The modelling exercise for building behavioural tax and benefit microsimulation model for Macedonia

Marjan Petreski

University American College Skopje

Objective

- The aim of the presentation is to provide an overview of the MK-MOD, the tax and benefit microsimulation model for Macedonia, and two adjacent models: MK-Labour and MK-Pens.

MK-MOD

- Belongs to the EUROMOD family
- A tax and benefit micro-simulation model where individual behaviour (labour-market activity, employment, childcare, saving, etc.) is assumed to be exogenous to the tax-benefit system
- A "standard" static model where individuals/households choose to supply labour (hours of work) until the point where the "marginal disutility of work equals the marginal utility of disposable (net-of-tax) income." (Saez, 2010, p.180)
- Taxes and social transfers affect the labour-market behaviour by changing the relative value of work vs. leisure

MK-MOD (2)

- Applies user-defined tax and benefit policy rules to micro-data on individuals and households, calculates the effects of these rules on household income, and then outputs results – still at the micro level
- The model is STATA-based
- We use MK-MOD to simulate as much as possible of the tax and benefit components of household disposable income, by simulating the following instruments: income taxes, social contributions, family benefits, social assistance and other income-related benefits

Data behind MK-MOD

- Quality of Life Survey 2017 – specially conducted survey for the MK-MOD
  - A representative sample of 1.200 households and 4.071 individuals
  - It provides detailed data on the income sources (such as income from wages, self-employment, pensions, dividends, interest rates, etc.) including social transfers (such as the social financial assistance, child allowance, unemployment benefit, financial reimbursement for assistance and care by other person, etc.) and remittances.

Validation of MK-MOD

	MK-MOD Estimation (Mil. MKD)	Official figures (Mil. MKD)	Deviation
Taxes			
Pension contributions	35,221,881,480	34,952,000,000	0.8%
Health contributions	20,632,654,680	20,682,477,000	-0.2%
Contributions for case of unemployment	2,342,015,940	2,160,000,000	8.4%
Personal income tax	15,229,451,640	15,306,000,000	0.7%
Benefits			
Social financial assistance	1,014,634,285	1,020,401,047	-0.6%
Permanent financial assistance	336,136,456	376,245,664	-10.7%
Child allowance	129,988,405	103,114,064	26.1%
Special child allowance	160,054,096	390,648,341	-59.0%
Third child allowance	1,144,446,460	2,225,492,365	-48.6%
Disability care	1,567,824,206	1,713,987,026	-8.5%
Conditional cash transfer	60,943,968	59,265,000	2.8%
Source: MK-MOD; Ministry of Finance; Ministry of Labour and Social Policy.			

MK-Labour

- The labour supply model investigates individual behaviour in a theoretically consistent manner (Clavet et al. 2013)
- The non-linearity of the budget constraints complicates the task when treating work hours as a continuous choice variable. Hence, the model is a discrete choice one (van Soest, 1995)
  - appearing in two sub-models: one estimates the preferences for singles and the other one for couples

MK-Labour

- For inactive and unemployed workers the hourly wage is not observed. Hence, we rely on the predictions from Heckman's (1979) selection model for their estimation. The Heckman model is of the standard two-stage form. In the first stage, the following probit model is used:

$$\Pr(Emp_i = 1) = \alpha_2 + \gamma_1 secondary_i + \gamma_2 tertiary_i + \gamma_3 age_i + \gamma_4 age\_sq_i + \gamma_5 gender_i + \gamma_6 children_i + \gamma_7 partner_i + \gamma_8 benefits_i + u_i$$

- In the second stage, self-selection into employment is corrected by incorporation of the transformation of the predicted individual probabilities of (1) as an additional explanatory variable.

$$lnw_i = \alpha_1 + \beta_1 secondary_i + \beta_2 tertiary_i + \beta_3 age_i + \beta_4 age\_sq_i + \beta_5 gender_i + \rho\sigma_u\lambda + \varepsilon_i$$

  - Whose predictions are used to calculate the labour income of the non-employed for the three working time alternatives and the corresponding sets of disposable income

MK-Labour

- Next, we apply the ML method on a conditional logit function so as to find out the preference parameters in the utility function
  - The assumption is that each individual/partner in a couple may work 0, 20 or 40 hours, corresponding to non-participation, part-time and full-time employment, respectively
  - Individuals/partners are assumed to maximize a well-behaved utility function defined over leisure, l, and net-income, y, with respect to time and income constraints:

$$\max U^i(l^i, y^i) \quad s.t.\ y^i \leq y^i(l^i, w) \ and \ \ l^i \leq T$$

MK-Labour

- Hours of leisure, $l^i = T - h^i$, are given by the time endowment, T, minus the work hours h^i. Net income equals labour earnings, wh^i, plus non-labour income, N, plus pensions and social benefits, B, less income taxes and contributions, T (Keane and Moffitt, 1998):

$$y^i(h^i) = wh^i + N + B(wh^i, N, Z^n) - T(wh^i, N, Z^n),$$

MK-Labour

- We write the translog utility function as the sum of a systematic part and a random component:

$$U_{ij}(y^i, J^i) = V(y^i, J^i; Z^n, \theta) + \xi^i$$

  - Whereby, U_{ij} is the utility of household i making choice j; y^i, J^i and Z^n are as before; θ is a vector of parameters to be estimated; and ξ^i is a random variable capturing the effect of unobserved variables upon the evaluation of (y^i, J^i).
  - We make the assumption that the utility function has a random component so as to allow for the possibility that individuals/partners may not know their utility levels perfectly
  - For the purpose of identification, ξ^i is assumed to be independently and identically distributed as a Type-I extreme value random variate (i.e., the Gumble distribution) (Clevet et al. 2013).

MK-PENS

- MK-Pens – Dynamic Microsimulation Pension Model has a dynamic form and involves the movement of individuals in a time horizon as they age, takes into account the mutual (family) relationships of the individuals, their behavioral reactions and the effects of changing of their labor-market status on development indicators.
  - In this way, MK-Pens creates a lifetime for any person, including the likelihood of death, a change in economic status, retirement age, earnings, and the like (Emmerson et al. 2004).

MK-PENS

- The first component of the dynamics of MK-Pens is the movement of the population over time.
  - In the models of static aging of the population, the projections are exogenously given, and only reweighting of the groups is made, without changing the individual characteristics over time (age, change in economic status, mortality, etc.) (Merz, 1993; 1994) .
  - In dynamic aging models, individual characteristics change endogenously over time (Caldwell, 1990), taking a certain likelihood of changing the characteristics.
  - In our model, fertility projections and total population are exogenously given, i.e. taken from the projections of UN-Population (static component), while total mortality is a residual and is calibrated to replicate the mortality rate published by the State Statistical Office of Macedonia. The mortality of the individuals in the sample is derived from a health function (dynamic component).

MK-PENS

- The second component of the dynamics is the change in the economic status of individuals taking into account their behavioral responses.
- Individuals in the model are classified into the following categories of economic status: unemployed, employed, inactive working-age persons, pensioners, children and persons without a pension over the age of 62/64 years.
  - The main assumption for the transition from one to another economic status is the employment rate, which is an exogenous variable, and the assumption for employment growth is on average 4 percentage points over a period of five years, according to the average annual growth of the past years.
  - Individuals receive employee status according to a derived function of probability of employment, regressed on a vector of variables.

MK-PENS

- Children, pupils and pensioners alter the economic status in a static way, by passage of time.
  - Children transit into the status of pupils at age 6; pupils transit into the status of inactive working-age persons with the age of 15 years; employees transit into retirees with fulfillment of retirement conditions.
  - After the change of status, the model reweights the persons in the sample according to their new status. The reweighting is conducted only for statically determined statuses (children, pupils, inactive working-age population, and people in retirement age without a pension).

Application

- Presently, two studies have been completed:
  - Marjan Petreski & Nikica Mojsoska-Blazevski, 2017. "Overhaul of the social assistance system in Macedonia: Simulating the effects of introducing Guaranteed Minimum Income (GMI) scheme," Finance Think Policy Studies 2017-11/11, Finance Think - Economic Research and Policy Institute.
  - Blagica Petreski & Pavle Gacov, 2018. "Sustainability of the pension system in Macedonia: A comprehensive analysis and reform proposal with MK-PENS - dynamic microsimulation model," Finance Think Policy Studies 2018-02/14, Finance Think - Economic Research and Policy Institute.

- Both currently available under Finance Think's Policy Studies Series: http://www.financethink.mk/pubs/policy-studies/

A summary

- Macedonia has a fairly complete and advanced behavioral tax and benefit microsimulation exercise
  - **MK-MOD** – static tax and benefit microsimulation model (EUROMOD)
  - **MK-Labour** – Structural labour supply model
  - **MK-Pens** – Dynamic pension microsimulation model
- They have been utilized in only two occasions so far, implying that the space for
  - Further exploring of their capabilities
  - Fine tuning (and possibly upgrading)

  Including, inter alia, within the present idea of building WB-MOD, is huge and intellectually ptovocative.

Thank you!

marjan.petreski@uacs.edu.mk