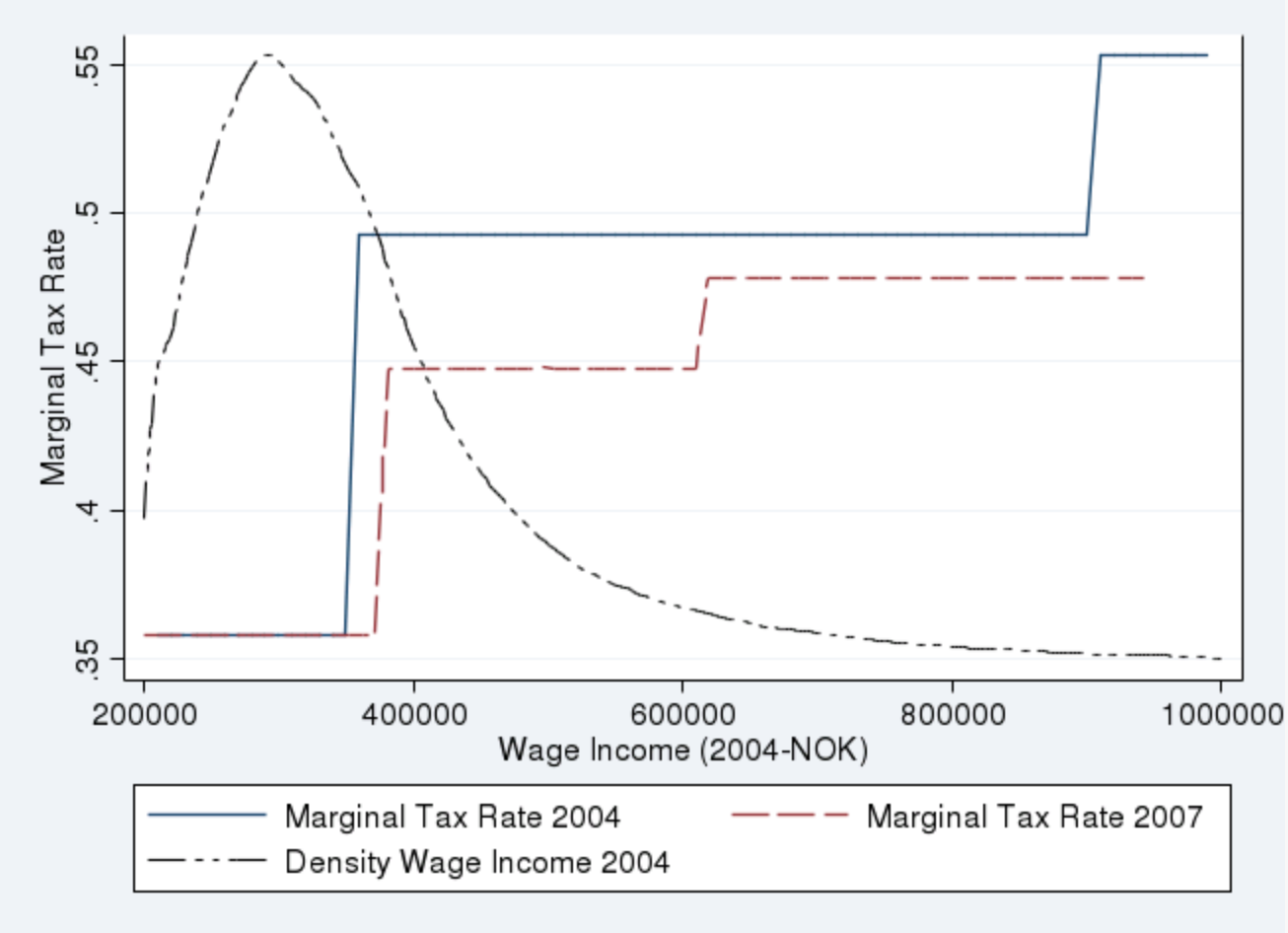
TABLE 2

ESTIMATED ELASTICITIES OF TAXABLE INCOME WITH RESPECT TO NET-OF-TAX RATES

Taxpayer Groups Classified by 1985 Marginal Rate	Net of Tax Rate (1)	Adjusted Taxable Income (2)	Adjusted Taxable Income Plus Gross Loss (3)
	Percentage Changes, 1985–88		
1. Medium (22–38)	12.2	6.2	6.4
2. High (42–45)	25.6	21.0	20.3
3. Highest (49–50)	42.2	71.6	44.8
	Differences of Differences		
4. High minus medium	13.4	14.8	13.9
5. Highest minus high	16.6	50.6	24.5
6. Highest minus medium	30.0	65.4	38.4
	Implied Elasticity Estimates		
7. High minus medium		1.10	1.04
8. Highest minus high		3.05	1.48
9. Highest minus medium		2.14	1.25

NOTE.—The calculations in this table are based on observations for married taxpayers under age 65 who filed joint tax returns for 1985 and 1988 with no age exemption in 1988. Taxpayers who created a subchapter S corporation between 1985 and 1988 are eliminated from the sample.

Thoresen and Vattø (2015) use the Norwegian tax reform of 2006



Using regression analysis for identification of tax elasticity (q=income, τ=tax)

$$\log q_{it} = \kappa_t + \lambda \log(1-\tau_{it}) + \mu_i + \xi_{it}$$

$$\Delta \log q_i = \kappa + \lambda \Delta \log(1-\tau_i) + \Delta \xi_i$$

$$E(\lambda \left| \delta_{it} = 1 \right.) = \frac{1-\tau}{q} \frac{\partial q}{\partial (1-\tau)}$$

$$\log\left(\frac{q_{it+3}}{q_{it}}\right) = \kappa_t + \lambda_1 \log\left(\frac{1-\tau_{it+3}}{1-\tau_{it}}\right) + X_{it}\omega + \xi_{it}$$

A major problem: endogenous tax variables

- Therefore we let the tax variable be calculated by first period income

$$\log\left[(1-\tau_{it+3}(q_{it+3}))/(1-\tau_{it}(q_{it}))\right]$$

$$\log\left[(1-\tau_{it+3}((1+b)q_{it}))/(1-\tau_{it}(q_{it}))\right]$$

Uncompensated or compensated effects?

- Income effect accounted for

$$R_{it} = I_{it} + \left(\tau_{it} q_{it} - \upsilon_{it}(q_{it})\right)$$

Estimates of the net-of-tax rate elasticity

Table 3. Estimates of the net-of-tax rate elasticity for working hours and earned income. 2SLS regression results for all wage earners, standard errors in parentheses

	Net-of-tax rate elastictity, working hours	Net-of-tax rate elastictity, earned income
No controls	0.0214***	-0.1878***
	(0.0025)	(0.0028)
Add socioeconomic characteristics	-0.0017	-0.0090***
	(0.0025)	(0.0020)
Add log base year hours/income	0.0481***	0.0221***
	(0.0024)	(0.0020)
Add polynomial of base year hours/income	0.0380***	0.0548***
	(0.0024)	(0.0022)
Number of observations	2,353,603	

Note: Socioeconomic characteristics include gender, wealth, age, age squared, married, number of children under and above the age of 6, newborn, residence in Oslo/ densely populated area, non-western origin, years of education and 9 dummies for field of education. Linear or polynomial control for base year working hours/labor income is included to account for mean reversion. All regressions include year dummies.

Responses of different population groups

Table 4. Estimates of the net-of-tax rate elasticity for working hours and earned income. 2SLS regression results for groups of wage earners

	Working hours		Earned income		
	Net-of-tax rate elastictity	Std error	Net-of-tax rate elastictity	Std error	Number of observations
Single females	0.0324***	(0.0059)	0.0204***	(0.0051)	353,905
Single males	0.0227***	(0.0055)	0.0392***	(0.0054)	450,519
Females, couple	0.0514***	(0.0046)	0.0312***	(0.0045)	680,881
Males, couple	0.0160***	(0.0037)	0.0525***	(0.0034)	1,162,743

Note: All regressions include control variables for wealth, age, age squared, married, number of children under and above the age of 6, newborn, residence in Oslo/ densely populated area, non-western origin, years of education, 9 dummies for field of education and year dummies. Polynomials of base year working hours or labor income respectively are used as control for mean reversion.

Comparison to what others find

- Kleven and Schultz (2011), wage earners, Denmark: 0.05
- Saez, Slemrod and Giertz (2013), US estimates for taxable income after Feldstein (1995): 0.12-0.40

But note

- ”Local” measure, i.e. it follows from the experiment under consideration
- Results for the intensive margin only
- Partial effects
- Short-term effects

Second approach to obtain information on tax responsivenes

- Estimation of a discrete choice labor supply model
- Measures of responses derived by model simulations

Discrete choice – a powerful tool in practical work

- Daniel McFadden on BART
  - The official forecast was that 15 percent would use the new train system
  - McFadden used discrete choice techniques and suggested 6.3 percent
  - Actual outcome was 6.2
- Arthur van Soest (1995) shows how a discrete choice labor supply model can be developed
- Idiosyncratic discrete choice labor supply model developed by John Dagsvik and colleagues at Statistics Norway
  - Used in the model system LOTTE of SSB, which is heavily used by Norwegian policy-makers

Labor supply modeling before the discrete choice approach

- Empirically challenging to handle taxes
- Hausman model
  - Approach to account for complicated budget sets
  - Practically cumbersome

Key ingredients of the discrete choice labor supply approach

- Representation of the choice close to economic theory
- A random utility representation of the decision model
- Finite number of choice alternatives: discrete approach
- The utility depends on characteristics of the alternatives – McFadden's conditional logit model

The structural choice model: preferences and the budget constraint

$$U(C,h) = v(C,h) + \varepsilon(C,h)$$

$$C = wh + I + f(wh, I)$$

The discrete choice

- Individuals maximize by finding the alternative with highest utility (no use of ”marginal” optimization)
- Only differences in utility matter
- Limited number of alternatives,
  - Different working hours can for example be seen as

$$h_w \in \langle 0-5, 5-10, 10-15, \ldots, 45-50, 50+ \rangle$$

McFadden's conditional logit model, extreme value (type III) distributed error term

$$U(C,h) = v(C,h) + \varepsilon(C,h)$$

$$P(h) = \frac{\exp v(f(hw, I), h)}{\exp v(f(hw, I), 0) + \sum_{h \in D} \exp v(f(hw, I), h)}$$

Further specification of the utility function in the estimation

- The specification of the utility function, for example a Box-Cox specification can be used

$$v(C,h) = \alpha_0 \frac{\left(C - C_0\right)^{\alpha_1} - 1}{\alpha_1} + (\beta_0 + \gamma X)\frac{\left(\bar{h} - h\right)^{\beta_1} - 1}{\beta_1}$$

Model can be estimated by cross-sectional data

- Maximum likelihood estimation
- Practical estimation issues
  - Wage equation using Heckman's two stage
  - Tax-benefit model useful to describe consumption (post-tax income) in different alternatives

Table A.4. Estimation results for the discrete choice labor supply model. Females and males in couple

		Females in couple		Males in couple	
		Coefficient	Std error	Coefficient	Std error
Consumption					
Constant (Scale 10^{-4})	α_0	0.6580***	(0.0071)	0.6728***	(0.0144)
Exponent	α_1	0.9248***	(0.0027)	0.5973***	(0.0073)
Leisure					
Age	γ_1	-0.7688***	(0.0286)	-0.0237***	(0.0058)
Age squared	γ_2	0.1061***	(0.0034)	0.0040***	(0.0008)
# Children under 6 years	γ_3	0.1274***	(0.0045)	0.0007	(0.0006)
# Children above 6 years	γ_4	0.0271***	(0.0030)	-0.0033***	(0.0007)
Constant (Scale 1/80)	β_0	2.8846***	(0.0786)	0.1103***	(0.0197)
Exponent	β_1	-2.9177***	(0.0294)	-3.6858***	(0.1252)
Alternative specific constants					
Non-participation	f_1	0.4954***	(0.0107)	0.2960***	(0.0266)
Full-time	f_4/f_3	0.6419***	(0.0061)	1.5241***	(0.0081)
Number of Observations		356,615		305,722	

Note: *significant at 0.10 level, ** significant at 0.05 level, ***significant at 0.01 level

Model evaluation: use the model to replicate actual distributions

Uncompensated elasticities: effect on hours of work from change in (gross) wage

Table 5. Wage elasticity estimates derived from simulation of labor supply model, standard errors in parentheses

	Total wage elasticity	Extensive margin wage elasticity	Intensive margin wage elasticity
Single females	0.40 (0.0019)	0.22 (0.0066)	0.17 (0.0055)
Single males	0.29 (0.0089)	0.25 (0.0073)	0.05 (0.0023)
Females in couple	0.46 (0.0182)	0.22 (0.0181)	0.24 (0.0002)
Males in couple	0.06 (0.0264)	0.03 (0.0187)	0.03 (0.0128)

Note: Standard errors obtained by non-parametric bootstrapping, 30 repetitions.

Comparable net-of-tax rate elasticities from the two approaches

Table 8. Comparison of net-of-tax rate elasticity estimates obtained from labor supply model simulations and the NTR approach for working hours and earned income. Standard errors in parentheses

	Discrete choice labor supply model simulations, working hours	Panel data information	
		Working hours	Earned income
Single females	0.018 (0.0005)	0.032 (0.0037)	0.020 (0.0051)
Single males	0.062 (0.0027)	0.023 (0.0055)	0.039 (0.0054)
Females in couple	0.026 (0.0001)	0.051 (0.0046)	0.031 (0.0045)
Males in couple	0.015 (0.0005)	0.016 (0.0059)	0.053 (0.0034)
Weighted average	0.026 (0.0012)	0.028 (0.0053)	0.041 (0.0043)

Note: The weighted averages are calculated by accounting for the number of observations in each group. Standard errors are obtained by using the so-called delta method.

Extensive and intensive margins and decision-making within the family

- Extensive margin
  - Reservation wage concept
- Family model
  - Harmony model vs bargaining

Responsiveness of couples, LOTTE-Arbeid of SSB, extensive and intensive margins

	Female				Male			
	Base Value	Own Wage Elasticity	Cross Wage Elasticity	Elasticity w.r.t. Both Wage Rates	Base Value	Own Wage Elasticity	Cross Wage Elasticity	Elasticity w.r.t. Both Wage Rates
Probability of Working								
Whole sample	0.89	0.333	-0.141	0.223				
Lowest decile	0.87	0.420	-0.181	0.276				
2nd to 8th decile	0.90	0.332	-0.141	0.223				
Highest decile	0.92	0.249	-0.090	0.174				
Mean Hours of Work, Conditional on Working								
Whole sample	1601	0.279	-0.086	0.197	2015	0.077	-0.015	0.063
Lowest decile	1581	0.289	-0.089	0.205	2002	0.067	-0.015	0.053
2nd to 8th decile	1602	0.279	-0.087	0.196	2015	0.077	-0.015	0.063
Highest decile	1618	0.272	-0.083	0.193	2030	0.090	-0.014	0.076
Unconditional Mean Hours of Work								
Whole sample	1444	0.612	-0.228	0.418				

Summary

- Tax responses in working hours and income are moderate in Norway
- The evidence indicate that they have been have become smaller over time
- Are models too simple?
  - Complicated decision process which is difficult to handle empirically
- What about institutional factors?
- Other margins may be more responsive (?)
  - Saving
  - Income shifting
  - Tax evasion