Decomposing Changes in household disposable income in mainland China: A distributional approach

C. Gong*, D. M. Sologon**,
Z.Nimeh*, C.O'Donoghue***

* Maastricht University and UNU-Merit
** Luxembourg Institute of Socio-Economic Research
*** University of Ireland, Galway and UNU-Merit

IMA 8th World Congress December 1st -3rd 2021

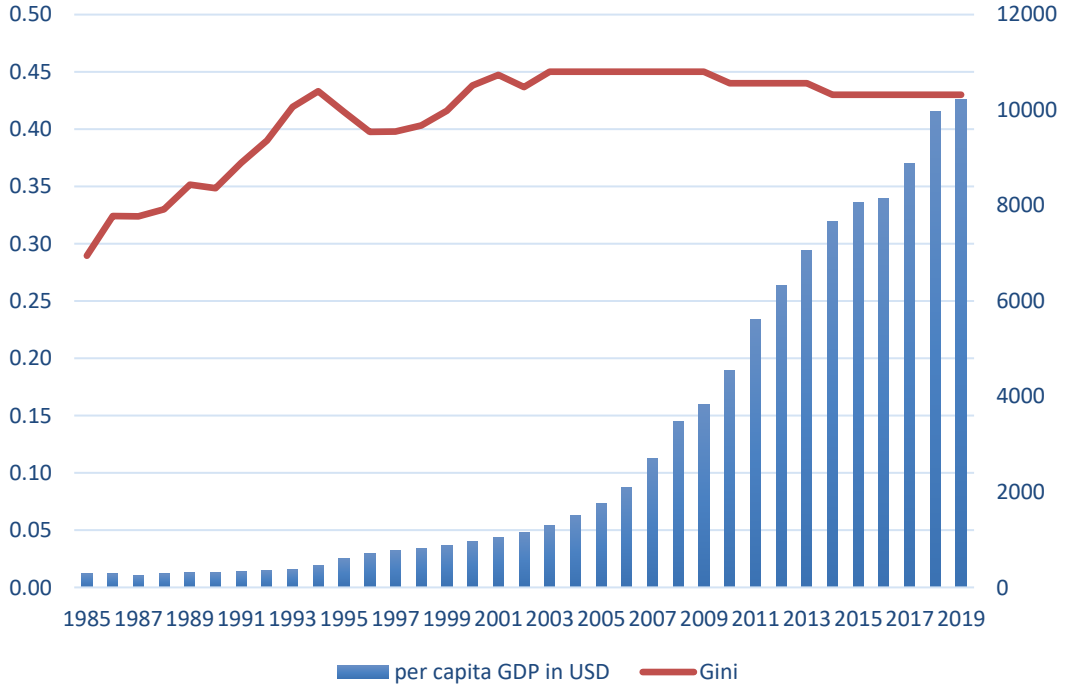
UNITED NATIONS UNIVERSITY
UNU-MERIT
Maastricht University
Maastricht Graduate School of Governance

Background

- China (PRC)
  - Fast growing economy, average nominal GDP growth rate 9.52% (1989-2019)
  - 800 million out of poverty, 70% of the total international poverty reduction in 1980s
  - National income growth rate: 6.2%, The poorest 20%: 4.0% (Ravallion & Chen, 2003)
  - Gini index: **0.23**(1980) to **above 0.4(1993 onward)**

- **11th and 12th Five-year Plan** (2005-2015)
  - Redistribution and social safety net
- **Long-Term Science and Technology Development (2006-2020)**
  - Change in Labor market structure and return

Figure 1. Per Capita GDP and National Gini index



Data sources for figure 1: 1985-2001 from Ravallion and Chen (2007), 2002-2019 from WIID, World Income Inequality Database of UNU-WIDER. All estimates are based on the dataset released by National Bureau of Statistics of PRC. GDP per capita is author's direct generation from World Bank.

UNITED NATIONS UNIVERSITY
UNU-MERIT
Maastricht University
Maastricht Graduate School of Governance

State of arts

- Decomposition by…
  - **Income source**: Formal vs. informal (Li, Sun & Zhu, 2013)
  - **Socio-demographic characteristics**: Gender, education, Hukou, etc. (Sicular, Ximing, Gustafsson, & Shi, 2007; Wan & Zhou, 2005)

– Limitation:
  - Descriptive and general (Within and between group difference)
  - Overlook the contribution of other characteristics that were not used to define the groups

- Methodology
  - **Regression-based method** (Blinder, 1973; Oaxaca, 1973)

– Limitation: only mean value or summary statistics such as Gini, Atkinson index

  - **Distributional approach** (Firpo, Fortin, & Lemieux, 2007, 2009)

– Limitation:
  - Few, focusing on individual level, single source of earning (Chi, Li, & Yu, 2011)

Research contribution

- Bring the inequality research to the most up-to-date household survey datasets (China Family Panel Study [CFPS] 2010-2016)
- Decompose on the full distribution of household disposable income
- Explore the income distributional change over time as a sequence of events, considering *sociodemographic characteristics* and *income from different sources*.

Methodology

- **Household income distribution model**
  - Developed by Bourguignon et al.(2007),
  - Extended by Sologon et al. (2021), Černiauskas et al. (2021), Li et al.(2021)

    - Step 1: **Parametric income generation process** to model the contribution of each factor to household disposable income

    - Step 2: **Counterfactual distribution simulations** done by swapping the parameters & error terms

    - Step 3: **Decomposition** of the contribution of the change in each factor to the overall change in income distribution

      Factors are grouped in the four dimensions:
      - Demographic
      - Labor market structure
      - Return structure
      - (Tax) Benefit scheme

Methodology

- $y_h = \frac{1}{n_h}(y_h^L + y_h^C + y_h^O + y_h^B)$

- $y_h^L = \sum_{i=1}^{n_h} I_{hi}^{LS}\left(I_{hi}^{wage} y_{hi}^{wage} + I_{hi}^{sel} y_{hi}^{sel}\right)$, Self-employment counts in y_{hi}^{sel}
- $y_h^C = \sum_{i=1}^{n_h}\left(I_{hi}^{C} y_{hi}^{C}\right)$, Capital investment, Property investment, Farming
- $y_h^O = \sum_{i=1}^{n_h}\left(I_{hi}^{O} y_{hi}^{O}\right)$, Other income (from dataset)
- $y_h^B = \sum_{i=1}^{n_h}\left(I_{hi}^{B} y_{hi}^{B}\right)$, Basic living(Dibao), Pension

I: participation indicator

Methodology: Step 1

$$y_h^L = \sum_{i=1}^{n_h} I_{hi}^{LS}\left(I_{hi}^{wage} y_{hi}^{wage} + I_{hi}^{sel} y_{hi}^{sel}\right), \qquad y_h^{C,O,B} = \sum_{i=1}^{n_h}\left(I_{hi}^{C,O,B} y_{hi}^{C,O,B}\right)$$

- Generic representation of the income generation process:

$$Y = m^{\beta}(X, \varepsilon;\ \beta)$$

Y : household disposable income; m^{β}: parametric structure;
X: vector of exogenous characteristics; ε: vector of residual;
β: vetor of parameter values

- Estimation of the parameters
  - Market structure & presence of income sources → logistics & multinomial logistics model
  - Wage → Singh-Maddala distribution regression
  - Other income sources → Log-linear model
  - Residual distribution → Multivariate model

Methodology: Step 2&3

- Generic representation of the income generation process:

$$Y = m^{\beta}(X, \varepsilon;\ \beta)$$

  - Demographic transformation: $Y^{d} = m^{\beta}(\tilde{X}(X), \varepsilon;\ \beta)$ → Done by reweighting technique (DiNardo et al.,1996)
  - Labor market structure transformation: $Y^{l} = m^{\beta}(X, \varepsilon;\ \tilde{l}(\beta))$
  - Return structure transformation: $Y^{r} = m^{\beta}(X, \varepsilon;\ \tilde{r}(\beta))$
  - Benefit transformation: $Y^{b} = m^{\beta}(X, \varepsilon;\ \tilde{b}(\beta))$

- $D_{\theta}^{d,l,r,b,\varepsilon} = \theta\left(F_{t_1}^{d,l,r,b,\varepsilon\,(t_2)}\right) - \theta(F^{t_1}),$
  - F^{t_1}, F^{t_2} the income distribution in periods t1 and t2;
  - $\theta(F^{t_1})$ and $\theta(F^{t_2})$ be functionals of these distributions.

- $\Delta_{\theta} = \theta(F^{t_1}) - \theta(F^{t_2}) = D_{\theta}^{d} + D_{\theta}^{l} + D_{\theta}^{r} + D_{\theta}^{b} + D_{\theta}^{\varepsilon} + I_{\theta}$
  - $I_{\theta} = \Delta_{\theta} - \sum_{k \in \{d,l,r,b,\varepsilon\}} D_{\theta}^{k}$: Interaction term

Data

- China Family Panel Studies (CFPS)
  - 2010 wave: 42,590 individuals from 14,960 households.
  - 2016 wave: 45,319 individuals from 14,763 households.

- Variables included
  - ***Demographic**:* age, gender, education level, marital status, hukou, residential location (urban or rural), number of children
  - ***Labor market structure**:* employment status, occupation, industry, presence of non-labor income
  - ***Income**:* employed income, self-employed income, capital income, other income, pension, basic living

Results

Table 1. Population and labor market structure

	2010	2016
Demographic		
Tertiary Education	0.080	0.122
Secondary Education	0.442	0.462
People 16-65	0.723	0.687
People > 65	0.090	0.122
Child 0-15	0.187	0.188
Child 0-3	0.043	0.046
Child 4-11	0.094	0.098
Child 12-15	0.050	0.044
Married	0.751	0.762
Urban Hukou	0.253	0.260
Male	0.504	0.497
Labour market		
In-work (non-agri employ)	0.379	0.495
All-work (Agri incl.)	0.695	0.782
Agricultural worker	0.316	0.287
Work-type		
Self-employed	0.100	0.117
employed	0.434	0.495
farming	0.466	0.389
Occupation		
Managers	0.021	0.057
Professionals	0.054	0.067
Assoc Prof.	0.031	0.038
Clerks	0.024	0.032
Service	0.139	0.147
Agri	0.474	0.397
Craft	0.150	0.126
Machines operate	0.086	0.076
Unskilled	0.021	0.060
Industry		
Agriculture	0.480	0.404
Industry	0.233	0.257
Services	0.286	0.339
Other market factors		
With capital income	0.088	0.130
With other income	0.472	0.231

Results

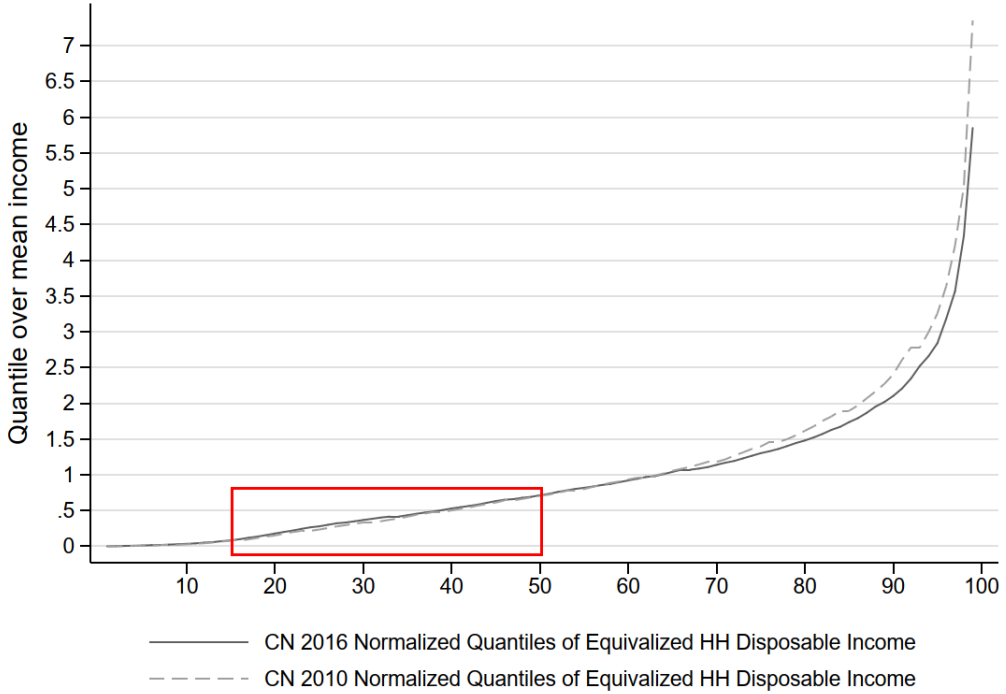
Table 2. Household per capita disposable income in 2010 and 2016 (Annual, in RMB)

	Mean	Median	Gini
CN10	7,769	4,225	0.562
CN16	19,394	12,237	0.522

Note: Author's calculation based on data adjusted for provincial price differences over year, In 2016 value

Results

Figure 2. Distribution of per capita household disposable income (Normalized quantile functions)



Results

Table 3. Household per capita disposable income decomposition by income source

Year	Share (s)	Gini (g)	Correlation (r)	Concentration (c=g*r)	Relative Contribution (s*g*r/G)
2010					
Labour Income	0.753	0.610	0.910	0.555	0.743
Capital and other	0.091	0.880	0.626	0.550	0.089
Benefits	0.156	0.884	0.685	0.606	0.168
Total		0.562			
2016					
Labour Income	0.808	0.567	0.910	0.516	0.799
Capital and other	0.051	0.928	0.613	0.569	0.055
Benefits	0.141	0.874	0.615	0.537	0.145
Total		0.522			

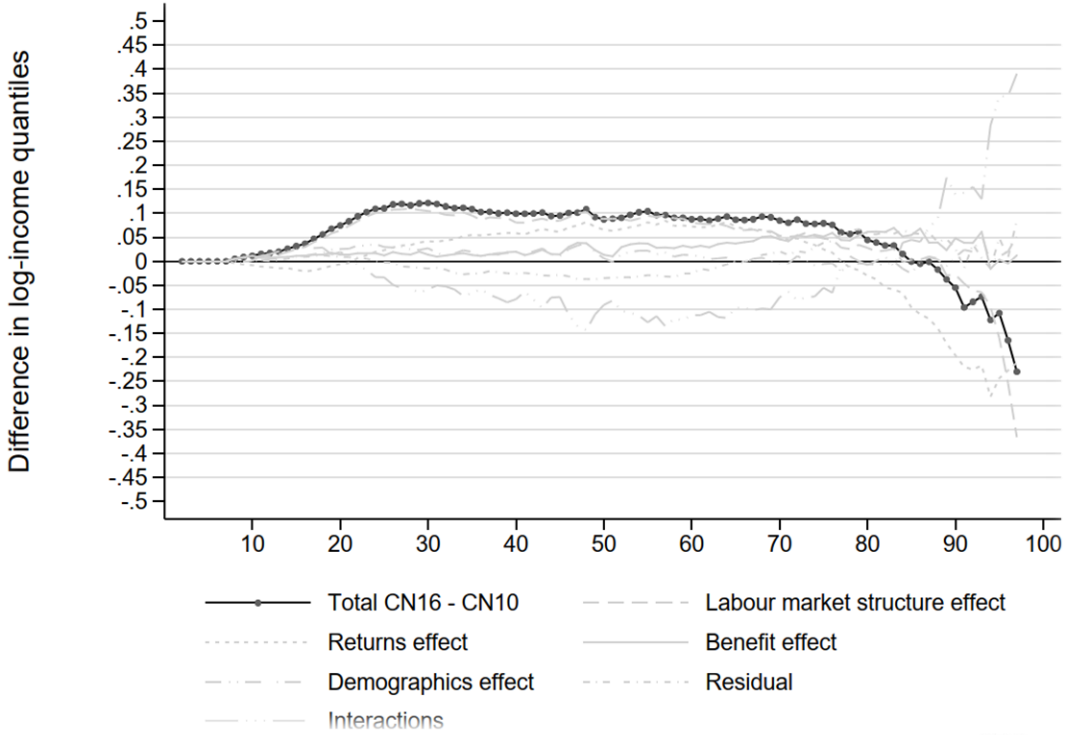
Results

Table 4. Household per capita gross market income decomposition by income source

Year	Share (s)	Gini (g)	Correlation (r)	Concentration (c=g*r)	Relative Contribution (s*g*r/G)
2010					
Labour Income	0.893	0.610	0.982	0.598	0.899
Capital and other	0.107	0.880	0.639	0.562	0.101
Total		0.595			
2016					
Labour Income	0.941	0.567	0.988	0.560	0.941
Capital and other	0.059	0.928	0.605	0.561	0.059
Total		0.561			

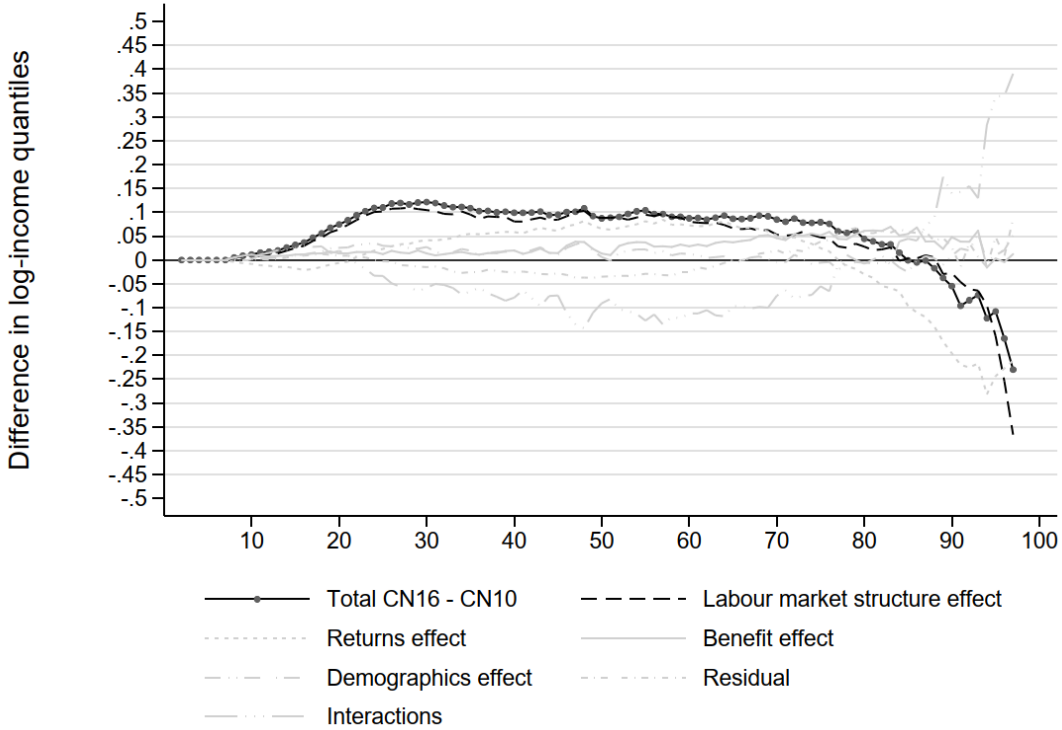
Results

Mean-normalized effect (Total)



Results

Mean-normalized effect (LMS)

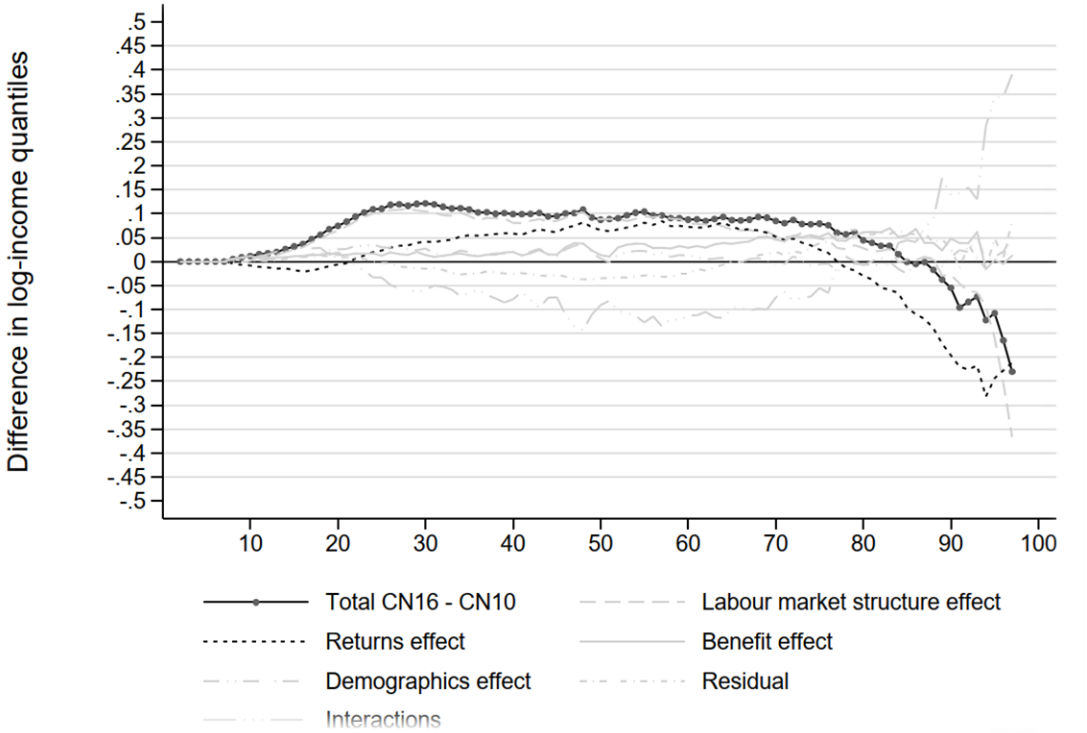


$$D_{\theta}^{l} = \theta\left(F^{16} - \theta\left(F_{16}^{l(10)}\right)\right)$$

UNITED NATIONS UNIVERSITY
UNU-MERIT
Maastricht University
Maastricht Graduate School of Governance

Results

Mean-normalized effect (Return)

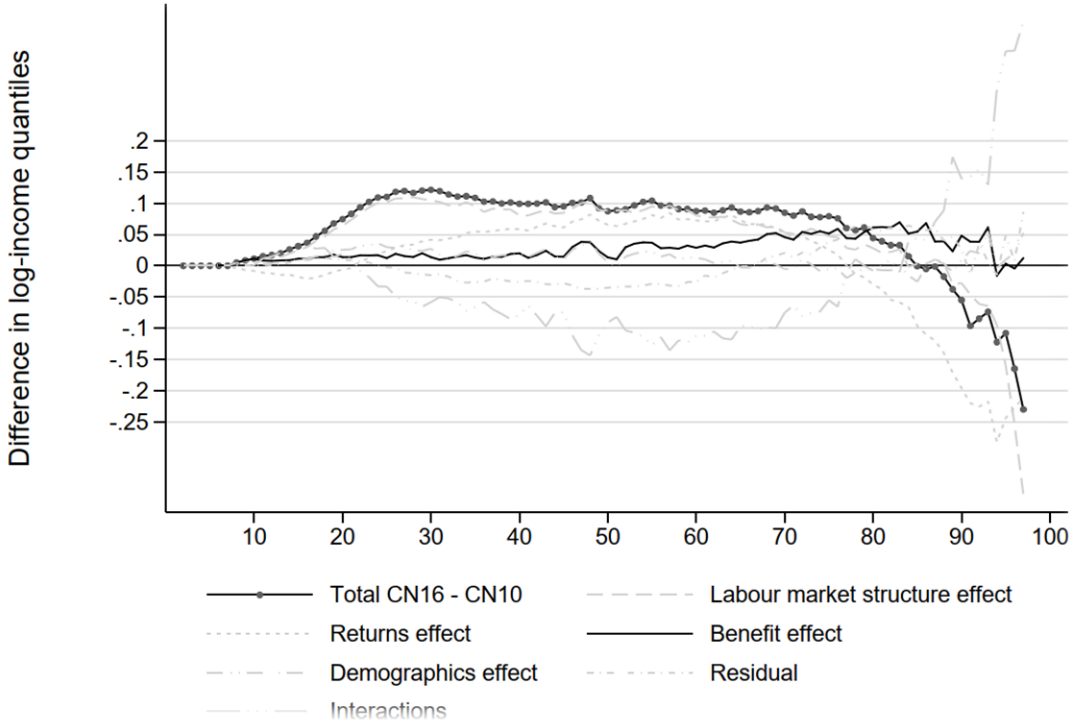


$$D_{\theta}^{r} = \theta\left(F^{16} - \theta\left(F_{16}^{r(10)}\right)\right)$$

UNITED NATIONS UNIVERSITY
UNU-MERIT
Maastricht University
Maastricht Graduate School of Governance

Results

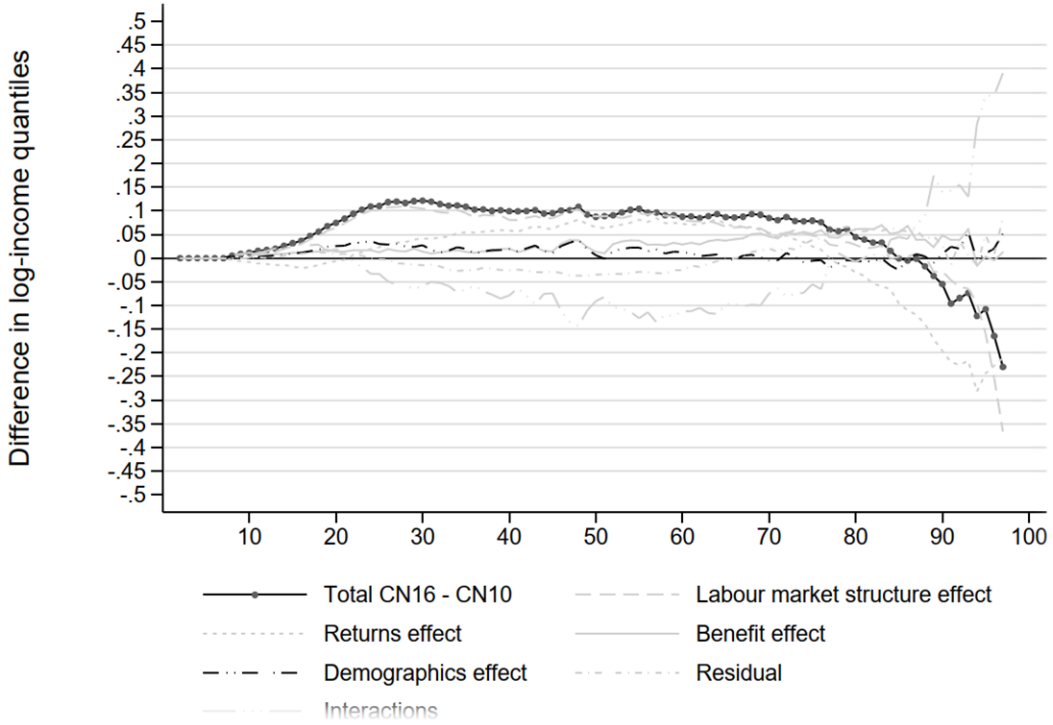
Mean-normalized effect (Benefit)



$$D_{\theta}^{b} = \theta\left(\mathrm{F}^{16} - \theta\left(\mathrm{F}_{16}^{b(10)}\right)\right)$$

Results

Mean-normalized effect (Demographic)



$$D_{\theta}^{d} = \theta\left(F^{16} - \theta\left(F_{16}^{d(10)}\right)\right)$$

Conclusion

- Household disposable income becomes more equally distributed in 2016.
- Change in labor market structure has the most equalizing effect on inequality. Possibly due the industrial upgrading. More people are employed in 2nd and 3rd industries and with higher ranking occupations, with the similar level of personal characteristics, such as education.
- Positive effect of return factor is centralized on the middle incomer (20%-75%)

- Benefit, pension and social safety net are benefiting all.
- However, the people at the bottom half of the income distribution receives less than the top half. The pension scheme need to be better structured and implemented.

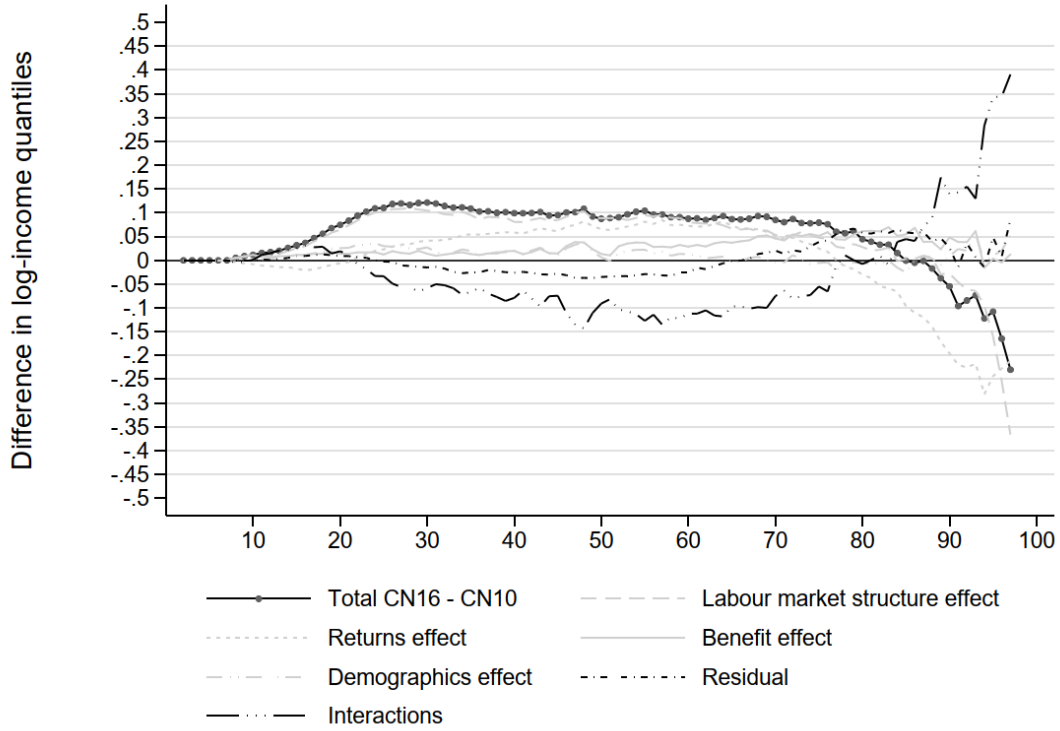
Thank you!

- Email: chen.gong@maastrichtuniversity.nl

- **Joint LISER-NUIG-IMA Microsimulation and Inequality Seminar Series**
- https://www.liser.lu/?type=module&id=247&tmp=microsimulation
  Those interested in attending or presenting, please contact *cathal.odonoghue@nuigalway.ie* and *denisa.sologon@liser.lu*.

Results

Mean-normalized effect (Residual & Interactions)



$$D_{\theta}^{\varepsilon} = \theta\left(F^{16} - \theta\left(F_{16}^{\varepsilon(10)}\right)\right)$$

UNITED NATIONS UNIVERSITY
UNU-MERIT
Maastricht University
Maastricht Graduate School of Governance