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

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January 2011
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This paper makes three contributions:

1. develop consistent micro-data for an aggregation analysis of three key countries - the US, the UK and France - over the past 30 years
2. provide a detailed decomposition of the evolution of total hours of work into changes at the extensive and intensive margin
3. recover elasticities at the intensive and extensive margin and explore the implications for measurement of aggregate hours elasticity
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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
Fig 2.A. Male total hours by age 1977
Fig 3.A. Male employment by age 1977
Fig 3.B. Male employment by age 2007
Fig 4.A. Female total hours by age 1977
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Fig 5.A. Female employment by age 1977

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Fig 5.B. Female employment by age 2007

[Graph showing female employment by age for different countries]
Decomposing Changes in Hours Worked

- Suppose there are \( j = 1, \ldots, J \) broad types
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\( H_t \) is computed in any year \( t \) as an average of hours \( H_{jt} \) with weights equal to the population shares \( q_{jt} \):

\[
H_t = \sum_{j=1}^{J} q_{jt} H_{jt}
\]
Decomposing Changes in Hours Worked

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- $H_t$ is computed in any year $t$ as an average of hours $H_{jt}$ with weights equal to the population shares $q_{jt}$

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

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

$$H_{jt} = p_{jt} h_{jt}.$$
De-Wosing Changes in Hours Worked

We develop a simple decomposition:

- 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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\Delta_{jt} = q_{j,t-1}[H_{jt} - H_{j,t-1}].
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H_t - H_{t-1} = S_t + \Delta_t
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- where $S_t$ measures the change in the composition of the population:

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S_t = \sum_{j=1}^{J} H_{jt}[q_{jt} - q_{j,t-1}].
$$
### Table 1 Decomposing the change in total hours, 1977-2007

<table>
<thead>
<tr>
<th>Year</th>
<th>Youth (16-29)</th>
<th>Prime aged (30-54)</th>
<th>Old (55-74)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>FR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>1402</td>
<td>871</td>
<td>2010</td>
</tr>
<tr>
<td>2007</td>
<td>858</td>
<td>627</td>
<td>1639</td>
</tr>
<tr>
<td>$\Delta_j$</td>
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<tr>
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<td>2117</td>
</tr>
<tr>
<td>2007</td>
<td>1219</td>
<td>876</td>
<td>1786</td>
</tr>
<tr>
<td>$\Delta_j$</td>
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<td>US</td>
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<td></td>
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<tr>
<td>1977</td>
<td>1344</td>
<td>835</td>
<td>2018</td>
</tr>
<tr>
<td>2007</td>
<td>1236</td>
<td>956</td>
<td>1922</td>
</tr>
<tr>
<td>$\Delta_j$</td>
<td>-19</td>
<td>22</td>
<td>-19</td>
</tr>
</tbody>
</table>


- Evolution of total $\Delta$ differs: -195 for FR, -118 for UK, +165 for US.
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<td></td>
<td>Men</td>
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<td>Men</td>
</tr>
<tr>
<td>FR</td>
<td>1977</td>
<td>1402 871</td>
<td>2010 951</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>858 627</td>
<td>1639 1116</td>
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<tr>
<td></td>
<td>Δj</td>
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</tr>
<tr>
<td>UK</td>
<td>1977</td>
<td>1707 938</td>
<td>2117 873</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>1219 876</td>
<td>1786 1055</td>
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<tr>
<td></td>
<td>Δj</td>
<td>-71 -9</td>
<td>-70 39</td>
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<tr>
<td>US</td>
<td>1977</td>
<td>1344 835</td>
<td>2018 947</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>1236 956</td>
<td>1922 1373</td>
</tr>
<tr>
<td></td>
<td>Δj</td>
<td>-19 22</td>
<td>-19 90</td>
</tr>
</tbody>
</table>


- Evolution of total Δ 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 $l_j = p_{lj}\Delta h_j$ and an extensive component $E_j = h_{Ej}\Delta p_j$. 
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Assuming the fraction $p_{lj}$ is in the interval $[p_{j,t-1}, p_{jt}]$, we get the intensive bounds:

$$I_j \text{ belongs to the interval } [p_{j,t-1}(h_{jt} - h_{j,t-1}), p_{j,t}(h_{jt} - h_{j,t-1})].$$
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Assuming the fraction $p_{ij}$ is in the interval $[p_{jt}, p_{jt-1}]$, 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 $[h_{j,t-1}(p_{jt} - p_{jt-1}), h_{j,t}(p_{jt} - p_{jt-1})]$.
At the limits, the change in total hours for any type $j$ satisfies two polar exact statistical decompositions:

$$\Delta_{jt} = q_{j,t-1} \left\{ \left[ h_{jt} - h_{jt-1} \right] p_{jt} + \left[ p_{jt} - p_{jt-1} \right] h_{jt-1} \right\}$$  \hspace{1cm} (1)$$

or

$$\Delta_{jt} = q_{j,t-1} \left\{ \left[ h_{jt} - h_{jt-1} \right] p_{jt-1} + \left[ p_{jt} - p_{jt-1} \right] h_{jt} \right\}$$  \hspace{1cm} (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)

<table>
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<tr>
<th></th>
<th>Year</th>
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<td>-82</td>
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<td>[-35, -29]</td>
<td>[14, 17]</td>
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<td>[41, 41]</td>
<td>[-23, -20]</td>
<td>[15, 17]</td>
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<td>Δ</td>
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<td>-9</td>
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<td>-42</td>
<td>10</td>
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<tr>
<td>US</td>
<td>I-P, I-L</td>
<td>[-6, -6]</td>
<td>[1, 1]</td>
<td>[-5, -5]</td>
<td>[14, 19]</td>
<td>[3, 3]</td>
<td>[3, 5]</td>
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<td></td>
<td>E-L, E-P</td>
<td>[-13, -13]</td>
<td>[21, 21]</td>
<td>[-14, -14]</td>
<td>[72, 77]</td>
<td>[3, 3]</td>
<td>[33, 35]</td>
</tr>
<tr>
<td></td>
<td>Δ</td>
<td>-19</td>
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Finally, link up these changes at the extensive and intensive margins to movements in the distribution of taxes, relative wages, demographics and other incomes.

- draw implications for the aggregate hours elasticity.
Aggregation and the Distribution of Elasticities

Consider preferences

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

where $R(h)$ is the disposable income of someone who works $h$ hours, $s$ is income when unemployed, $\lambda$ is the marginal utility of income, $\alpha (T-h)/h$ is the Frisch elasticity, and $\beta$ (unobserved heterogeneity in) fixed costs of work.

The 'aggregate' hours elasticity is given by

$$\varepsilon = \frac{1}{H} \int_w \int_\alpha \int_\lambda p() h() [\varepsilon_I(\alpha, \lambda, w) + \varepsilon_E(\alpha, \lambda, w)] g(\alpha, \lambda, w) d\alpha d\lambda dw.$$
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\]

\( - h(\alpha, \lambda, w) \) hours, \( p(\alpha, \lambda, w) \) proportion of type \((\alpha, \lambda, w)\) workers
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  - there have been distinct changes in participation tax rates and effective marginal tax rates over this period, see Mirrlees Review (IFS, 2010).
  - recover Marshallian elasticities for within period utilities - Frisch elasticities can also estimated using the consumption data.
Fig 8.A Empirical distribution of extensive elasticities: UK men and women, age 30-54
Fig 8.B Empirical distribution of Intensive elasticities: UK men and women, age 30-54
Aggregate responses and elasticities at the intensive and extensive margins

- elasticities for women at both margins are larger than those for men - but the key determinant of these differences across gender is the age composition of children in the family.
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- median intensive elasticity ranges between .09 and .23. Hicksian and Frisch are larger.

- aggregate hours elasticity lies in the range .3 to .44 (using the empirical distribution of the wages and estimated unobserved heterogeneity).
We have proposed a systematic way of decomposing the importance of the extensive and the intensive margins of life-cycle labour supply in explaining the overall movements in aggregate hours of work.
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– Applied this analysis to the evolution of hours of work in the US, the UK and France over the past 30+ years.

– Shown that the extensive and intensive margins both matter in explaining changes in total hours.
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- applied this analysis to the evolution of hours of work in the US, the UK and France over the past 30+ years.
- shown that the extensive and intensive margins both matter in explaining changes in total hours.

developed an approach to estimating the total hours elasticity from the distribution of micro elasticities at the extensive and intensive margins.