Labour Income Dynamics and the Insurance from Taxes, Transfers, and the Family

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Inequality has many dimensions
- individual earnings → joint earnings → income → consumption

Here we explore the links between individual earnings, and individual and family disposable income over the life cycle

Examining the role of taxes and transfers, and spouse’s labour income to smooth/attenuate shocks

Make use of detailed population register (panel) data from Norway

Provide a detailed picture of life-cycle inequality dynamics by following many birth cohorts across their working life-time
An extensive literature has concentrated on assessing the types and levels of income risk (for a review see Meghir and Pistaferri, 2011).

This literature has pointed out three key ingredients of potential significance:

- persistence of shocks
- age and time dependence in the variance of shocks
- heterogeneous age profiles

1. How do these factors vary over the life-cycle and differ across education groups and birth cohorts in Norway?

2. To what extent does the tax and transfer system attenuate these various factors in the evolution of life-cycle inequality in Norway?

3. What happens when we add in income sources of other family members?
WHAT WE FIND

- The nature of labour income dynamics in Norway
  - quite different by skill groups
  - quite different at different points in the life-cycle
  - quite different at different points in time

- The impact of taxes and transfers in Norway
  - remarkable flattening of life-cycle inequality
  - reduces persistence of shocks
  - reduces the variance of transitory and permanent shocks

- The comparison with family income dynamics:
  - spouse’s income seem to matter less for the dynamics of inequality
  - balance between assortative matching and insurance
For each birth cohort we write log-income of individual $i$ of age $a$ as

$$\log Y_{i,a} = \mathbb{X}_{i,a}' \varphi + \alpha_i + \beta_i a + v_{i,a} + \tau_{i,a}$$

- $\mathbb{X}$ includes a polynomial in age and its interaction with education, dummies for region, marital status and family size and the interaction of the latter.
- $\beta_i a$ is an individual-specific linear trend in age, allow for correlation between $\alpha$ and $\beta$.
- $v_{i,a}$ is the persistent process,

$$v_{i,a} = \rho v_{i,a-1} + u_{i,a}$$

where $u_{i,a}$ is a mean-zero shock with variance $\sigma_a^2$.
- $\tau_{i,a}$ is the transitory component assumed to follow an MA(1) process,

$$\tau_{i,a} = \varepsilon_{i,a} + \theta \varepsilon_{i,a-1}$$

where $\varepsilon_{i,a}$ is a mean-zero shock with variance $\omega_a^2$.

We allow variances to vary in an unrestricted way with age and across birth cohorts and education groups. By averaging across cohorts at a given age we account for calendar time effects.
Panel data covering the entire Norwegian population, 1967-2006

- several registry databases linked through unique identifiers for each individual
- include individual demographic information (including gender, date of birth, and marital status) and socioeconomic data (including years of education, market income, cash transfers)
- unique family identifiers allow us to match spouses and parents to their children

Income variables

- *individual market income*: annual pre-tax earnings
- *individual disposable income*: annual earnings and cash transfers net of taxes
- *family disposable income*: pooled disposable income of the spouses adjusted by the square root equivalence scale
Transfer system (including DI benefits, child benefits, etc.)
- Since 1967, key program parameters are fairly stable over time

Tax system (2006): Progressive through deductions and surtaxes
- 7.8% social security contribution on labour income
- (taxable income - deductions) is taxed at a flat rate of 28%
  - single persons/dual earner couples: 50% of standard deductions
  - two surtax brackets adding an additional 9 and 12 percent to the marginal tax rates

- over time, the Norwegian tax system has become less progressive through a series of policy changes
SAMPLE SELECTION

In each year we select

- males born between 1925 and 1964
  - between the ages of 25 and 60
  - non-immigrants and non-self-employed
  - with non-zero earnings

Applying these restrictions gives us an unbalanced panel with

- 40 time periods
- 1,004,294 individuals (25,107 individuals on average per cohort)

This sample is then partitioned into three mutually exclusive groups according to educational levels

- low-skilled (33%): not having completed high school
- medium-skilled (48%): high school degree
- high-skilled (19%): attended college
AGE PROFILES IN INDIVIDUAL EARNINGS

- Low-Skilled: concave profile over the life-cycle.
- Medium-Skilled: very flat for the low-skilled, very steep for the high-skilled early in life.
- High-Skilled: progressive nature of the tax and transfer system dampens the income differentials between high skilled and low skilled after age 35.
AGE PROFILES - VARIANCES OF INDIVIDUAL EARNINGS

- U-shaped profile over the life-cycle
- Remarkable flattening of the increase in the variance of individual log-income due to the tax and transfer system especially for the low-skilled at the end of the life-cycle
AGE PROFILES IN FAMILY EARNINGS

Low-Skilled

Market Income
Disposable Income

Medium-Skilled

Market Income
Disposable Income

High-Skilled

Market Income
Disposable Income
AGE PROFILES - VARIANCES OF FAMILY EARNINGS

Low-Skilled

Medium-Skilled

High-Skilled
## ESTIMATION RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Individual Market Income</th>
<th>Individual Disposable Income</th>
<th>Family Disposable Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>$\rho$</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>(0.000688)</td>
<td>(0.000571)</td>
<td>(0.027814)</td>
</tr>
<tr>
<td>$\sigma^2_{\alpha}$</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma^2_{\beta}$</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
<tr>
<td></td>
<td>(0.768047)</td>
<td>(0.491246)</td>
<td>(0.032024)</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.254247</td>
<td>0.256168</td>
<td>0.316701</td>
</tr>
<tr>
<td></td>
<td>(0.007009)</td>
<td>(0.006322)</td>
<td>(0.010004)</td>
</tr>
</tbody>
</table>

- Taxes and transfers reduce the persistence of shocks; e.g. when $\rho = 0.82$ the effect of an income shock is reduced to 14 percent of its initial value in ten years.
- Persistence only changes little when we go from individual disposable income to family disposable income.
- Some evidence for heterogenous profiles, but not in market income.
VARIANCE OF PERMANENT SHOCKS

Robustness

0 0.05 0.1 0.15 0.2

σ^2

25 30 35 40 45 50 55

age

Individual Market Income Individual Disposable Income

Low-Skilled

U-shaped profile over the life-cycle: importance of non-stationarity in age

quite different across skill groups: large shocks for high-skilled early in life and for low-skilled at the end of the life-cycle

taxes and transfers: flattening of the age profiles; e.g., a permanent shock of one standard deviation implies a 16 (10) percent change in market income (disposable income) for a low-skilled aged 55.

adding spouse’s income: closely mirroring, slightly larger

Medium-Skilled

High-Skilled
VARIANCE OF TRANSITORY SHOCKS

Robustness

- a decreasing and convex profile over the lifetime: importance of non-stationarity in age
- early in life transitory shocks are much larger for the high-skilled than for the low-skilled + a larger MA(1) parameter
- adding spouse’s income: closely mirroring, slightly larger

Low-Skilled

Medium-Skilled

High-Skilled
SUMMARY

- The nature of labour income dynamics in Norway
  - quite different by skill groups
  - quite different at different points in the life-cycle
  - quite different at different points in time

- The impact of taxes and transfers in Norway
  - remarkable flattening of life-cycle inequality
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- The comparison with family income dynamics:
  - spouse’s income matters less for the dynamics of inequality
  - balance between assortative matching and insurance
Let $y_{i,a,t} \equiv \log Y_{i,a,t} - \hat{X}'_{i,a,t} \hat{\phi}_t$ be the residual income of individual $i$ at age $a$ and time $t$.

For a given cohort, the theoretical moments we use is the Covariance matrix of the quasi-difference $(\Delta^\rho y_{i,a} \equiv y_{i,a} - \rho y_{i,a-1})$,

$$
\text{Var}(\Delta^\rho y_i) = ((1 - \rho) \nu, \Delta^\rho a) \left( \begin{array}{cc} \sigma_\alpha^2 & \rho_{\alpha\beta}\sigma_\alpha\sigma_\beta \\ \rho_{\alpha\beta}\sigma_\alpha\sigma_\beta & \sigma_\beta^2 \end{array} \right) ((1 - \rho) \nu, \Delta^\rho a)' \\
+ \text{Var} \left( u_i + \left[ 1 + (\theta - \rho) L^1 - \rho\theta L^2 \right] \varepsilon_i \right)
$$

Calendar time effects are accounted for by averaging these moments across cohorts (equal weights) for a given age.

For a given $\rho$, we then minimize the distance between the theoretical and empirical moments and pick the estimates associated with $\rho$ that yields the minimum norm.
EXCLUDING LOW INCOMES

Low-Skilled

Medium-Skilled

High-Skilled
Excluding Low Incomes

Individual Market Income

Individual Disposable Income

Low-Skilled

Medium-Skilled

High-Skilled
NON-PARTICIPATION

- **Low-Skilled**
- **Medium-Skilled**
- **High-Skilled**
PARTICIPATION RATES SPOUSE

Low-Skilled

Medium-Skilled

High-Skilled
Marriage Rates

Low-Skilled

Medium-Skilled

High-Skilled
Total household income by income source for each decile:

<table>
<thead>
<tr>
<th>Decile</th>
<th>Labour income</th>
<th>Self-employment</th>
<th>Capital income</th>
<th>Cash Transfers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42%</td>
<td>4%</td>
<td>-5%</td>
<td>59%</td>
</tr>
<tr>
<td>2</td>
<td>45%</td>
<td>5%</td>
<td>1%</td>
<td>49%</td>
</tr>
<tr>
<td>3</td>
<td>58%</td>
<td>5%</td>
<td>1%</td>
<td>36%</td>
</tr>
<tr>
<td>4</td>
<td>68%</td>
<td>4%</td>
<td>1%</td>
<td>26%</td>
</tr>
<tr>
<td>5</td>
<td>74%</td>
<td>4%</td>
<td>1%</td>
<td>21%</td>
</tr>
<tr>
<td>6</td>
<td>77%</td>
<td>4%</td>
<td>2%</td>
<td>17%</td>
</tr>
<tr>
<td>7</td>
<td>79%</td>
<td>5%</td>
<td>2%</td>
<td>14%</td>
</tr>
<tr>
<td>8</td>
<td>81%</td>
<td>5%</td>
<td>2%</td>
<td>12%</td>
</tr>
<tr>
<td>9</td>
<td>82%</td>
<td>6%</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>10</td>
<td>69%</td>
<td>11%</td>
<td>15%</td>
<td>5%</td>
</tr>
</tbody>
</table>
HETEROGENEOUS PROFILES - IND DISPOSABLE INCOME

Low-Skilled

Medium-Skilled

High-Skilled

- non-negligible fanning out
- Note however, negative correlation between initial conditions and growth rate. Thus some of the fanning out will be offset.