Appendix: Microsimulation methodology

The computable general equilibrium (CGE) model used for generating the BAU and MDG scenarios (MAMS) provides only relatively aggregate outcomes for employment and wages by labour category. Similarly, the model typically only distinguishes between a few groups of households for assessing the impact of alternative policy scenarios on per capita household consumption and income. CGE simulations therefore only allow us to draw conclusions about the differences in impact for these aggregate labour and household groups — thus ignoring income distribution changes within those groups. Hence, we revert to a microsimulation methodology to take account of the full income distribution. In line with recent practice of methodologies studying the economy-wide effects of economic policies, we adopt a top-down approach. That is to say, we take the CGE simulation results and apply them to the full distribution as given by a micro data set (i.e., the household survey) and assume there are no further feedback effects.

The top-down causal chain works from policy changes or exogenous shocks through the operation of factor and product markets yielding prices, wages and employment, and finally to household income and expenditure. A crucial part of analysing and modelling distributional outcomes at the household level is the specification of the various sources of income at that level and of how those sources are linked to the operation of factor and product markets.

For current purposes, we focus on the labour market as the main transmission channel of the modelled impact of the simulated scenarios on poverty and income distribution. To go from the counterfactual labour-market effects simulated with the CGE model to poverty and income distribution at the household level, we need to deal with two methodological issues. First, how can both between- and within-group effects be incorporated into the distribution analysis? That is

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to say, how can we account for the full distribution and thus for the heterogeneity of the
population within households when assessing the poverty and inequality effects? Second, people
may change position in the labour market (and hence also affect household income) due to
external shocks, trade reforms, or other policy changes such as the MDG strategies examined in
this study. Workers may shift from one sector to another, change occupation or lose their jobs.
The methodological issue is to find a procedure that can account for such labour-market shifts
and identify which individuals are most likely to shift position in order to be able to simulate a
new, counterfactual income distribution.

Various microsimulation methodologies have been proposed in the literature to deal with
these problems. We note two types that attempt to answer the type of questions raised in this
study. The first involves the estimation of a microeconomic, partial-equilibrium household
income generation model through a system of equations that determine occupational choice,
returns to labour and human capital, consumer prices and other household (individual) income
components (see, for instance, Bourguignon, Fournier and Gurgand, 2001; Bourguignon, Ferreira
and Lustig, 2001). Combining this methodology in “top-down” fashion with a CGE model has
been probed by Bourguignon, Robilliard and Robinson (2002) for the case of Indonesia.

A second microsimulation approach of less modelling intensity assumes that occupational
shifts may be proxied by a random selection procedure within a segmented labour-market
structure. This procedure allows the imposition of counterfactual changes in key labour-market
parameters (participation rate, unemployment, employment composition by sector, wage structure,
and so on) on a given distribution derived from household survey data, and the estimation of the
impact of each change on poverty and income distribution at the household level. This is the
approach used here, based on the methodology developed in Ganuza, Paes de Barros and Vos

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2 See Bourguignon, Pereira da Silva and Stern (2002) for an overview of related methods. It should be
noted that the approach is relatively new in its application to the developing country context, but that
combinations of macro or CGE policy models and microsimulations, for instance to assess distributional
effects of tax reforms, are quite common in applications in developed countries.
(2002) and more widely applied in Vos and others (2006). The basic intuition behind this approach is as follows.

Total per capita household income is defined as:

$$ypch = \frac{1}{n_h} \left[ \sum_{i=1}^{n_h} yp_{hi} + yq_h \right]$$  \hspace{1cm} (1)

where $n_h$ is the size of household $h$, $yp_{hi}$ the labour income of member $i$ of household $h$, and $yq_h$ the sum of all non-labour incomes of the household, defined as:

$$yq_h = \sum_{i=1}^{n_h} yqp_{hi} + yqt_h$$  \hspace{1cm} (2)

In equation (2), $yqp_{hi}$ equals individual non-labour income of member $i$ of household $h$ and $yqt_h$ equals other household incomes. In the simulations, $yp_{hi}$ is altered for some individuals $i$ of household $h$ as a result of changes in the labour-market parameters. Ganuza, Paes de Barros and Vos (2002) define the labour-market structure in terms of rates of economic participation $P_j$ and unemployment $U_j$ among different groups $j$ of the population at working age (defined according to sex and skill), the structure of employment (defined according to sector of activity $S$ and occupational category $O$) and remuneration $W_1$, as well as overall level of remuneration $W_2$. The skill composition of the employed population is represented by variable $M$. The labour-market structure can be written as $\pi = \pi(P,U,S,O,W_1,W_2,M)$. In the application of the methodology in the country studies referred to in the present paper, the labour-market structure was defined in a somewhat more limited fashion as $\pi = \pi(U,S,W_1,W_2,M)$, as changes in participation rates $P$ are not explicitly modelled in MAMS and the labour factor was not classified by occupational group $O$.

For all types of individuals, the unemployment rates determine part of the labour-market structure. The latter is further determined by the structure of employment. The employed workforce is classified according to segment $k$, defined on the basis of sector of activity. For the three skill groups (unskilled, semi-skilled and skilled workers) within segments $k$ in the labour
market, the average remuneration is calculated and these averages are expressed as a ratio of the overall average. The effect of altering each of the parameters of the labour-market structure on poverty and inequality can then be analysed using the accounting identities of equations (1) and (2). The impact of changes in the labour market can be analysed both separately and sequentially.

The Ganuza-Paes de Barros-Vos approach introduces a number of important assumptions about the labour market. First, as indicated, for lack of a full model of the labour market, a randomized process is applied to simulate the effects of changes in the labour-market structure. That is to say, random numbers are used to determine which persons at working age change their labour force status; who will change occupational category; which employed persons obtain a different level of education; and how new mean labour incomes are assigned to individuals in the sample. Hence, the assumption is that, on average, the effect of the random changes correctly reflects the impact of the actual changes in the labour market. Because of the introduction of a process of random assignation, the microsimulations are repeated a large number of times in Monte Carlo fashion. This allows constructing 95 per cent confidence intervals for the indices of inequality and poverty, except in the case of the simulations of the effect of change in the structure and level of remuneration, which do not involve random numbers. In each simulation, a number of poverty and inequality measures are calculated.

The approach outlined above is fairly straightforward when applied with static CGE models; in other words, when generating just one change from a given base year which is also close to the base year of a household survey. The present analysis, however, covers a simulation period that runs from the country-specific base year to 2015, the point at which the MDGs are reached.

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3 Mean incomes per decile are calculated in the simulations. These means are subsequently assigned to newly employed or to already-employed persons who changed sector of employment, occupational category or moved from one educational group to another. In principle, to assess the impact of changes in the labour-market structure, one would have to calibrate the database prior to simulating the effect of said changes — that is to say, to replace the original labour incomes by mean incomes per decile. A test showed that neither the direction of change nor the magnitude of the effect altered when using the original values of the labour incomes instead of calibrated values.

4 Experiments with the methodology for several household survey data sets show that about 30 iterations are sufficient. Further iterations do not alter the results.
expected to have been achieved. Therefore, the application of the microsimulation method needs to be situated in a dynamic setting.

For the application of the methodology in a dynamic setting, we follow the procedure spelled out in Sánchez (2004) and Sánchez and Vos (2005 and 2006). As indicated in these studies, a number of additional, restrictive assumptions are required, as observed survey data may only be available for the base year and perhaps a few years beyond that, but not for the entire projected forward period. In the microsimulations beyond the base year of the household survey data and for lack of additional modelling of demographic shifts and labour participation, it is assumed that no changes in the population structure (such as migration or population ageing) take place during the simulation period. This is an obvious limitation of the methodology, but justifiable to the extent that the CGE model does not consider such demographic changes either.

References


