Linking EUROMOD with CGE model

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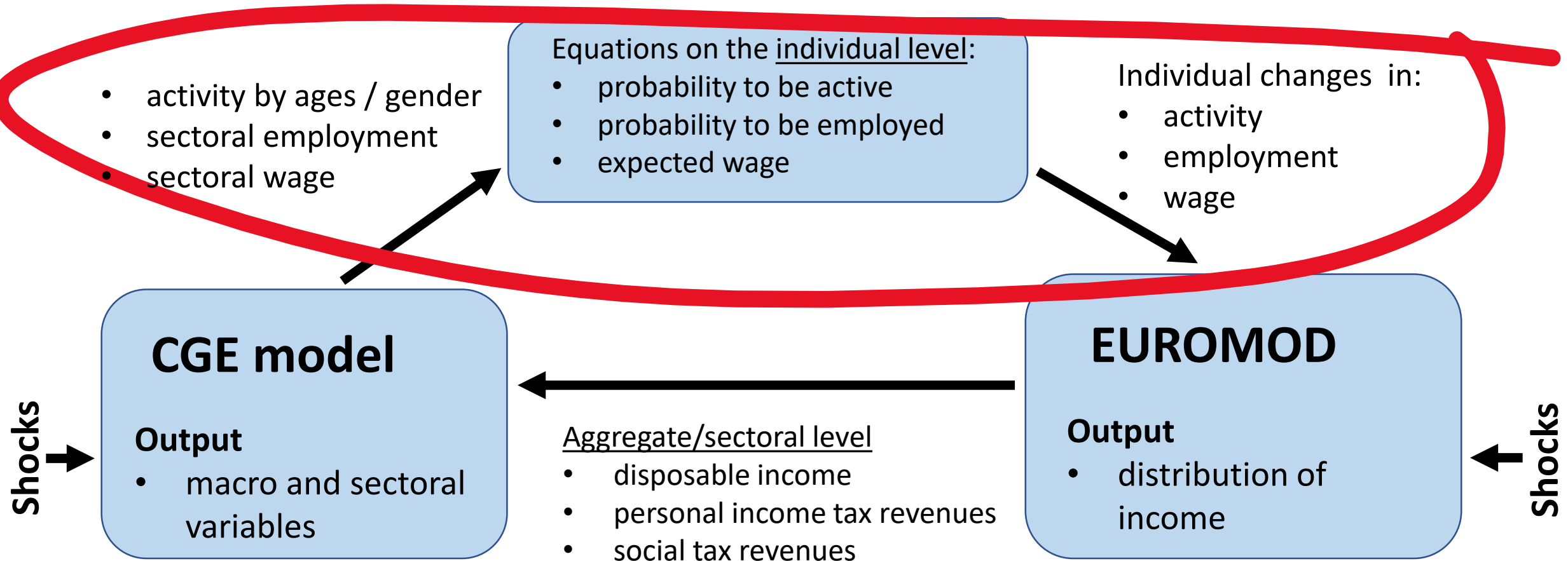
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Motivation

- Both models are widely used for policy analysis in Latvia
- Advantages and drawbacks of each model type:
  - EUROMOD:
    - (+) accounts for the agents' heterogeneity and allows analyzing distributional effects of a reform
    - (-) partial equilibrium
  - CGE model:
    - (+) account for general equilibrium effects of a reform
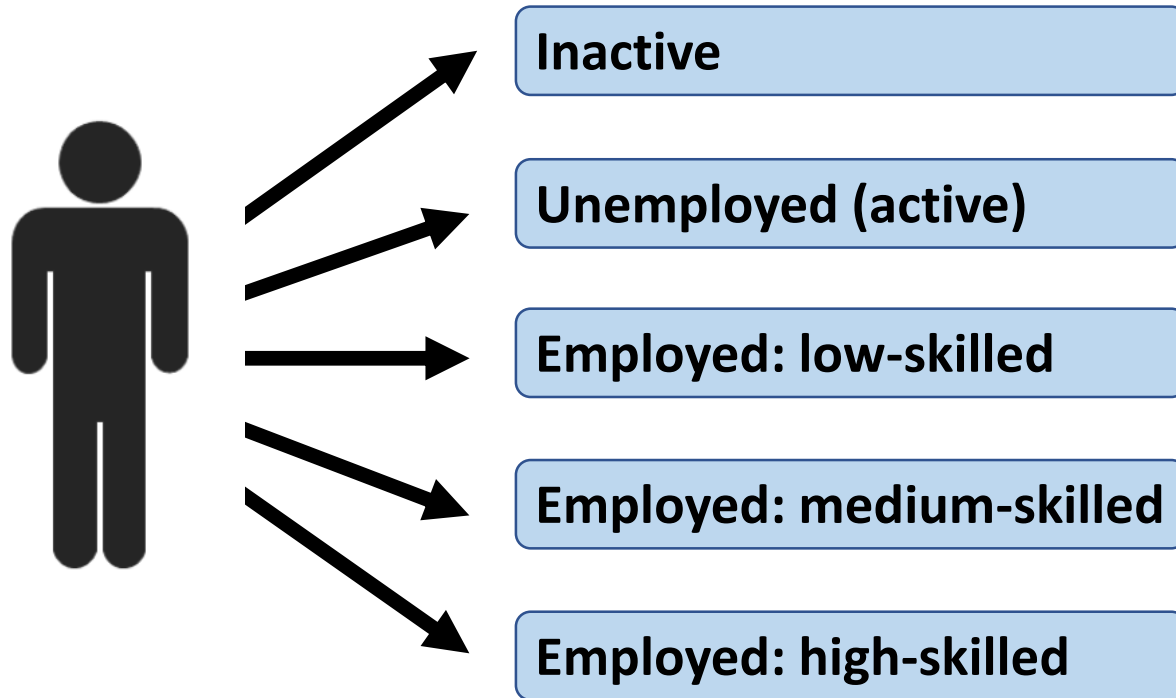   - (-) aggregate/sectoral model

CGE model with fiscal sector

- Latvia's CGE model (see Benkovskis et al., 2016)
  - similar in structure to MONASH, see Horridge (2000) and Dixon et al. (2013)
- <u>Some important adjustments</u> for this project:
  - **30 thousand variables**, almost 3 thousand are exogeneous
    - based on **2015 IO tables** for Latvia: **63 industries** and products
  - Imperfect labour mobility
  - Three types of labour introduced: **high-skilled, medium-skilled** and **low-skilled**
    - by 63 industries
  - Klein-Rubin utility function instead of Cobb-Douglas: income elasticity of consumption can differ from unity
    - five quintiles of consumers with different propensities to consume

General scheme of the linked model(s):
Bottom-up-top-down approach

activity by ages / gender
sectoral employment
sectoral wage

Equations on the <u>individual level</u>:
- probability to be active
- probability to be employed
- expected wage

Individual changes in:
- activity
- employment
- wage

CGE model

Output
- macro and sectoral variables

Aggregate/sectoral level
- disposable income
- personal income tax revenues
- social tax revenues

EUROMOD

Output
- distribution of income

Shocks

Shocks

Modelling individual labour supply

Inactive

Unemployed (active)

Employed: low-skilled

Employed: medium-skilled

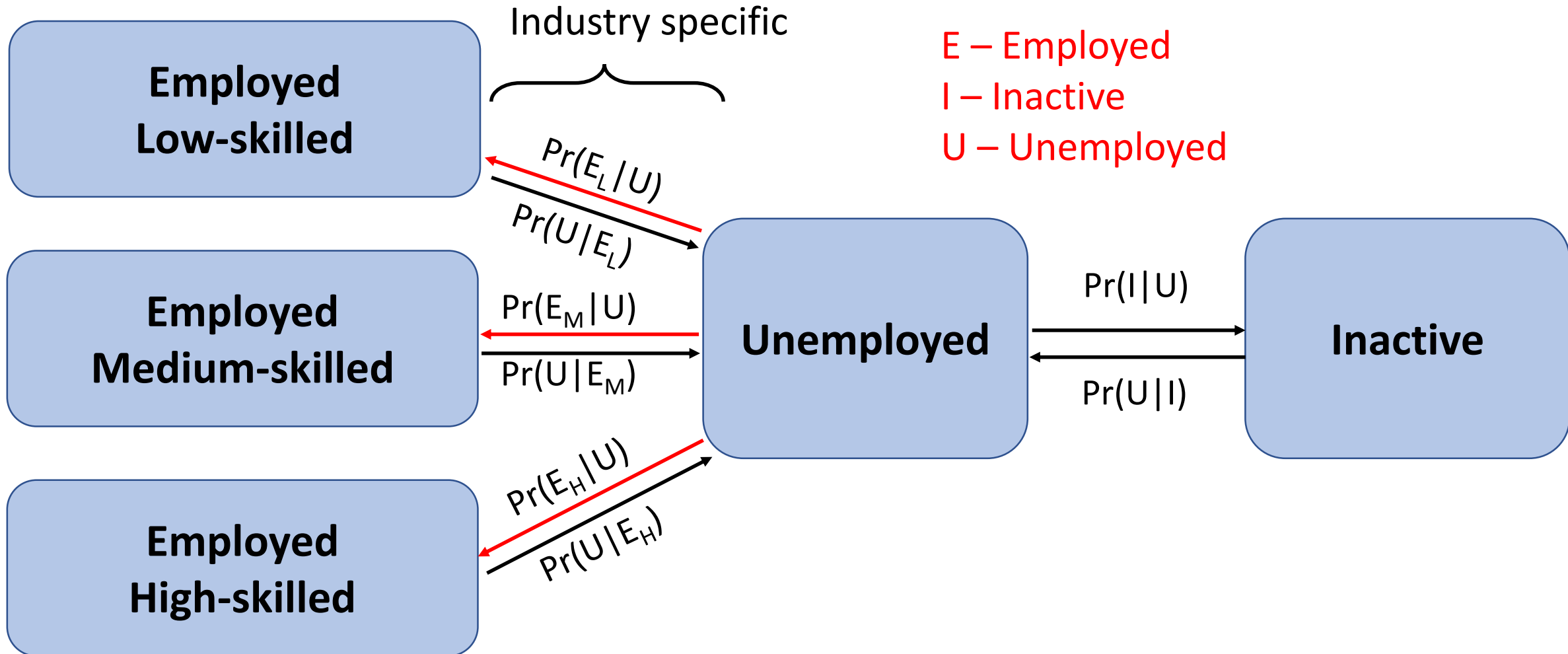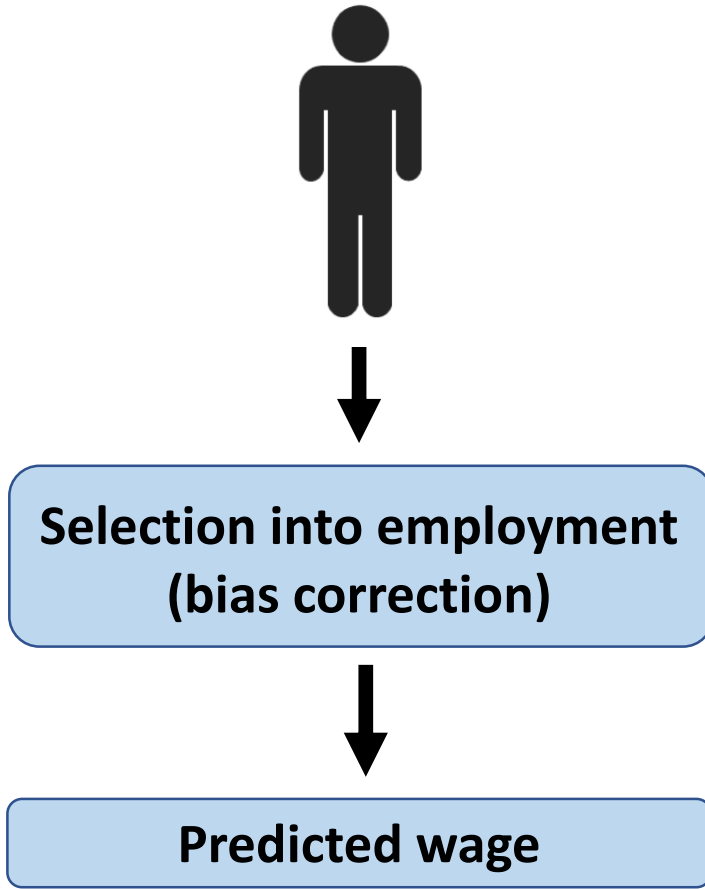| Employed: high-skilled |
|---|

- Each person can be in one of the **five states**
- Probability of each state estimated using **multinomial logit** by gender
- Determinants:
  - demographics
  - household composition
  - education
  - other household members' earnings
  - household non-employment income

Change of economic status in EUROMOD-CGE

Industry specific

E – Employed
I – Inactive
U – Unemployed

Employed Low-skilled

$Pr(E_L|U)$
$Pr(U|E_L)$

Employed Medium-skilled

$Pr(E_M|U)$
$Pr(U|E_M)$

Employed High-skilled

$Pr(E_H|U)$
$Pr(U|E_H)$

Unemployed

$Pr(I|U)$
$Pr(U|I)$

Inactive

Predicting wage for new hires
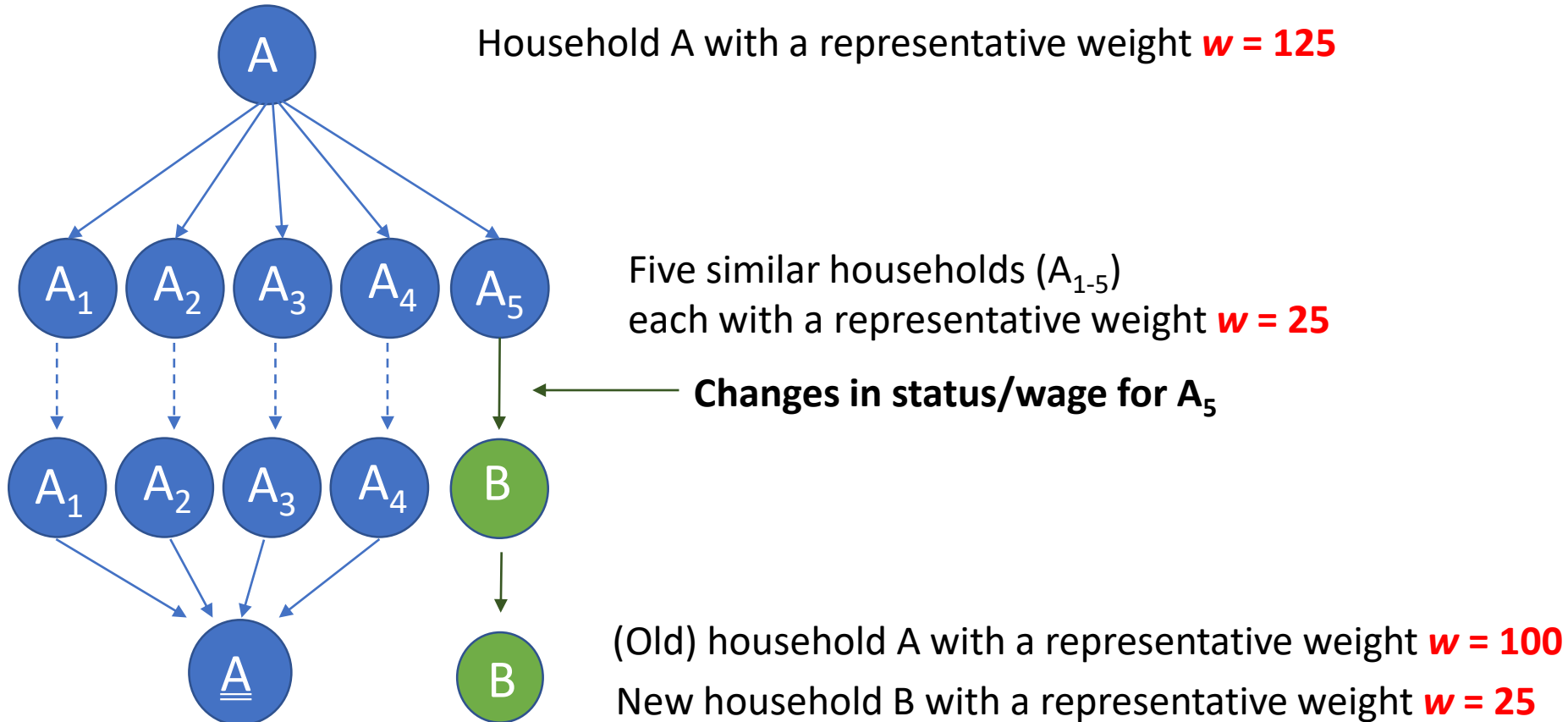
Selection into employment (bias correction)
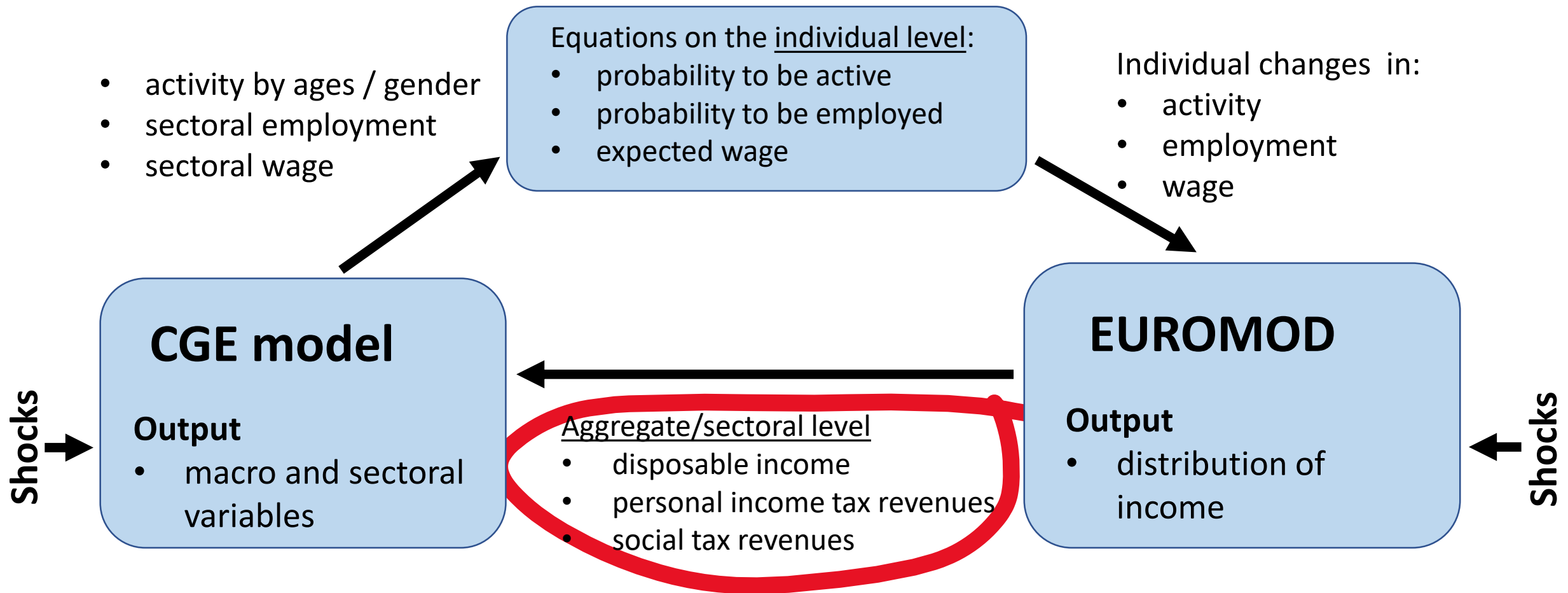
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Predicted wage

- Predicting **wage relative to industry/year average**
  - **Heckman model** to correct for selection bias
  - Determinants of wage:
    - demographics
    - household composition
    - education
    - skills
  - Instruments for the selection equation:
    - number of children
    - mortgage
    - other household members' earnings
    - household non-employment income

Changes in status and weights

Household A with a representative weight **w = 125**

Five similar households (A_{1-5})
each with a representative weight **w = 25**

Changes in status/wage for A_5

(Old) household A with a representative weight **w = 100**

New household B with a representative weight **w = 25**

By that we take into account changes in status/wage for "individual" household

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EUROMOD

Output
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Shocks

Shocks

How do CGE and EUROMOD models converge?

Disposable income by quintiles (5 equations):

$$y_{quintile}^{disp} = f(wage, employment, \dots) + \varepsilon_{quintile}^{disp}(EUROMOD - CGE)$$

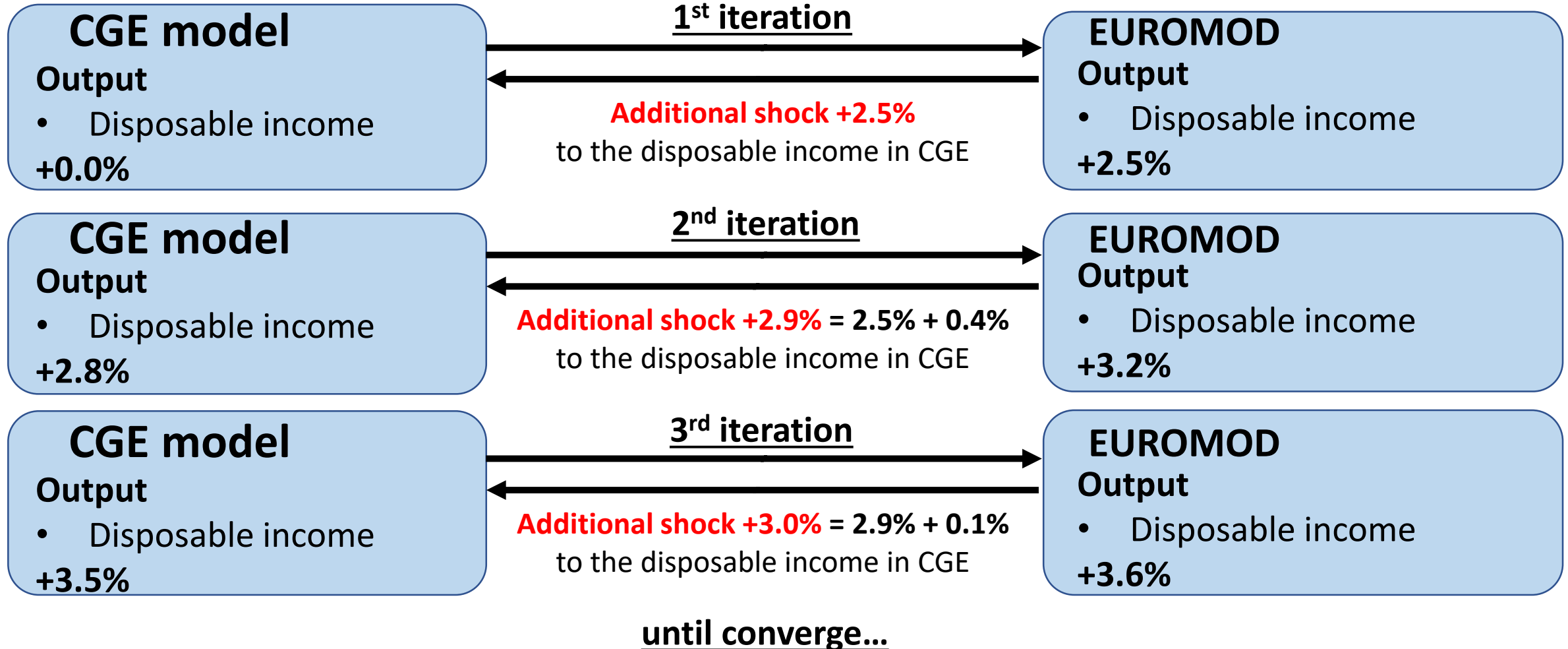Total revenues from PIT and social security contributions (3 equations):

$$revenues^{tax} = wage + employment + \varepsilon^{tax}(EUROMOD - CGE)$$

Benefits (unemployment, family, other: 3 equations):

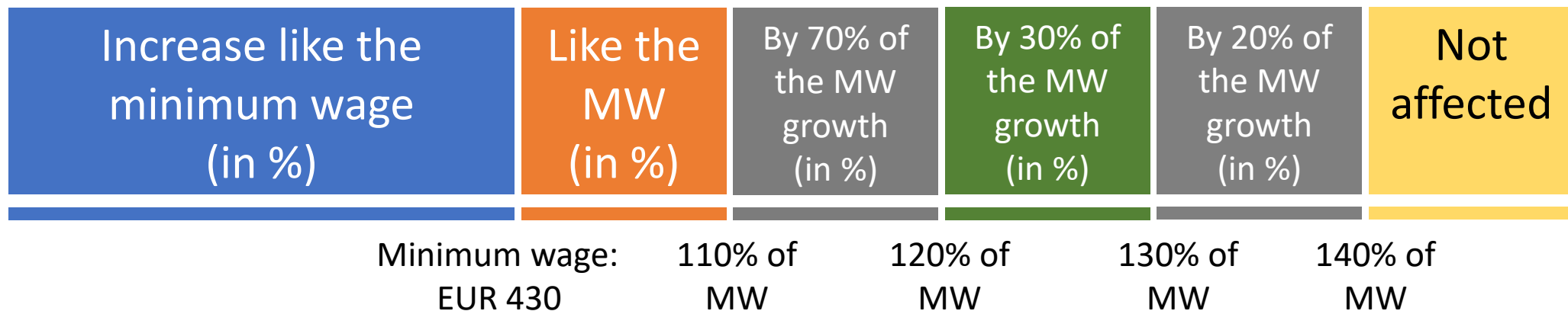$$expenditures^{benefits} = \varepsilon^{benefits}(EUROMOD - CGE)$$

$\boldsymbol{\varepsilon(EUROMOD - CGE)}$: cumulated difference between the output of EUROMOD and the output of CGE in the previous iteration

Shock to EUROMOD that stimulates income

CGE model
Output
- Disposable income

+0.0%

1ˢᵗ iteration

EUROMOD
Output
- Disposable income

+2.5%

Additional shock +2.5%
to the disposable income in CGE

CGE model
Output
- Disposable income

+2.8%

2ⁿᵈ iteration

EUROMOD
Output
- Disposable income

+3.2%

Additional shock +2.9% = 2.5% + 0.4%
to the disposable income in CGE

CGE model
Output
- Disposable income

+3.5%

3ʳᵈ iteration

EUROMOD
Output
- Disposable income

+3.6%

Additional shock +3.0% = 2.9% + 0.1%
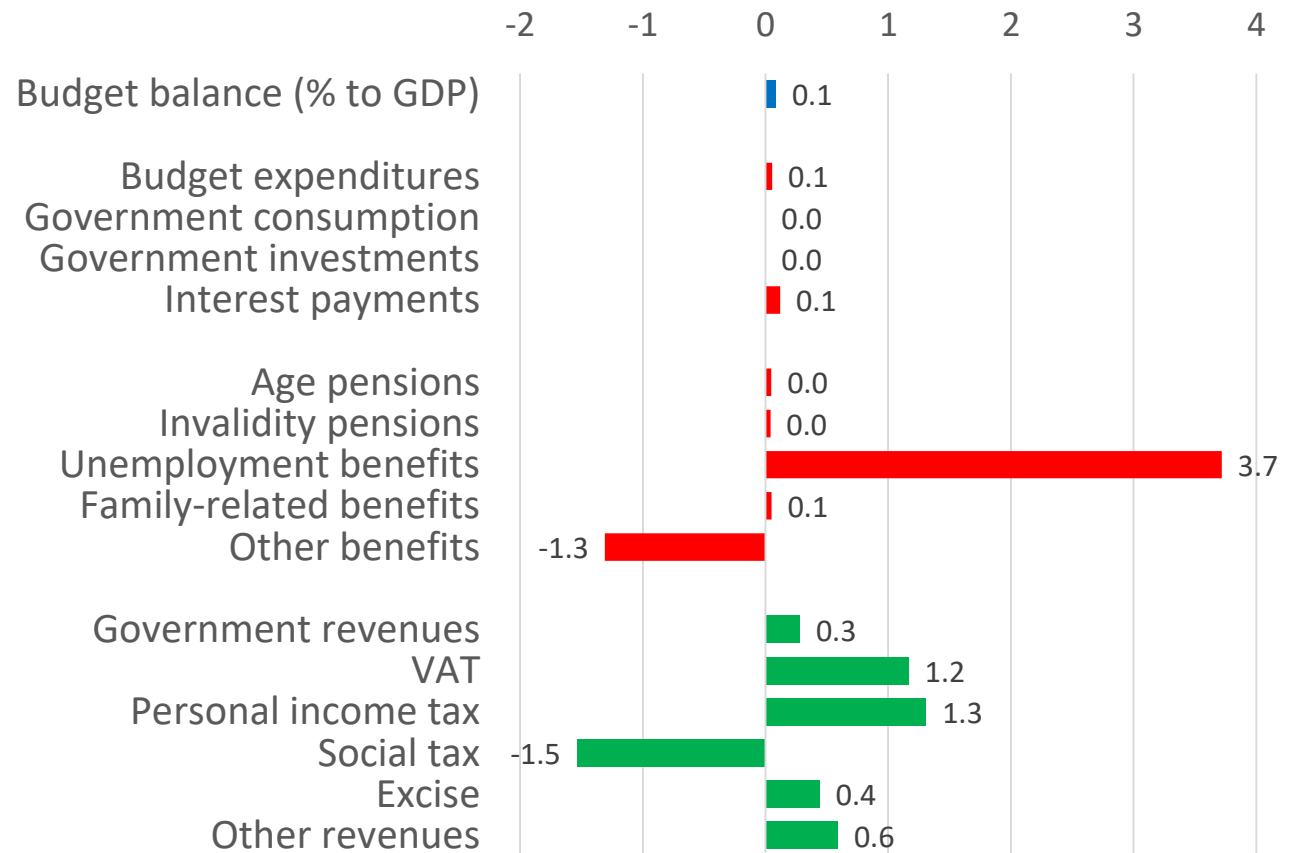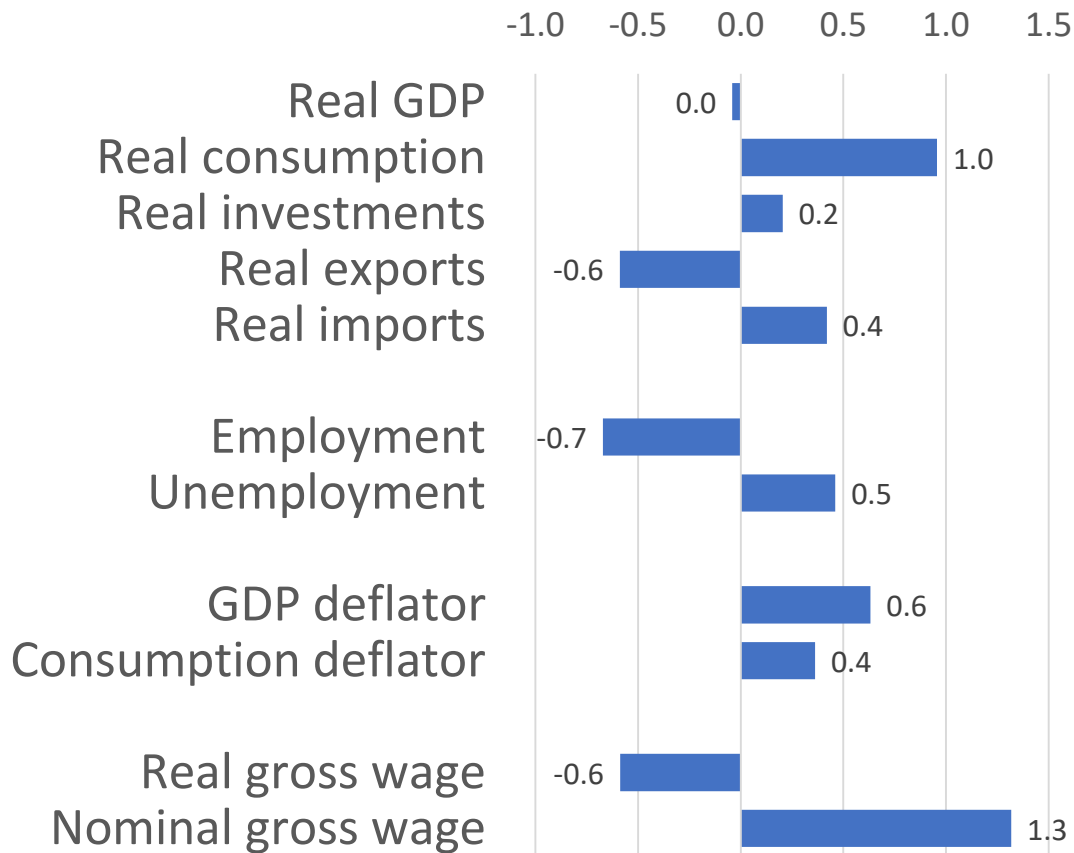to the disposable income in CGE

until converge…

Increase in the minimum wage

- Increase in the **minimum wage in 2019 from 430 to 500 EUR**
- Assume spillovers to wages above the minimum wage: employers are likely to keep the relative wage unchanged
- Shock to the CGE: **industry-specific increase in wage**
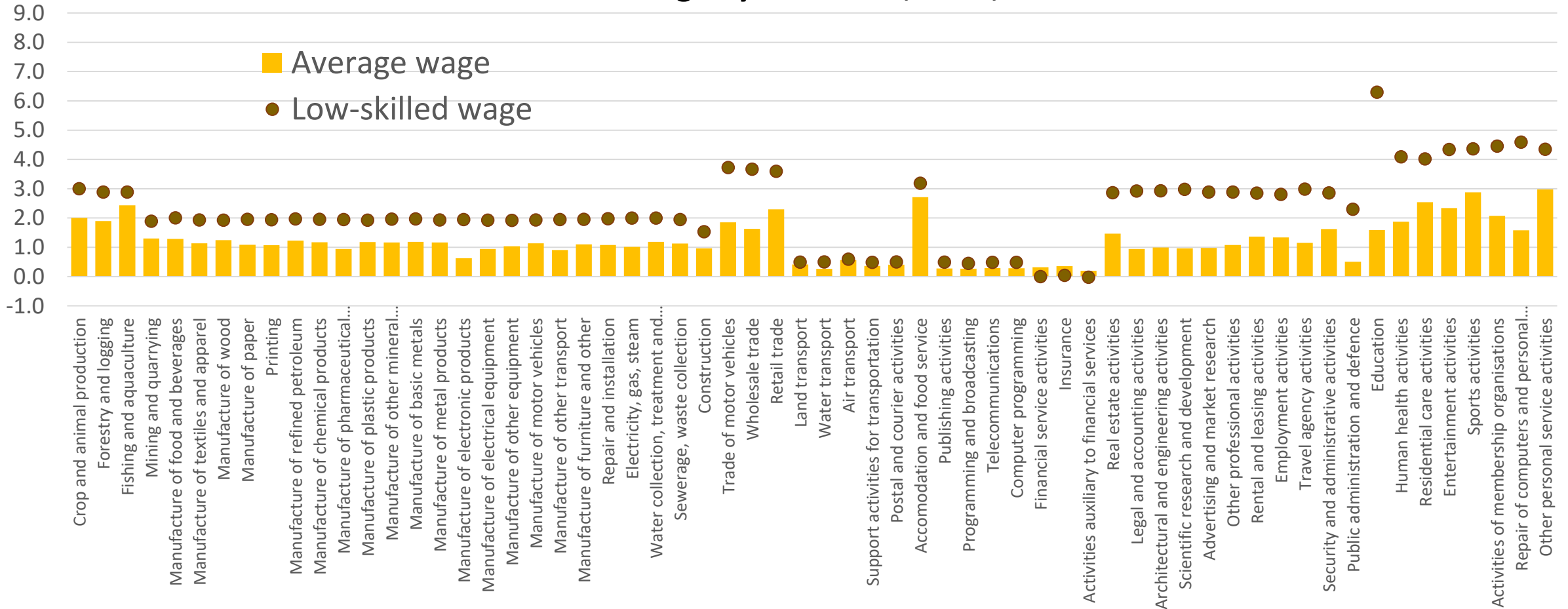 - obtained from the EUROMOD

Increase like the minimum wage (in %)	Like the MW (in %)	By 70% of the MW growth (in %)	By 30% of the MW growth (in %)	By 20% of the MW growth (in %)	Not affected
Minimum wage: EUR 430	110% of MW	120% of MW	130% of MW	140% of MW	

Increase in minimum wage: macro effects

2019, % to baseline

Left chart:

	%
Real GDP	0.0
Real consumption	1.0
Real investments	0.2
Real exports	-0.6
Real imports	0.4
Employment	-0.7
Unemployment	0.5
GDP deflator	0.6
Consumption deflator	0.4
Real gross wage	-0.6
Nominal gross wage	1.3

Right chart:

	%
Budget balance (% to GDP)	0.1
Budget expenditures	0.1
Government consumption	0.0
Government investments	0.0
Interest payments	0.1
Age pensions	0.0
Invalidity pensions	0.0
Unemployment benefits	3.7
Family-related benefits	0.1
Other benefits	-1.3
Government revenues	0.3
VAT	1.2
Personal income tax	1.3
Social tax	-1.5
Excise	0.4
Other revenues	0.6

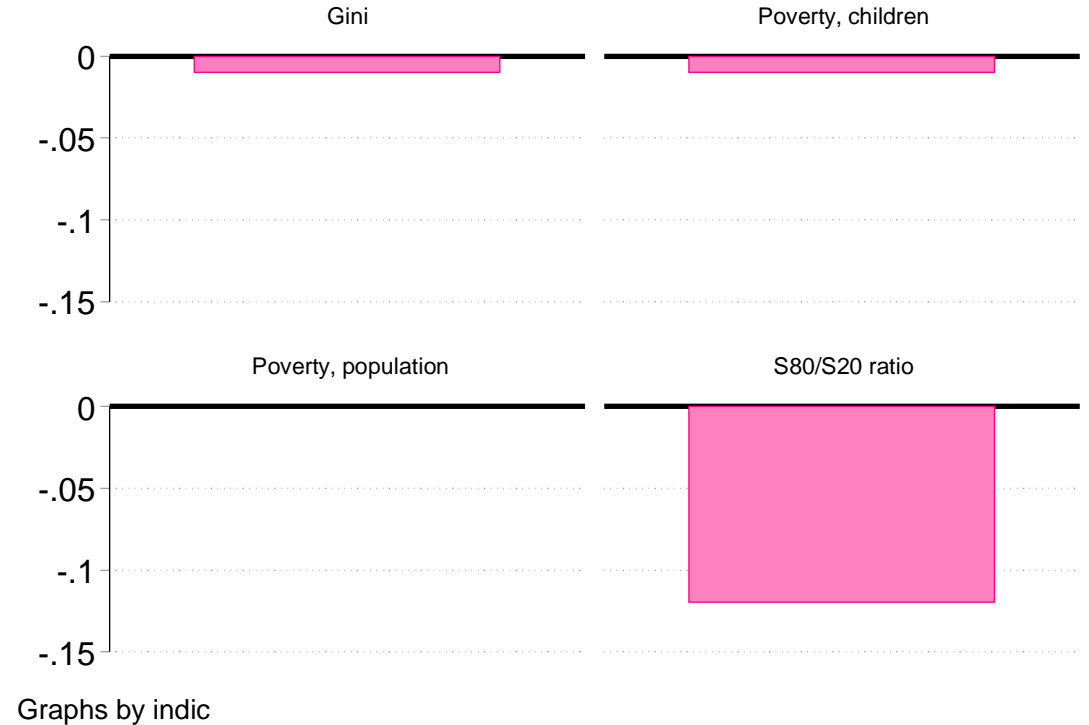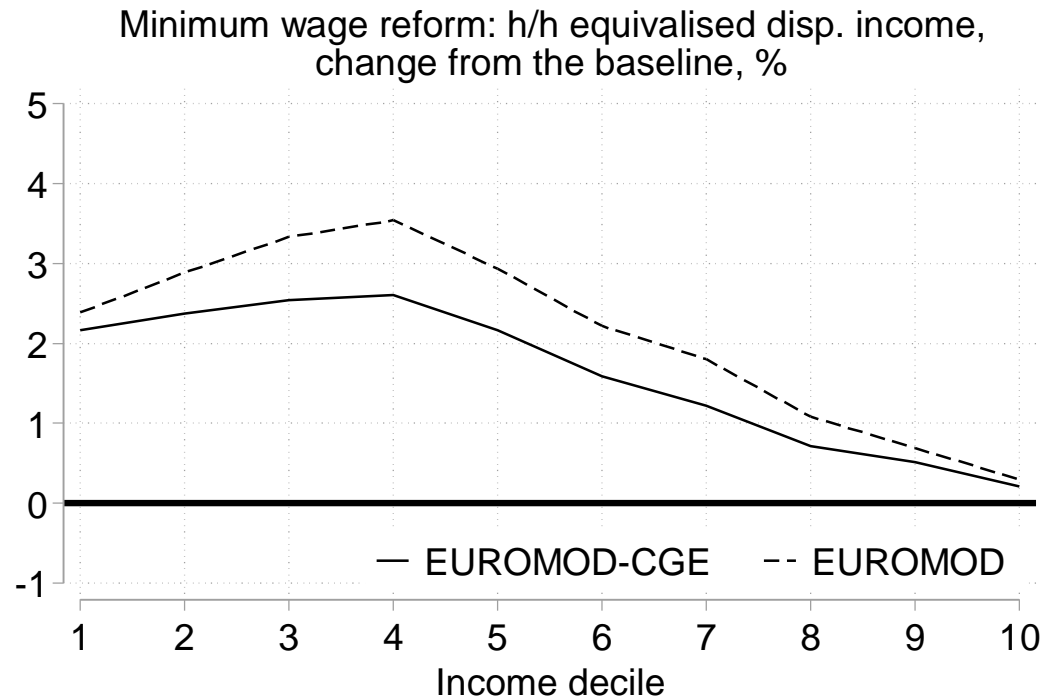# Increase in minimum wage: industry effects

Gross nominal wage by industries, 2019, % to baseline

Increase in minimum wage: micro effects

Minimum wage reform: h/h equivalised disp. income, change from the baseline, %
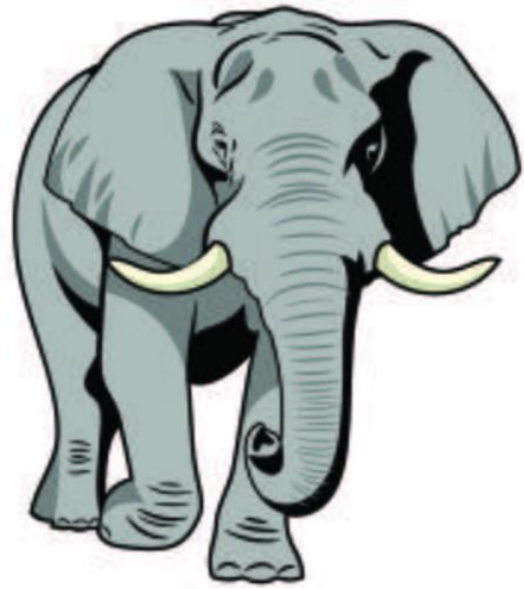
- Disposable income: households in the 4th decile gain the most
- Slight decrease in child poverty, decline in inequality

(Some) problems while linking the models

- CGE contains the endogenous informal sector. Latvia's EUROMOD assumes no informality
  - Simulation of minimum wages implicitly assumes no envelope wages
  - Can compliment with a negative shock to a envelope wages in CGE
- Models are linked dynamically using predictions from CGE
  - Predict the individual employment/wages
  - Uprate non-simulated income components in EUROMOD
  - … BUT demographics in EUROMOD assumed to remain at the latest EU-SILC year
    - Relatively minor issue for the medium-term projections
    - Adding more links may disturb the convergence process

Conclusions

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… but it flies