Chapter 3. War in Ukraine: Risks to Poverty and Inequality in the Caucasus and Central Asia

Online Annex

Inflation and War's Potential Impact on Poverty and Inequality (Sections 3.2 and 3.4)

Microsimulations

Using household consumption and income surveys, Deaton (1989) and De Hoyos and Medvedev (2011) estimate changes in consumer welfare (defined as a change in nominal consumption) based on changes in food prices. This chapter generalizes this framework to assess how changes in food prices, nonfood prices, and other sources of income impact consumption.

Let each individual's nominal consumption in period *t* be $X_t = p_t^f q_t^f + p_t^n q_t^n$ where q_t^f is the quantity of food consumed and q_t^n is the quantity of nonfood items consumed (p_t^f and p_t^n are price indexes for food and nonfood items, respectively), and let $Y_t = p_t^f y_t^f + p_t^n y_t^n + p_t y_t^O + p_t z_t^* + p_t s_t^*$ be total nominal income derived from producing food y_t^f and nonfood items y_t^n, other wage real income y_t^O, real income from remittances z_t^*, and real income from transfers s_t^*, where p_t is an aggregate price index ($\ln p_t = \eta \ln(p_t^f) + (1-\eta)\ln(p_t^n)$), which is also used to deflate nominal remittances and transfers (z_t and s_t). Let θ_t be the saving rate of each household such that: $X_t = (1-\theta_t)Y_t$.

This implies that the direct change in nominal consumption resulting from price changes (with quantities and saving rate fixed) is:

$$\Delta X_{t+1}^p = \left((1-\theta_t)y_t^f - q_t^f\right)\Delta p_{t+1}^f + ((1-\theta_t)y_t^n - q_t^n)\Delta p_{t+1}^n + (1-\theta_t)(y_t^O + \phi_z z_t^* + s_t^*)\,\Delta p_{t+1}$$

where $\Delta x_{t+1} = x_{t+1} - x_t$ and nominal changes in remittances and transfers are assumed to be proportional to price changes and real values in period *t*, with ϕ_z being bounded between 0 and 1. Thus, $\phi_z = 1$ implies that remittances adjust to fully offset changes in purchasing power from price changes. This can be rewritten as:

$$\Delta X_{t+1}^p = p_t^f\left((1-\theta_t)y_t^f - q_t^f\right)\pi_{t+1}^f + p_t^n((1-\theta_t)y_t^n - q_t^n)\pi_{t+1}^n + p_t(1-\theta_t)(y_t^O + \phi_z z_t^* + s_t^*)\,\pi_{t+1}$$

where π_{t+1}^f, π_{t+1}^n, and π_{t+1} are inflation rates for food, nonfood, and aggregate prices, respectively ($\pi_{t+1}^i = \Delta p_{t+1}^i / p_t^i$). Expressing this as a share of total consumption in period *t* yields:

$$\frac{\Delta X_{t+1}^p}{X_t} = (\varepsilon_t^f - \alpha_t^f)\pi_{t+1}^f + (\varepsilon_t^n - \alpha_t^n)\pi_{t+1}^n + (\varepsilon_t^O + \phi_z \varepsilon_t^z + \varepsilon_t^s)\pi_{t+1} \qquad (1)$$

where ε_t^i is income from source *i* as a share of nominal income and α_t^i is the share of spending on good *i* in nominal consumption. Thus, the direct effect of a higher price for good *i* will benefit net producers of good i ($\varepsilon_t^i > \alpha_t^i$) and hurt net consumers ($\varepsilon_t^i < \alpha_t^i$). Likewise, the overall change in nominal consumption resulting from changes in income can be expressed as:

$$\Delta X_{t+1}^y = (1-\ \theta_t)\left(\Delta p_t^f \Delta y_{t+1}^f + \Delta p_t^n \Delta y_{t+1}^n + \Delta p_t\ (\Delta y_{t+1}^O + \Delta z_{t+1}^* + \Delta s_{t+1}^*\ )\right)$$

This can be rewritten as:

$$\Delta X_{t+1}^y = (1-\ \theta_t)\left(p_t^f y_t^f g_{t+1}^f + p_t^n y_t^n g_{t+1}^n + p_t(y_t^O g_{t+1}^O + z_t^* g_{t+1}^{z^*} + s_t^* g_{t+1}^{s^*})\right)$$

where g_{t+1}^i denotes the nominal growth rate of income from source i ($g^i = \pi_{t+1}^{\mathrm{i}}\ \Delta y_{t+1}^i / y_t^i$). Expressing this as a share of consumption yields:

$$\frac{\Delta X_{t+1}^y}{X_t} = \varepsilon_t^f g_{t+1}^f + \varepsilon_t^n g_{t+1}^n + \varepsilon_t^O g_{t+1}^O + \varepsilon_t^z g_{t+1}^{z^*} + \varepsilon_t^s g_{t+1}^{s^*} \qquad (2)$$

Combining 1 and 2 produces the overall change in nominal consumption and the impact on consumption from rising prices assuming saving and spending patterns are unchanged:

$$\frac{\Delta X_{t+1}}{X_t} = \frac{\Delta X_{t+1}^p}{X_t} + \frac{\Delta X_{t+1}^y}{X_t}$$

Projections

To operationalize the equations above to make projections, it is necessary to make some assumptions for consumption of food items and nonfood items as shares of consumption expenditure (α_t^i), wage income, remittances, and transfers as shares of income (ε_t^i), inflation rates for food and nonfood expenditure, and real income growth for all individuals. Estimates of saving rates and shares for food, nonfood, wage income, remittances, and transfers are relatively easy to derive from household budget surveys. However, more tenuous assumptions need to be made for the production shares of food and nonfood and the inflation and real growth rates at the individual level. In the scenarios, it is assumed that food and nonfood inflation rates for all individuals are the associated aggregate inflation rates derived from World Economic Outlook (WEO) projections (see below). Likewise, WEO projections for real GDP growth per capita are used as real income growth rates for all individuals and income items. In the baseline projections, the parameters determining the price sensitivity of income from remittances (ϕ_z) is set to one for all individuals. Some further assumptions relating to expenditure/income shares that are used in the scenarios are described below.

Food

As in De Hoyos and Medvedev (2011), it is assumed that the quantity of food produced by individuals in urban areas is zero so that $\varepsilon_t^f = 0$. For rural residents, it is assumed that the quantity of food produced is proportional to the level of income from self-employment m_t (a proxy for agricultural production in rural areas) relative to total consumption expenditure:

$$\varepsilon_t^f = \frac{m_t}{X_t}$$

Nonfood

It is assumed that the quantity of nonfood produced by rural households is zero so that $\varepsilon_t^n = 0$. Like the assumptions made above for agricultural production of rural residents, nonfood production of urban residents is assumed to be proportional to each person's level of income from self-employment relative to total consumption expenditure:

$$\varepsilon_t^n = \frac{m_t}{X_t}$$

Other income

The share of other income is assumed to be $\varepsilon_t^o = 1 - \varepsilon_t^f - \varepsilon_t^n - \varepsilon_t^z - \varepsilon_t^s$.

Additional survey data assumptions

Tajikistan's household survey is a consumption survey and lacks any data on income sources. To be able to run the simulations, it is assumed that total income is equal to consumption. Since remittances as a share of GDP is equal to 30 percent, it is assumed that income from remittances will be, on average, 30 percent of total income. We then leveraged a question on the main sources of income, whose answers are described in the table below:

Table A1. Income Source Assumptions Based on Survey Answers

Answer to the question: What is your main source of income?	Income Source
Salary in main place of work	Wage Income
Salary in temporary place of work	Wage Income
Adjuvant private farm	Self-Employment Income
Income from private work or trade, rent	Self-Employment Income
Dehkan farm	Self-Employment Income
Accidental money	Other Income
Remittances	Remittances
Social payments (pension, cash allowance)	Social Transfers
Other	Other income

It is assumed that 70 percent of income comes from the main income source. For households whose main source of income is remittances, remittances are assumed to be 70 percent of total income, and 30 percent is assumed to be other income.

Remittances then are evenly distributed among all other households whose main source of income is not remittances so that the average share of remittances is 30 percent. The residual (Total Income – Main Income Source – Remittances) is then classified as other income.

Deriving the necessary variables: A simple macroeconomic model

The microsimulations above rely on projections for food and nonfood inflation, and real production growth per capita. WEO databases do not include projections for food and nonfood inflation, so a model was developed to derive them. The model uses the Kalman filter and Bayesian estimation to produce forecasts and historical estimates of food and nonfood inflation conditional on WEO projections for real

GDP growth per capita, CPI inflation, and world food and energy prices. Estimation is at annual frequency. The key equations in the model are Phillips curves for food and nonfood inflation, and an identity that links these inflation rates to aggregate CPI inflation.

$$\pi_t^f = \beta_1 \pi_t^* + (1-\beta_1)\pi_{t-1}^f + \beta_2 Y_t + \beta_3 \pi_t^s + \beta_4 \pi_t^{f*} + \beta_5 \pi_t^{e*} + \epsilon_t^f$$

$$\pi_t^n = \gamma_1 \pi_t^* + (1-\gamma_1)\pi_{t-1}^n + \gamma_2 Y_t + \gamma_3 \pi_t^s + \gamma_4 \pi_t^{e*} + \epsilon_t^n$$

$$\pi_t = \eta \pi_t^f + (1-\eta)\pi_t^n$$

where π_t^* is long-term inflation expectations, Y_t is the output gap, π_t^s is the percent change in the nominal exchange rate versus the US dollar, π_t^{f*} is international food price inflation, π_t^{e*} is international energy price inflation, and ϵ_t^f and ϵ_t^n are shocks; the prior distributions for all parameters are bounded between 0 and 1.

All variables in the equations above are expressed as deviations from trend except the inflation rates (π_t, π_t^f, π_t^n, and π_t^*). The trends are estimated using a modified Hodrick-Prescott (HP) filter that allows for conditioning information to be imposed. Parameters are estimated using data spanning from 2000 to 2020. Estimation of the trends uses all available data (including projections) with a standard smoothing parameter, and the filter imposes the condition that all estimated gaps are closed at the end of the WEO projection horizon. The long-term inflation expectation π_t^* is simply the HP trend of headline inflation π_t, where the trend converges to the WEO projection for headline inflation at the end of the projection horizon.

Scenarios

The scenarios will be developed in four steps.

1. *Extending household surveys*. Household budget surveys for ARM, GEO, KGZ, and TJK are first extended to 2021 using a standard method used by the World Bank (that is, all nominal variables will be assumed to grow at 85 percent of nominal GDP per capita from the most recent WEO database, so that consumption and income shares remain fixed). Poverty and inequality statistics are computed using data on consumption per person in 2021.

2. *Baseline projections.* Using data from the October 2021 WEO, baseline projections for inflation rates, and real per capita growth rates between 2021 and 2023 are used to produce estimates of consumption per person in the surveys in 2023. Poverty and inequality statistics are then computed, along with contributions to changes in the consumption distributions from food prices, nonfood prices, and real GDP growth per capita.

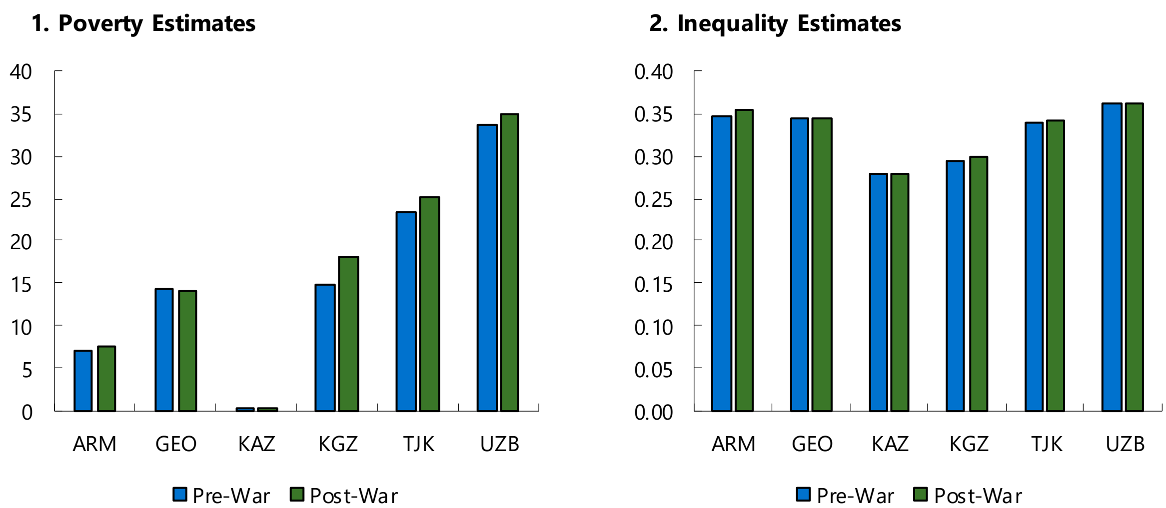
3. *Post-war projections.* The exercise in 2 is replicated with projections between 2021 and 2023 from the October 2022 WEO. Some additional assumptions are made to determine the impact of the war on remittances:

   - Remittances in the baseline projections are assumed to grow at the same rate as real GDP per capita. The additional shock to remittances is based on the estimated behavior of remittances following shocks to Russian growth, and the indexation parameter (ϕ_z) is calibrated based on the estimated responses of remittances to food-price shocks across the income distribution (see below the discussion of the local projection model for details).

4. *Potential impacts of the war.* The potential impacts of the war are the changes in the poverty and inequality statistics between the baseline and post-war projections.

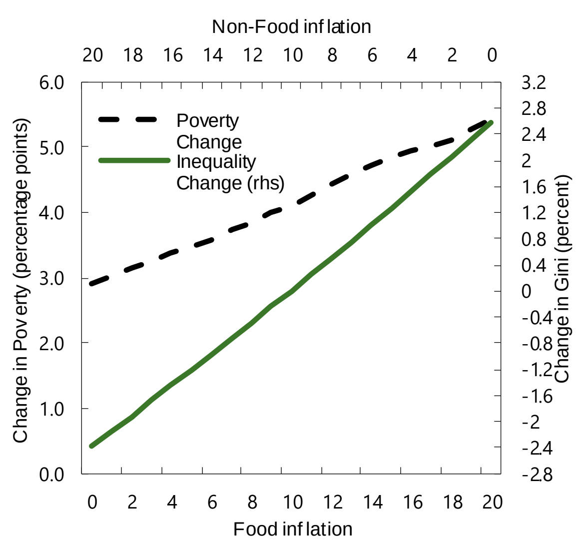
Figure A1 reports the poverty and inequality levels corresponding to the changes in these indicators as reported in the chapter's Figure 3.8. In addition, relaxing the chapter's assumption of non-production income indexed to inflation (which may not hold in short horizons), Figure A2 and A3 report the sensitivity to relative price changes and alternative simulation results for poverty and inequality under the assumption of no indexation (corresponding to the chapter's Figure 3.4 and 3.8, respectively).

Figure A1. Figure 3.8, Results in Levels (Simulations based on Pre- and Post-War WEO Scenarios, 2023)



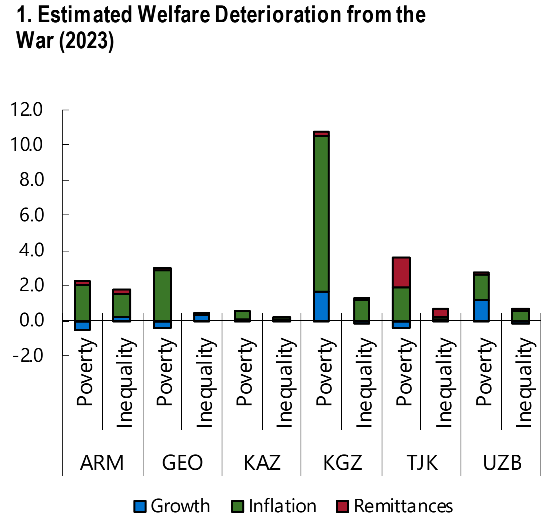
Sources: IMF staff calculations.

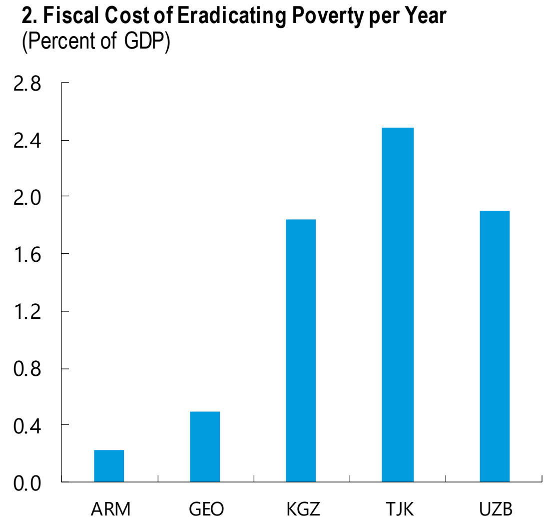
Figure A2. Figure 3.4 Results Assuming Non-Production Income is not Indexed to Inflation



Source: IMF staff calculations.

Figure A3. Figure 3.8 Results Assuming Non-Production Income is not Indexed to Inflation





Source: IMF staff calculations.
Note: In panel 1, changes in poverty are measured in percentage point change, and changes in inequality are measured in percentage change. Poverty is measured at the $3.65 purchasing power parity US dollars per day. Kazakhstan is omitted from panel 2 because poverty rates based on the poverty lines displayed are effectively zero. Country abbreviations are International Organization for Standardization country codes.

Figure A4. Annual Inflation Rates (2005 to 2023, Live WEO)

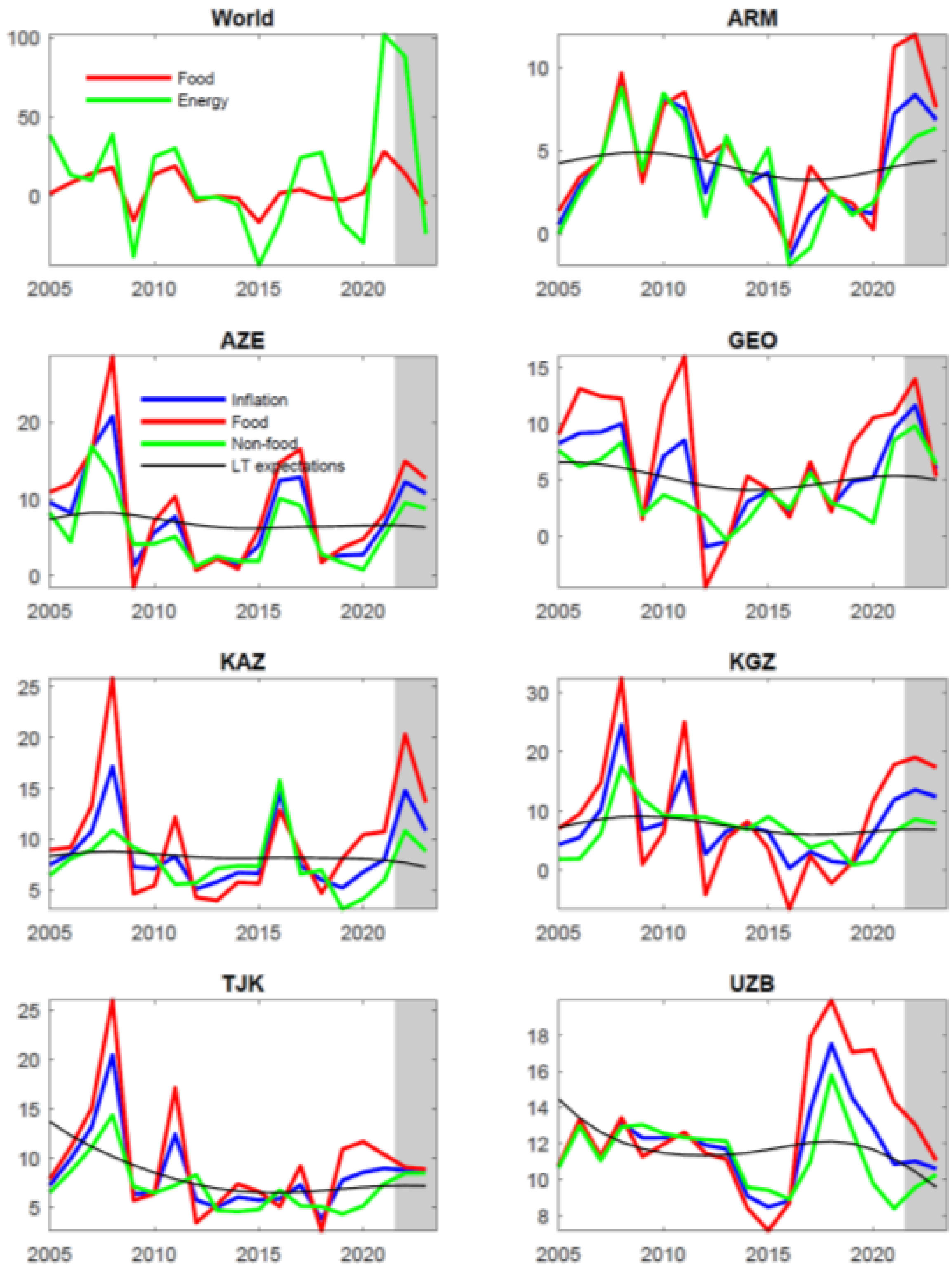
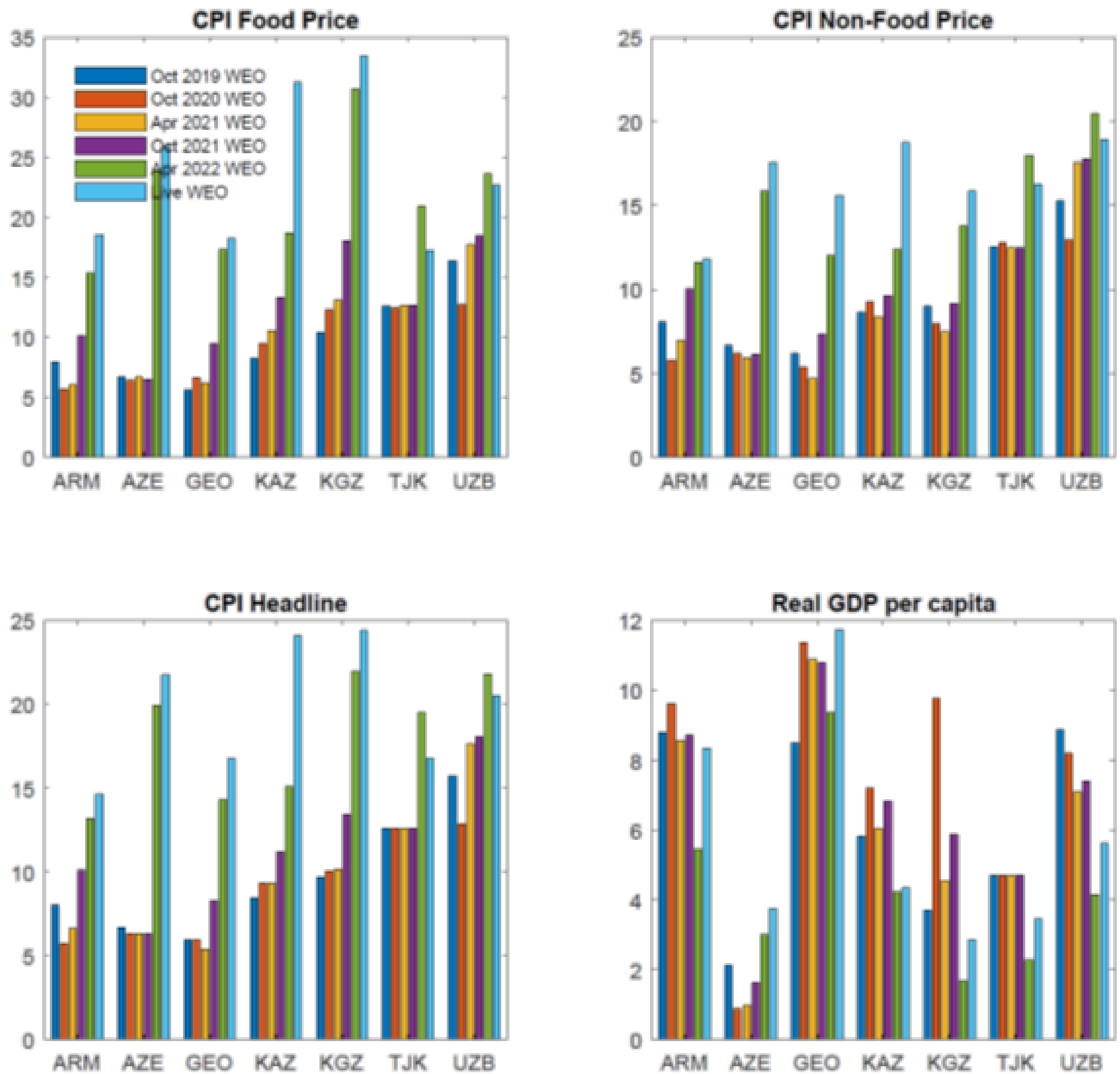


Figure A5. Expected Growth Rates between 2021 and 2023, precent



Do Remittances Help to Reduce the Impact of Higher Food Prices? Estimation of Impacts Using Local Projections (Section 3.2)

The Local Projections (LP) framework is flexible enough to accommodate a panel structure, does not constrain the shape of the impulse response functions, and is thus less sensitive to misspecification. Auerbach and Gorodnichenko (2013), Jordà and Taylor (2016), Ramey and Zubairy (2018), Born, Müller, and Pfeifer (2020), among others, relied on local projections for analyzing the impact of global shocks or unexpected policy changes.

To estimate the response of remittances to shocks to domestic food prices, we use panel data for three CCA countries (ARM, GEO, KGZ). Data on quarterly inflation (food and headline) was retrieved from IMF's IFS database. The sample is restricted to countries for which remittances are available on quarterly frequencies. The estimation period ranges from the first quarter of 2014 to the fourth quarter of 2021.

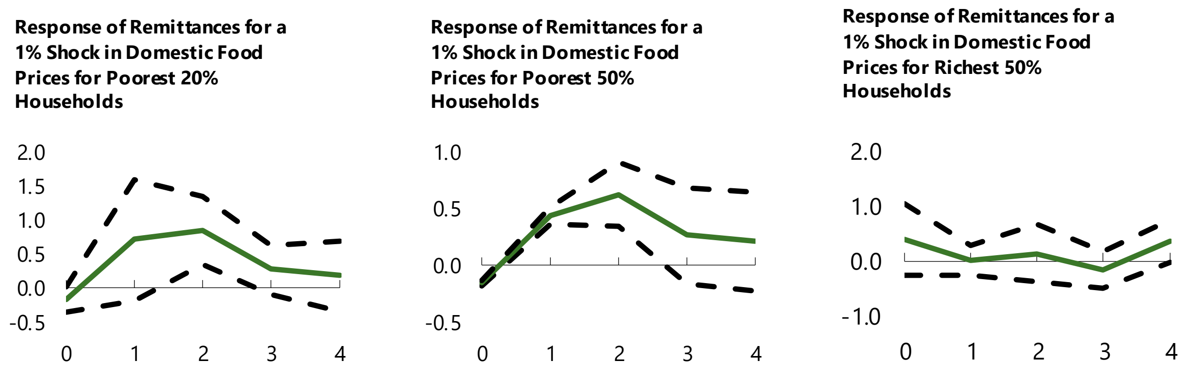
In its basic form, LP consists of a sequence of regressions of the endogenous variable shifted several steps ahead. As a result, the approach consists of estimating the following equation:

$$y_{i,t+h} - y_{i,t-1} = \alpha_{t,h} + \beta_h \Delta x_{i,t} + \theta_h Z_{i,t} + \epsilon_{h,i,t}$$

where $y_{i,t+h}$ corresponds to the log of household remittances in the country *i* from the base quarter t_0 up to quarter $t+h$, with h = 1, …, H; $\alpha_{t,h}$ refer to quarter fixed effects; $x_{i,t}$ denotes the domestic food consumer price index (CPI) component in quarter *t*; and $Z_{i,t}$ refers to a vector containing a set of control variables that include the number of household members, total income, number of elderly in the household, number of children in the household, the age of the household head, the number of the household members. The impulse responses are constructed based on the estimated β_h coefficients at each horizon. The number of lags (l) included in the model is 1 for the dependent and the control variables, but the results are robust to different lag length. Since fixed effects are included in the regression, the dynamic impact on inflation should be interpreted as relative to a country-specific trend. The confidence bands are based on the respective estimated standard errors. While adding the large set of controls mitigates most of the endogeneity concerns, the LP exercise remains subject to the possibility that remittances may also have inflationary effects, that is, reverse causality, through supporting aggregate demand. In our context, however, we only focus on the effect of food inflation and interpret our findings as stylized facts without claiming a causal effect.

The empirical analysis shows that a 1-percent rise in domestic food prices translates on average into an increase in remittances of about 0.8 percent two quarters after the initial shock for households in the bottom quintile of the income distribution. The effect is also visible for households in the bottom half of the distribution. Figure A6 reports the results for households at the bottom 20 percent, bottom 50 percent, and top 50 percent of the income distribution.

Figure A6. Impulse Responses of Remittances to 1 percent Shock to Domestic Food Prices



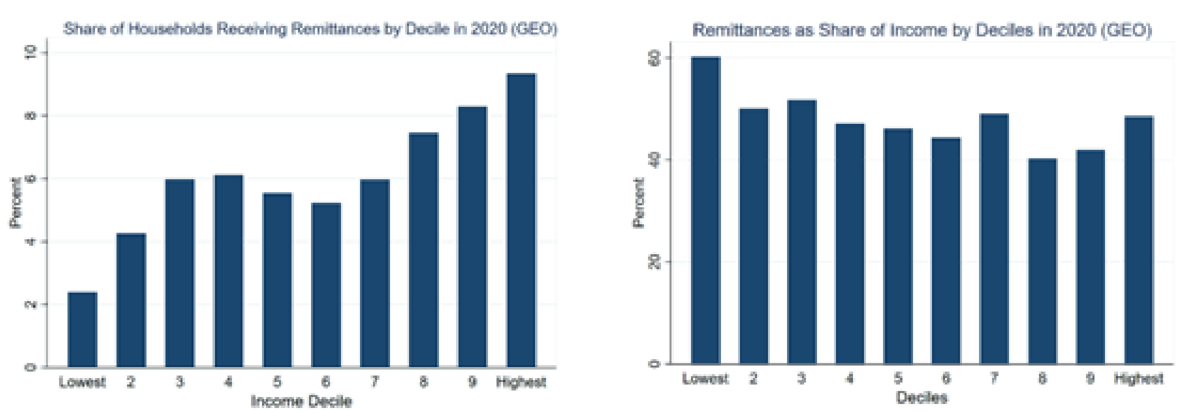
Source: IMF staff calculations.

The Role of Remittances (section 3.3)

What are the characteristics of households that are more likely to receive remittances?

- In Georgia, 5 percent of all households received remittances in 2020. This figure is 11 percent in Armenia (for 2020) and 21 percent in the Kyrgyz Republic (for 2018). The share of poor households that receive remittances is higher in the Kyrgyz Republic relative to Georgia and Armenia. In all three countries, the share of households that receive remittances is higher in more affluent income groups.
- Households that receive remittances in Georgia tend to have larger families with more children and fewer elderly than households in Armenia and the Kyrgyz Republic. Remittance-receiving households in Georgia have also higher levels of tertiary education, while educational differences between remittance-receiving households and other households are relatively small in Armenia. In the Kyrgyz Republic, remittance-receiving households have lower tertiary education levels compared to other households. In Georgia and Armenia, remittance-receiving households are also more likely to be from urban areas in contrast to the Kyrgyz Republic, where they are more likely to be from rural areas.

Figure A7. Remittances in Georgia

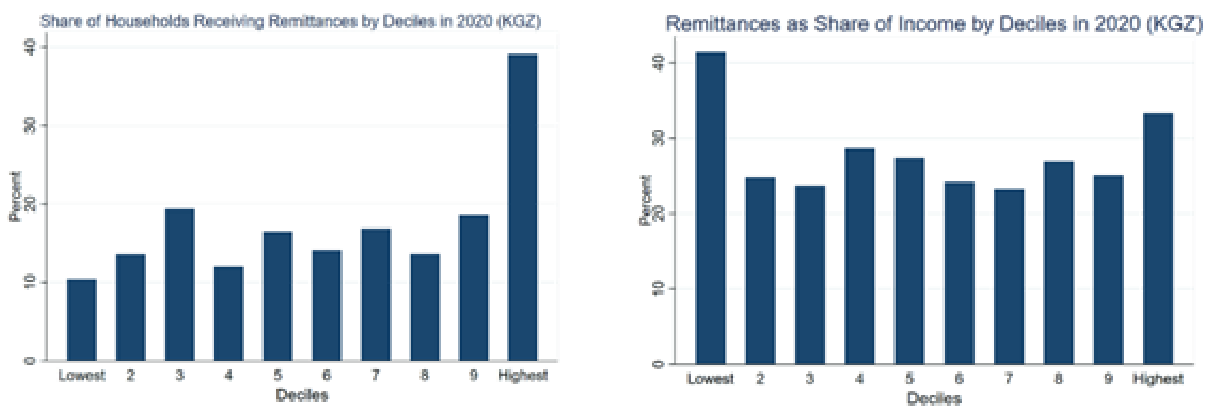


Source: IMF staff calculations.

Figure A8. Remittances in Armenia

Source: IMF staff calculations.

Figure A9. Remittances in Kyrgyz Republic



Source: IMF staff calculations.

Table A2. Summary Statistics for Households in Armenia, Georgia and Kyrgyz Republic

Characteristics of Remittance-Receiving and Non-Remittance-Receiving Households (GEO)

	2009				2020			
	Remittance receiving households		Non-Remittance receiving households		Remittance receiving households		Non-Remittance receiving households	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Family size	3.82	1.86	3.68	1.94	3.68	1.87	3.38	1.89
Number of elderly	0.58	0.74	0.71	0.75	0.64	0.73	0.78	0.77
Number of children	0.71	0.94	0.64	0.95	0.90	1.02	0.64	1.00
Employed	0.33	0.47	0.39	0.49	0.35	0.48	0.47	0.50
Self-employed	0.13	0.34	0.16	0.36	0.13	0.34	0.14	0.35
HH is female	0.37	0.48	0.34	0.47	0.36	0.48	0.33	0.47
HH primary education	0.03	0.18	0.06	0.23	0.01	0.12	0.02	0.15
HH tertiary education	0.29	0.45	0.22	0.41	0.23	0.42	0.23	0.42
HH head married	0.66	0.47	0.61	0.49	0.65	0.48	0.60	0.49
HH head age	57.35	15.24	60.89	14.55	58.56	16.03	61.88	14.14
HH head urban	0.56	0.50	0.37	0.48	0.56	0.50	0.42	0.49
Consumption decline (total consumption)	6.62	2.72	5.69	2.87	6.69	2.78	5.84	2.87

Characteristics of Remittance-Receiving and Non-Remittance-Receiving Households (ARM)

	2009				2020			
	Remittance receiving households		Non-Remittance receiving households		Remittance receiving households		Non-Remittance receiving households	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Family size	3.97	1.82	4.14	1.93	2.98	1.75	3.47	1.78
Number of elderly	0.44	0.65	0.54	0.71	0.63	0.74	0.60	0.73
Number of children	0.80	1.00	0.97	1.11	0.54	0.91	0.75	1.03
Employed	0.28	0.45	0.54	0.50	0.40	0.49	0.61	0.49
Self-employed	0.02	0.15	0.06	0.24	0.17	0.37	0.23	0.42
HH is female	0.30	0.46	0.30	0.46	0.36	0.48	0.31	0.46
HH primary education	0.60	0.49	0.60	0.49	0.34	0.48	0.40	0.49
HH tertiary education	0.12	0.33	0.15	0.36	0.01	0.09	0.01	0.11
HH head married	0.65	0.48	0.66	0.48	0.60	0.49	0.64	0.48
HH head age	57.08	13.44	58.24	14.41	59.91	13.78	58.65	14.33
HH head urban	0.59	0.49	0.56	0.50	0.71	0.45	0.61	0.49
Consumption decline (total consumption)	5.66	2.90	5.61	2.83	6.41	2.83	5.87	2.87

Characteristics of Remittance-Receiving and Non-Remittance-Receiving Households (KGZ)

	2010				2018			
	Remittance receiving households		Non-Remittance receiving households		Remittance receiving households		Non-Remittance receiving households	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Family size	3.66	1.81	3.85	1.84	3.50	1.89	3.95	1.98
Number of elderly	0.27	0.53	0.30	0.57	0.26	0.52	0.36	0.62
Number of children	1.44	1.34	1.42	1.36	1.48	1.42	1.51	1.45
Employed	0.62	0.49	0.72	0.45	0.56	0.50	0.65	0.48
Self-employed	0.26	0.44	0.33	0.47	0.23	0.42	0.31	0.46
HH is female	0.42	0.49	0.35	0.48	0.48	0.50	0.35	0.48
HH primary education	0.12	0.32	0.11	0.31	0.10	0.30	0.07	0.26
HH tertiary education	0.16	0.36	0.19	0.39	0.16	0.37	0.20	0.40
HH head married	0.57	0.49	0.64	0.48	0.54	0.50	0.65	0.48
HH head age	50.51	13.72	51.44	12.79	51.64	12.88	53.69	12.72
HH head urban	0.58	0.49	0.62	0.48	0.60	0.49	0.58	0.49
Consumption decline (total consumption)	5.52	2.94	5.61	2.87	5.80	2.93	5.59	2.88

Source: IMF staff calculations.

How did remittances behave following previous downturns in Russia?

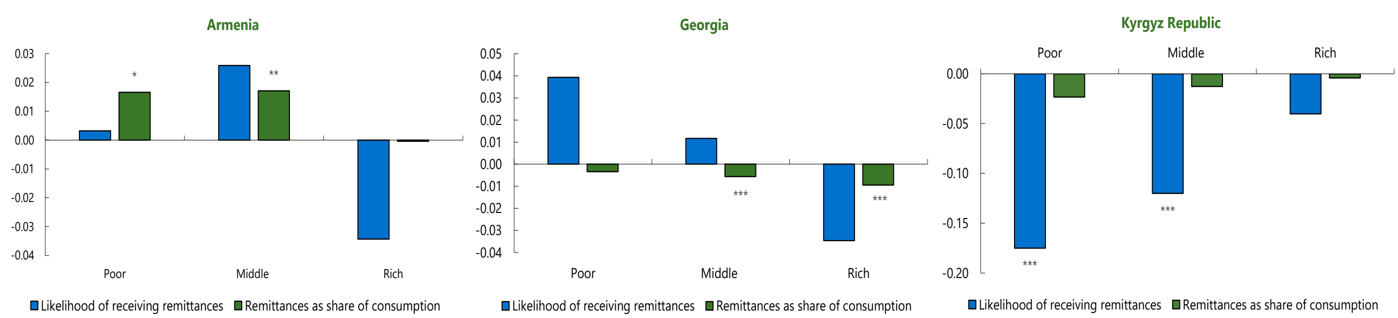
The empirical strategy follows Koczan and Loyola (2021) using a pooled cross-section and a probit model to investigate whether the likelihood of receiving remittances as well as remittances as a share of consumption was affected by the slowdown in Russia in 2014 and whether the impact on remittances was different at the top compared to the bottom-end of the distribution:

$$Y_i = \alpha_{1+} \beta_1 X_i + \beta_2 D_i + FEs + \mu_i$$

where Y_i is a dichotomous variable that equals to 1 if the household received remittances and zero otherwise. X_i is a vector of all other household and individual characteristics affecting remittances such as the size of the household, dummy for being self-employed, gender, marital status and age of the household head, and a dummy if the household lives in an urban area. D_i is a dummy variable that captures Russia's slowdown in 2014. Probit and OLS regressions will be conducted by consumption quintiles. Poor is defined as the bottom third of the income distribution and rich as the upper third of the income distribution. The regressions are conducted using granular household data for Armenia (2004-2020), Georgia (2009-2020), and the Kyrgyz Republic (2010-2018).

Remittances were adversely affected by Russia's downturn in 2014, but there were significant differences in the nature of the impacts across countries and income distributions. To better understand the impact of a potential decline in remittances from Russia in the years ahead, it is useful to assess the distributional impact of the decline in remittances following Russia's downturn in 2014. The results show that remittances received as a share of consumption fell by more for affluent households in Georgia. At the same time, while not statistically significant, the likelihood of receiving remittances increased for poorer and middle-income households. In contrast, the likelihood of receiving remittances and remittances as a share of consumption fell by more for poorer households in the Kyrgyz Republic. Remittances acted as a buffer for poorer households following the downturn in Armenia.

Figure A10. Results from the Regression Analysis



Source: IMF staff calculations.

Did remittances reduce income inequality and poverty in the CCA?

Despite a considerable number of contributions discussing the linkages between remittances, poverty, and inequality, empirical results are ambiguous. Although some studies found that migration and remittances increase inequality (see Barham and Boucher 1998; Moellers and Meyer 2014; Adams, Cuecuecha, and Page 2008), others found that they reduce it (Koczan and Loyola 2021). Studying the impact of remittances on poverty and inequality should account for, among others, endogeneity, selection bias, reverse causality, and omitted variables bias (Adams 2011). Therefore, several recent studies have focused on creating counterfactual income distributions using propensity score matching for cross-sectional datasets (PSM) (see Möllers and Meyer 2014; Koczan and Loyola 2021).

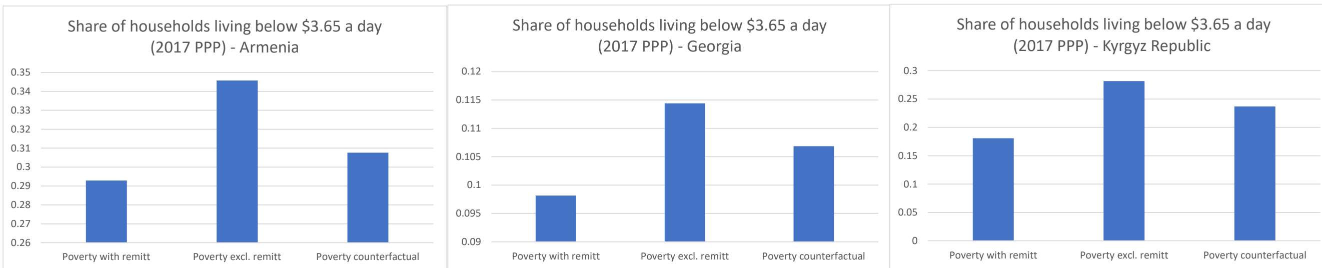
The PSM method essentially constructs a counterfactual situation reflecting what the income status of a migrant household would have been if the household had not migrated. It maintains that participants in treatment (migrant households) and control groups (nonmigrant households) have potential outcomes in both conditions, one of which is observed and the other which is not observed. The outcome of interest on inequality is per capita consumption. For poverty, the proportion of the poor below the poverty line of $3.65 a day is used. The outcome of the control observation can be interpreted as the counterfactual income of the treated observations (in the absence of treatment). The counterfactual framework for a participant *i* with potential outcomes in both treatment and control condition (denoted as Y_{0i} and Y_{1i}) is expressed as:

$$Y_i = D_i Y_{1i} + (1 - D_i) Y_{0i}$$

D is a dichotomous variable that indicates the probability of participation in the treatment, that is, participation in migration, and $(1 - D_i)$ denotes the probability of not participating in the treatment. Estimation of propensity scores relies on binary models and observed household and individual characteristics influencing participation, such as household size, self-employment, gender, age of the household head, number of children, number of elderly people, and urban-rural residence. Based on the binary regression results, the propensity scores are predicted, which measure the probability of participation in migration. A matching algorithm is used to match migrant and nonmigrant households. Austin (2014) advises to use nearest neighbor matching without replacement and within a specified caliper, in our case calculated at 0.3 times the standard deviation of the propensity scores. The observed income of the matched nonmigrant household is imputed as the counterfactual income of the migrant household. The PSM approach is illustrated using household data from Armenia (2004−20), Georgia (2009−20), and the Kyrgyz Republic (2010−18).

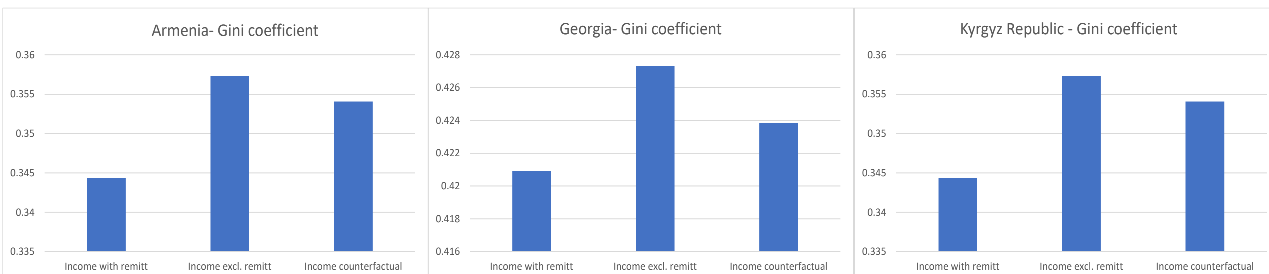
Country-Specific Results

Figure A11. Poverty



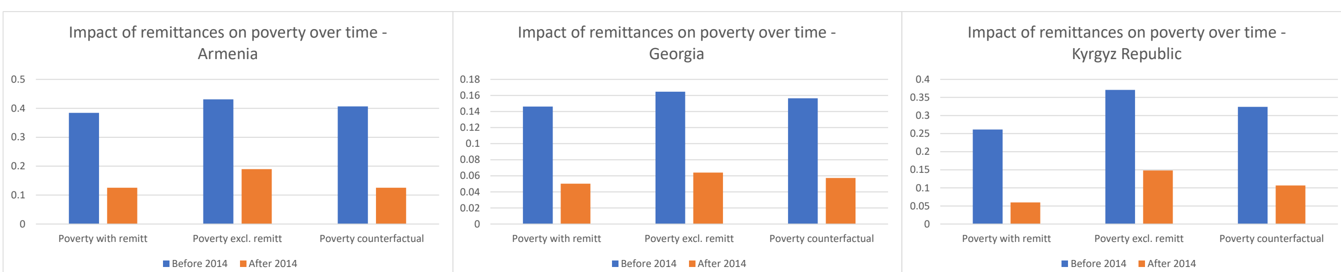
Source: IMF staff calculations.

Figure A12. Inequality



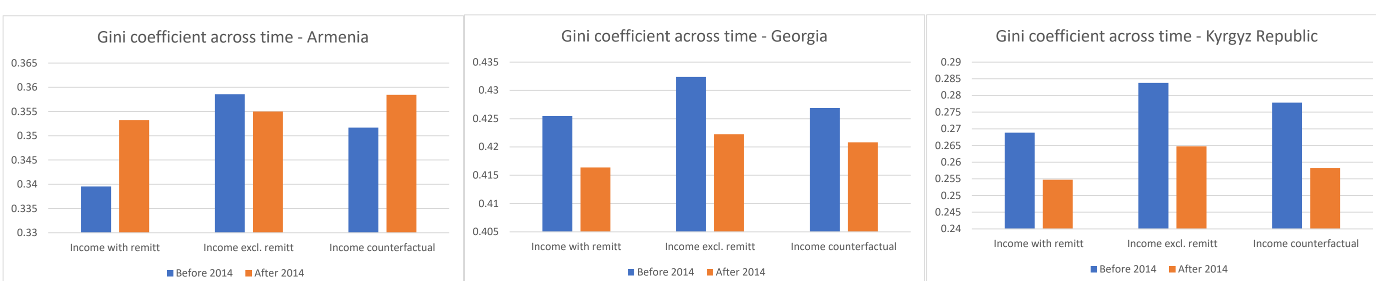
Source: IMF staff calculations.

Figure A13. Poverty Over Time



Source: IMF staff calculations.

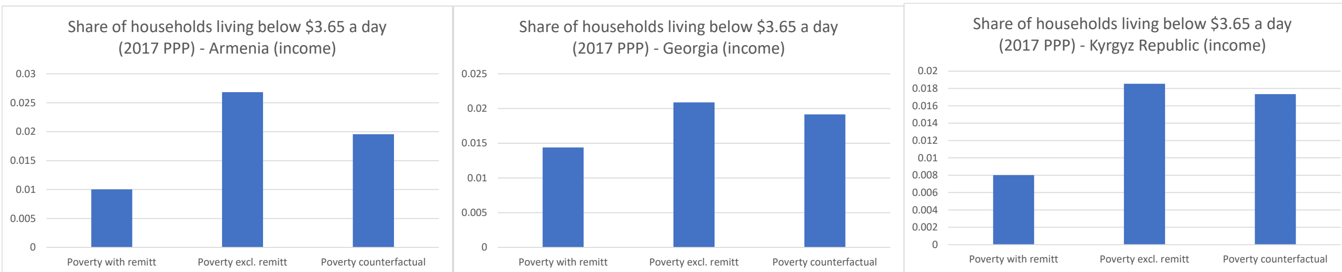
Figure A14. Inequality Over Time



Source: IMF staff calculations.

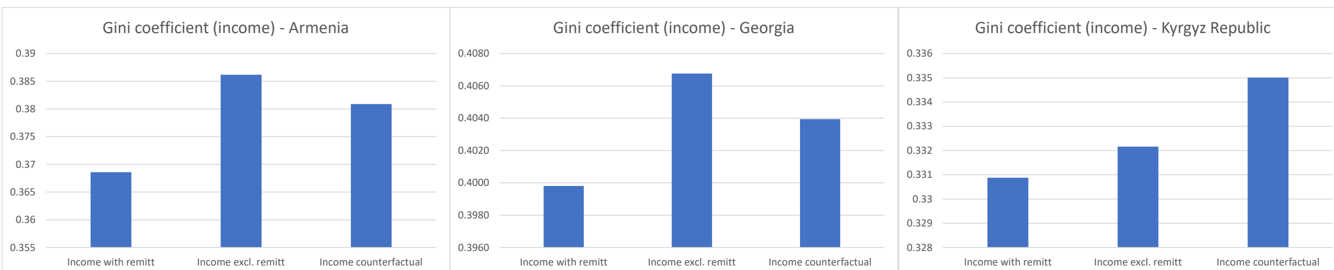
Robustness Results

Figure A15. Poverty (using income instead of consumption)



Source: IMF staff calculations.

Figure A16. Inequality (using income instead of consumption)



Source: IMF staff calculations.

References

Adams Jr, Richard H. 2011. "Evaluating the Economic Impact of International Remittances on Developing Countries Using Household Surveys: A Literature Review." *Journal of Development Studies* 47 (6): 809–28.

Auerbach, A. J., and Y. Gorodnichenko. 2013. “Fiscal Multipliers in Recession and Expansion.” In *Fiscal Policy After the Financial Crisis*, edited by Alberto Alesina and Francesco Giavazzi. Chicago: University of Chicago Press.

Austin, P. C. 2014. “A Comparison of 12 Algorithms for Matching on the Propensity Score.” *Statistics in Medicine* 33 (6):1057–69. doi:10.1002/sim.6004.

Barham, Bradford, and Stephen Boucher. 1998. "Migration, Remittances, and Inequality: Estimating the Net Effects of Migration on Income Distribution." *Journal of Development Economics* 55 (2): 307–31.

Born, B., G. Müller, and J. Pfeifer. 2020. "Does Austerity Pay Off?" *Review of Economics and Statistics*. 102 (2): 323–38.

Deaton, Angus. 1989. “Rice Prices and Income Distribution in Thailand: A Non-Parametric Analysis.” *The Economic Journal* 99: 1−37.

de Hoyos, Rafael E., and Denis Medvedev. 2011. “Poverty Effects of Higher Food Prices: A Global Perspective.” *Review of Development Economics* 15 (3): 387–402.

Jordà, Ò. 2005. “Estimation and Inference of Impulse Responses by Local Projections.” *American Economic Review* 95: 161–82.

Jordà, Ò., and A. Taylor. 2016. “The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy.” *Economic Journal* 126: 219–55.

Koczan, Zsoka, and Franz Loyola. 2021. “How Do Migration and Remittances Affect Inequality? A Case Study of Mexico.” *Journal of International Development* 33 (2): 360–81.

Möllers, Judith and Wiebke Meyer. 2014. “The Effects of Migration on Poverty and Inequality in Rural Kosovo.” *IZA Journal of Labor & Development* 3 (16).

Ramey, V., and S. Zubairy. 2018. “Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data.” *Journal of Political Economy* 126: 850–901.

Richard H. Adams, Jr., Alfredo Cuecuecha, and John Page. 2008. “The Impact of Remittances on Poverty and Inequality in Ghana.” Policy Research Working Paper 4732, World Bank, Washington, DC.