Labour Supply Responses and the Extensive Margin: The US, UK and France

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Extensive and Intensive Margins of Labor Supply

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Our analysis finds that neither margin dominates in explaining changes in total hours worked.

- the relative importance of the extensive and intensive margin is shown to differ systematically by age, gender and family composition.
Fig 1.A Mean annual hours per individual aged 16 to 74
Fig 1.B. Employment rate (per population) aged 16 to 74
Fig 1.C. Mean annual hours per worker aged 16 to 74

[Graph showing mean annual hours per worker for UK, FR, and US from 1968 to 2008]
Fig 2.A. Male total hours by age 1977
Fig 2.B. Male total hours by age 2007
Fig 3.A. Male employment by age 1977
Fig 3.B. Male employment by age 2007
Fig 5.B. Female employment by age 2007
Elasticities at the Intensive and Extensive Margin

We consider intertemporal preferences represented by

\[ U = \begin{cases} 
    \lambda R(h) - \frac{h^{1+1/\alpha}}{1 + 1/\alpha} - \beta & \text{if } h > 0 \\
    \lambda s & \text{if } h = 0,
\end{cases} \]

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- \( \alpha \) is the Frisch elasticity of labor supply with respect to the net marginal wage rate.

The distribution of heterogeneity is described through the conditional distribution of fixed costs \( \beta \) given \((\alpha, \lambda, w)\), \( F(\beta|\alpha, \lambda, w) \), and the marginal pdf of \((\alpha, \lambda, w)\), \( g(\alpha, \lambda, w) \).
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\[
\tilde{H} = \int_{w} \int_{\alpha} \int_{\lambda} p(\alpha, \lambda, w) h(\alpha, \lambda, w) d\alpha d\lambda dw,
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\tilde{H} = \int_w \int_\alpha \int_\lambda p() h() g(\alpha, \lambda, w) d\alpha d\lambda dw,
$$

so that the 'aggregate' hours elasticity is given by

$$
\varepsilon = \frac{1}{\tilde{H}} \int_w \int_\alpha \int_\lambda p() h() [\varepsilon_I(\alpha, \lambda, w) + \varepsilon_E(\alpha, \lambda, w)] g(\alpha, \lambda, w) d\alpha d\lambda dw.
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- elasticities are weighted by the share of type $(\alpha, \lambda, w)$ labor supply in the aggregate.
Decomposing Changes in Hours Worked

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Suppose there are $j = 1, ..., J$ broad categories, $H_t$ is computed in any year $t$ as an average of the category hours $H_{jt}$ with weights equal to the population shares $q_{jt}$

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$$H_t = \sum_{j=1}^{J} q_{jt} H_{jt}.$$

- where each $H_{jt}$ can be expressed as the product of hours per worker $h_{jt}$ and participation in the labour market $p_{jt}$

$$H_{jt} = p_{jt} h_{jt}.$$
We develop a simple decomposition:

\[ \Delta_{jt} = q_j, t-1 [H_{jt} - H_{j, t-1}] \]

The total change across all \( J \) categories of workers is then

\[ \Delta_t = J \sum_{j=1}^{J} \Delta_{jt} \]

and, by construction, we have

\[ H_{t} - H_{t-1} = S_t + \Delta_t \]

where \( S_t \) measures the change in the composition of the population:

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- We measure the change due to the behavior of category $j$, holding the population structure constant as in date $t-1$, as in a Laspeyres index

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<th>Year</th>
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<td></td>
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<td>FR</td>
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<td>1402</td>
<td>871</td>
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<td>627</td>
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- Evolution of total \(\Delta\) differs: -195 for FR, -118 for UK, +165 for US.
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- Evolution of total ∆ differs: -195 for FR, -118 for UK, +165 for US.
- Composition $S$: +10 for FR, +25 for UK, +46 for US, see Figure 6..
Fig 6. Decomposing the change in total hours (1977-2007)
We decompose the change in total hours for the $j$ type $\Delta_j$, into the sum of an intensive component $I_j = p_{ij}\Delta h_j$ and an extensive component $E_j = h_{Ej}\Delta p_j$. 
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Assuming the fraction $p_I j$ is in the interval $[p_j, t_{-1}, p_j t]$, we get the intensive bounds:

$$I_j \text{ belongs to the interval } [p_j, t_{-1}(h_j t - h_j, t_{-1}), p_j, t(h_j t - h_j, t_{-1})].$$
We decompose the change in total hours for the $j$ type $\Delta_j$, into the sum of an intensive component $I_j = p_{lj} \Delta h_j$ and an extensive component $E_j = h_{Ej} \Delta p_j$.

Assuming the fraction $p_{lj}$ is in the interval $[p_{jt-1}, p_{jt}]$, we get the intensive bounds:

$I_j$ belongs to the interval $[p_{jt-1}(h_{jt} - h_{j,t-1}), p_{jt}(h_{jt} - h_{j,t-1})]$.

From the identity $\Delta_{jt} = I_j + E_j$, the extensive bounds are given by

$E_j$ belongs to the interval $[h_{j,t-1}(p_{jt} - p_{j,t-1}), h_{j,t}(p_{jt} - p_{j,t-1})]$. 
At the limits, the change in total hours for any category satisfies two polar exact statistical decompositions:

\[ \Delta_{jt} = q_{j,t-1} \{ [h_{jt} - h_{jt-1}]p_{jt} + [p_{jt} - p_{jt-1}]h_{jt-1} \} \quad (1) \]

or

\[ \Delta_{jt} = q_{j,t-1} \{ [h_{jt} - h_{jt-1}]p_{jt-1} + [p_{jt} - p_{jt-1}]h_{jt} \} \quad (2) \]
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The first term on the right hand side of both expressions is the intensive margin, weighted in (1) with the final participation rate (as in a Paasche index) and in (2) with the initial participation rate (as in a Laspeyres index).
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The second term is the extensive margin (Laspeyres in (1), Paasche in (2)).
Table 2. Decomposing the changes at the extensive and intensive margins by age and gender (1977-2007)

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<td>E-L, E-P</td>
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- We allow for general fixed costs of work and heterogeneity in preferences for work.
- We highlight differences between the extensive and intensive margins and draw implications for the aggregate hours elasticity.
Finally, we illustrate the way we use this micro-data analysis to recover the distribution of labour supply elasticities that is consistent with the decomposition in Table 2.

Use UK FES - consistent series on marginal taxes, incomes, hours of work, wages and consumption for a representative sample of households since 1978.

We allow for general fixed costs of work and heterogeneity in preferences for work.

We highlight differences between the extensive and intensive margins and draw implications for the aggregate hours elasticity.

There have been distinct changes in participation and effective marginal tax rates over this period.
Fig 7.A Changes in the participation tax rate in the UK

![Graph showing changes in participation tax rate](image)
Fig 7.B Changes in the marginal tax rate in the UK

![Graph showing changes in the marginal tax rate in the UK](image-url)
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Recover Marshallian elasticities for within period utilities - Frisch elasticities are also be estimated.
Estimating the Elasticity Decomposition

- The labour supply specification and approach to identification follows closely that in Blundell, Duncan and Meghir (Ecta, 1998).
- Use the large changes in relative growth in after tax wages and other incomes across different education, age and gender groups over the years 1978, 1987 1997 and 2007 to identify the distribution of wage and income elasticities.
- Recover Marshallian elasticities for within period utilities - Frisch elasticities are also be estimated.
- The extensive margin is a structural normal binary response model which allows for general unobserved fixed costs of work as well as a set of demographic and education characteristics.
Aggregate responses and elasticities at the intensive and extensive margins

- Elasticities at the extensive margin are larger than at the intensive margin and elasticities for women at both margins are larger than those for men - key determinant of these differences across gender is the age composition of children in the family.

Median intensive elasticity ranges between .09 and .23. (Frisch elasticities are somewhat larger.) Median extensive elasticity for women is .34, for men is .25. Aggregate hours elasticity lies in the range .3 to .44 (using the empirical distribution of wages and estimated unobserved heterogeneity).

Little evidence of instability of preferences over time, given demographics and composition.
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Fig 8.A Intensive elasticity estimates: UK men and women, age 30-54
Fig 8.B Extensive elasticity estimates: UK men and women, age 30-54
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We have shown that the extensive and intensive margins both matter in explaining changes in total hours.

We have estimated the total hours elasticity from the distribution of micro elasticities at the extensive and intensive margins.