The COVID-19 resilience of a Central European Welfare Regime - nowcasting the distributional impact of the crisis

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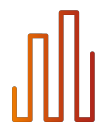
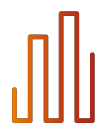
Online Expert Meeting on Nowcasting and Mid-Term Projections through Microsimulation Models

July 19, 2021



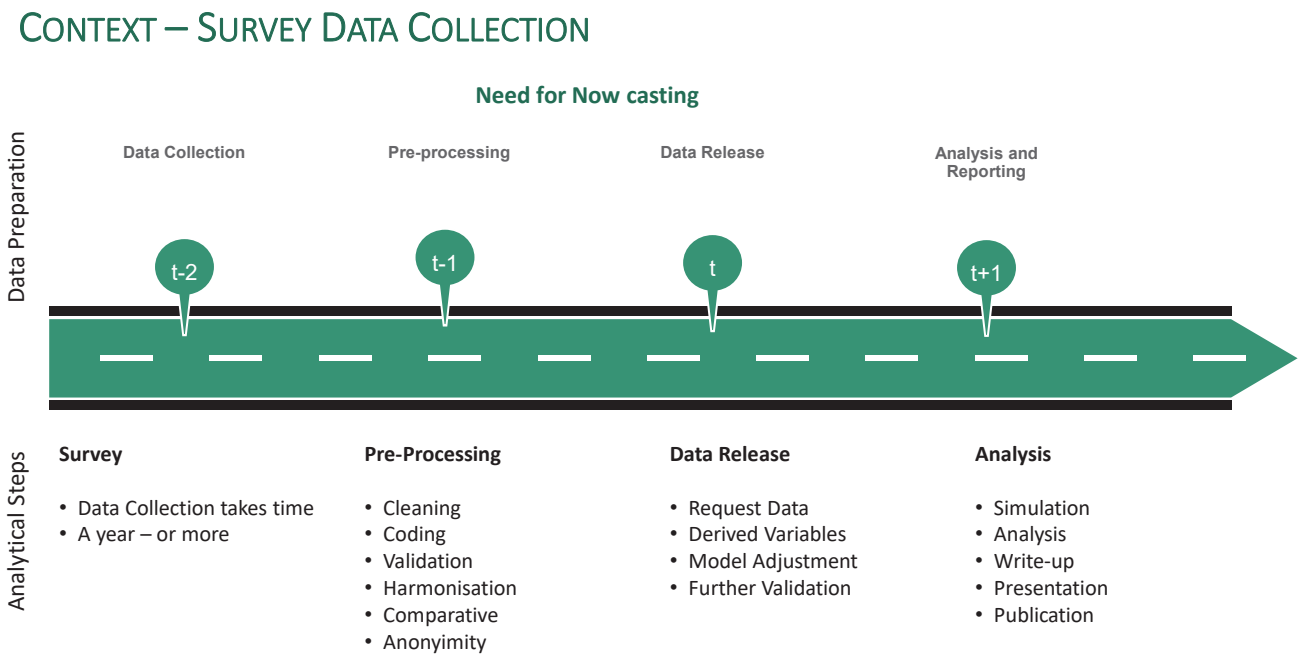
Aim

- assess the impact of the COVID-19 crisis and its associated policy responses on the distribution of disposable income in Luxembourg during the peak (April), Q2, Q3 and Q4 of 2020
- Luxembourg
  - one of the richest countries with well-established fiscal and social policy instruments
  - efficient in mitigating the impact of the previous crisis
  - enabled a swift policy response
- lack of up-to-date survey data - need for a "nowcasting" approach



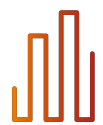
Aim

- main challenge in assessing the immediate distributional impact of the COVID-19 pandemic - lack of up-to-date survey data
- large-scale representative surveys on income and living conditions - lag
- when sudden economic shocks hit $->$ obsolete



Aim

- Governments need real-time information on the income situation of the individuals during the crisis
- We overcome this challenge by applying a "nowcasting" approach based on dynamic microsimulation using up-to-date official statistics
- A "nowcasting" approach built upon:
  - a *household income generation model (IGM)* - describes the distribution of disposable income and generates counterfactual distributions
  - nowcasting component to calibrate the simulations from the IGM to current external statistics



Aim

A "nowcasting" approach built upon:

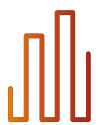
- a *household income generation model (IGM)* - describes the distribution of disposable income and generates counterfactual distributions

Income Generation Model

-Sologon, D.M., Van Kerm, P., Li, J., C. O'Donoghue. Accounting for differences in income inequality across countries: tax-benefit policy, labour market structure, returns and demographics. J Econ Inequal (2020)

- Černiauskas, N., Sologon D.M., O'Donoghue C., Tarasonis, L. *Income inequality and redistribution in Lithuania: the role of policy, labour market, income and demographics*. RIW (2021 Forthcoming)

- nowcasting component to calibrate the simulations from the IGM to current external statistics



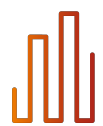
Aim

A "nowcasting" approach built upon:

- a *household income generation model (IGM)* - describes the distribution of disposable income and generates counterfactual distributions
- nowcasting component to calibrate the simulations from the IGM to current external statistics

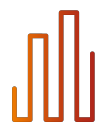
Nowcasting

-O'Donoghue, C., Sologon, D., Kyzyma, I. McHale, J. *Modelling the Distributional Impact of the COVID-19 Crisis*. Fiscal Studies (2020)
-O'Donoghue, C., Sologon, D. *Microsimulation Based Method to Nowcast Household Income Survey Data. (Forthcoming 2021)*



Generic Income Generation Model

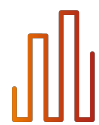
- a micro-simulation micro-econometric approach
  - extends the approach developed in Bourguignon, Ferreira & Leite (2007) (BFL) - a unified framework portable across countries and over time
    - harmonized cross-country survey data
    - model - common specification for each country/period so as to permit the simulation of counterfactuals holding components constant across comparing units (countries/periods)
    - pan-European tax-benefit simulator (EUROMOD)
  - **flexible applicability in nowcasting the distributional impact of sudden economic changes when there is a lack of up-to-date survey data**



Methods:

The uses of the IGM differ slightly depending on:

1. decomposition of distributional difference over time - with data available in both periods
2. nowcasting the distributional impact of sudden economic changes - lack of up-to-date survey data



Methods#1

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/country, if these factors were swapped between periods/countries
- the logic of the Generalized Oaxaca-Blinder decomposition - extended to the entire distribution
- isolate the ceteris paribus effects following Biewen(2012) to take care "partially" of path dependency

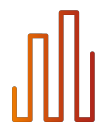
Methods#2

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

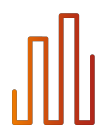


Methods#3

Household income generation process

- Household disposable income components

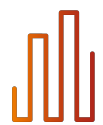
$$
\begin{aligned}
y_h &= y_h^L + y_h^K + y_h^O + y_h^B - t_h. \\
y_h^L &= \sum_{i=1}^{n_h} I_{hi}^{lab} \left(I_{hi}^{emp} y_{hi}^{emp} + I_{hi}^{se} y_{hi}^{se} \right) \\
y_h^K &= \sum_{i=1}^{n_h} \left(I_{hi}^{inv} y_{hi}^{inv} + I_{hi}^{prop} y_{hi}^{prop} \right) \\
y_h^O &= \sum_{i=1}^{n_h} \left(I_{hi}^{pripen} y_{hi}^{pripen} + I_{hi}^{other} y_{hi}^{other} \right) \\
y_h^B &= y_h^{pens} + y_h^{mtb} + y_h^{nmtb} \\
t_h &= tax_h + \sum_{i=1}^{n_h} ssc_{hi}.
\end{aligned}
$$



Methods#4

Household income generation process

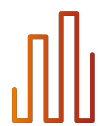
- Parametric specifications - parametric relationships between income components and observed household/individual characteristics
  - Labour incomes: model the probability to be at work, to earn income from salaried employment or self-employment, self-employment income, the occupational, sector and 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



Methods#5

Household income generation process

- Estimation of parameters
  - market structure & presence of income sources - logistic & multinomial 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



Methods#6

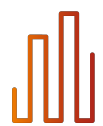
Household income generation process

The generic representation of the income generation process:

$$Y = m^{\xi}(X, \Upsilon; \xi)$$

Y is income, X a vector of 'exogenous' characteristics, Υ a vector of unobserved characteristics (residual) terms, m^{ξ} the specific parametric structure and ξ the vector of parameter values.

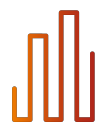
- Generating counterfactual distribution - transformations of the income generation process 'swapping coefficients':
  - demographic transformation
  - labour market structure transformation
  - price and return transformation
  - tax-benefit transformation



Methods#7

Household income generation process

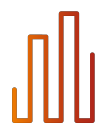
- **Demographic transformation**: $F^d = m(\tilde{X}(X), \Upsilon; \xi)$
  - re-weighting techniques in the tradition of DiNardo et al. (1996): age, gender, migrant status, marital status, education, number of children
  - impact of a demographic transformation, $m^{\xi}(\tilde{X}(X), \Upsilon; \xi) - m^{\xi}(X, \Upsilon; \xi)$, on distribution functionals of interest θ is $\Delta_{\theta}^{d}(F) = \theta(F^d) - \theta(F)$.



Methods#7

Household income generation process

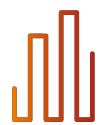
- **Labour market structure transformation**: $F^{l} = m^{\xi}(X, \Upsilon; \tilde{l}(\xi))$
  - import the parameters of the equations characterising the labour market structure: employment probabilities, occupational, industrial structure, the presence of non-labour incomes, etc....
  - impact of the labour market structure transformation, $m^{\xi}(X, \Upsilon; \tilde{l}(\xi)) - m^{\xi}(X, \Upsilon; \xi)$, on distribution functionals of interest θ is $\Delta^{l}_{\theta}(F) = \theta(F^{l}) - \theta(F)$.



Methods#7

Household income generation process

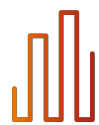
- **Price and returns transformation**: $F^r = m^{\xi}(X, \Upsilon; \tilde{r}(\xi))$
  - import the parameters of the equations characterizing the level of earnings and all other pre-tax incomes
  - impact on θ is $\Delta^r_{\theta}(F) = \theta(F^r) - \theta(F)$.



Methods#7

Household income generation process

- **Tax-benefit transformation**: $m^{\xi}(X, \Upsilon; \tilde{tb}(\xi))$
  - import the regression parameters determining the level/eligibility of public transfers
  - import the parameters if the EUROMOD tax-benefit calculator
  - impact on θ is $\Delta_{\theta}^{tb}(F) = \theta(F^{tb}) - \theta(F)$.

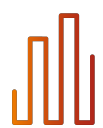


Methods#8: Nowcasting from period s to t (before crisis) and t+1 (during crisis)

Steps:

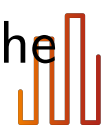
- estimate the IGM for year s, saving the parameter estimates and the residuals from each model
- simulate the changes in the distribution of disposable income by calibrating the labour market, income and tax-benefit transformations so as to reflect the components of the IGM of period t and t+1

$$Y_s = m^{\xi}(X, \Upsilon; l_s(\xi), r_s(\xi), tb_s(\xi)) -> \tilde{Y}_t; \tilde{Y}_{t+1}$$



Methods#9: Nowcasting to t and t+1

- Labour market transformation: LM structure aligned with the external statistics wrt the in-work composition by age and gender, the composition of employment by gender, the occupation and industry structure by gender.
  $-> \tilde{l}_t(\xi)$
- Returns transformation:
  -simulate all income sources based on the new simulated labour market structure;
  -update all income sources using the EUROMOD uprating factors for period t for pre-fiscal monetary variables.
  $->$ updated pre-fiscal income vector, $\tilde{r}_t(\xi)$, expressed in period t values.
- Tax-benefit transformation: update the tax-benefit rules to reflect the nowcasted period (EUROMOD) $-> \tilde{tb}_t(\xi)$



Methods#9: Nowcasting to t and t+1

- these transformations result in the nowcasted outcomes before the crisis, Y_t and during the crisis Y_{t+1}

$$\tilde{Y}_t = m^{\xi}(X, \Upsilon; \tilde{l}_t(\xi), \tilde{r}_t(\xi), \tilde{tb}_t(\xi))$$

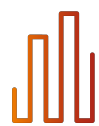
$$\tilde{Y}_{t+1} = m^{\xi}(X, \Upsilon; \tilde{l}_{t+1}(\xi), \tilde{r}_{t+1}(\xi), \tilde{tb}_{t+1}(\xi))$$

- the change in the distribution of disposable income under the impact of the crisis is assessed by:

$$\tilde{Y}_{t+1} - \tilde{Y}_t$$

- the impact on any distribution functional of interest, θ, Gini, quantiles:

$$\Delta_{\theta}(F^{t+1}, F^t) = \theta(F^{t+1}) - \theta(F^t)$$



Methods#10: Decompose the distributional Δ between t and t+1: policy effect and labour market shock

$$\tilde{Y}_{t+1} - \tilde{Y}_t =$$

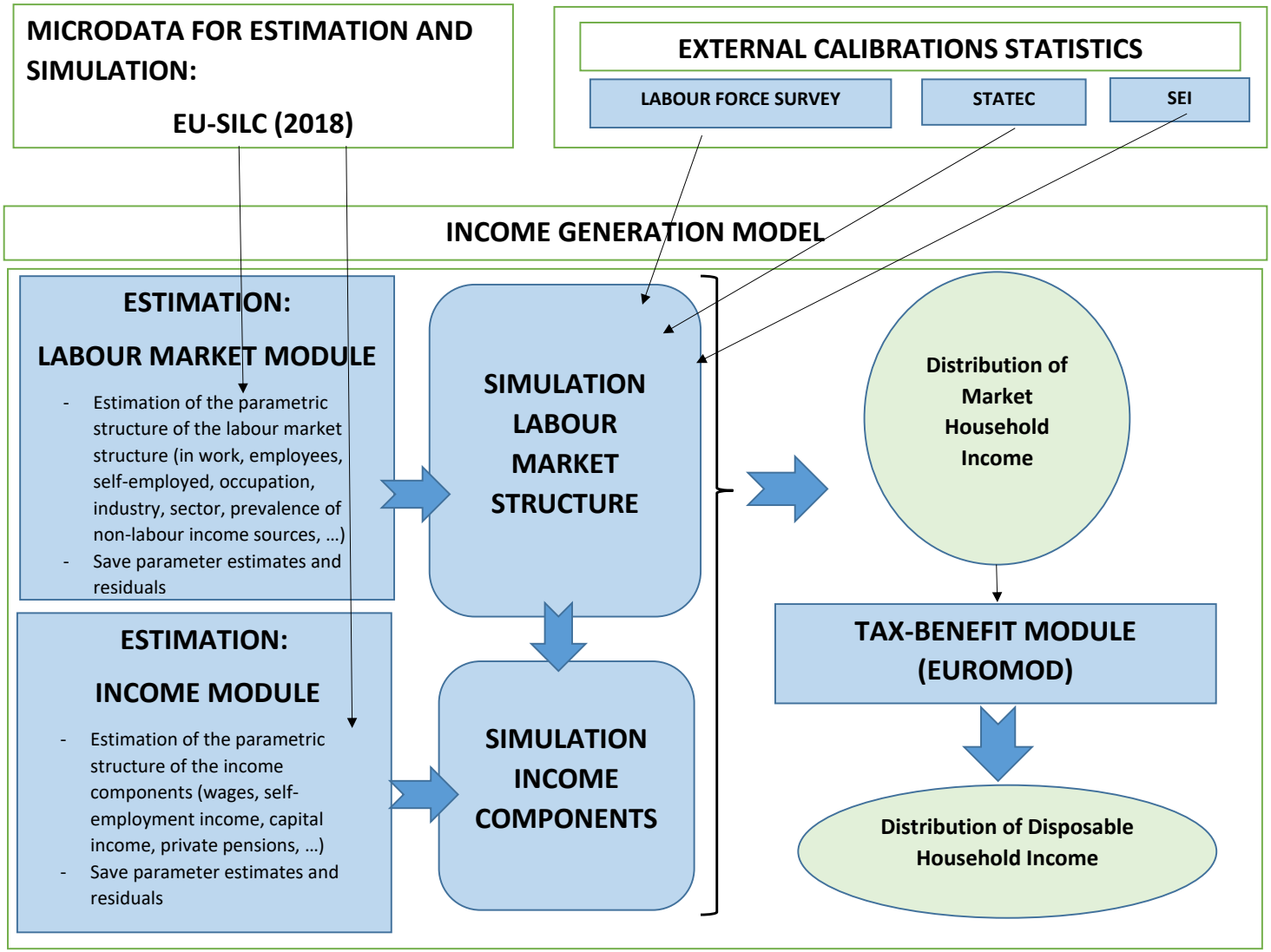
- labour market shock: contrast $distribution_t$ with the counterfactual distribution that would prevail if in period t we "import" the labour market shock of period t+1:

$$m(X, \Upsilon; \tilde{l}_{t+1}(\xi); \tilde{r}_t(\xi); t\tilde{b}_t(\xi)) - m(X, \Upsilon; \tilde{l}_t(\xi); \tilde{r}_t(\xi); t\tilde{b}_t(\xi))$$

- COVID-specific policy response: contrast the $distribution_{t+1}$ with the counterfactual distribution of no COVID-specific policy intervention

$$m(X, \Upsilon; \tilde{l}_{t+1}(\xi); \tilde{r}_{t+1}(\xi); t\tilde{b}_{t+1}(\xi)) - m(X, \Upsilon; \tilde{l}_{t+1}(\xi); \tilde{r}_t(\xi); t\tilde{b}_t(\xi))$$

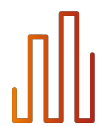
Model Philosophy



Economic Stabilization Program - March 18th

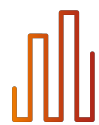
Policy Instruments

- Short-term unemployment scheme (chomage partiel en cas de force majeure): the State takes over 80% of the remuneration costs of employees who had to temporary reduce their working hours, up to a maximum of 2.5x the social minimum wage;
- Special family leave: the state overtakes 100% of the remuneration costs of employees who had to interrupt their work to guard children under 12 due to the closure of educational establishments;
- Special sick leave: the National Health Fund (CNS) overtakes 100% of the remuneration costs for individuals who got sick with COVID-19 from the first day of their illness



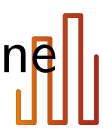
Data

- EUROMOD standardized datasets based on EU-SILC for Luxembourg (2018, incomes refer to 2017)
- Labour Force Survey (Q4 2019; Q2, Q3, Q4 2020) for the alignment of the labour market
- ADEM, STATEC data and the survey on the Socio-Economic Impact of the COVID-19 Crisis (SEI) for the alignment of partial unemployment
- Outcome income measure : equivalized household disposable income (LIS equivalence scale - square root of the household size)



Accounting period

- average monthly incomes based on the labour market information available in EU-SILC;
- calibrated to the monthly employment data provided by the LFS and national statistics;
- April 2020 scenario: nowcasted average monthly income using the LFS labour market statistics for Q2 and the April national statistics for partial unemployment to capture the shock.
  - LFS published in June 2020 (Q2) as representative for April to calibrate the labour market;
  - monthly administrative statistics on partial unemployment for April;
  - assumes the shock persists the entire year => the reported result is the monthly average.
- Q2 2020 scenario: nowcasted average monthly income using the LFS labour market statistics for Q2 and the average across April-May-June (Q2) national statistics for partial unemployment.



Results

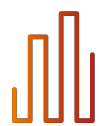
- short-term impact of the crisis, between the start of 2020 (Q1, before the start of the COVID crisis) and the second quarter (i) April and (ii) Q2: average across April-June.
- changes in the income distribution:

$$\Delta_\theta(F^{Q_2}, F^{Q_1}) = \theta(P^{Q_2}, LM^{Q_2}) - \theta(P^{Q_1}, LM^{Q_1})$$

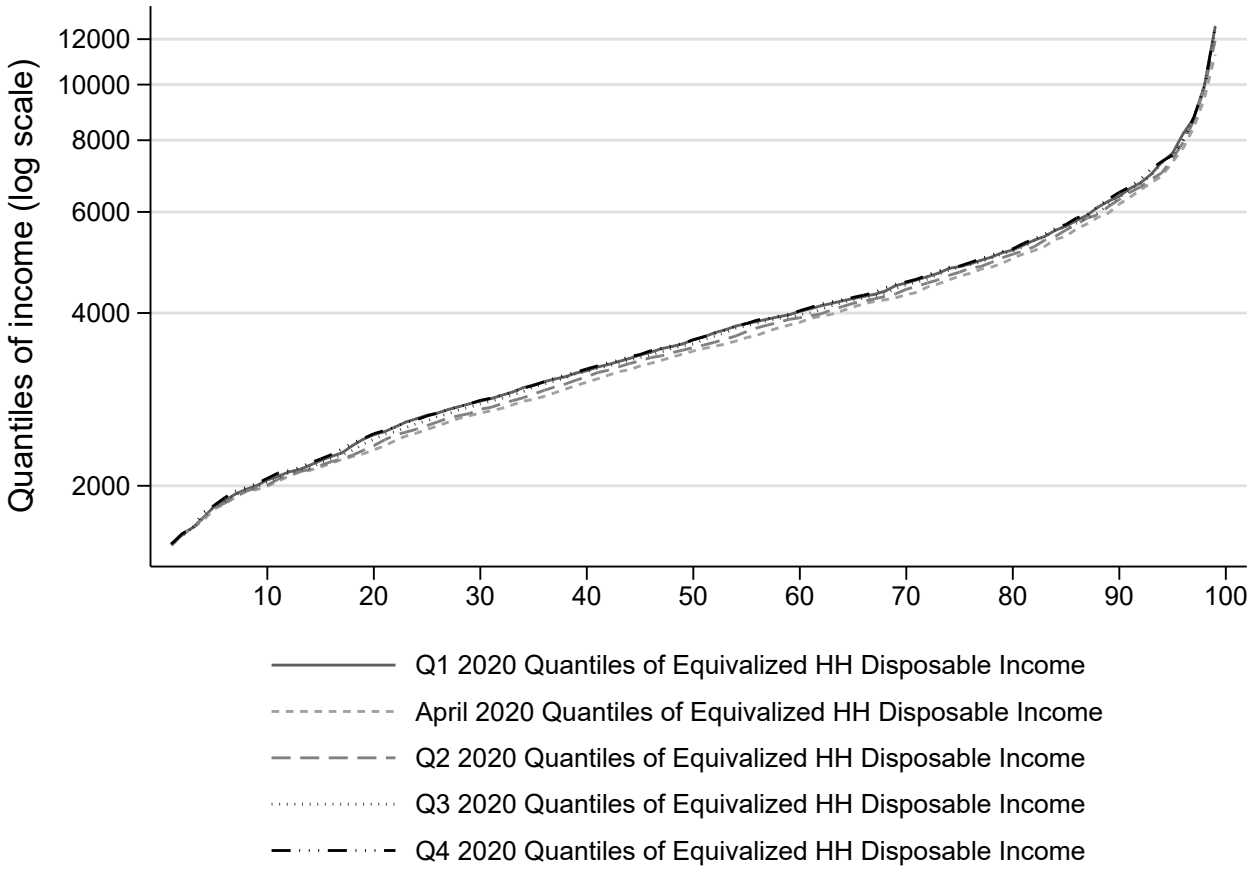
$$= \theta(P^{Q_1}, LM^{Q_2}) - \theta(P^{Q_1}, LM^{Q_1})\{partA - LMShock\}$$

$$+\theta(P^{Q_2}, LM^{Q_2}) - \theta(P^{Q_1}, LM^{Q_2})\{partB - CovidPolicy\}$$

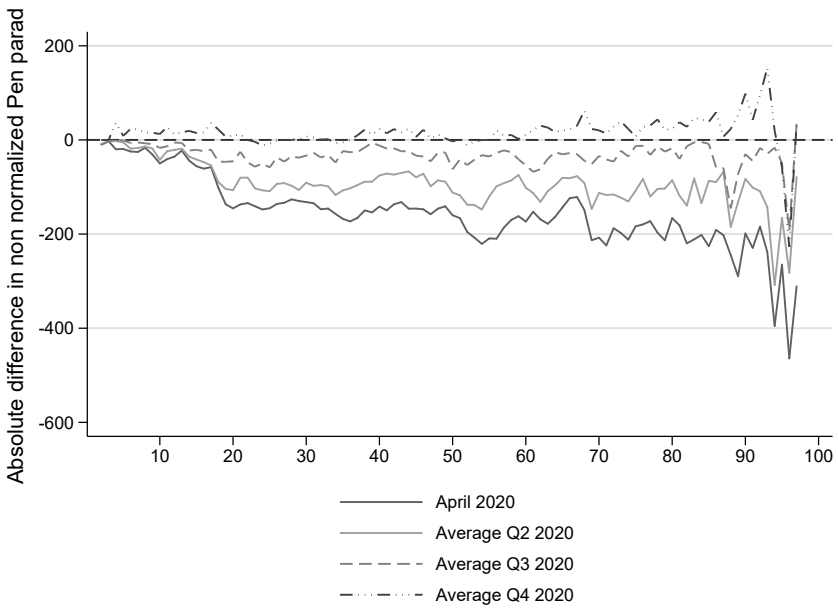
- we assume: all people who fall into partial unemployment reduce their hours by 100%.

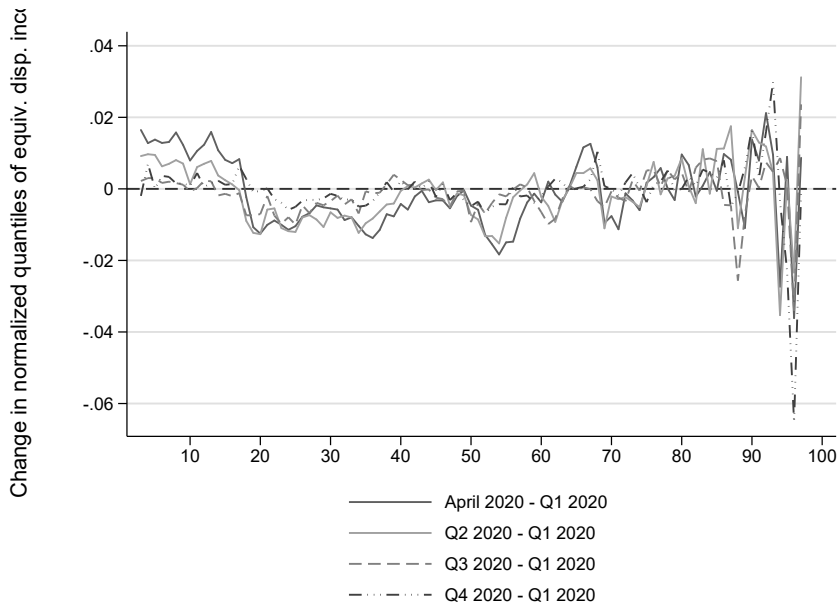


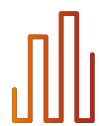
Pen Parades: 2020 Q1 vs 2020 April, Q2, Q3, Q4 nowcasted



Absolute and Normalized Change

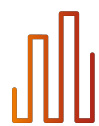




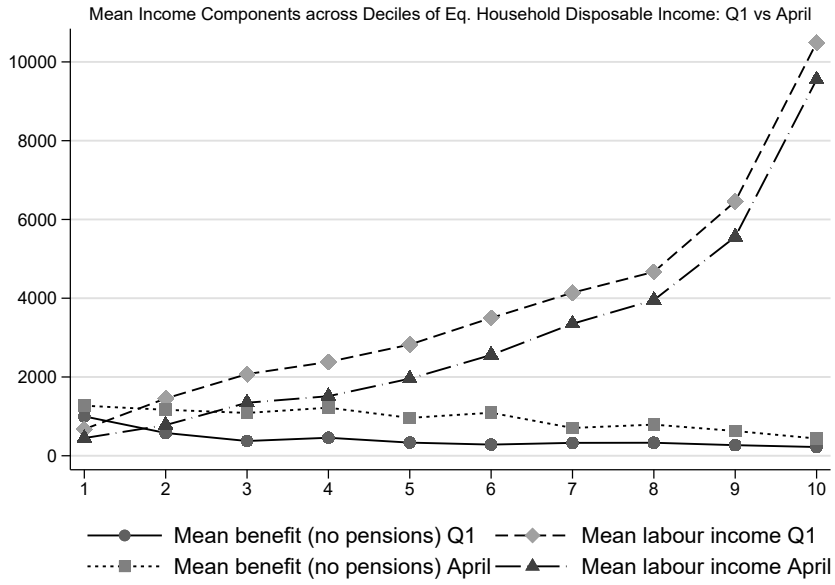


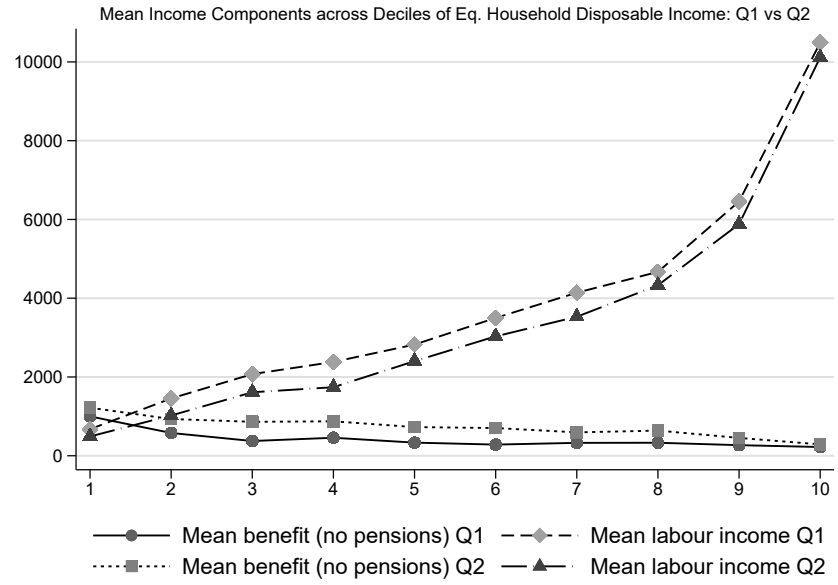
Income sources

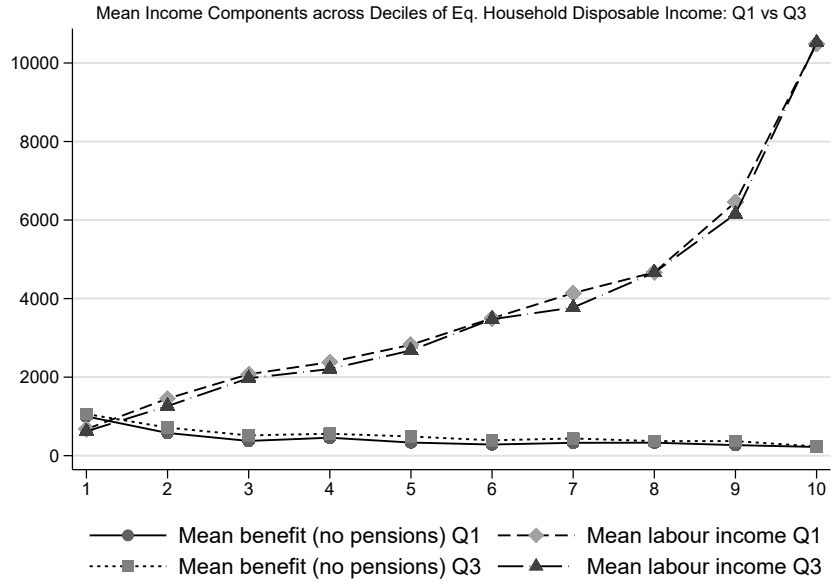
- composition of disposable income changed substantially over the crisis, whereas the level of inequality stayed roughly unchanged
- decrease in the share of labour incomes compensated by an increase in the share of benefits, reflecting the cushioning effect of the transfer system

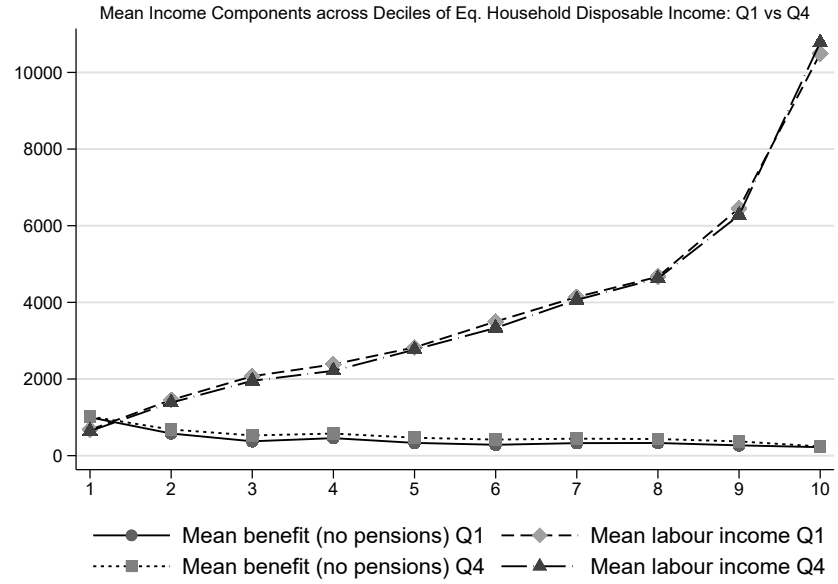


Income sources

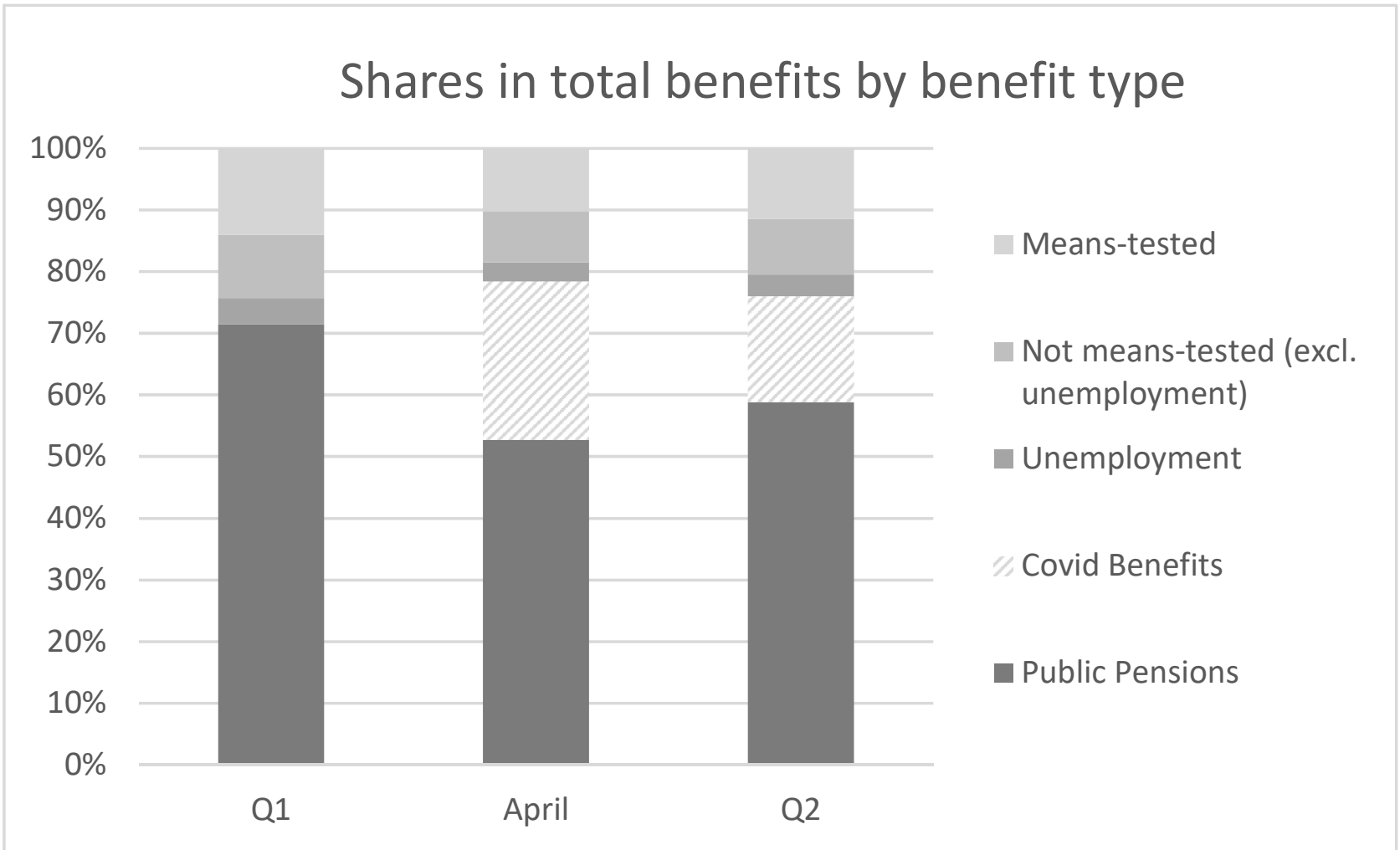








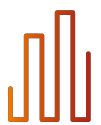
Benefits Composition



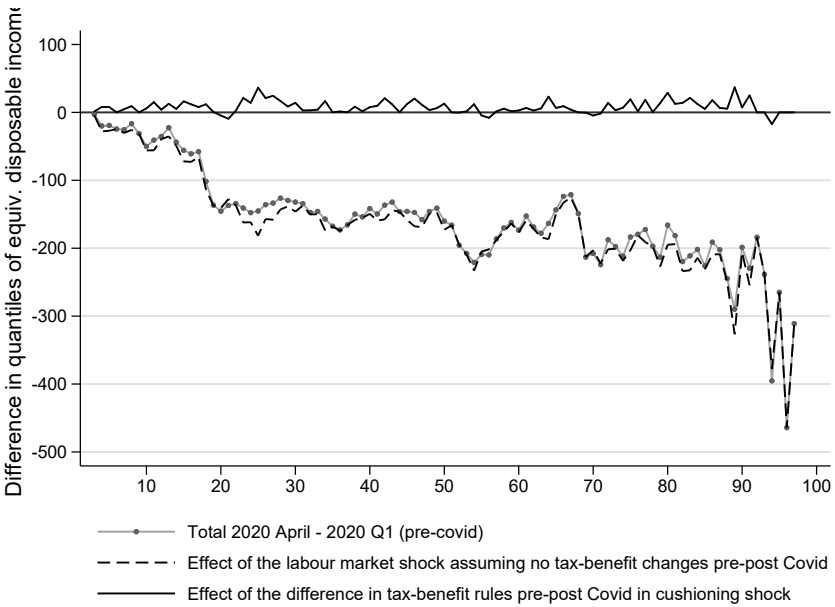
Changes in redistribution during the crisis

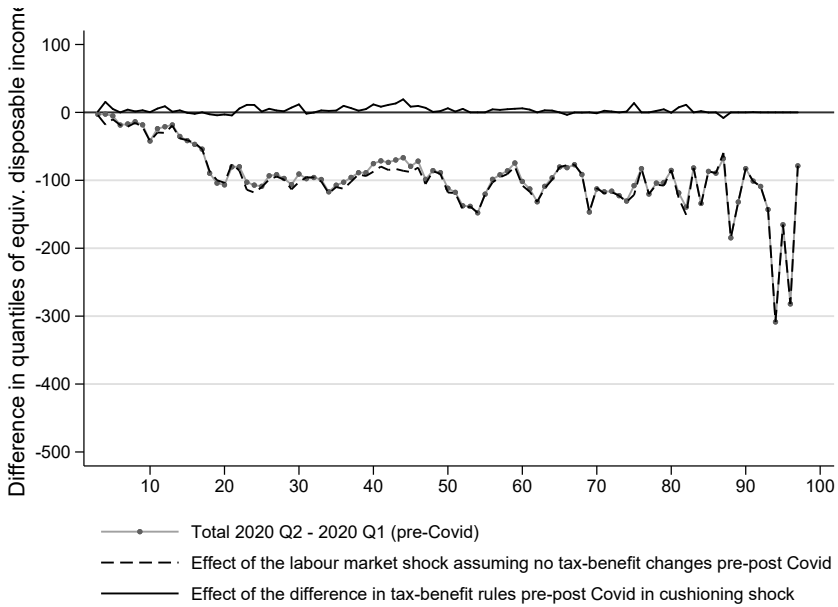
Table: Progressivity and redistribution of taxes and benefits on household equivalized disposable income

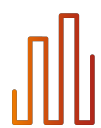
	Q1	April	Q2	Q3	Q4	Ratio: April/Q1	Ratio: Q2/Q1	Ratio: Q3/Q1	Ratio: Q4/Q1
Gini Gross Income	0.484	0.571	0.538	0.503	0.499	1.179	1.110	1.039	1.031
Gini Gross Income (+ benefits)	0.328	0.328	0.330	0.331	0.329	1.000	1.005	1.008	1.002
Average transfer rate	0.354	0.591	0.482	0.390	0.385	1.669	1.361	1.101	1.086
Benefit Regressivity (K)	0.910	0.896	0.906	0.916	0.912	0.985	0.996	1.007	1.003
Benefit Redistribution (RS)	0.156	0.243	0.208	0.173	0.171	1.556	1.330	1.106	1.093
Gini (gross + benefits - taxes)	0.268	0.268	0.270	0.270	0.268	1.001	1.007	1.007	1.001
Average tax rate	0.165	0.160	0.162	0.165	0.166	0.971	0.987	1.000	1.008
Tax Progressivity (K)	0.314	0.322	0.319	0.317	0.313	1.024	1.013	1.007	0.995
Tax Redistribution (RS)	0.061	0.060	0.061	0.061	0.061	0.991	0.999	1.007	1.005
Gini Disposable Income	0.260	0.260	0.261	0.262	0.260	1.001	1.006	1.007	1.002
Net Redistributive Effect	0.224	0.311	0.276	0.242	0.239	1.385	1.230	1.077	1.066



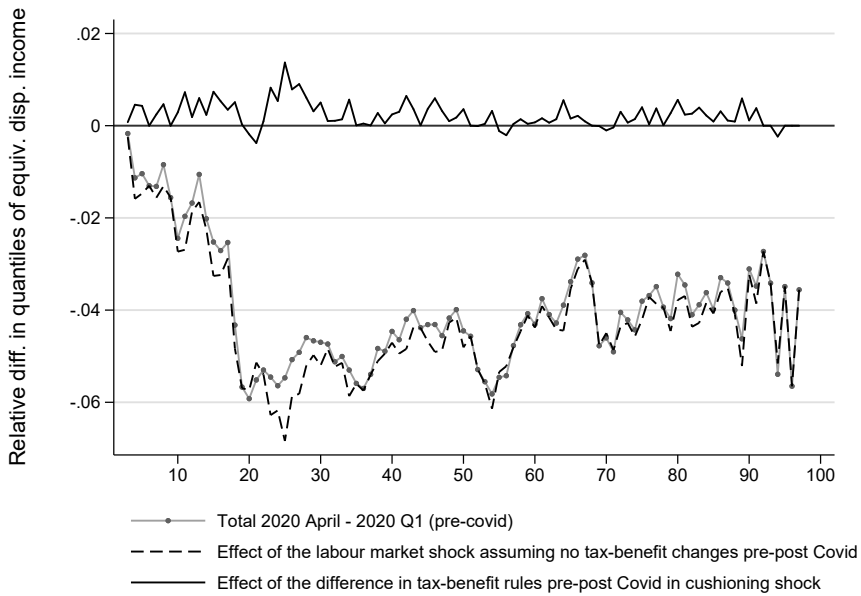
Absolute contribution of the labour market shock and policy response to the changes in disposable incomes and inequality

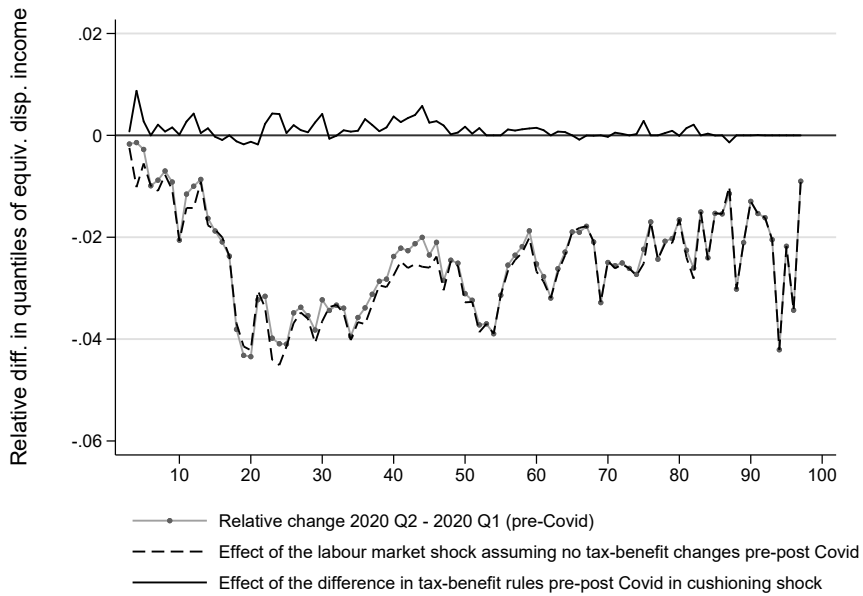






Relative contribution of the labour market shock and policy response to the changes in disposable incomes and inequality

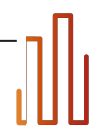




Inequality Decomposition

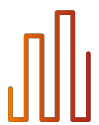
Table 6: Decomposition of the change in Gini coefficients and in redistribution measures before (Q1) and during the COVID-19 crisis (April and Q2)

	Gini Disposable (1)	Gini Gross Income (2)	Net Redistr. (3)	Benefit Regressivity (4)	Avg. Benefit Rate (5)	Tax Progressivity (6)	Avg. Tax rate (7)
2020 Q1	0.260	0.484	0.224	0.910	0.354	0.315	0.165
Changes under COVID-19							
April - Q1	0.000	0.087	0.086	-0.013	0.237	0.008	-0.005
Contribution of the shock and policy response to the change April - Q1							
LMS	0.001	0.087	0.086	-0.011	0.234	0.007	-0.004
TB	-0.001	0.000	0.001	-0.002	0.003	0.000	-0.000
Changes under COVID-19							
Q2 - Q1	0.002	0.053	0.052	-0.003	0.128	0.004	-0.002
Contribution of the shock and policy response to the change Q2 - Q1							
LMS	0.002	0.053	0.051	-0.003	0.127	0.004	-0.002
TB	-0.000	0.000	0.000	-0.001	0.001	0.000	-0.000



Conclusion

- the system is effective in cushioning household income across the distribution and in mitigating an increase in income inequality in the early stages of the pandemic.
- labour incomes dropped and became more unequally distributed (by 5.3 Gini points in Q2 and 8.7 Gini points in April).
- this was overpowered by an increase in redistribution through the tax-benefit system
  - an increase in the generosity of benefits and larger access to benefits
  - changes are mainly explained by the labour market shock, signalling the automatic stabilizers embedded in the pre-COVID system.
- the system was well-equipped ahead of the crisis to cushion household incomes against job losses
- method: our approach is applicable both to other countries and also to assessing the impact of later stages in the COVID crisis
- model: near real-time analysis and decision support tool to monitor the recovery, with high applicability for policy makers



- The authors are grateful to the Luxembourg National Research Fund, the Irish Health Research Board and Irish Research Council for funding of this research.

Joint LISER-NUIG-IMA Global Webinar "Microsimulation and Inequality"

(Second Thursday of every month at 14:00 Lux time). Those interested in attending or presenting, please contact *cathal.odonoghue@nuigalway.ie or denisa.sologon@liser.lu*.

Thank you!