Changes in income inequality in Lithuania: the role of policy, labour market structure, returns and demographics

Nerijus Černiauskas, Denisa M. Sologon, Cathal O’Donoghue and Linas Tarasonis

Bank of Lithuania and Vilnius University
nerijus.cerniauskas@evaf.vu.lt

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The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank of Lithuania or the Eurosystem.
Motivation: what’s the Gini up to?
Motivation: first country from the region

- First east European country to decompose household disposable income by demographics, labour market structure, returns structure and tax-benefit system.


- We use micro-simulation micro-econometric decomposition approach developed by Sologon et al. (2018, 2019).
In a nutshell...  

▶ factors:  
  ▶ demographics  
  ▶ labour market structure  
  ▶ returns structure  
  ▶ tax-benefit systems  

▶ the contribution of each factor is assessed using a sequence of simulated counterfactual distributions of household disposable incomes that would prevail in each period, if these factors were swapped between periods  

▶ the logic of the Generalized Oaxaca-Blinder decompositions - extended to the entire distribution take care ”partially” of path dependency
Methods #2

Household income generation process

- describe the overall household income distribution & *create counterfactual distributions*

**Components:**

- hierarchically structured, multiple equation specifications for detailed sources of income
  - a set of basic observable characteristics (individual and household level)
  - vector of 'parameters' describing how the receipt and level of income sources vary with household and individual characteristics
  - a vector of household-specific 'residuals' linking predictions from model parameters to observed income sources
- public transfers, taxes and social security contributions
Household income generation process

- Household disposable income components

\[ y_h = y^L_h + y^K_h + y^O_h + y^B_h - t_h. \]

\[ y^L_h = \sum_{i=1}^{n_h} I_{hi}^{lab} (I_{hi}^{emp} y_{hi}^{emp} + I_{hi}^{se} y_{hi}^{se}) \]

\[ y^K_h = \sum_{i=1}^{n_h} (I_{hi}^{inv} y_{hi}^{inv} + I_{hi}^{prop} y_{hi}^{prop}) \]

\[ y^O_h = \sum_{i=1}^{n_h} (I_{hi}^{pripen} y_{hi}^{pripen} + I_{hi}^{other} y_{hi}^{other}) \]

\[ y^B_h = y_{h}^{pens} + y_{h}^{mtb} + y_{h}^{nmtb} \]

\[ t_h = \text{tax}_h + \sum_{i=1}^{n_h} \text{ssc}_{hi}. \]
Household income generation process

- Parametric specifications - parametric relationships between income components and observed household/individual characteristics
  - Labour incomes: model the probability to be at work, to earn income from salaried employment or self-employment, self-employment income, the occupational, sector and industry choices, wages, hours
  - Other market incomes: model the probability of receiving each income source and the level
  - Public transfers (non-simulated/partially simulated): model the probability of receiving the benefit and the level

- Tax-benefit calculator - EUROMOD
  - public transfers
  - taxes and social security contributions
Household income generation process

- Estimation of parameters
  - market structure & presence of income sources - logistic & multinominal logistic model
  - wage rate - Singh-Maddala distribution regression (without and with endogenous selection) (Van Kerm, 2013)
  - income sources - log-linear model
  - residual distribution: Juhn et al. (1993) extended to a more complex multivariate model
Household income generation process

The generic representation of the income generation process:

\[ Y = m^\xi(X, \Upsilon; \xi) \]

\( Y \) is income, \( X \) a vector of 'exogenous' characteristics, \( \Upsilon \) a vector of unobserved characteristics (residual) terms, \( m^\xi \) the specific parametric structure and \( \xi \) the vector of parameters values.

- Generating counterfactual distribution - transformations of the income generation process 'swapping coefficients':
  - labour market structure transformation
  - price and return transformation
  - tax-benefit transformation
  - demographic transformation
Household income generation process

- **Price and returns transformation**: \( F' = m^\xi(X, \gamma; \tilde{r}(\xi)) \)
  - import the parameters of the equations characterizing the level of earnings and all other pre-tax incomes
  - impact on \( \theta \) is \( \Delta^r_\theta(F) = \theta(F) - \theta(F') \).
Household income generation process

- **Labour market structure transformation:**
  \[ F^l = m^\xi(X, \gamma; \tilde{l}(\xi)) \]
  
  - import the parameters of the equations characterising the labour market structure: employment probabilities, occupational, industrial structure, the presence of non-labour incomes, etc....
  
  - impact of the labour market structure transformation,  
    \[ m^\xi(X, \gamma; \xi) - m^\xi(X, \gamma; \tilde{l}(\xi)) \], on distribution functionals of interest \( \theta \) is
    \[ \Delta^l_\theta(F) = \theta(F) - \theta(F^l) \].
Household income generation process

- **Tax-benefit transformation**: \( m^\xi(X, \gamma; \tilde{tb}(\xi)) \)
  - import the regression parameters determining the level/eligibility of public transfers
  - import the parameters if the EUROMOD tax-benefit calculator impact on \( \theta \) is \( \Delta^\theta_{tb}(F) = \theta(F^{tb}) - \theta(F) \).
Household income generation process

- **Demographic transformation**: \( F^d = m(\tilde{X}(X), \gamma; \xi) \)
  - re-weighting techniques in the tradition of DiNardo et al. (1996): age, gender, migrant status, marital status, education, number of children
  - impact of a demographic transformation, \( m^\xi(X, \gamma; \xi) - m^\xi(\tilde{X}(X), \gamma; \xi) \), on distribution functionals of interest \( \theta \) is \( \Delta^d_\theta(F) = \theta(F) - \theta(F^d) \).
'Direct effects' (Biewen and Juhasz, 2012; Biewen, 2014) - to reduce issues of path-dependence:

- assess the impact of each factor from the same initial benchmark distribution:

- \[ D^k_\theta(F^A, F^B) = \theta(F^A) - \theta(F^k_A) \]

- \( F^k_A \) = counterfactual distribution obtained by applying one particular transformation \( k \) (e.g. tax-benefit systems swap)

- \[ \Delta_\theta(F^A, F^B) = D^l_\theta(F^A, F^B) + D^r_\theta(F^A, F^B) + D^{tb}_\theta(F^A, F^B) + D^d_\theta(F^A, F^B) + R_\theta(F^A, F^B) + \Delta^\gamma_\theta(F^A, F^B) \]

- \[ R_\theta(F^A, F^B) = \theta(F^A) - \theta(F^d_{A pop}^B) \]

- Unexplained effect

\[ \theta(F^A) - \theta(F^B) - \left( \sum_{k \in \{l, r, tb, d\}} D^k_{\theta}(F^A, F^B) \right) \]
Data

- EUROMOD standardized datasets based on European Union Statistics of Income and Living Conditions (EU-SILC) database
- Outcome income measure: equivalized household disposable income (LIS equivalence scale - square root of the household size)
Results#1: Accounting for changes in income inequality

Total change

Percentage changes in equivalised disposable income (relative to 2015)

Cumulative proportion of the population ranked from poorest to richest

2007 - 2015
2007 - 2011
2011 - 2015
Results #2: Accounting for differences in income inequality

Counterfactual distribution Price and Returns

Prices and returns effect

Percentage changes in equivalised disposable income (relative to 2015)

Cumulative proportion of the population ranked from poorest to richest
Results #3: Accounting for differences in income inequality

Counterfactual distribution Taxes and Benefits

Percentage changes in equivalised disposable income (relative to 2015)

Cumulative proportion of the population ranked from poorest to richest

Taxes and benefits effect

- 2007 - 2015
- 2007 - 2011
- 2011 - 2015
Results 4: Accounting for differences in income inequality

Counterfactual distribution Demographics

Demographic effect

Percentage changes in equivalised disposable income (relative to 2015)

Cumulative proportion of the population ranked from poorest to richest

-20 -10 0 10 20 30 40

10 20 30 40 50 60 70 80 90 100

2007 - 2015

Demographic effect

2007 - 2011

2011 - 2015

-20 -10 0 10 20 30 40

10 20 30 40 50 60 70 80 90 100

Cumulative proportion of the population ranked from poorest to richest

2007 - 2015

Demographic effect

2007 - 2011

2011 - 2015
Results 5: Accounting for differences in income inequality

Counterfactual distribution Labour Market Structure

Labour market structure effect

Percentage changes in equivalised disposable income (relative to 2015)

Cumulative proportion of the population ranked from poorest to richest

2007 - 2015
2007 - 2011
2011 - 2015
The image contains a table with results for changes in Gini indices over different time periods. The table has columns indicating the time period over which statistics were calculated (e.g., 2007-2011 refers to the change from 2007 to 2011). The table is broken down into sections for Gini Market Income, Gini Disposable Income, and Net Redistribution, each with respective changes for each category over the specified time periods.

Here is the table in markdown format:

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Gini Market Income</strong></td>
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<td></td>
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<tr>
<td>Total change</td>
<td>0.042</td>
<td>0.040</td>
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<tr>
<td>Labour Market Structure</td>
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<td>-0.015</td>
<td>-0.001</td>
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<tr>
<td>Returns</td>
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<td>-0.007</td>
<td>0.013</td>
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<tr>
<td>Tax-benefit system</td>
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<td>0.004</td>
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<td>Demographics</td>
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<td>0.017</td>
<td>0.003</td>
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<tr>
<td>Interactions</td>
<td>0.003</td>
<td>0.009</td>
<td>-0.006</td>
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<tr>
<td>Unexplained</td>
<td>0.026</td>
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<tr>
<td><strong>Gini Disposable Income</strong></td>
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<tr>
<td>Total change</td>
<td>0.021</td>
<td>-0.008</td>
<td>0.029</td>
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<tr>
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<tr>
<td>Returns</td>
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<td><strong>Net Redistribution</strong></td>
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<tr>
<td>Total change</td>
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<td>0.048</td>
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<tr>
<td>Returns</td>
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<td>Tax-benefit system</td>
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<tr>
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<td>0.010</td>
<td>0.023</td>
</tr>
</tbody>
</table>

Columns indicate the time period over which statistics were calculated (e.g., 2007-2011 refers to the change from 2007 to 2011).
Main conclusions

- Changes in the tax and benefit system successfully accommodated a rapid rise in market income inequality due to the crisis during the 2007-2011...

- but did less during the subsequent years when the rising returns in the labour market significantly increased the disposable income inequality

- Demographic effects contribute significantly to the rising inequalities in Lithuania
Thank you

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Results: Accounting for differences in income inequality

Counterfactual distribution (f) Unexplained and interactions
Results
Incomes barely changed from 2007-2011, but rose rapidly thereafter.
The decomposition procedure aims to decompose the total difference between the income distributions in two periods, described by some summary index measure $\theta(F)$:

\[ \Delta_\theta(F^A, F^B) = \theta(F^B) - \theta(F^A) \]

into a number of factors that capture the contribution of different components of the model to the gap:

\[ \Delta_\theta(F^A, F^B) = \sum_{k=1}^{K} D^k_\theta(F^A, F^B). \]

\[ k = \text{TB system, market composition, returns, demographics.} \]