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EUROMOD Net Replacement Rate (NRR) Add-on - technical note

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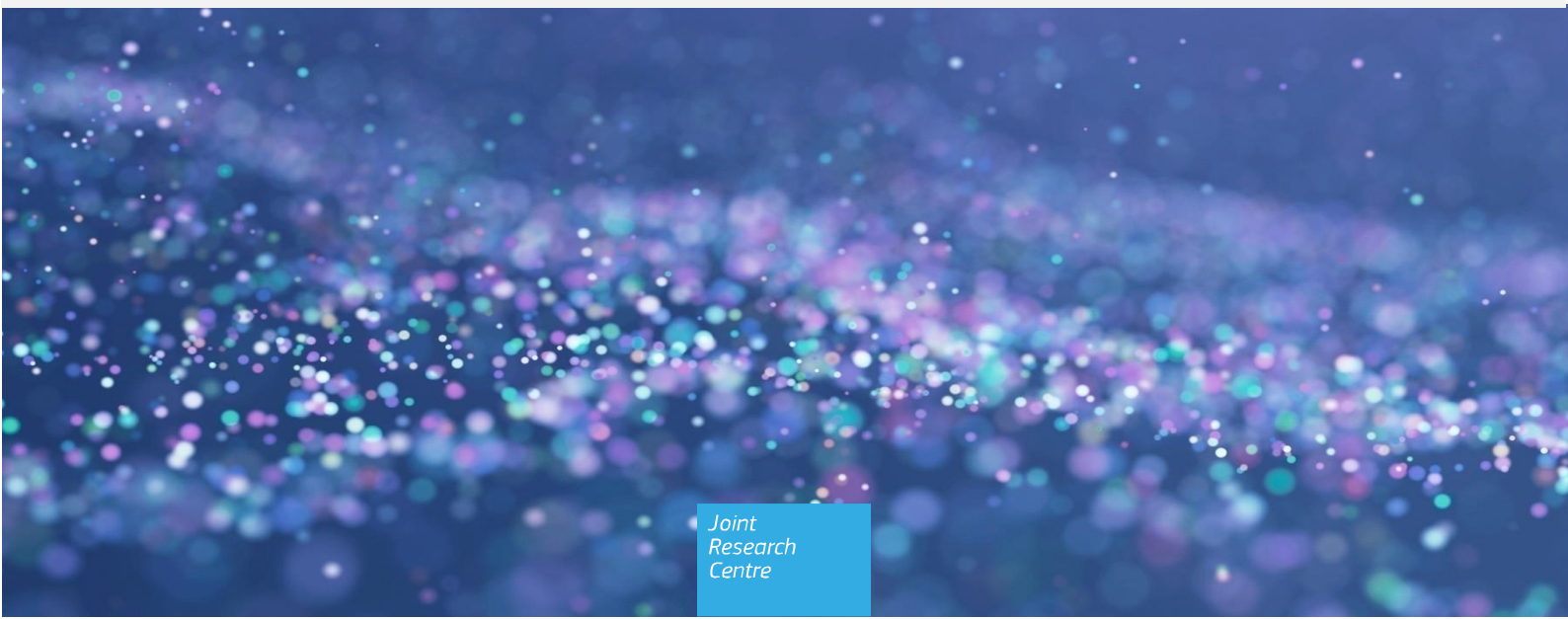

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Contents

Acknowledgements 2
1 General aspects 3
2 Specific assumptions 4
3 Structure of the NRR Add-On 5
4 Modified spine (by default) 8
5 Adding extra variables to the NRR output 9
6 Basic Checks of NRR results with Stata 10

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1 General aspects

The NRR Add-On simulates disposable income in case of unemployment for all people currently in work (i.e. all people observed with positive earnings in the data). In particular:

- It calculates two main indicators:
  - the net replacement rate (NRR) and the participation tax rate (PTR)

    $\mathrm{NRR_i} = \frac{Y_h^U}{Y_h^W}$ and $\mathrm{PTR_i} = 1 - \frac{Y_h^W - Y_h^U}{E_i}$, where

    i, h ... the indices refer to individual *i* and household *h*

    Y_h^W ... simulated household disposable income in work

    Y_h^U ... simulated household disposable income in unemployment

    E_i ... individual gross earnings before becoming unemployed
  - the net replacement rate (NRR) is the ratio between household disposable income in unemployment and household disposable income in employment[1]
  - the participation tax rate (PTR) measures the proportion of income kept after becoming unemployed (due to increased benefits or reduced SIC/taxes).
- For the NRR Add-On to run without errors, it is a requirement for all countries to implement unemployment benefits according to the EUROMOD Modelling Conventions.
- The NRR Add-On works in a similar way as the Marginal Tax Rate (MTR) Add-on. It simulates household disposable income in a hypothetical case of people in work becoming unemployed and it does so for each person in the household in case there are multiple earners in the household.
- In order to simulate disposable income in unemployment, the NRR Add-On replaces the values of earnings by setting them to zero. It also changes the value of other labour market variables to reflect the change in status from employment to unemployment (e.g. hours of work are set to zero, labour market status is changed to unemployed).

[1] As such, the Add-On could be referred more precisely as a NRR to unemployment Add-On.

2 Specific assumptions

Some assumptions need to be made in order to simulate disposable income in case of unemployment, for individuals observed with positive earnings in the data:

- First, the duration of the unemployment spell is set equal to number of months (previously) in employment in order to compare disposable income in employment and unemployment for the same period of time.
- Second, months of contributions to unemployment insurance (contribution history) are assumed equal to months in employment. However, in few cases, an adjustment is made for eligibility periods above 12 months. For instance, in Latvia contribution history is evaluated over a period of 16 months. In our simulations, months of contributions would be equal to months (previously) in employment times 16 divided by 12.

A particular problem arises when simulating disposable income in unemployment for individuals who in the data are observed receiving both earnings from work but also unemployment benefit in the income reference period. This is an issue of technical nature. Individuals can fulfil two conditions in the model that should be in principle considered mutually exclusive:

- (i) they are observed receiving benefit in the data and therefore get (part-)simulated unemployment benefit;
- (ii) they have positive earnings which will be set to zero to simulate unemployment benefit using the Add-On.

Moreover, in case we want to integrate NRR simulations of unemployment benefits as well as baseline (part-) simulations of unemployment benefits into the same variable, it is not clear which would be the relevant variables to be used in the simulation. Which previous earnings would become relevant? Those used in the baseline simulations (which are based on reverse ruling or imputed wages) or those used in the NRR simulations (which correspond to earnings before assuming transition into unemployment)? It is likely that assumptions about the structure of the two different unemployment spells (the one observed in the data and that assumed for the NNR simulations) would need to be made to choose the relevant variables.

For the reasons in the previous point, a particular approach was used to consider individuals with both positive earnings and unemployment benefit receipt in the data, separately from those with positive earnings and no unemployment benefit receipt. In order to calculate NRR for the former group, we disregard the unemployment benefits from their disposable income by setting them to zero. Then in a second step, we simulate their disposable income in case they had been unemployed for the same number of months that they had been employed. In this sense we compare similar durations in employment and unemployment and avoid mixing baseline (part-)simulations and NRR simulations of unemployment benefits.

More precisely, the NRR Add-On runs in three iterations of an outer loop and two household level loops (inner loops). The first iteration of the outer loop runs the EUROMOD baseline as it is. The second iteration runs after having setting to zero the unemployment benefits for those individuals who have both positive earnings and receive unemployment benefit. The NRR Add-On sets to zero the unemployment related benefits for each individual in the household in turn (first inner loop). Finally, the third iteration runs, and calculates household disposable income in case of unemployment for all the people with positive earnings. If there are multiple earners in the household, the NRR Add-On runs this third iteration for each individual in the household in turn (second inner loop).

3 Structure of the NRR Add-On

The NRR Add-On consists of the following policies:

- ao_control_NRR
    - defines which country systems the Add-on can be run with (AddOn_Applic)
    - defines which additional NRR 'policies' are added to the policy spine and where (AddOn_Pol)
    - restricts the standard output policy to the baseline results only (AddOn_Par)
    - switches OFF tax compliance (TCA) and benefit take-up (BTA) adjustments, i.e. full compliance with the policy rules and full take-up of benefits are assumed (AddOn_Extension)
- NRR_SWITCH
    - switches ON or OFF specific country policies for the NRR simulations (ChangeParam)
- NRR_PREP
    - performs general adjustments needed before the looping of tax-benefit policies: e.g. define new tax units (TUs), income lists (ILs) and variables etc.
    - stores backup values of variables that will be changed in the Add-on
        - note that all variables are stored at the individual level
    - defines/starts the outer loop (named NRR_BASE) (Loop): 1st loop is the baseline
    - defines/starts the first inner loop (named PREP) (UnitLoop) within the 2nd iteration of the outer loop: unemployment benefits and months in unemployment are set to zero for individuals with both positive earnings and unemployment benefit receipt, for each person in the household in turn, therefore, the number of runs depends on how many people with positive earnings and unemployment benefits there are in the household
    - defines/starts the second inner loop (named NRR) (UnitLoop) within the 3rd iteration of the outer loop: earnings are set to zero and other labour market variables are adjusted to simulate disposable income in unemployment, for each person in the household in turn, therefore, the number of runs depends on how many people with positive earnings there are in the household
- NRR_PADJ
    - runs on the second iteration of the outer loop (Run_Cond: {loopcount_nrr_base=2}) for all individuals
    - sets unemployment benefits and months in unemployment to zero for individuals with both positive earnings and unemployment benefit receipt, for one person at a time in each household
- NRR_ADJ
    - runs on the third iteration of the outer loop (Run_Cond: {loopcount_nrr_base=3}) for individuals with positive earnings
    - sets values of the NRR-specific variables, before earnings and labour market variables are adjusted to represent individuals' characteristics in unemployment: e.g.
        - identifier of new unemployed: 'lnu' is set equal to 1 for all individuals with positive earnings
        - previous earnings: 'yempv_a' is set equal to yem or the income concept used as base for the unemployment insurance benefit simulation
        - number of moths worked in qualifying period: 'liwmy_a' is set equal to liwmy or yemmy, adjusted by the length of qualifying period
    - switches ON or OFF country specific policies in the third loop only (ChangeParam)

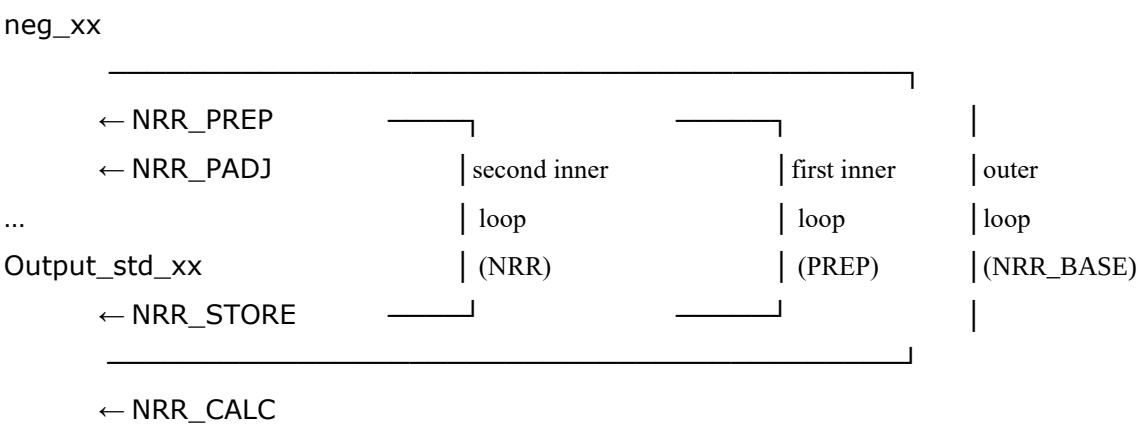
- NRR_INIT
    - runs on the third iteration of the outer loop (Run_Cond: {loopcount_nrr_base=3}) for individuals with positive earnings
    - adjusts values of earnings and labour market variables to represent the situation of individuals in unemployment: e.g. yem=0; yse=0; lhw=0; lunmy=liwmy; liwmy=0; etc.
        - note that months in unemployment is set equal to months in employment in order to compare disposable income in employment and unemployment over a similar period of time
    - switches ON or OFF country-specific policies in the third loop only (ChangeParam)
    - *(Update tax units (UpdateTu) – currently not used)*
- NRR_BUN
    - runs on the third iteration of the outer loop (Run_Cond: {loopcount_nrr_base=3}) for individuals with positive earnings
    - switches ON unemployment benefit policies, which are switched OFF in the baseline
    - allows to modify unemployment benefit policies in each country (optional)
        - note that, by default, the NRR Add-on uses the unemployment policies of the baseline
- NRR_STORE
    - stores the baseline results (Store, *postloop=nrr_base*); by default all standard income lists (ils_*) and their components, and labour market variables
        - note that all variables are stored at the individual level
        - variables stored in the first (baseline) iteration will appear in the output with a suffix _NRR_BASE1
    - stores the second iteration results (Store, *postloop=prep*); by default all standard income lists (ils_*) and their components, and labour market variables
        - note that all income lists are stored at the household level by default (as *level=tu_household_nrr*)
        - however, variables and specific income lists are stored at the individual level (as *il_level=tu_individual_=cc=* and *Var_level=tu_individual_=cc=*)
        - variables stored in the second loop will appear in the output with a suffix _PREP
    - stores the third iteration results (Store, *postloop=nrr*); by default all standard income lists (ils_*) and their components, and labour market variables
        - variables for the NRR run have "missing" values (i.e. 9999999) for people from households not included in that run; those with no earnings
        - note that all income lists are stored at the household level by default (as *level=tu_household_nrr*)
        - however, variables and specific income lists are stored at the individual level (as *il_level=tu_individual_=cc=* and *Var_level=tu_individual_=cc=*)
        - variables stored in the third iteration will appear in the output with a suffix _NRR
    - restores variables to their 'backup' values (Restore), after each individual loop within the household, see also NRR_PREP
- NRR_CALC
    - calculates the NRR related indicators:
        - change in earnings (ils_earns_diff)

        - NRR in percent (nrrpc): nrrpc = (ils_dispy_nrr/ils_dispy_prep)*100
        - NRR components in percent, such that nrrpc = nrrpc_pen + nrrpc_benmt + nrrpc_bennt + nrrpc_tax + nrrpc_sicee + nrrpc_sicse + nrrpc_origy
    - *(restores baseline results (Restore) – currently not needed and switched OFF)*
        - *note that this is <u>only</u> limited to the variables listed in NRR_STORE (Store, postloop=nrr_base)*
    - defines a separate output for NRR results; by default initial earnings, all (standard) income lists and labour market variables in the baseline; and variables named nrr*, *nrr, *prep, *nrr_base1 or *diff
        - note that missing values for variables from the NRR loop (see NRR_STORE) are replaced with 9999999

4 Modified spine (by default)

The placement of the Add-on in the country-specific policy spines is described in Figure 1.

Figure 1. NRR Add-on location in the country spine



5 Adding extra variables to the NRR output

To output additional variables:

- First iteration (baseline) results
    - Add the variable/IL to Store in NRR_STORE (*postloop=nrr_base*) unless already included, e.g. bsa_s
    - Add to DefOutput in NRR_CALC, e.g. *bsa_s_nrr_base1*
- Second iteration results (inner loop prep, nrr_base=2)
    - Add the variable/IL to Store in NRR_STORE (*postloop=prep*) unless already included, e.g. bsa_s
    - Specify if the variable/IL in NRR_STORE (*postloop=prep*) should be stored at the individual level (Var_level=tu_individual_=cc=)
    - Add to DefOutput in NRR_CALC, e.g. *bsa_s_prep*
- Third iteration results (inner loop nrr, nrr_base=3)
    - Add the variable/IL to Store in NRR_STORE (*postloop=nrr*) unless already included, e.g. bsa_s
    - Specify if the variable/IL in NRR_STORE (*postloop=nrr*) should be stored at the individual level (Var_level=tu_individual_=cc=)
    - Add to DefOutput in NRR_CALC, e.g. *bsa_s_nrr*

6 Basic Checks of NRR results with Stata

In order to check results with stata the following commands can be used:

su nrrpc if isulelig_nrr>0 & ils_dispy_prep>0 & ils_dispy_nrr>0, d*

isulelig_nrr is the identifier of individuals for which NRR are calculated (those with positive earnings in the data).

Note that we condition on disposable income to be positive, this is because NRR are not interpretable in a consistent way when either the numerator or denominator are negative.

While NRR above 100 are completely plausible, some of these cases might represent either outliers or point to problems with the simulations in EUROMOD. For this reason, it is important to check these cases on an individual basis to find out which income components (or components interactions) are driving the results. As a check:[2]

count if nrrpc>100 & isulelig_nrr>0 & ils_dispy_prep>0 & ils_dispy_nrr>0

count if nrrpc>150 & isulelig_nrr>0 & ils_dispy_prep>0 & ils_dispy_nrr>0

count if nrrpc>200 & isulelig_nrr>0 & ils_dispy_prep>0 & ils_dispy_nrr>0

In case many observations present NRR values above 100, checks should be made to describe what is driving these results. In order to check results of extreme cases, it might be handy to output more variables than the ones specified by default in the Add-On (See section 5 above).

[2] For participation tax rates (PTR), the relevant variables produced by the add-on are: ptrpc, ptrpc*.

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