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Simulating the Impact of the 2009 Financial Crisis on Welfare in Latvia

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Abstract

This note details simulations of the distributional impacts of the 2009 financial crisis on households in Latvia. It uses household survey data collected prior to the crisis and simulates the impact of the growth slowdown. The simulations show that Latvia experienced a sharp rise in poverty, widening of the poverty gap, and a rise in income inequality due to the economic contraction in 2009. The 18 percent contraction in gross domestic product (affecting mainly trade hotels and restaurants, construction, and manufacturing) likely led the poverty head count to increase from 14.4 percent in 2008 to 20.2 percent in 2009. The poverty gap, which measures the national poverty deficit, was simulated to increase from 5.9 percent in 2008 to 8.3 percent in 2009. The analysis finds that the results are robust to most assumptions except post-layoff incomes, which substantially mitigated household welfare. The authors also simulate the impact of Latvia's Emergency Social Safety Net components and find that the Safety Net likely mitigated crisis impacts for many beneficiaries. The simulations measure only direct short-run impacts; hence, they do not take into account general equilibrium effects. Post-crisis income data from a different data source suggest that poverty rates increased by 8.0 percentage points between 2008 and 2009. As a result, the authors suggest that their ex-ante simulation performs reasonably well and is a useful tool to identify vulnerable groups during the early stages of a crisis.

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Simulating the Impact of the 2009 Financial Crisis on Welfare in Latvia*

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I. Introduction

What began as a financial crisis in developed countries led to a severe contraction in global output and trade. This turned the financial crisis into a crisis in the real economy, with serious impacts on workers and their families. The global economy, according to the World Bank, shrank by about 2.2 percent in 2009, from a 3.2 percent expansion in 2008—the first time the global economy has shrunk since World War II.[1] The World Bank estimated that 90 million more people would be living in poverty by the end of 2010 than would have been the case without the crisis.[2] Countries in Eastern Europe and Central Asia are the most adversely affected by the crisis and the growth slowdown was thought likely to shrink GDP by about 4.7 percent in 2009, from a 4.2 percent increase in 2008.

Latvia is one of the hardest hit countries in Eastern Europe; its GDP was projected to shrink by 18 percent in 2009. The objectives of this note are: (i) to estimate the distributional impact of the financial crisis on households in Latvia; and (ii) to assess the distributional impact of several policy reforms undertaken in response to the crisis. To do so, we use a methodology that assesses the impact of the growth slowdown or policy reform through its impact on the sources of household income. The impacts quantified are direct short-run impacts; hence, they do not take into account general equilibrium effects.[3]

In most countries, measuring real-time impacts of financial crises or economic slowdowns on households is rarely possible due to delays associated with household surveys; consequently simulation tools are often used to analyze welfare impacts. However, among the genre of welfare simulation tools, considerable variation exists in methodology, data requirements, assumptions, and analyst time requirements.

A computable general equilibrium (CGE) model and a micro-simulation (MS) model can be combined in a sequential approach to assess the effects of various macroeconomic policies and shocks on households. For example, Agénor et al. (2006), Cockburn (2006), Cogneau and Robilliard (2006), and Bourguignon and Savard (2008) investigate the distributional impacts of macro-economic structural changes. The CGE models have also been combined with micro-simulation models to investigate the impact of macro-economic shocks on households across the

[1] World Bank (2010)
[2] World Bank (2010)
[3] For example, relative price changes due to changes in domestic demand are not taken into account.

entire income distribution. For example, Robilliard, Bourguignon, and Robinson (2002) apply a CGE model based on a social accounting matrix with 38 sectors and 15 factors of production to quantify the poverty and inequality impacts of the 1997 financial crisis in Indonesia. The CGE models take into account not only immediate or direct effects but also knock-on effects but they require substantial data. So constructing social accounting matrices (SAM) in countries that lack data requires a significant amount of time, which makes SAMs unsuitable when quick turnaround is essential.

Given the data and time requirements of the combined CGE micro-simulation approach, the tendency is to estimate welfare impacts of the crisis using the output elasticity of poverty method, and the PovStat software. The former uses historical trends of output and poverty to determine the relationship between poverty rates and output growth. Once the relationship is estimated, macroeconomic projections of output can be used to simulate poverty rates. This method is easy to implement and as a result is often used for regional or global poverty simulations. For example, Chen and Ravallion (2008) use this technique for global poverty simulations, and Tiongson, et al. (2009) use it for Eastern European and Central Asian poverty simulations. The main drawbacks of the elasticity method are that only aggregate poverty numbers can be estimated and the model requires an inequality estimate, which is difficult to predict based solely on past information because of the wide variations among crises.

The PovStat software has been adopted in several settings, including estimating the poverty impacts of the Asian Crisis during 1997-98 and the recent economic slowdown in Armenia (World Bank, 2009a) and Bulgaria (World Bank, 2009b); PovStat has four main shortcomings. First, its capacity to disaggregate within sectors is limited to three sectors—agriculture, industry, and services; during the crisis it was observed that some sectors *within* these three broad classifications were hit harder. For example, in Latvia, trade hotels and construction were the hardest hit. Second, PovStat works well for aggregate poverty/inequality indices but not for disaggregated distributional impacts. Third, PovStat does not distinguish between formal and informal employment, but differences in the way labor laws are implemented across formal and informal sectors may lead to outcome differences across sectors. Fourth, PovStat is not flexible enough for policy simulations in cases where researchers are interested in examining the impact of various policies on poverty outcomes.

This note is organized as follows. Section II describes the data used in the note, Section III summarizes aggregate impacts of the financial crisis, Section IV describes the methodology used to measure distributional impacts of the crisis, Section V presents results, and Section VI concludes.

II. Data

The main data source for this effort was the Latvian EU-SILC 2006 database, which was the most recent survey available in 2009 when the simulations were conducted. The survey is annual with a four-year rotational panel.[4] In 2006, the fieldwork was carried out March through November during which time 4,315 households (9,391 individuals aged 16 and over) were interviewed. Sampled households also included 1,594 children under 16 years of age. The reference population comprises private households with members residing in the national territory. The survey includes modules of income, labor market activity, demographics, education, health, housing, social programs, access to some durable consumption goods, and subjective welfare.

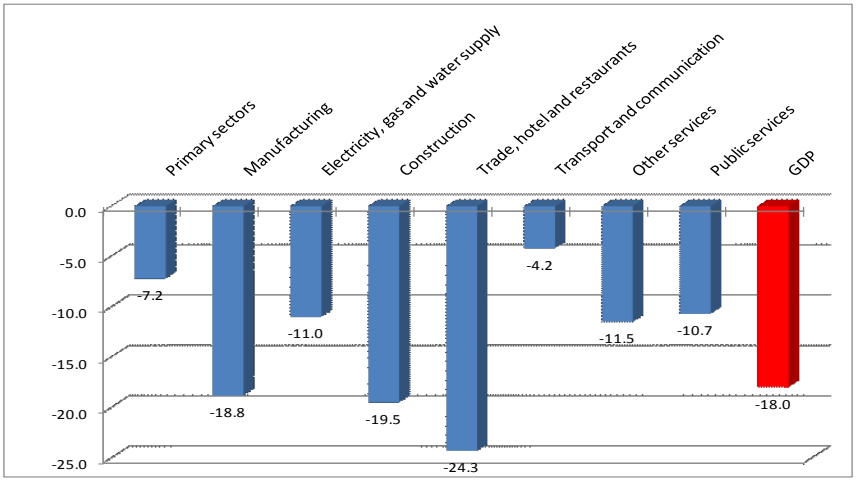
III. Aggregate Impact of the Financial Crisis

Latvia's GDP contracted by 18 percent in 2009 relative to its GDP in 2008.[5] The Ministry of Economics forecast the sectoral breakdown of the GDP contraction (Figure 1). The three hardest hit sectors were trade hotels and restaurants (projected to contract by 24 percent); construction (projected to contract by 19.5 percent); and manufacturing (projected to contract by 18.8 percent). The forecasts suggested that the sectors likely to be least affected were transport, expected to decline by 4.2 percent, and communication and the primary sectors, expected to decline by 7.2 percent.

[4] The Latvian EU-SILC survey uses a stratified two-stage sampling design. In the first stage, systematic sampling of the primary sampling units was selected. In the second stage, simple random sampling was used to select secondary sampling units. The survey was stratified by the degree of urbanization.

[5] Ministry of Economics, Government of Latvia.

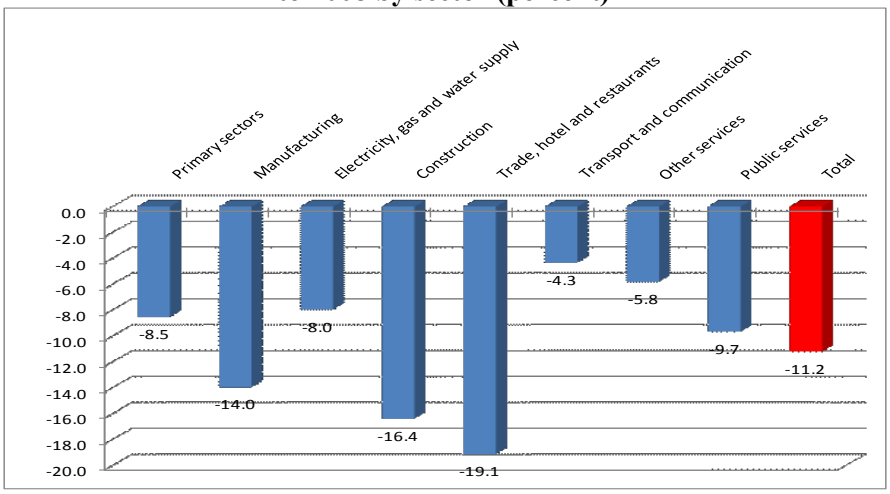
Figure 1: Projected contraction in sectoral GDP in 2009 relative to 2008 (percent)



Source: Weighted averages computed by authors based on data from the Ministry of Economics, Government of Latvia.

Based on the Ministry of Economics' projections, Figure 2 presents projected employment contraction by sector. During 2009, it was expected that more than 126,000 (11.2 percent) jobs would be lost; the trade, hotels, and restaurants sector; and the construction sector were expected to shed some 60,000 jobs; the manufacturing sector was expected to shed almost 14 percent of its jobs or about 24,000 workers.

Figure 2: Projected contraction in employment in 2009 relative to 2008 by sector (percent)



Source: Ministry of Economics, Government of Latvia.

IV. Methodology

The macroeconomic impacts of the financial crisis are transmitted to households through the following: (a) financial markets via reduced access to credit, eroding savings and asset values; (b) labor markets via reduced employment, wages and remittances; (c) product markets via lower growth and production, and relative prices changes; and (d) government and non-governmental services such as public and private education, health and social protection services.[6]

For Latvia, the dominant short-run crisis impact was expected to come from labor markets through reduced wages and employment. To measure the distributional impact of the financial crisis, aggregate shocks to employment and GDP must be linked to individual households, which can be done by combining aggregate information with household survey data.

Our base simulation assumed that workers were employed in the formal sector, or the informal (grey) sector. The expectation was that the formal sector would cut *both* the size of the workforce and wage rates, but the informal sector would cut *only* wage rates.[7] Our simulations used projected employment reductions, but wage reductions were computed such that the total sector GDP growth rates were as predicted above. An implicit assumption was that wage growth rates correspond exactly to GDP growth rates.

Abundant literature exists on the characteristics of workers most likely to be laid off when a sector contracts. In this note, we considered four layoff models. First, we postulated the determinants of employment, based on a range of observable worker-specific characteristics such as gender, education level, age (a proxy for experience), location of residence, and so forth. Then, for each worker we computed a propensity score—the likelihood that an individual with those observable characteristics would be employed. Next, the model assumed that the first workers to be laid off would be those with the least probability of being employed. The second and third models of layoffs were based on worker age; older workers might be selected for layoffs because they command higher wages, perhaps due to acquired rights or a specific set of productive characteristics. Younger workers may be selected for layoffs because there are fewer regulatory

[6] See World Bank (2011) for a discussion of the transmission channels through which macroeconomic crises are passed to households.

[7] Alternate scenarios are also tested. For example, in one scenario the formal sector only lays off workers, and the informal sector reduces wages. In another scenario, the we do not make a distinction between formal and informal sectors and hence, all workers can experience layoffs or wage reductions.

hurdles to surmount before letting them go, or because severance payments would be cheaper for employers. The fourth model assumes that the first workers to be cut would be the least educated. Finally, we assumed that worker layoffs could be random—that observable characteristics did not predict layoff patterns.

We assumed that all workers who lose their jobs receive an income equal to about 28.3 percent of their pre-crisis wage, which is the average share of unemployment benefits. This is because households that lose a significant source of income typically cope by tapping other sources of income, such as unemployment benefits, remittances, or a part-time job, for example.[8] Since household coping strategies for income loss could not be predicted ex-ante, we assumed that post-layoff income would equal total unemployment benefits.

Further, we assumed that households with a main source of income from the informal sector would experience a welfare decline in line with the decline in per capita GDP. However, the welfare decline of all other households, i.e., those without a worker in either the formal or informal sector, is determined endogenously such that the cumulative welfare decline is equal to overall GDP contraction for the economy.

The objective of micro-simulations was to estimate Latvian income distribution under different scenarios. The work follows the spirit of Oxaca (1973), Juhn, Murphy and Pierce (1993) and, more recently, Bourguignon, Ferreira and Lustig (eds.) (2004). Formally, defining the Latvian income distribution at year *t* as D_t:

$$D_t = \{y_{1t}, y_{2t}, ..., y_{Nt}\} \tag{1}$$

where y_{ht} stands for the household per-capita income of household *h*. The total income of the household comes from the sum of the labor income (Y^L) and non-labor income (Y^{NL}) of all the members of the household:

$$Y_{ht} = \sum_{\forall j \in h} (Y_{jt}^L + Y_{jt}^{NL}) \tag{2}$$

On the one hand, labor income equals the hourly wage earned by the individual (w_i), times the number of hours worked (L_i):

$$Y_{it}^L = w_{it}.L_{it} \tag{3}$$

[8] Dasgupta and Ajwad (2011), using crisis response survey data from five Eastern European countries, showed that households impacted by income shocks adopt a host of coping strategies.

On the other hand, we can assume that non-labor income equals the sum of an exogenous component ($\overline{Y}^{NL}$) and the unemployment benefit (UB), where

$$UB_{it}(\lambda, w_{it-1}) = \lambda . w_{it-1} \quad \text{where} \quad 0 \le \lambda \le 1 \tag{4}$$

A typical micro-simulation exercise assesses the change in income distribution that arises from a change in a parameter (or in a set of parameters*)* that affects the previous sources of income. For instance, we can simulate the change in the Latvian income distribution that would arise if the unemployment benefit were increased to λ'%, and the remaining variables are not modified:

$$D_{t'}(\lambda') = \{y_{1t'}(\lambda'), y_{2t'}(\lambda'), ..., y_{Nt'}(\lambda')\} \tag{5}$$

The objective of the exercise is to compare the distributions (1) and (5) in terms of some distributive index I (measuring poverty or inequality), for instance:

$$I(D_{t'}(\lambda')) - I(D_t) \tag{6}$$

In particular, for those workers employed in a formal sector *s* we assume in our benchmark exercise that:

$$Y_{it}^{L}(\text{s}) = 0 \text{ if } \phi(X\beta) < threshold(s) \text{ and } formal = 1 \tag{7}$$

where $\phi(X\beta)$ is the likelihood of being employed. Therefore, if the likelihood of being employed is under a certain threshold, we simulate that the individual will be laid off, therefore, his labor income will be zero. This threshold is endogenously adjusted to replicate unemployment projections for sector *s* in our micro-data. Total income would never be zero since $\lambda = 28\%$.

On the other hand, we assume that the labor income of informal workers will be:

$$Y_{it}^{L}(s) = (1 - \alpha^{I}(s))(w_{it}.L_{it}) \text{ if } formal = 0 \tag{8}$$

Where $\alpha^{I}(s)$ is the GDP contraction projected for sector *s*. In addition, the labor income of formal workers that keep their jobs would be endogenously adjusted (through $\alpha^{F}(s)$) to be consistent with the GDP projections of sector *s*

$$Y_{it}^{L}(s) = (1 - \alpha^{F}(s))(w_{it}.L_{it}) \text{ if } \phi(X\beta) > threshold(s) \text{ and } formal = 1 \tag{9}$$

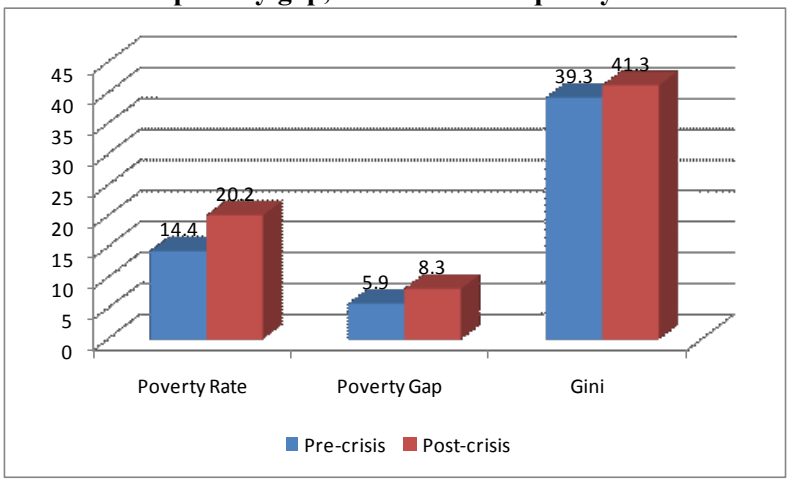
V. Results

V.I Results: Simulated impact on poverty and inequality

Applying the above methodology with aggregate projections and assumptions of the model, some interesting results were observed.

Simulations showed that Latvia would experience a sharp rise in poverty, the poverty gap would widen, and income inequality would increase (Figure 3). In 2009, with an 18 percent GDP contraction and the above employment projections, the percentage of people in poverty was predicted to increase from 14.4 to 20.2;[9] which would add 130,234 poor people in 2009 (over 2008), to reach a total of 453,575 people. The poverty gap, which measures the poverty deficit of the entire population, was projected to increase from 5.9 to 8.3 percent.[10] Finally, income inequality was projected to increase due to the effects of the crisis; Gini coefficient was predicted to rise from 39.3 to 41.3 percent. These simulations assumed that *no countervailing measures* were implemented by the government to specifically address the impact on poverty.

Figure 3: Simulated impact of the crisis on the poverty head count, poverty gap, and income inequality



Source: Authors' calculations using 2006 EU-SILC.

There were substantial differences in the impact of the contraction across regions and specific population groups (Figure 4). The largest poverty increase was observed in the poor region of Latgale where most workers were likely to have been employed in low-wage jobs even prior to the crisis. In this region, the crisis had a substantial impact on poverty rates because many full-

[9] A household is considered poor if total household income is below LVL 90 per capita per month, or about US$6 per person per day. Latvia has no official poverty line but the LVL 90 per capita per month is known as the "needy" line.

[10] The poverty gap ratio is the sum of the income gap ratios for the population below the poverty line (z), divided by the total population (n):

$$PG = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z - y_i}{z}\right]$$

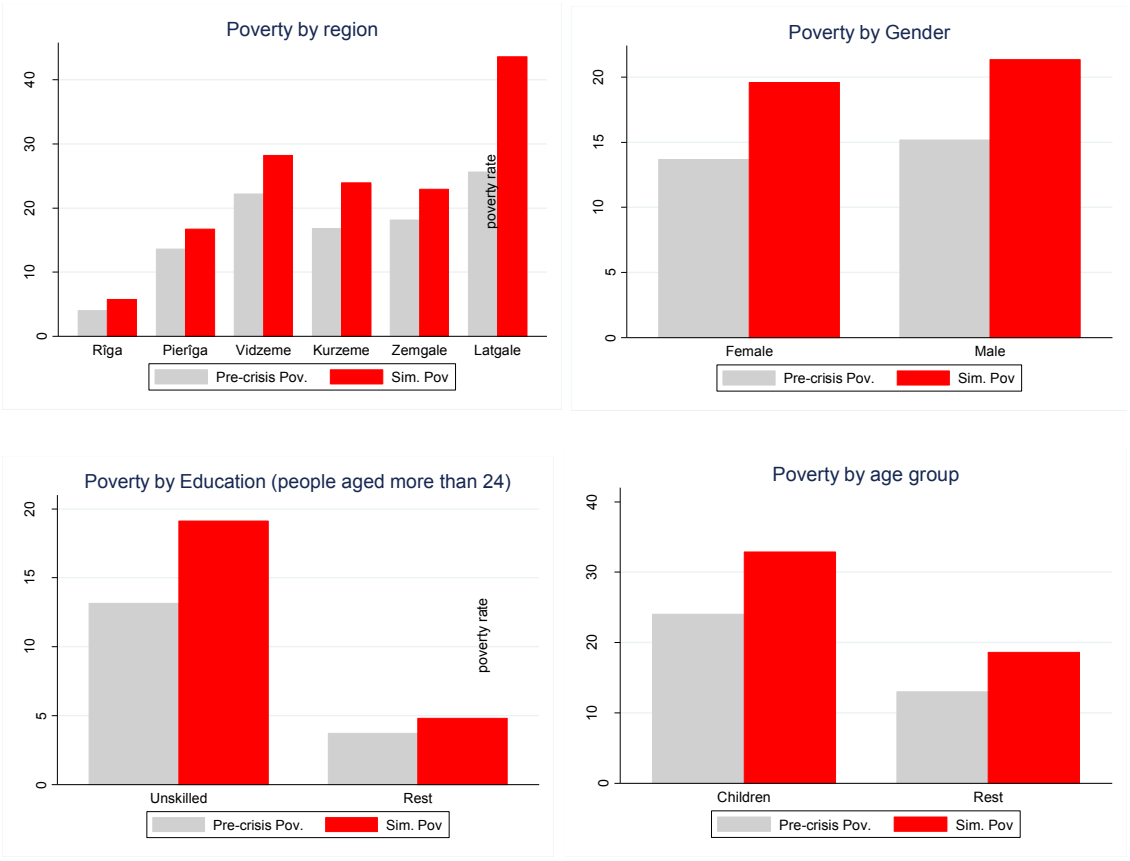
time workers' wages were at or near the poverty line. The impact of the crisis was also felt more sharply in households with a male as the primary source of earnings because many men were employed in the construction and manufacturing sectors, which experienced dramatic contractions after the crisis. Households suffered relatively more if their economically active members had fewer skills and lower education attainment—high school or less, and/or if the household included children.

To analyze where in the distribution people are most affected by the economic contraction, we plotted growth incidence curves (GIC).[11] Figure 5 plots GIC for Latvia as a whole and disaggregates the GIC by densely and thinly populated areas. For all of Latvia, households with per capita income in the bottom 40 percent of the income distribution, and people in densely populated areas, which includes the major cities, were hardest hit by the economic slowdown. However, although people in the bottom 40 percent of the income distribution were hit harder by the crisis, very poor rural households were somewhat spared—it was more likely that people above the 5th percentile and below the 40th percentile were hardest hit by economic slowdown.[12]

[11] These curves compare across two time periods, t−1 and t, the growth rate in income of the pth quantile as $g_t(p) = \left[{y_t(p)}/{y_{t-1(p)}}\right] - 1$. Varying p from 0 to 1, $g_t(p)$ traces growth incidence curve (GIC).

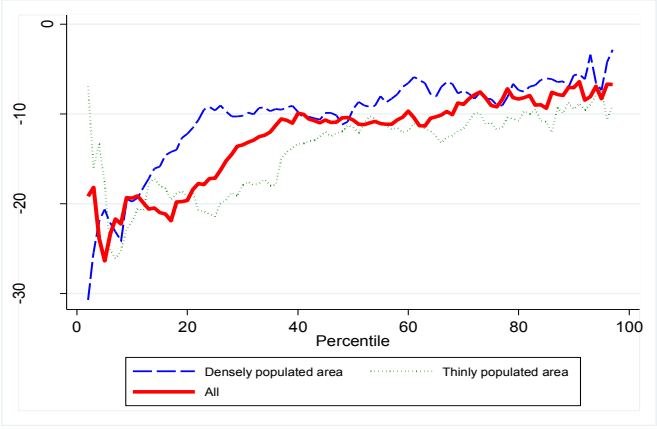
[12] Habib, et al. (2010) report that in the Philippines and Mexico the poor were hardest hit, but in Bangladesh, richer households, especially in rural areas, were hardest hit.

Figure 4: The impact of the crisis by region, gender, education and age group



Source: Authors calculations based on 2006 EU-SILC.

Figure 5: Growth incidence curve for Latvia: Percentage increase in per capita household income between 2008 and 2009



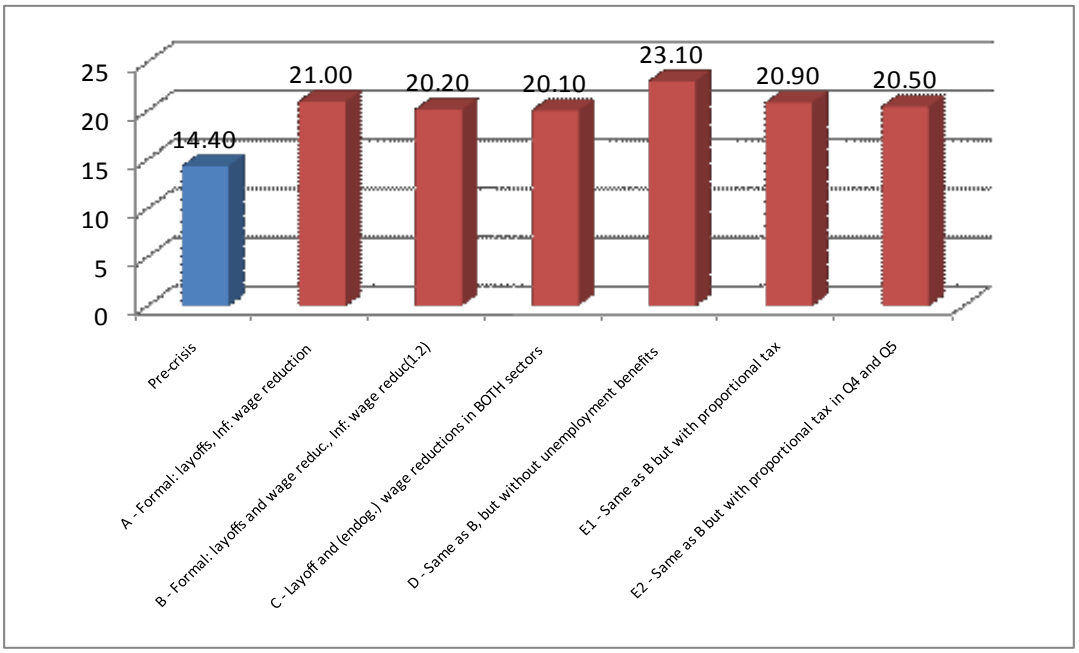
Source: Authors calculations based on 2006 EU-SILC.

V.II Results: Sensitivity Analysis of poverty and inequality impact

Among the modifications in the assumptions tested for robustness are the following: (a) allowing layoffs in the formal sector but no wage reductions, and in the informal sector, allowing only wage reductions but no layoffs; (b) allowing formal sector layoffs and wage reductions but only wage reductions in the informal sector; (c) allowing layoffs in both the informal and formal sector and endogenously determining the wage reduction; (d) same as (b) but with no unemployment benefits paid out; (e1) same as (b) but with a proportional tax to pay for the increased unemployment benefits; and (e2) same as (b) but with a proportional tax on households in quintile 4 and 5 to pay for the increased unemployment benefits. Based on discussions with various stakeholders in Latvia, model (b) was chosen as the preferred model.

The sensitivity tests concluded that the increase in poverty from 14.4 to 20.2 is very robust to different scenarios (Figure 4) with one exception. If post-layoff incomes are not comparable to unemployment benefits that workers would be eligible to receive, the impact on poverty can be as high as 23 percent.

Figure 4: Sensitivity analysis of poverty simulations for various assumptions

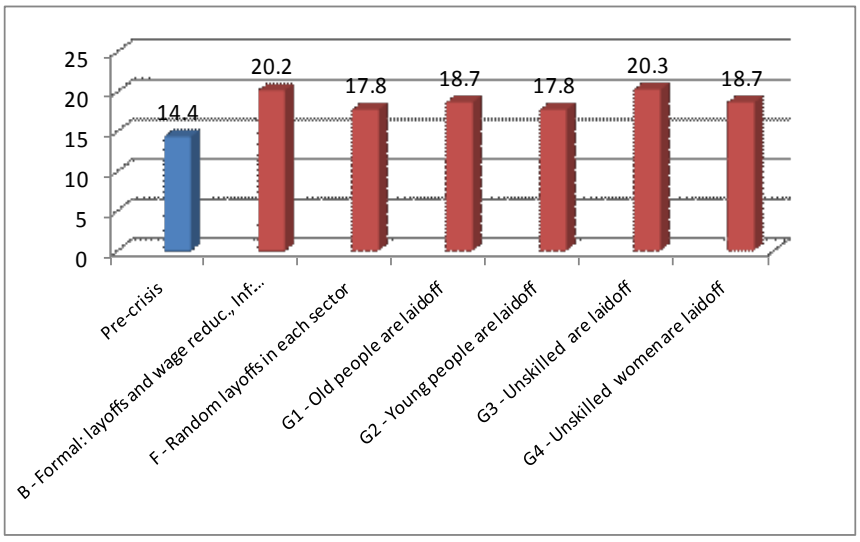


Source: Authors calculations based on 2006 EU-SILC.

A further test of sensitivity was conducted for layoff patterns (Figure 5). The layoff models considered included the following: (i) layoffs occur by propensity scores for employment; (ii) layoffs are random; (iii) older workers are laid off; (iv) younger workers are laid off; (v) unskilled workers are laid off; and (v) unskilled female workers are laid off.

Simulated poverty rates were dependent on the layoff model chosen; however, it appears that the random layoff scenario leads to a lower simulated poverty head count than most of the other models. Unsurprisingly, unskilled worker layoffs lead to the largest increase in poverty relative to other layoff models. Consultations with Government of Latvia officials and others suggested that using the model with layoffs based on propensity scores was likely to be most useful for Latvia.

Figure 7: Sensitivity under different layoff models



Source: Authors calculations based on 2006 EU-SILC.

V.III Simulated impact of policy responses

Reacting to the crisis, the Government of Latvia initiated several policy responses to mitigate potential distributive implications, especially for the poor. Below, we present a few hypothetical tradeoffs between social safety net scenarios.

a) Raising the eligibility threshold for guaranteed minimum income (GMI) provision

To mitigate crisis impacts on the poorest population in Latvia, the government raised the eligibility threshold for GMI provision to households in need, which led to (i) higher coverage; (ii) higher transfers to poor households; and (iii) a lower poverty gap. At the end of 2007, the GMI threshold was LVL 28 per person per month; at the beginning of 2008, it was increased to LVL 37 per person per month; and in October 2009, it was increased to LVL 40. If targeting had been perfect, the threshold increase would have led to 21,000 new GMI beneficiaries. Because the GMI eligibility threshold was still below the "needy" poverty line used in this note for the simulations (90 LVL per capita per month, approximately equivalent to the Leaken measure), there would be no change in the poverty rate. However, the poverty gap would decrease, hence, household deprivation would decline.

b) Withdrawing the existing Family State Benefits program and replacing it with targeted cash transfers to the poor

Although the government did not pursue this option, we simulated the impact of withdrawing the untargeted Family State Benefits (FSB) allowance and using the funds for more targeted transfers. We found that if the FSB were withdrawn, the post-crisis poverty rate would have jumped from 20.4 percent to 22.8 percent in 2009. If the FSB were replaced by top-up cash transfers to the poverty line of 90 LVL per capita per month, the poverty level would have been unaffected (because the poverty threshold is 90 LVL per capita per month). However, the poverty *gap* would decrease. We can also project program costs to see how they increase. This type of information can help policymakers streamline various safety net programs, especially during financial stress.

Table 1: Hypothetical tradeoff between Family State Benefits and a targeted cash transfer

	With family allowance		*If family allowance is withdrawn*		*If family allowance is withdrawn and replaced by TOP-UP GMI*
Income	2008 % of population	2009* % of population	2008 % of population	2009* % of population	2009* % of population
less than 50 LVL	5.04	8.23	6.70	10.13	0
>=50 & <75 LVL	5.70	7.87	5.98	8.08	18.21
>=75 & <90 LVL	3.63	4.29	3.43	4.58	4.58
Poverty Rate (<90 LVL)	**14.36**	**20.39**	**16.11**	**22.79**	**22.79**
Poverty GAP	**5.86**	**8.27**	**7.236**	**10.30**	**6.49**

Notes: A household will get 70-percap LVL/child and 50-percap LVL/adult if its per capita income is less 50 LVL
*Projections based on the baseline scenario

Table 2: Cost Projections

	Estimated Cost in Million LVL
Total amount paid as family benefits in 2008	83.40
Total projected amount needed for Top-UP GMI in 2008	65.69
Total projected amount needed for Top-UP GMI after crisis in 2009	92.46

c) Increasing household incomes of unemployed people through augmented unemployment benefits or public works provision

Unemployed people are disproportionately represented among the poor in Latvia. Improving their welfare without creating disincentives to seek regular work is crucial. In this regard, the government took two steps. First, it increased the overall duration of unemployment benefit payments to nine months; a payment of 45 LVL (one-quarter of minimum wage) is made for three months if the unemployed person receives unemployment insurance benefits for six months; or for six months if the unemployed person receives unemployment insurance benefits for three months. Second, the government implemented a public works program that paid a net wage of 100 LVL per month (the gross minimum wage is 180 LVL per month, which leads to a net minimum wage of about 130 LVL per month) to participants. Both measures increase household incomes.

In the aftermath of the crisis, if no unemployment benefits were paid, poverty would have risen dramatically to 23.1 percent. Under the 2008 unemployment insurance plan rules, newly

unemployed workers typically received a benefit of about 28 percent of their pre-layoff income. With no changes to the plan, the anticipated poverty rate in the wake of the contraction would have been 20.2, as reported above. However, if the average post job-loss benefit of about 28 percent were to increase to 40 or 50 percent (using the more generous parameters passed early in 2009, or using a public works stipend), then post-contraction aggregate poverty would be reduced to 19.1 or 18.1 percent, respectively. Neither measure would be likely to deter workers from rejoining the formal labor force when the labor market starts to recover because the unemployment benefits top-up is low and because the public works stipend is lower than the minimum wage.

Table 3: Poverty and cost of unemployment bill under unemployment benefit rate scenarios

Unemployment Benefit Rate	Poverty Rate	Gini	Unemployment Bill in Millions LVL
Pre-Crisis	**14.4**	**39.33**	
0	23.1	43.19	0
5	22.8	42.84	19.57
10	22.4	42.51	39.13
15	21.7	42.2	58.70
20	21.1	41.9	78.27
25	20.6	41.62	97.83
30	20.3	41.36	117.40
35	19.8	41.11	136.97
40	19.1	40.88	156.53
45	18.7	40.66	176.10
50	18.1	40.46	195.67

VI. Conclusion

Our simulations indicated that Latvia would have experienced a sharp rise in poverty, a widening poverty gap, and a rise in inequality due to the financial crisis. Using Latvia's "needy" line (LVL 90 per capita per month) as the poverty threshold—roughly equivalent to the Leaken measure of relative poverty—the impact of the labor market adjustment was to raise poverty from 14.4 at the end of 2008 to 20.2 by the end of 2009. In other words, Latvia would have had more than 130,000 more poor people in 2009 than in 2008, increasing the total number of poor people to more than 453,000. During the same period, the poverty gap was simulated to increase from 5.9

to 8.3 percent, indicating that poor households were becoming poorer. Simulations also indicated that income inequality—the Gini coefficient—would rise from 39.3 to 41.3.

When compared with recently released post-crisis data, our ex-ante simulation model performed reasonably well in predicting the direction and magnitude of changes in poverty. Although, post-crisis EU-SILC data are not available, the household budget surveys (HBS) indicate that poverty rates increased from 10.12 percent in 2008 to 18.05 percent in 2009: an increase of about 8.0 percentage points.[13,14] and our simulation model predicted a poverty increase of about 6.0 percentage points. Similarly, between 2008 and 2009, the poverty gap increased by 3.6 percentage points compared to our predicted increase of 2.4 percentage points. Some differences may have arisen because our income data sources differ from those of the HBS. However, poverty numbers from post-crisis HBS data show the usefulness of our model in predicting ex-ante effects of a crisis, despite many data limitations.

Much of the social impact of the crisis can be traced through crisis effects on the labor market. In 2009, GDP contracted 18 percent and the sectors most severely affected were trade hotels and restaurants, construction, and manufacturing—a loss of more than 126,000 formal jobs, comprising about 11.2 percent of the workforce. The large contraction in overall employment reflects employment contractions of 19 percent in trade, hotels, and restaurants, 16 percent in construction, and 14 percent in manufacturing. Finally, substantial differences exist in the impact of the financial crisis across regions and specific population groups in Latvia.

The Government of Latvia implemented several programs to mitigate crisis impacts on households, including increasing the threshold rate of the Guaranteed Minimum Income program, the main national poverty-targeted program; and a self-targeted public works program for unemployed people. Our simulations indicate that these measures may have helped cushion crisis impacts for some of the hardest hit households. However, the scale of the crisis exceeded the ability of programs launched under the Emergency Social Safety Net to offset negative impacts. As a result, poor and near-poor people continued to suffer considerable hardship.

[13] We have SILC data collected in 2009 but since SILC income data refer to the previous year's earnings, the 2009 SILC income data cannot be used as post-crisis income.
[14] Poverty numbers are based on HBS income data. A household is considered to live in poverty if total household disposable income is below LVL 90 per capita per month.

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Annex

The following are the step-by-step adjustments and assumptions made in the simulation.

1. Our starting point is 2006 SILC data for Latvia. Two income types accrue to households—household-level income and individual-level income. We aggregate individual-level incomes within a household and add household income to arrive at total household income, which is then divided by household size to get per capita expenditure.
2. To bring the 2006 data (latest available SILC data) to 2008 level, we apply the real sectoral (12 sectors) wage growth rate during 2006-08 to the 2008 labor income. Pension income is also inflated by public administration wage growth. The remainder of individual or household income is inflated by average wage growth during 2006-08.
3. We use four classifications: employed, unemployed, retired, and inactive. Employed workers are categorized as formal or informal and by sector.
4. We estimate individual employment probability using a probit model.
5. In our base-case scenario, we assume that the formal sector experiences job cuts *and* wage cuts; the informal sector experiences a wage cut that is 20 percent higher than the sectoral GDP contraction. In our layoff scenarios, sector layoffs match projected sector employment contractions; thus, the formal sector wage reduction becomes endogenous as it is determined by sector-wide GDP contraction and contraction in informal wages.
6. We calculate the simulated labor income per individual, then we construct the per capita household income as described in Step 1, which yields crisis per capita income.