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Updating the Poverty Estimates in Serbia in the Absence of Micro Data

A Microsimulation Approach

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Abstract

The continued poverty impact of the financial crisis in Serbia is difficult to establish beyond 2010 because of the lack of survey data. This paper tackles this difficulty. It uses a micro-simulation approach that accounts for a key pathway of the financial crisis in Serbia, the labor market. The results suggest a further increase in poverty in 2011 on account of a continued deterioration of the labor market indicators and despite a recovering gross domestic product. In order to evaluate the forecast, the model is applied to generate forecasts for previous years (2009 and 2010), which are compared with realized poverty estimates. The micro-simulation model performs well in predicting poverty dynamics during 2009–10 and less so during 2008–09. The accuracy of the predictions improves when the response of the social protection system is accounted for.

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Updating the Poverty Estimates in Serbia in the Absence of Micro Data: A Microsimulation Approach*

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1. Introduction

During the nine-year period prior to the financial crisis, the economy of Serbia grew at an average annual growth rate of 5%. The financial crisis hit the economy significantly with a reduction of 3.5% of gross domestic product (GDP) in 2009. It impacted all economic sectors except agriculture which remained constant in real terms. The industrial sector shrank by 20%, particularly construction; while services reduced only by 1%.[1] This reduction in GDP was mirrored by a decrease in employment by 7%, mainly focused in industry as well as a decline of 10% in average net earnings in real terms. Manufacturing and construction experienced significant declines in earnings by 10% and 17% respectively.

After the crisis the economy essentially remained stagnant during 2010 and registered a marginally positive growth rate in 2011 (Table 1). Current estimates suggest that the economy likely contracted again in 2012.[2] On the other hand, employment continued falling in 2010 and 2011 at similar rates. The largest losses in the absolute number of the employed have been recorded in the agricultural sector, where total employment fell by more than 10 percent each year. The unemployment rate almost doubled the levels prior to the crisis[3], and the activity rate fell from 51.4% to 46.4% during the same period (Table 2). However, the average earnings remained stable in real terms.

While the economic contraction was registered primarily in 2009, the poverty impact of the crisis was revealed with a lag. The total incidence of poverty increased from 6.1% to 6.9% in 2008-09 interval; then rising substantially to 9.2% in 2010. This increase was most heavily realized in rural areas. Poverty dynamics were mirrored by the worsening of households' own assessments of their financial situation in 2010.[4]

An analysis of how this economic context, continued deterioration of labor market conditions and lack of Household Budget Survey (HBS) data for 2011 has affected poverty and distribution of welfare during 2011 in Serbia would require a method flexible enough to capture these particularities. In this paper we use a micro-simulation model to evaluate the distributional impact of these restrictions that allows also addressing key questions such as: how are the impacts shared across the distribution, which areas are likely to be impacted and what are the characteristics of those who would become poor as the result of these dynamics? Section 2 provides a brief methodological discussion of the approach, its limitations and assumptions. Underlying household survey data, as well as macroeconomic inputs into the simulations are described in Section 3. In Section 4 we discuss the results of the simulations for poverty and distribution of welfare for 2011. In order to provide context for these predictions, validation exercises are performed in Section 5 using the same method with previous actual data. The results are also compared to projections based on a standard elasticity approach. Section 6 concludes.

[1] Wholesale/retail trade and transportation declined by 7.5% and 10% respectively.
[2] The IMF estimates that the economy will contract by about 0.5% in real terms in 2012 (IMF WEO Database, October 2012).
[3] The unemployment rate increased from 13.6% in 2008 to 23% in 2011.
[4] Most households (77%) assessed their financial situation as either somewhat or substantially worse than in 2009 according to HBS data.

2. Methodology[5]

A number of methodologies can be employed to simulate an income or consumption distribution and associated poverty measures when household survey data are missing. However, not all of them are adequate in addressing the kind of questions posed above. In this paper we propose a micro-simulation model focused on multiple transmission channels which seem appropriate for the Serbian context, namely (i) labor markets as a key pathway for the deterioration of the economic situation in Serbia over the past years; as well as (ii) non-labor income components, mainly international remittances; and (iii) price changes.

The micro-simulation approach superimposes macroeconomic projections on behavioral models built on last available household survey (HBS 2010). The model is loosely based on previous approaches to micro-simulation described in Bourguignon, Bussolo and Pereira da Silva (2008) and Ferreira, et al. (2008) – with an important simplification of omitting the computable general equilibrium (CGE) component, which is difficult to employ in most developing countries. Instead the approach described here links the behavioral model to sectoral and aggregate macroeconomic data for Serbia in 2011, and extrapolates the microeconomic snapshot of a future scenario from this projection.[6]

Using actual macroeconomic data for the period 2010-2011, we are able to predict income distributions at the individual and household level. The poverty and distributional assessment can be performed by comparing the simulated scenario with 2010 data. The model focuses on labor markets and (international) remittances as transmission mechanisms and allows for changes to labor income- modeled as employment changes, earning changes or a combination of both- and changes to non-labor income, modeled as a change to (international) remittances.[7] These changes can be positive or negative depending on the trends outlined by the macroeconomic inputs. The model is able to capture most of the changes in total income since in most cases labor income and remittances account for a significant proportion of household income.[8] Reasonable assumptions are made about impacts on the other sources of income, such as capital and financial income or public transfers, as discussed below.

2.1 The microsimulation model setup

The simulation process is accomplished in three main steps. The first step consists of using household data for the latest available year (i.e HBS 2010) to *estimate* a set of parameters and unobserved characteristics for various equations of the household income generation model developed by Bourguignon and Ferreira (2005). This model allows accounting for multiple transmission channels and working at the individual/household level. The first component of the model is an identity that defines the per capita income in a household *h* as the ratio between the total household income and the total number of members (n_h) in that household:

$$y_h = \frac{1}{n_h}\left[\sum_{i=1}^{n_h}\sum_{j=1}^{J} I_{hi}^{Lj}\; y_{hi}^{Lj} + y_{0h}\right] \qquad (1)$$

The total household income, expression in brackets of equation (1), is the result of the addition of two main sources of family income: *labor* and *non-labor* income. At the same time, the total family labor income is the aggregation of earnings in different economic sectors across members. So, for each individual we see not only if she (he) participates (or not) in the sector but also if she (he) receives (or not) an earning for that job. The

[5] This section is based on the Manual for the ADePT Simulation module which can be consulted for further details.
[6] A similar approach has been applied recently to update poverty and distributional studies on a number of developing countries, including Costa Rica, Panama, Moldova, Tajikistan and Mexico.
[7] Note that simulating international remittances is not exclusive of applying the same method to other non-labor income component. However, macro projections for this component are required in order to estimate the simulated distribution.
[8] Labor income represents more than 40% of total household income while remittances only about 2%.

labor participation model relies on the utility maximization approach develops by McFadden[9]. Assume that the utility (U_{hi}^{Lj}), for individual *i* of household *h*, associated with labor status *j=0,…,J*, and level of education *L*, can be expressed as a linear function of observed individual and household characteristics (Z_{hi}^{L}) and unobserved utility determinants of the occupational status (v_i^{Lj}). Furthermore, individual *i* chooses sector *j* (the indicator function $I_{hi}^{Lj} = 1$) if economic sector *j* provides the highest level of utility[10]:

$$U_{hi}^{Lj} = Z_{hi}^{L}\ \Psi^{Lj} + v_i^{Lj} \qquad \text{with } j = 0,\ldots,J \text{ and } L = \text{education level}$$
$$I_{hi}^{Lj} = 1 \ \ if\ U_{hi}^{Lj} \geq U_{hi}^{Ll} \qquad \text{for all } l = 0,\ldots,J,\ \forall l \neq j \tag{2}$$

In the Serbian case, each individual has to choose from five alternatives: being inactive, unemployed or being employed in an economic sector (i.e; agriculture, industry and services). The criterion value associated with being inactive is arbitrarily set to zero. The unobserved utility determinants of each occupation status are assumed to be identically and independently distributed across individuals, occupations and skill-levels.

The observed heterogeneity in earnings in each economic sector *j* can be modeled by a log-linear function of observed individual and household characteristics (X_{hi}^{L}) and unobserved factors (μ_{hi}^{Lj}) as a standard Mincer equation[11]. These earning functions are defined independently on each economic sector by skill level (*L*):

$$\log y_{hi}^{Lj} = X_{hi}^{L}\ \Omega^{Lj} + \mu_{hi}^{Lj} \ \ for\ i = 1,\ldots,n_h\ and\ \ j = 1,\ldots,J \tag{3}$$

The second component of the total household income, total family *non-labor* income, is the sum of different elements at the household level such as international (r_h^I) and domestic remittances (r_h^D), capital, interest and dividends (k_h), social transfers (tr_h) and other non-labor incomes (z_h). Formally,

$$y_{0h} = r_h^I + r_h^D + k_h + tr_h + z_h \tag{4}$$

We focus mainly on international remittances and make some minimal assumptions about other components. Ideally, we would model international remittances but migration-related information in most surveys is poor or insufficient.

Equations (1) to (4) complete the model. Total household income is a nonlinear function of the observed characteristics of the household and its members, and unobserved characteristics of household members. This function depends on a set of parameters: those of the occupational choice model for each skill level and the parameters in the earning functions for each economic sector and skill level.

The second step consists of *replicating* the macro-level changes in output and employment (actual or projected) between baseline and 2011 on the household data of the baseline year 2010. This process uses predictions of behavioral models estimated on the baseline household data (as in step 1 above), and generates household and individual-level predictions for employment, earnings and remittances for 2011. Since an individual's labor income depends on his/her employment status and labor earnings, how the output change in a particular sector is apportioned between employment change, earnings change and adjustments across sectors depends on how responsive (elastic) employment in that sector is to output change. It also implies that at the household level, the extent of the impact depends on the size of the aggregate change at the sector level and the demographics and characteristics of household members, which influence the labor force status and earnings of household members after the change.

[9] McFadden (1974)

[10] Bourguignon & Ferreira (2005) say that this interpretation is not fully justified because occupational choices may actually be constrained by the demand side of the market, as in the case of selective rationing, rather than individual preferences.

[11] Mincer (1974)

The simulations are also adjusted for population growth, using official population projections (disaggregated by gender and age groups) to fully account for demographic changes that would affect the size and composition of the labor force and, through that, the estimates of per capita household income. This is done by re-weighting households in the baseline data to replicate demographic changes predicted by population projections.

To simulate changes in *non-labor* income, projections of aggregate changes in remittances are linked to baseline remittance information from household data using a simple assignment rule (rank-preserving regional transformation) to ensure that the total change in remittances received by households is equal to the projected change in remittances from the macro data. Some components of non-labor income are assumed to grow at the rate of aggregate GDP for the relevant period (profits, rents and domestic remittances), while others are kept constant in real terms at the 2010 year level (social benefits, pensions or other transfers, depending on the country).

The final step consists in using price projections to adjust the poverty line to reflect the difference in food and non-food inflation rates between baseline and projected year. Since the poverty line is typically anchored to a food basket that ensures a minimum calorie intake, in case where food inflation is expected to be significantly different from general inflation between baseline and projected year, the baseline poverty line would not be enough for a household to meet the basic food requirements in the projected year.[12]

The income projections from the model can be used to produce a variety of outputs, including the aggregate poverty and inequality comparisons across groups, profiles of groups entering (and exiting) employment or poverty as a result of the evolution of the economy, and various measures of how the macroeconomic change is distributed across the population. The results from our simulation for Serbia presented below capture the likely impact of the growing period of the Serbian economy over 2011 on the household welfare.

2.2 Limitations and assumptions

There are several limitations and assumptions to apply this method which are important to be mention. Firstly, the quality of model projections depends on the nature and accuracy of the data underpinning the exercise. The results would depend not only on the validity of the micro-models but also on the macro projections. In addition, the use of the last available household data (HBS 2010) as a comparator is tricky because the comparison could potentially attribute certain outcomes to that particular projection when they are a result of other factors that occurred over the period.[13]

Secondly, the simulation relies on behavioral models built on past data that reflect the pre-existing structure of the labor market, household incomes and their relationships with demographics as they stood before the expected change. Consequently, the simulation assumes these structural relationships remain constant over the period for which projections are made. The more distant in the past the baseline year is, the more questionable this assumption is likely to be.

The model is limited in its ability to account for shifts in relative prices between different sectors of the economy as a result of the shock. While the poverty impact of shifts in the price of food relative to other prices is taken into account, other potential sources of price impacts are ignored – for example, the general equilibrium effect of a change in the terms of trade between agriculture and other sectors. In the absence of a CGE model, it is nearly impossible to explicitly model for changes in terms of trade between sectors.

The model works in the income space to account for different transmission channels through which households are affected. But to provide poverty projections for Serbia household incomes must be converted into consumption, using the assumption that the household's ratio between consumption and income is constant over time. This questionable assumption has at least the advantage of being simple and transparent.

[12] All macro and micro inputs used for the micro-simulation model are detailed in Annex 1.
[13] It is a standard limitation for every "before-after" impact analysis.

Finally, the model does not allow for geographic mobility of factors (labor or capital) across time. Thus, all individuals are assumed to remain in their 2010 place of origin, even as they experience a change in labor force status or sector of employment. While this assumption is an abstraction from truth, it is likely to matter only when the results are disaggregated spatially or across rural and urban areas.

3. Data description

There are two main sources of information demanded by the micro-simulation model: macroeconomic and microeconomic inputs. The *macroeconomic inputs* are intended to capture most of the transmission channels mentioned in previous section. These variables are: i) changes in aggregate GDP and by economic sector; ii) changes in labor force participation and total and sectoral employment levels; iii) changes in international remittances; iv) population growth; and v) changes in price of food relative to non-food. These inputs are based on historical data provided mainly by Statistical Office of Serbia; except for international remittances which are based on World Development Indicators (WDI) database (Table 1 and 2).

The different aggregates of the GDP were classified in three main economic sectors: agriculture, industry which includes construction and mining among others; and services. Employment information, obtained from the Labor Force Survey (LFS) was defined for those individuals with more than 15 years old and it follows the same sectoral classification as the GDP. Population growth is not particularly relevant in the Serbian case. The total population is projected to decline marginally by 0.4 percent annually between 2010 and 2011. We use the population projections from the Statistical Office of the Republic of Serbia (SORS).

The *microeconomic inputs* are based on the HBS from 2008 until 2010 rounds. Table 3 presents some summary statistics about these micro data. Most characteristics of the population remained relatively stable during the interval. However, the unemployment rate increased sharply in 2009 and 2010 for individuals with more than 15 years old. This is consistent with the trend described by the Labor Force Survey during and after the financial crisis.

A number of assumptions needed to be made in order to combine the GDP and employment data with that of the HBS. First, the sector of employment is not available in the HBS survey. It is constructed based on the occupation reported by the respondent (Table 4). The sectoral distribution of employment in the HBS derived from occupations (Table 3) is similar to the sectoral distribution of employment as recorded by the LFS (see Table 2). The share of agricultural population is the same across the two surveys, whereas the HBS records a somewhat lower share of those in industry (by about 6 percentage points), and a somewhat higher share of those employed in the services sector of the economy (by about 8 percentage points).

The second assumption concerns individual incomes, which were constructed based on a total of two income categories, reported by individual household members: (i) Regular and irregular receipts from employment (incomes, receipts based on quarterly or semi-annual reports, benefits etc.); and (ii) Receipts from out of regular employment, premiums, rewards, savings from business trips, transport costs – remunerations, clothes.

Agricultural incomes: these are based on a separate agricultural revenues and expenditures module in the HBS. About 30 percent of households in 2008 – 2010 rounds of HBS report revenues and expenditures at a household level in a separate module. In order to assign these incomes to individuals, they are distributed, in per-farmer terms, across those household members who report their occupation to be agricultural. If there are no household members with agricultural occupations, these incomes are assigned to those employed members and considered as income from a secondary occupation (i.e. agricultural).[14]

[14] Note that in allocating net revenue across household members we are constrained by the fact that information on hours worked, which would have allowed for a more accurate allocation, is not available in the HBS.

Another difficulty with incomes from the agricultural module concerns households with agricultural incomes that report negative net revenue (Table 5).[15] While this is problematic and can be due to various causes, it is notable that the share of households with negative agricultural incomes is stable between 2009 and 2010 (34% of agricultural households) and only somewhat higher in 2008 (38 percent). It is also broadly similar throughout the 2008-2010 period across areas (urban - rural), geographic regions, or welfare distribution. The households with negative agricultural net revenues are also uniformly distributed across the welfare distribution in all years. For these reasons, we recode negative values to zero for purposes of the simulation (Table 6).

Incomes from family business: In addition to the agricultural income module there is a separate module for revenues and expenditures from business. Non-zero incomes from business are recorded for 2-3% on average of households in the sample between 2008 and 2010.[16] Net incomes from this module are imputed (on a per-worker basis) to household members who report a non-agricultural occupation based on the same algorithm as the one described above for agricultural incomes.

Other sources of incomes, recorded at the level of the household, include (i) income from remittances; (ii) capital income (interest); (iii) farming income for households where no one is employed; and (iv) other income, which includes various social protection transfers.

4. Estimation results for 2011

The macroeconomic context for Serbia in 2011 is not particularly simple to predict poverty and distributional measures with a high degree of confidence. There are several forces in the economy that would affect households in opposite direction via different transmission channels. For instance, on the one hand, GDP is increasing in all sectors of the economy; mainly in industry. This would positively impact the labor income of households whose members remain employed in 2011. However, labor market conditions are still deteriorating in 2011 with higher unemployment and inactivity rates than in 2010. From the non-labor viewpoint Serbian households face the same problem: while international remittances decreases by almost 6 percent in 2011, other non-labor income components remain constant in real terms or increase at the total growth of the economy.

4.1 Overall predictions on poverty

Table 7 presents the projected poverty measures which consider all labor market movements via employment and earnings as well as non-labor income. The national poverty incidence is expected to increase by 2 percentage points between 2010 and 2011. This represents about 150 thousands individuals falling into poverty in one year period. The condition of those who were poor in 2010 would also be deteriorated in this period. Depth and severity of poverty are expected to show similar trends as the headcount rate. Aggregate inequality would also increase in 2011. Inequality measures like the Gini and Theil indices present an increment of 2 and 1.5 points in one year.

Notably, aggregate trends on poverty incidence for 2011 based on the microsimulation model diverge from the predictions based on the projection methodology that has been used in the ECA region in the past (World Bank 2010), which maps GDP dynamics to household expenditure dynamics. This approach takes as a baseline the welfare vector and the associated poverty line from a household survey at time t and GDP dynamics (in real terms) between t and $t+1$, and maps these dynamics to a new welfare vector at $t+1$, given a certain degree of pass-through from GDP to consumption (here, the *elasticity approach*). Based on this projected welfare vector and the constant (in real terms) poverty line, new poverty estimates for $t+1$ are

[15] These households represent about 10% of the overall sample.
[16] A total of 159 HH in 2008, 145 HH in 2009 and 106 HH in 2010, of which only 5 HH in 2009 and 6 HH in 2010 are negative. These are recoded to zero.

generated. These simulations assume homogeneous expenditure shocks across households, such that the degree of vulnerability to economic shocks is assumed to be constant in a population.

Table 8 shows the results for poverty headcount projections based on the elasticity approach. We produce two sets of estimates, one assuming full pass-through, and another assuming a growth elasticity of consumption equal to 0.33, which is the coefficient estimate from the regression of the logarithm of consumption on the logarithm of GDP for the time period 2003-2010, for which HBS data are available. Starting from the expenditure data in HBS 2010, with its associated poverty headcount of 9.2%, the model that relies on the full pass-through from GDP to consumption predicts a poverty rate of 8.3% in 2011, while the prediction based on the partial pass-through is 8.8%. In both cases, the lower poverty headcount in 2011 is due to the positive GDP growth between 2010 and 2011.

The key difference between the elasticity-based projections and the microsimulation-based projections is that the latter takes explicit account of the continued deterioration of the labor market conditions between 2010 and 2011, including falling employment and activity rates, and rapidly increasing unemployment rate. Thus, the improvements in household income as a consequence of the recovery process of the economy are compensated with increases in unemployment and inactivity rates, resulting in a higher predicted poverty headcount compared with the elasticity approach.

4.2 Distributional predictions

One further advantage of the microsimulation approach over the elasticity approach is the possibility of fully taking into account the heterogeneity of individuals observed in the household survey. By generating predicted levels of income and consumption for all households in 2011, the simulation model allows the type of households that are likely to be affected by the macroeconomic context, the primary channels of impact and their relative importance, and the distribution of the impact across different welfare groups. We present two types of analysis: firstly, we examine the characteristic of the group called "New Poor", which refers to those households that are not poor in 2010 but would have been in 2011 as consequence of the macroeconomic context. We also compare this group with "Old-Poor" or those who remain poor over time and the "Non-Poor" or those who are not poor in either year. Secondly, we use the growth incidence curves to see how changes in welfare are distributed across consumption groups and between areas.

4.2.1 A profile of the "New-Poor"

Households that are expected to be in poverty in 2011 but were above the poverty line in 2010, termed as "New-Poor" are projected to suffer larger income losses – with more than 70% drop in average of household income (Figure 1). Most of this loss is due to a massive decrease in their labor income. Reductions in international remittances are almost negligible as a component of the overall income loss.

The characteristics of the New-Poor, relative to the rest of the population, are as follows (Figure 2). These households are slightly more rural (44% as compared to non-poor 39%) and fewer of them are headed by women compared to other groups (19% compared to 31% for non-poor). More than 50% of their household heads have less than 55 years of age and their levels of education are very similar to those of the non-poor households (albeit with a smaller share of post-secondary education).

The reason of their deterioration in social status would be explained by their change in labor status. In 2010 almost 70% of these household heads were employed -- mainly in services and almost equally distributed in industry and agriculture (Figure 2). However, the simulation in 2011 predicted that around 88% of them would be unemployed or inactive. The "New-Poor" households are different in a number of key aspects from the more permanently poor. Compared to the "Old-poor", they have "better" characteristics such as higher skills levels, living in urban areas, younger and employed in services.

4.2.2 Distributional changes of welfare

We examine how per capita consumption changes are distributed across households with different baseline consumption levels. For this purpose we use the Growth Incidence Curves (GIC) and perform three estimates: one for all households and for two specific groups (i.e. urban and rural areas). Each GIC allows us to compare percentage per capita consumption gains or losses across households within the group. Comparisons across groups (e.g. rural versus urban households) are not straightforward. For instance, given that on average consumption levels are higher in urban than in rural areas, a household in the 30th percentile of the urban consumption distribution is quite likely to be significantly better off than that of the rural distribution.

Actual economic growth over time is expected to translate into higher consumption mainly in the upper half of the entire distribution as well as in both rural and urban areas (Figures 3 and 4). Per capita consumption gains are largest among those at the top of the distribution (80th to 100th percentile), with an average gain of 4% annual growth rate between 2010 and 2011. Households at the bottom 1st to 30th percentile have been less fortunate than the rest. They are projected to experience an average -5% annual decrease in per capita consumption (Figure 3).

Consumption losses are higher in urban than in rural areas and are mainly concentrated in the lower part of the distribution (Figure 4). This difference is likely due to the fact that the deterioration of labor market conditions was mostly felt in urban than in rural areas. However, the gains of the recovery process that Serbia has experienced during 2011 were distributed in the upper part of both distributions.

5. Validation exercises

One important limitation of any ex-ante approach is related to the validation of the hypothesis. The only validation or test for the micro-simulation model is to combine ex-ante and ex-post analysis.[17] Since HBS 2011 data is not available, some uncertainty about the simulation results is bound to remain. However, it is possible to conduct some validation exercises using historical data and assess how well the model performs in predicting poverty and distributional changes over time in Serbia.

5.1 Projected point estimates

In order to evaluate the probable accuracy of these estimates, we use the same model to predict poverty incidence in 2009 (2010) by applying 2008-2009 (2009-2010) GDP dynamics to 2008 (2009) baseline data and then compare these predictions to the actual poverty incidence in 2009 (2010). The model performs well in making a prediction for 2010 (Table 9). The observed national poverty estimate increases from 6.9% in 2009 to 9.2% in 2010, and the predicted estimate is statistically indistinguishable from the actual poverty rate during 2010. On the other hand, applying the model to 2008 data provides a poor prediction of the 2009 poverty rate. The model overestimates the poverty impact of the financial crisis, predicting an increase in the poverty rate from 6.1% in 2008 percent to 8.9% in 2009, instead of the actual increase to 6.9% according to HBS data.[18]

5.2 Distributional projections

Figure 5 presents actual and simulated GICs for 2009 and 2010 using the GDP as macro inputs. The first graph for 2009 shows a very good fit of the projections from the 30th percentile up. However, the lower part of the distribution is underestimated which relates with an overestimation not only of the poverty incidence but also for those indices which capture the distribution among the poor such as gap and severity.

[17] See Bourguignon and Ferreira (2003)

[18] This is similar to Tiongson and Sulla (2013) who also find that microsimulation-based forecasts for a set of ECA countries are more accurate between 2009-2010 compared to 2008-2009.

The second graph presents distributional projections for 2010. In contrast to previous graph, this shows a relatively good fit for the lower part of the distribution which mirrors insignificant differences between actual and projected poverty incidence. However, it still produces higher indices for depth and severity of poverty and it overestimates consumption levels in upper quantiles of the distribution.

5.3 Factors that bias the projections

The overestimation of the 2009 poverty rates is due various factors coming from limitations and assumptions of the simulation model. Firstly, in Section 2 we point out the strong assumption of constant consumption to income ratio over time. Figure 6 shows significant differences between these ratios across the distributions, particularly in the lowest deciles between 2008 and 2009. This could be interpreted as changes in consumption or saving patterns which present a turning point during the year of the crisis. Unfortunately, the micro-simulation model does not allow for consumption smoothing via savings or borrowing and projections are biased when using 2008 as baseline year.

Given we are using ex-post macro and micro data; it is possible to identify other factors that may contribute to this bias in the projection for 2009. One possibility is the divergence between macro and micro inputs dynamics. Figure 7 present annual growth in labor, non-labor, total income and consumption per capita based on HBS data from 2008-2010, together with GDP dynamics. During 2008-09 labor income declined, in line with GDP dynamics, and much more sharply than consumption. This decline in labor income is captured explicitly by the microsimulation model. On the other hand, non-labor income increased, in line with movements in international transfers, such that total income growth during this period was positive. Even though the model applies a 50% increase in remittances between 2008 and 2009; this component contributes only with 2% of total household income not enough to counterbalance the reduction in labor income.[19] Thus, the dynamics of macro and micro inputs appear consistent, but there still is a problem in tracking the movements from the non-labor income side.

The poverty impact of the crisis has been cushioned by the expansion of social assistance programs and of unemployment benefits in 2009.[20] According to administrative data, spending on the material support for low income households program (MOP) – the flagship last resort social assistance program – increased by 16.8 percent in real terms between 2008 and 2009, a higher rate of growth than in the previous year (12.6 %) or subsequently during 2009-2010 (4.9%).[21] Likewise, unemployment benefits increased by 10% in real terms during 2008-2009 (only 1.2% during 2007-2008) and the number of beneficiaries of UB increased by 19% (only 2% during the previous year).

The expansion of social assistance and unemployment benefits is again not well captured by the HBS data, which is due to the small coverage of the programs in the overall population. For instance, according to HBS data the share of households receiving MOP declined from 2.7% of total to 2.5% between 2008 and 2009; those receiving children's allowances remained stable and the share of individuals receiving back to work receipts[22] has also fallen in 2009. However, non-labor income increment is driven by pensions, which the microsimulation model assumes to remain constant in real terms between t and $t+1$.[23]

To address this, we can alternatively aggregate all social protection payments [24] and allow them to grow at the growth rates observed in HBS data, i.e. 14% between 2008 and 2009 and 1.6% between 2009 and 2010. The

[19] See Annex 1

[20] Habib et al. (2012) similarly find transfer schemes and automatic stabilizers to have a cushioning impact on the poverty increase due to crisis in Poland.

[21] The expansion of the MOP appears to be primarily in terms of budget, rather than beneficiaries – the number of beneficiaries grew by 7% during 2007-2008 and by 9% during 2008-2009.

[22] Back to work receipts are benefits provided to the unemployed who have been employed in the past. The amount of benefit is in function of the duration of past employment.

[23] This item includes various pension payments such as those related to old-age, disablement, family pensions, protection contributions and other contributions

[24] Including pensions, social assistance and unemployment benefits as one category within no labor income.

resulting poverty predictions for 2009 and 2010 are reported in Table 9. Notably, the poverty projections become closer to the actual poverty estimates for 2009 and 2010. The 2009 projection is within the confidence interval of the observed poverty headcount while 2010 projections are largely unaffected, given the marginal increase in the SP system between 2009 and 2010, and remain statistically indistinguishable from the actual 2010 poverty estimate.[25]

5.4 Point estimates projections based on the elasticity approach

For comparison, we also forecast the poverty incidence for 2009 and 2010 based on the elasticity approach (Table 10). The results suggest that the full pass-through model predicts a poverty incidence for 2009 that is statistically indistinguishable from the actual poverty headcount in 2009, whereas the partial pass-through model forecasts a poverty incidence of 6.2 percent in 2009, lower than the actual estimate.

Given positive GDP growth between 2009 and 2010, the full path-through simulation suggests a decrease in the poverty headcount from 6.9 in 2009 to 6.6 in 2010, whereas the partial pass-through model leaves the poverty headcount estimate unchanged. This is in sharp contrast with the considerable increase in poverty between 2009 and 2010, as recorded in the HBS data.

The key reason for the poor forecast for 2010 of the elasticity approach is the divergence in the dynamics of GDP and household consumption between 2009 and 2010, noted above (see figure 7). Recall that GDP growth was marginally positive during 2009-2010. Changes in consumption during 2009-2010 do not mirror changes in GDP. According to HBS data, total household consumption decreased by 5.9 percent in real terms during 2009-2010. Similarly, during 2008-2009 total household consumption declined by 1.7 percent, less than half the contraction of GDP during the same period.

One possible improvement is to rely, instead of GDP, on the dynamic of household final consumption expenditure (HFCE). According to Eurostat data, in countries like Romania and Bulgaria HFCE accounts for 85 percent or more of actual household expenditures, such that HFCE may constitute a decent approximation for actual consumption dynamics. Figure 8 suggests that HFCE fell in real terms between 2009 and 2010, whereas GDP growth was positive.[26]

Assuming a full pass-through from HFCE to household consumption, the forecast for 2009 slightly underestimates the poverty headcount, although the true estimate is within the 95% confidence interval. For 2010 the predicted poverty estimate is lower than the true poverty headcount of 9.2%, but it is still a considerable improvement over the simulations relying on GDP dynamics, which would imply a declining poverty rate in 2010 as the result of GDP growth.

These results suggest that simple poverty forecasts based on GDP dynamics can fall rather far from the true poverty estimates, and can even imply poverty dynamics of opposite sign from the true poverty changes between two points in time. Furthermore, using HFCE data instead of GDP data appear to offer an improvement, especially when the poverty measure is based on expenditure data, which need not follow GDP dynamics. HFCE data are not available, however, for 2011, such that it is not possible to simulate a poverty headcount for that year.

6. Concluding remarks

Faced with the absence of HBS data for 2011, the purpose of this paper was to forecast the prevalence of poverty in Serbia for that year in a way that captures the complex macroeconomic dynamics during the 2010-2011 period, including positive GDP growth accompanied with continually deteriorating labor market

[25] These results are broadly in line with those of Tiongson and Sulla (2013), who find that the accuracy of microsimulation-based projections improves when social protection projections are available and are incorporated into the microsimulation model.
[26] HFCE data only available through 2010.

indicators. The microsimulation model we employ predicts that the poverty rate would continue increasing from 9.2 percent in 2010 to 11.1 percent in 2011, on account of a further 4 percentage points increase in the unemployment rate and a 2 percentage points reduction in the employment rate during 2010-2011. The profile of the "new poor" suggests that they are more similar to the "non-poor" population than to the "old poor" population that is below the poverty line according to 2010 data. In particular, the "new poor" younger, more urban, and have higher skills levels. Among those "new poor" who were employed in 2010, the primary employment sector is services.

The validation exercises reveal that microsimulation-based projections of the 2010 poverty rate based on actual 2009 micro data and actual macroeconomic dynamics, are in line with the 2010 poverty headcount. However, the poverty increase in 2009 is overestimated, a result that also echoes recent findings from the ECA region in Tiongson and Sulla (2013). This can be due to a number of factors, including the divergence between income dynamics (employed by the model) and consumption dynamics that poverty estimates are based on, and the fact that the microsimulation model does not allow for consumption smoothing via savings or borrowing. It could also be due to the fact that the baseline micro data does not adequately capture the crisis response of automatic stabilizers such as unemployment benefits or social assistance. In fact, when we account for increases in all social protection benefits (including pensions) between 2008 and 2009, as recorded in the HBS data, the poverty projection for 2009 becomes smaller, in fact, statistically indistinguishable from the actual 2009 poverty headcount estimate.

In light of this, the estimated further increase in poverty in 2011 seems plausible, particularly since the structural parameters of the underlying model are unlikely to have changed dramatically over time. At the same time, modeling assumptions vis-à-vis the dynamics of consumption and income, as well as the effects of the social protection payments, are important, and the 2011 prediction should be regarded with the appropriate caveats in mind.

Notably, the microsimulation-based forecast for 2011 diverges from the prediction based on the elasticity approach, which suggests a reduction in poverty in 2011, based on positive growth in GDP during 2010-2011. Furthermore, estimates for 2010 suggest that the elasticity approach forecasts can fall rather far from the true poverty estimates, and can even imply poverty dynamics of opposite sign from the true poverty changes between two points in time. Using HFCE data instead of GDP data appear to offer an improvement, especially when the poverty measure is based on expenditure data, which need not follow GDP dynamics.

References

Bourguignon, F., M. Bussolo and L. Pereira da Silva (2008). "Introduction: Evaluating the Impact of Macroeconomic Policies on Poverty and Income Distribution", in *The Impact of Macroeconomic Policies on poverty and Income Distribution*, eds. Bourguinon, F., Bussolo, M. and Pereira da Silva, L. The World Bank, Washington, DC.

Bourguignon, F. and F. Ferreira (2003). "Ex-ante evaluation of policy reforms using behavioral models" in *The Impact of Economic Policies on Poverty and Income Distribution*, Bourguignon, F. and Pereira da Silva, L. (eds), World Bank-Oxford University Press.

Bourguignon, F. and F. Ferreira (2005). "Decomposing Changes in the Distribution of Household Incomes: Methodological Aspects" in *The microeconomics of income distribution dynamics in East Asia and Latin America*, eds. Bourguignon, F., Ferreira, F., and Lustig, N., Washington DC: Oxford University Press and The World Bank.

Deaton, A., J. Muellbauer, (1980). *Economics and Consumer Behavior*, Cambridge Books, Cambridge University Press.

Ferreira, F., P. Leite, L. Pereira da Silva and P. Picchetti (2008). "Can the Distributional Impacts of Macroeconomic Shocks Be Predicted? A Comparison on Top-Down Macro-Micro Models with Historical Data for Brazil" in *The Impact of Macroeconomic Policies on Poverty and Income Distribution*, eds. Bourguinon, F., M. Bussolo, and L. Pereira da Silva. The World Bank, Washington, DC.

Habib, B., A. Narayan, S. Olivieri, and C. Sanchez-Paramo (2010a). "Assessing Ex Ante the Poverty and Distributional Impact of the Global Crisis in a Developing Country: A Micro-simulation Approach with Application to Bangladesh". Policy Research Working Paper 5238. The World Bank, Washington DC.

_____(2010b). "Assessing poverty and distributional impacts of the global crisis in the Philippines : a microsimulation approach". Policy Research Working Paper 5286. The World Bank, Washington DC.

_____(2010c). "The impact of the financial crisis on poverty and income distribution: Insights from simulations in selected countries". PREM Economic Premise 7. The World Bank, Washington DC.

_____(2012). "Assessing the Poverty and Distributional Impacts of the Financial Crisis with Microsimulations: An Overview of Country Studies" in "*Knowing, When You Do Not Know. Simulating the Poverty and Distributional Impacts of an Economic Crisis*" eds. Narayan, A. and Sanchez-Paramo, C.The World Bank, Washington DC.

MacFadden, D. (1974) "Conditional Logit Analysis of Qualitative Choice Behavior" in Paul Zarembka, ed., Frontiers in Econometrics. New York, Academic Press.

Mincer, J (1974) "Schooling, experience and earnings" New York: Columbia University Press for NBER.

Tiongson, E. and V. Sulla, (2013). "Simulating the poverty impact of the global financial crisis in ECA." (mimeo), Washington, DC: The World Bank Group.

World Bank. (2010). *The Crisis Hits Home: Stress Testing Households in Europe and Central Asia.* Washington DC: The World Bank Group.

World Bank. (2012). "ADePT Simulate Module: The Manual." Washington, DC: The World Bank Group.

Table 1: Gross Domestic Product by economic sector
(Billion RSD, Constant 2005 prices)

	2008	2009	2010	2011	08-09	09-10	10-11
					Change: $(t_1-t_0)/t_0$		
Agriculture	168	169	169	172	0.80	-0.40	2.10
Industry	425	366	362	372	-13.90	-1.10	3.00
Services	1,600	1,582	1,602	1,637	-1.10	1.20	2.20
Total (at factor prices)	2,193	2,117	2,132	2,182	-3.50	0.70	2.30
Worker's remittances (BoP, Mil. 2005 RSD)	142,288	213,578	179,510	169,256	50.10	-16.00	-5.70

Source: Own estimates based on data from the Statistical Office of the Republic of Serbia & WDI.

Table 2: Selected labor market indicators
(More than 15 years old 2008-2011)

	2008	2009	2010	2011	2008-09	2009-10	2010-11
					Change: $(t_1-t_0)/t_0$		
Sectoral employment							
Agriculture	708,844	625,317	532,969	478,111	-11.8	-14.8	-10.3
Industry	739,124	661,833	623,106	603,821	-10.5	-5.9	-3.1
Services	1,373,755	1,329,286	1,240,168	1,171,278	-3.2	-6.7	-5.6
Total	2,821,723	2,616,436	2,396,243	2,253,210	-7.3	-8.4	-6.0
Sectoral employment shares							
Agriculture	25.1	23.9	22.2	21.2	-4.9	-6.9	-4.6
Industry	26.2	25.3	26.0	26.8	-3.4	2.8	3.1
Services	48.7	50.8	51.8	52.0	4.4	1.9	0.4
Unemployment rate	13.6	16.1	19.2	23.0	18.3	19.0	19.6
Activity rate	51.4	49.1	46.9	46.4	-4.5	-4.5	-1.1
Employment rate	44.4	41.2	37.9	35.8	-7.3	-7.9	-5.7

Source: Own estimates based on data from the Statistical Office of the Republic of Serbia.

Table 3: Summary statistics

	2008	2009	2010	08 vs. 09 (%)	09 vs. 10 (%)
Individual-level variables					
Household heads	38.0	38.5	38.9	1.32	1.04
Age	48.3	48.6	49.5	0.62	1.85
Male	47.9	47.9	48.3	0.00	0.84
Married	58.6	57.6	57.9	-1.71	0.52
Primary or less	35.9	35.7	36.6	-0.56	2.52
Secondary	48.0	49.2	47.9	2.50	-2.64
Post-secondary	16.2	15.1	15.4	-6.79	1.99
Inactive	46.2	47.3	48.8	2.38	3.17
Unemployed	10.2	11.0	13.5	7.84	22.73
Employed	43.6	41.7	37.7	-4.36	-9.59
Agriculture	21.2	23.2	21.5	9.43	-7.33
Industry	21.4	18.2	18.9	-14.95	3.85
Services	57.4	58.6	59.6	2.09	1.71
Average labor income (main)	20,866	20,539	20,477	-1.57	-0.30
HH level variables					
Consumption per a.e. (RSD)	17,301	17,126	16,451	-1.01	-3.94

Note: Weighted estimates based on data from HBS 2008, 2009 and 2010. Incomes and expenditure are in constant 2008 RSD.
Source: Own estimations

Table 4: Mapping from occupation to economic sector

Occupation	Agriculture	Industry	Services
Military personnel			X
Lawmakers and officials			X
Corporate executives, managers			X
Managers of small enterprises			X
Experts of physics, mathematics and engineering			X
Experts of biological and medical sciences			X
Teaching staff			X
Experts of social sciences, other			X
Professional staff: Science and engineering			X
Professional staff: biological and medical			X
Professional staff: teaching			X
Professional staff: other social sciences			X
Administrative and related staff			X
Teller employees			X
Workers of personal service and care			X
Vendors, demonstrators and models			X
Workers in agriculture, fishery and forestry	X		
Farmers: producers of their own needs	X		
Miners and construction workers		X	
Metal and Mechanical Engineers and related occupations		X	
Precision mechanics, craftsmen, printers		X	
Other trades and related occupations		X	
Operators of industrial plants		X	
Operators and installers of machinery and equipment		X	
Drivers and transport operators			X
Trade and services: vendors, cleaners			X
Manual workers in agriculture, fishery	X		
Manual workers in mining, construction		X	
Workers with no particular interest			X

Source: HBS 2008-2010

Table 5: Household with agricultural incomes
(percentages)

	2008	2009	2010
HH with agricultural incomes/expenditures	29.8	30.6	29.7
- out of which, with negative net income	75.6	73.4	72.8
- with negative net-income, accounting for self-consumption	38.1	33.6	34.4

Source: Own estimates based on HBS 2008, 2009, 2010 data.

Table 6: Share of households with negative agricultural net incomes
(percentages)

	2008		2009		2010	
	w/o diary	w/ diary	w/o diary	w/ diary	w/o diary	w/ diary
Belgrade	9.2	6.9	5.7	3.8	7.7	5.8
Central Serbia	27.3	14.0	27.0	13.5	24.6	12.1
Vojvodina	24.7	10.1	28.0	9.7	27.7	10.4
Rural	45.8	23.5	44.5	20.0	42.4	20.5
Urban	6.2	2.8	7.0	3.5	7.2	3.1
1st quintile	25.3	9.2	27.1	9.8	23.1	7.6
2	23.2	11.4	26.1	10.0	24.9	10.0
3	24.4	12.4	22.7	10.3	23.0	12.1
4	22.7	12.9	19.8	10.6	20.5	10.0
5th quintile	17.6	10.7	17.6	10.6	17.5	11.1
Total	22.5	11.3	22.4	10.3	21.6	10.2

Source: Own estimates based on HBS 2008, 2009, 2010 data.

Table 7: Poverty and inequality projections

	2010*	2011	□01
Headcount rate	9.2	11.1	1.9
Poverty Gap	1.8	2.9	1.1
Severity	0.6	1.4	0.8
Gini	0.267	0.282	0.02
Theil	0.117	0.133	0.02

Source: Own estimations based on HBS 2010. (*) Actual data.

Table 8: Poverty headcount projections based on GDP dynamics

	2010*	2011	□
Full pass-through	9.2 (8.7-9.7)	8.3 (7.8-8.8)	-0.9
Partial pass-through	9.2 (8.7-9.7)	8.8 (8.3-9.3)	-0.4
Micro-simulation	9.2 (8.7-9.7)	11.1 (10.5-11.6)	1.9

Note: 95% confidence intervals in parenthesis. (*) Actual data.
Source: Own estimates based on HBS 2010.

Table 9: Poverty projections using different inputs

	Actual	Different Macro Inputs	
		w/o SP	With SP
2009			
Headcount	6.9	8.9	7.5
-LB: 95% CI	6.5	8.4	7.1
-UB: 95% CI	7.3	9.3	8.0
2010			
Headcount	9.2	9.2	8.9
-LB: 95% CI	8.7	8.7	8.4
-UB: 95% CI	9.7	9.7	9.4

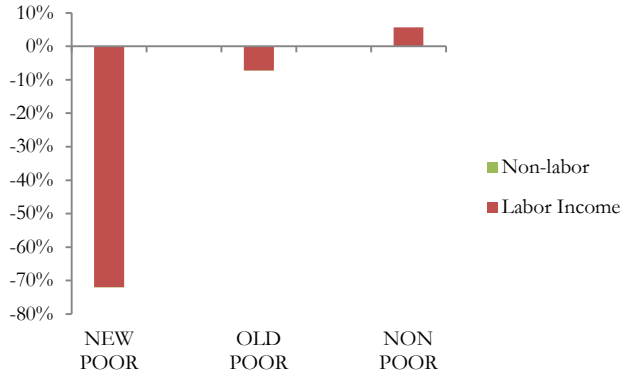
Source: Own estimates based on HBS 2008 and 2009.

Table 10: Poverty projections based on the elasticity approach

	2009	2010
Poverty forecast (full pass-through)		
Headcount	6.9	6.6
LB: 95% CI	6.5	6.2
UB: 95% CI	7.3	7.1
Poverty forecast (partial pass-through)		
Headcount	6.2	6.9
LB: 95% CI	5.8	6.4
UB: 95% CI	6.6	7.3
Poverty forecast (HFCE)		
Headcount	6.5	8.1
LB: 95% CI	6.1	7.6
UB: 95% CI	7.0	8.6

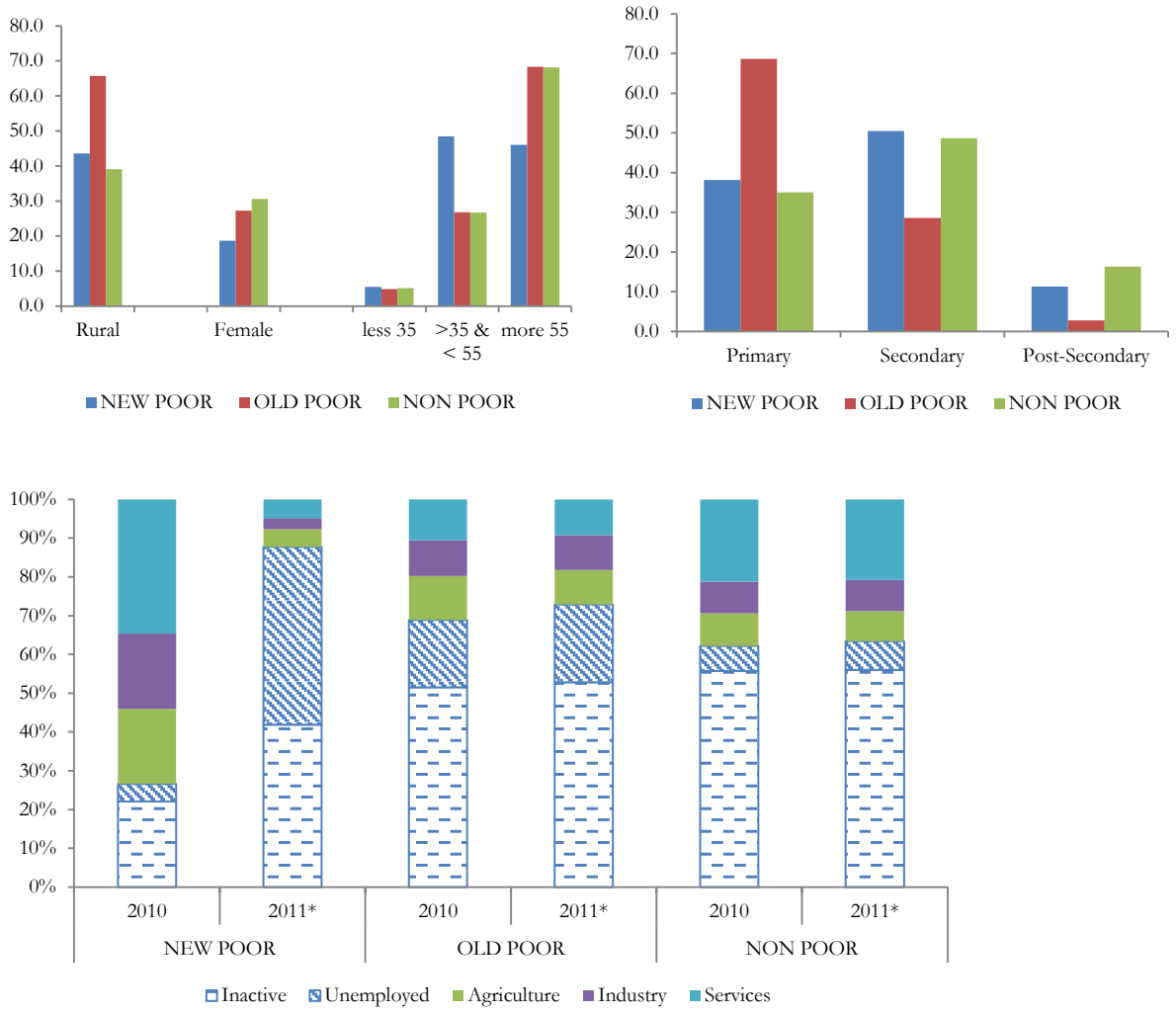
Source: Own estimates based on HBS 2008 and 2009.

Figure 1: Income changes for different population groups



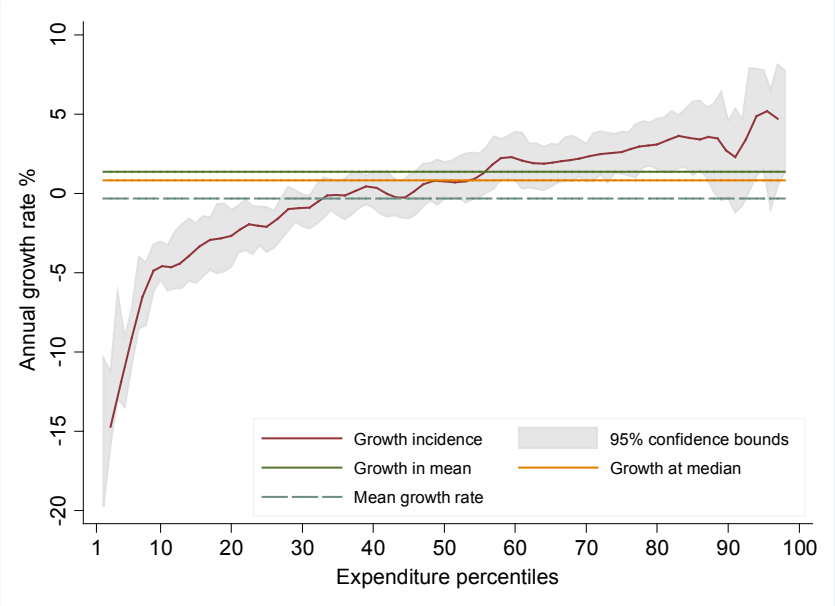
Source: Own estimates based on HBS 2010 data and micro-simulation projections for 2011.

Figure 2: Characteristics of the New Poor



Source: Own estimates based on HBS 2010 data and micro-simulation projections for 2011.

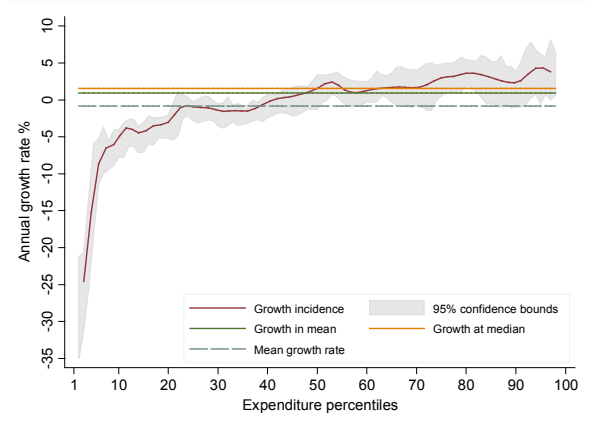
Figure 3: Growth Incidence Curves – Total country



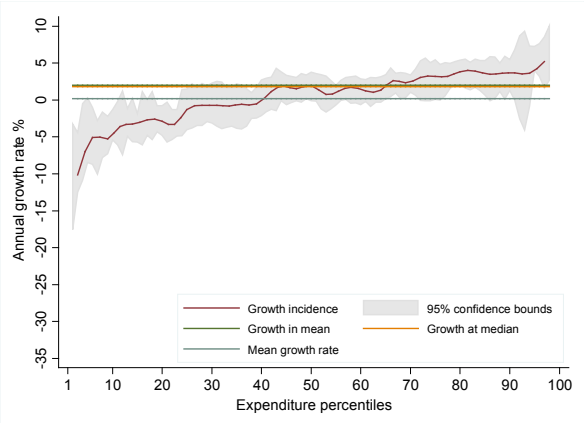
Source: Own estimates based on HBS 2010 data and micro-simulation projections for 2011.

Figure 4: Growth Incidence Curves - Areas

Urban



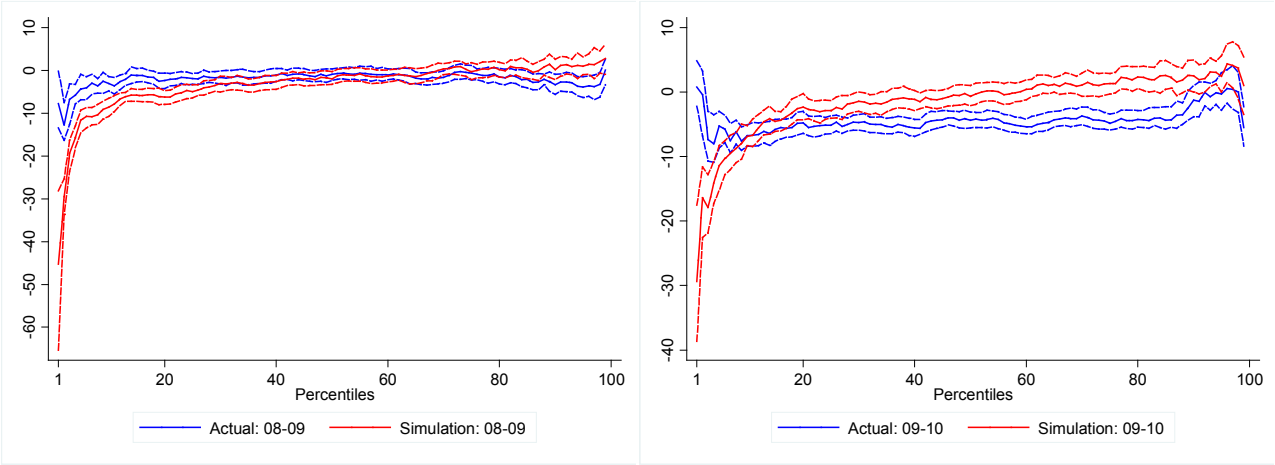
Rural



Source: Own estimates based on HBS 2010 data and micro-simulation projections for 2011.

Figure 5: Actual and Simulated Growth Incidence Curves

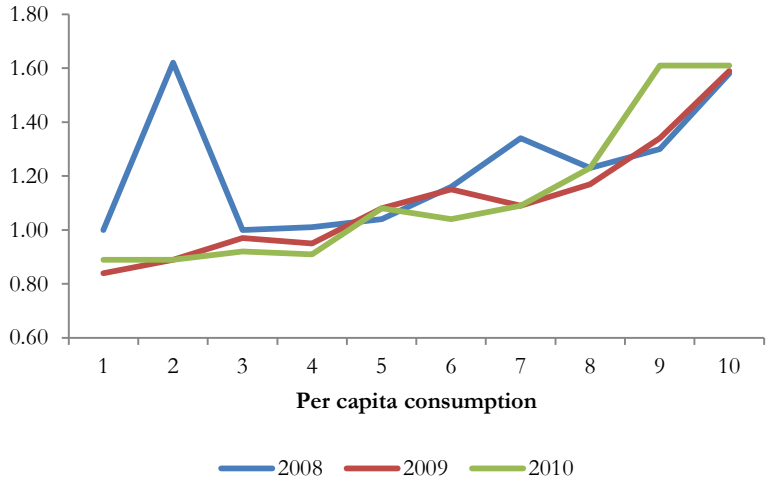
2008-2009 2009-2010



Source: Own estimates based on HBS 2008 and 2009 data and macroeconomic inputs.

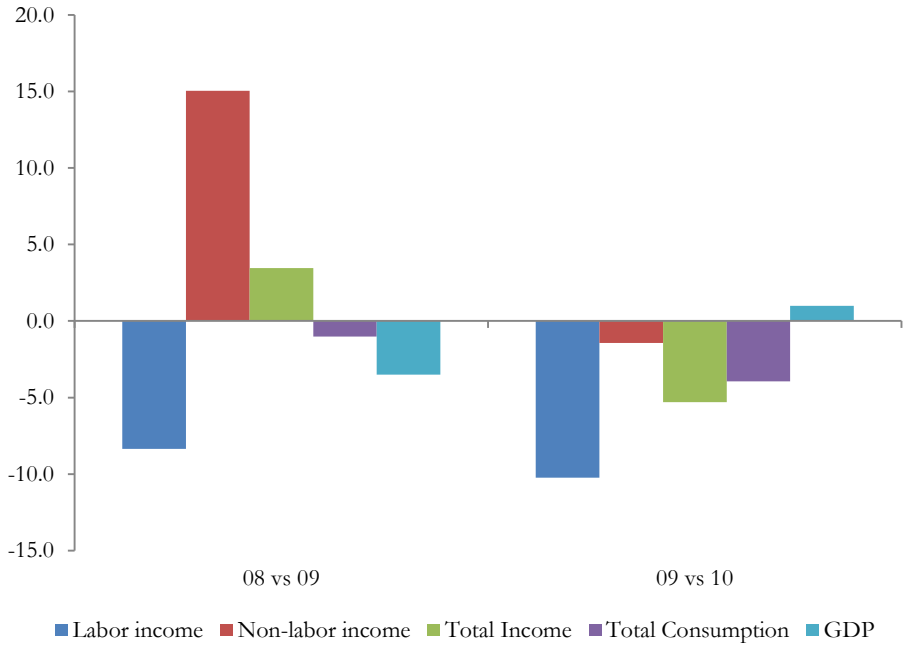
Figure 6: Evolution of consumption income ratio

(deciles of per capita consumption)



Source: Own estimates based on HBS 2008, 2009, 2010 data.

Figure 7: HBS income and consumption growth 2008-2010 (annual % change)



Source: Own estimates based on HBS 2008, 2009, 2010 data.

Figure 8: GDP and HFCE dynamics (annual % change)

Source: World Bank national accounts data, and OECD National Accounts data files.

Annex 1: Labor income components

Table A1: HBS income by source (2008-2010)
(constant RSD)

HBS 2008	Mean per capita income	Source share in total income	% of HH receiving	Per capita income (receiving HH only)
Labor income (main job)	7229.5	45.0	59.7	12100.5
Labor income (secondary job)	230.4	1.3	7.3	3135.3
Remittances	249.7	1.7	4.5	5536.4
HH income (other)	7093.6	50.2	74.6	9511.3
HH income (financial)	3.0	0.0	0.2	1459.7
HH income (farm)	248.2	1.8	16.7	1483.0
Total HH income	15054.4	100.0	99.2	15180.4

HBS 2009	Mean per capita income	Source share in total income	% of HH receiving	Per capita income (receiving HH only)
Labor income (main job)	6646.9	40.6	56.6	11748.5
Labor income (secondary job)	190.8	1.2	7.4	2570.4
Remittances	341.8	1.9	4.2	8112.7
HH income (other)	8138.7	54.4	77.1	10551.5
HH income (financial)	0.9	0.0	0.1	1247.7
HH income (farm)	254.9	1.9	19.6	1300.6
Total HH income	15573.9	100.0	99.4	15669.1

HBS 2010	Mean per capita income	Source share in total income	% of HH receiving	Per capit income (receiving HH only)
Labor income (main job)	5960.7	38.9	52.6	11321.8
Labor income (secondary job)	177.3	1.1	6.5	2726.5
Remittances	225.8	1.5	3.1	7192.9
HH income (other)	8114.8	56.4	77.4	10477.8
HH income (financial)	8.5	0.1	0.9	951.5
HH income (farm)	261.9	2.0	18.7	1402.3
Total HH income	14748.9	100.0	99.2	14870.9

Source: Own estimates based on HBS 2008, 2009, 2010 data.