# Distributional Impacts of the Russia–Ukraine Crisis: The Case of Egypt

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**Abstract**

In February 2022, global supply chains were disrupted amid the eruption of the Ukraine–Russia war. A jump in prices followed, particularly for basic commodities including food and energy. Using commodity-level data for January–August 2022 from the Central Bank of Egypt, separately for Urban and Rural Egypt, and the 2017 Household Income, Expenditure and Consumption Survey, we investigate the pass-through of commodity prices – through households' consumption and substitution patterns – to households' cost of living and welfare. Our results show the distributed lag effects of commodity inflation on households' consumption patterns, and identify socio-economic groups that are affected most adversely by the shock. We find that those at the lower end of the expenditure distribution as well as those residing in rural areas have experienced systematically higher welfare changes. Between January and May of 2022, when international prices were rising the fastest, the bottom decile of rural households saw an increase in their cost of living of 11.9% while that of the top decile rose by 9.9%. In urban areas the bottom decile's cost of living rose by 9.9% while that of the top decile rose by 7.4%.

Keywords: Cost of living changes, inflation inequality, food security, Egypt

JEL Classification: C43, E31, I31, O18

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## I. Introduction

The conflict in Ukraine and its effects on food and energy markets and global supply chains have brought large-scale negative shocks that many countries in the region were ill-equipped to handle as they grappled with the aftermath of the ongoing Covid-19 pandemic, amid existing structural deficiencies in terms of socioeconomic, institutional and governance factors. As with the rest of the world, Egypt has faced significant challenges over the last two years as a result of the

global pandemic, and volatility in the commodity markets. While Egypt did relatively better in some respects than its peers in the region, continuing to register positive GDP growth (albeit lower than pre-Covid projections), the Egyptian economy was already facing many challenges due both to the pandemic but also to long standing structural problems. The Russia–Ukraine crisis and its dramatic impact on international food and fuel prices come after another painful inflationary period in 2017 following the devaluation of the Egyptian pound by 50%, and the sizeable loss of purchasing power, from which many Egyptians have yet to recover.

Egypt is the largest importer of wheat in the world, importing up to 13 million tons of wheat annually. Two thirds of wheat imported by Egypt was sourced from the Russian Federation and Ukraine, while the two countries provide over 90% of Egypt's sunflower oil imports (ARI 2022). Bread and other wheat products account for up to 40% of caloric intake per person in Egypt, and imports account for over 60% of wheat use across the country.[1] Meanwhile, Egypt has had high levels of malnutrition, as evidenced by stunting rates reported by the World Development Indicators.

Between the end of 2019 and the beginning of 2022, wheat prices have risen nearly 110%, corn and vegetable oil prices are up 140%, and soybean prices are up 90% (USDA 2022), and these price rises pass through to domestic inflation. In May 2022 food price inflation in Egypt reached a high of 25%, with grave implications for households' ability to meet their basic needs. In oil importing MENA countries, rising commodity prices are also increasing countries' fiscal and current account deficits, which aggravates their external deficits and liquidity shortages and triggers increases in their external borrowing. Fiscal deficits are expected to increase between 2 and 6 percentage points over pre-war projections. Countries that had planned their 2022 budgets based on lower projections of oil

[1] https://csis-website-prod.s3.amazonaws.com/s3fs-public/congressional_testimony/051822_Welsh_Written_Testimony.pdf?Cul4W5FK7UWli8.xx9WFE2OYPjJlM4MH

prices – such as Egypt's projection of $60 – are likely to experience an even steeper increase in their deficits.

In light of the shocks, oil importing MENA countries' GDP is now projected to decline by 2.3% in 2022. Low-income households are expected to bear the brunt of the crisis, given their high expenditure share of basic commodities including food, much of which is imported, and the expected pass through effect of rising energy prices to all other consumption items. This will have severe implications for welfare. Extreme poverty in the Arab region is now projected to rise above both pre- and post-COVID-19 levels – 12.4% in 2019 and 13.9% in 2020, respectively – to reach 14.4% in 2022 and 14.5% in 2023. Beyond extreme destitution, approximately one in three Egyptians is poor according to the national poverty line, and at the higher international poverty line of $5.50 (2011 PPP) per day about 70% of Egyptians would be poor (World Development Indicators 2022).

This study aims to advance our knowledge of the impact of the Russia–Ukraine crisis in several ways by addressing the following questions: How has the crisis affect prices of basic commodities in the MENA region, and specifically its largest country – Egypt? What implications did the increase in prices have for households' cost of living? Are these implications sensitive to the way the cost of living changes are computed? Were there disparities in cost of living changes by income level, region of residence or household demographics? We use disaggregated data on product prices, and household budget compositions to study this major macroeconomic shock. We use an advanced structural estimation strategy to identify the distributional impacts for households across geographic and economic dimensions, accounting for both direct and substitution welfare effects.

The rest of the study is organized as follows. The next section briefly reviews the history of inflation and exchange rates in Egypt, and the existing academic literature linking inflation, exchange rate fluctuations and cost of living. Section III describes our estimation methods and the data used.

Section IV presents the main results, and section V concludes with main findings and their policy implications.

## II. Country Background

The recent increase of international prices in food and fuels have already spilled over to significant inflation in Egypt over the last several months. While inflation ranged between 5 and 8% (y/y) during 2021, it has jumped to double digits since February 2022, reaching a high of 15.3% last May, and continuing at roughly this level until August (CAPMAS 2022). There are wide disparities between regions that are already evident in the Consumer Price Index (CPI) for all items published by CAPMAS (Figure 1). Average inflation between January and August 2022 was 10.6% for Egypt overall, 10.7% for rural and 10.6% for urban areas. The Food and Beverage inflation index (figure 2) was even higher at 16.9% for all Egypt, 16.7% for rural and 17% for urban areas. In May 2022 at the height of the international food price hikes, food and beverages inflation relative to January was 20.6% in rural areas and 17.8% in urban areas. While food price hikes have slowed down somewhat since their height in April/May, fuel prices started to rise sharply in July.

International food and fuel prices increased significantly since early 2022 due to the war. Much of the increase in food prices was reflected almost immediately in domestic consumer prices in Egypt. Consumer prices of fuel, however, have not increased domestically as much as international levels given that these are still under some government control in Egypt and adjust only with a lag. Between January and May 2022 for example fuel items in the CPI, reflected both in the housing category and the transport category, had only increased by 1.5% and 6.2%, respectively. Nevertheless, the analysis below encompasses price increases in all items in household expenditure, whether food or fuels.

Egypt's inflation was the highest among all MENA countries as depicted in Figure 3. This rapid inflation has differential effects on households not only based on their region of residence but also based on their consumption patterns. Consistent with Engel's Law, Egypt's household data show a strong negative correlation between household wealth or income and consumption of cereals and grains in particular. Households in lower socioeconomic income groups tend to consume more of these grains within their food budgets given their high calorie content per dollar spent, thus they are also likely to suffer the most (Abay et al. 2022). The poorest households spend 2 to 3 times more of their budgets on staples such as bread and cereals, cooking oils, sugar and vegetables compared to the richest households (Figure 4). At the same time, urban households and those at higher income levels tend to spend relatively more on fuels and transportation. A careful analysis of overall variation in the cost of living increases by income group and region of residence is thus warranted.

## III. Methodology

We first examine the extent to which the recent international price hikes in food and energy have passed-through to domestic prices, both directly and indirectly. The estimated crisis-induced price changes are then used along with households' expenditure data from the most recent waves of the Household Income, Expenditure and Consumption Surveys for Egypt to estimate the welfare effect on households at different income levels and household characteristics. We calculate the increase in the cost of living different households would have faced if the price changes had not taken place by netting out the pass-through effect (the counterfactual) and compare it to the actual increase in their cost of living today. The difference between the two gives an estimate of the direct impact of the crisis on each household type.

*Pass through to domestic prices*

Changes in the cost of living due to international price shocks are notoriously hard to estimate because of several challenges. The first challenge is isolating the effect of the price shock from the effect of other factors. We start by examining the extent to which food and energy price hikes affected prices of various commodity groups across Egyptian regions, referred to as pass-through rate. We use monthly consumer price index data for over 40 goods and services (12 broad categories, and 30+ disaggregated food and essential items featuring highly in household budgets[2]) for all regions in Egypt to estimate disaggregated pass-through regressions. These yield estimates of the impact of war-induced price hikes on different types of goods and services as well as the regional variation in the pass-through effect on different parts of the country.

Specifically, the following empirical model is adopted from AlAzzawi and Hlasny (2020) and Kraay (2007). The price of a commodity group $i$ in region $r$ and month $t$, $P_{irt}$, is modeled as a geometric average of the price of a non-tradable component $P_{irt}^{N}$ and the price of a tradable component $P_{irt}^{T}$, that is, related to them through a first-order homogeneous exponential function:

$$P_{irt} = (P_{irt}^{N})^{\alpha_{ir}} \times (P_{irt}^{T})^{1-\alpha_{ir}}.$$

This is consistent with assuming that the technology for transforming traded goods and local goods into retail tradable goods is akin to Cobb-Douglas (Burstein et al. 2005).

The non-tradable component covers both purely non-traded goods in the commodity group, as well as non-tradable factors used in distribution of traded goods. The tradeable price component can be modeled as a function of exchange rates $E_t$, which have also been affected by the recent crises,

[2] The 12 broad categories are: food and non-alcoholic beverages; alcoholic beverages, tobacco and narcotics; clothing and footwear; housing, water, electricity, gas and other fuel; furnishings, household equipment and routine house maintenance; health; transport; communications; culture and recreation; education; restaurants and hotels; miscellaneous goods and services. Data on 59 disaggregated food and essential items' prices featured in household budgets are not available consistently at this time to be utilized. The eight regions are: Cairo; Alexandria; Suez Canal cities; Lower urban; Lower rural; Upper urban; Upper rural; Border region.

and a measure of production costs in Egypt's main trading partners $C_t$, where $E_t$ and $C_t$ are weighted by commodity- and region-specific parameters $\delta_{1ir}$ and $\delta_{2ir}$: $P_{irt}^T = E_t^{\delta_{1ir}} C_t^{\delta_{2ir}}$.

Using logarithmic transformation of $P_{irt}$, we would get an expression estimable by linear regressions. However, these regressions could yield spurious estimates because of expected non-stationarity or persistence in all variables (Campa and Goldberg 2005; Campa and González-Mínguez 2006; Burstein and Gopinath 2015). A consistent approach, particularly in models linking short-term effects among variables and in samples with limited time dimensions, is to first-difference all variables. Estimating the relationships among logged variables in first differences is an approximation to estimating a relationship among the growth rates of the original variables. We thus estimate the following first-differenced logarithmic form:

$$\Delta \, log \, log \, P_{irt} \; = \alpha_{ir} \Delta \, log \, log \, P_{irt}^N \; + (1 - \alpha_{ir})[\beta_{1 \, ir} \Delta \, log \, log \, (E_t) \; + \beta_{2 \, ir} \Delta \, log \, log \, (C_t) \; ] + \; u_{irt}. \quad [1]$$

Domestic price component $P_{irt}^N$ can be approximated from national input-output tables and from prices of purely domestically produced services. [3] $E_t$ is the trade-weighted exchange rate index computed using the exchange rates with Egypt's eighteen most significant trading partners, weighted by their import shares.[4] $C_t$ are approximated using producer price indexes (PPIs) of the ten most significant importers to Egypt, again weighted by their import shares.[5]

[3] These are taken to be the following commodity categories: Tailoring and clothes repair; housing and utilities; housing rent; dwelling repairs; water, refuse and sewage; electricity and fuels; furnishings repair; appliance repair; medical services; transport services; school transport; communication services; recreation and culture services; education; catering service; restaurants and hotels; personal care; insurance and finance. These categories account for approximately 30% of households' spending on average in a population-weighted sample. To validate our classification of nontradable commodities, we find that rural and lower-income households spend significantly higher shares of their expenditures on tradable categories (refer to Table A2 in the appendix), in agreement with prior evidence.

[4] The currencies are: Australian Dollar, Bahraini Dinar, Canadian Dollar, Chinese Yuan, Danish Krone, Euro, Jordanian Dinar, Japanese Yen, Kuwaiti Dinar, Norwegian Krone, Omani Riyal, UK Pound Sterling, Qatari Riyal, Saudi Riyal, Swedish Krona, Swiss Franc, UAE Dirham, US Dollar.

[5] China, Germany, Italy, Korea, Russia, Saudi Arabia, Spain, Turkey, Ukraine, US. These countries accounted for 54.7% of Egypt's imports in 2019.

Coefficients $\alpha_{ir}$, $\beta_{1\,ir}$ and $\beta_{2\,ir}$ can be estimated using non-linear least squares at the level of regions (population weighted). The estimated coefficients are expected to be consistent for the true effects given that the explanatory variables and their lags are exogenous in the regressions, the pass-through regressions are dynamically fully specified, and the transformed variables have desirable properties including stationarity and weak dependence. Coefficients $\alpha_{ir}, \beta_{ir}, \gamma_{ir}$ can be interpreted as the percentage point changes in the growth rate of the price index ($\dot{P}_{irt}$) due to a one percentage point increase in the growth rate of nontradable-goods prices ($\dot{P}^{N}_{rt}$), growth rate of the trade-weighted exchange rate ($\dot{E}_t$), and growth rate of the price index in countries exporting to Egypt ($\dot{C}_t$). Finally, distributed lags of $E_t$ and $C_t$ are used to allow for delayed price adjustments.

*Consumption substitution response to price changes*

Price changes due to the crisis that are predicted in equation 1 are next applied to households' consumption baskets to estimate the welfare effects. A crucial challenge is that rising prices in a given basket of goods, as measured by the CPI, do not accurately measure changes in the cost of living. This is most notably due to the well-known substitution effect, but changes in preferences due to past consumption or habit formation, quality improvement, introduction of new goods, and seasonal variation in prices within a year are other challenges.

A price index is a weighted average of prices in the economy, where the weight is fixed, taken to be the expenditure share allocated to each commodity in consumer expenditure budgets, either in the base year (which gives rise to a Laspeyres price index, LPI) or in the current year (which gives rise to a Paasche price index). It denotes the changing relative cost of a fixed basket of goods at market prices. It thus serves its purpose well: to monitor the extent of price changes over time from consumers' perspective. Over time, however, consumers can vary their preferences and this can lead to a bias in the fixed-weight CPI in terms of how well it gauges *cost of living changes*. It ignores

substitutions due to price changes and changes in consumer preferences due, for example, to past consumption or habit formation. It may overestimate cost of living changes if people resort to substitution when prices rise. It may underestimate cost of living changes in the case of taste changes and habit formation (Heien and Dunn 1985; Lieu et al. 2008). These biases in the CPI can lead to inaccurate estimation of the true changes in the cost of living, and any economic variables that rely on it for indexing.

Equally important, especially in the case of developing countries, is that distinct demographic and socio-economic groups have vastly different consumption patterns. A single average consumption bundle is a purely theoretical concept that may not describe anyone in the economy. Typical bundles consumed by different groups are subject to different cost increases, particularly when individual prices are sensitive to foreign exchange fluctuations to different degrees. Accounting for housing cost inflation, and heterogeneity of housing and rent increases across demographic groups is a related specific challenge (Fares 1997).

The fixed basket CPI does not differentiate various groups, while indexes accounting for heterogeneity across economic agents can produce different estimates of the cost of living changes across groups. The True Cost of Living Index (TCLI) initially proposed by Konüs (1936) provides a solution to these challenges by measuring the ratio of the minimum expenditures required to attain a particular utility level (standard of living) at two different sets of prices. TCLIs can be estimated using information on prices and consumption levels alone under simple assumptions about preference functions (Basmann et al. 1984, 1985a,b) and allow us to measure changes in cost of living under different price regimes while holding the utility level of the consumer constant. AlAzzawi (2017, 2020) examined regional and income disparities in cost of living changes in Egypt over the period 2008 and 2016 and found the disparities both between regions and across income

levels to be substantial compared to the fixed basket CPI. The current paper builds on this research to isolate and examine the role of Russia-Ukraine crisis in creating or exacerbating these disparities.

*Estimating the welfare effect of the price shock*

To estimate the welfare effect of a price shock on households it is customary to calculate the compensating variation that would be needed to keep households at the same utility level after the shock induced price changes: $CV = e(p_1, u_0) - e(p_0, u_0)$. The TCLI is a convenient way to calculate how much a household must be compensated under one set of prices versus another to sustain their utility level, by calculating the components of the compensating variation – one due to the higher cost of the initial consumption bundle, and another due to the household's substitution into different commodities in response to price changes – without having to compute price elasticities.[6] To perform the analysis, we examine a counterfactual scenario absent the change in prices and compare that to the cost of living increase that actually occurred. We calculate the increase in prices and cost of living that households would have faced if the war induced price hikes had not taken place and compare it to the actual increase in prices they faced with the current price shocks. The difference between the two gauges how much worse the current situation has been for these households.

[6] An alternative methodology that has been used in the literature relies on calculating the compensating variation after breaking it down into two estimable components, one due to the higher cost of the initial consumption bundle, and another due to the household's substitution into different commodities in response to price changes. The compensating variation can be approximated as follows

$$CV/_{e_0} \approx \sum (p_1 - p_0)w_0/_{p_0} + 0.5 \sum w_0 \left[(x_1 - x_0)/_{x_0} - \varepsilon_{xe} \sum \left(w_0 (x_1 - x_0)/_{x_0}\right)\right]\left[(p_1 - p_0)/_{p_0}\right]$$

where $w_0$ is the share of each product category in households' baseline expenditures $e_0$, $x_t$ is the consumption of each product category, $\varepsilon_{xe}$ is the elasticity of consumption with respect to total expenditure, and the summations are over all product categories. Estimating this requires enough information to first calculate the elasticity of consumption, which is feasible using several different household budget surveys and frequent price changes prior to the current shock, but would not be as accurate when the budget surveys are conducted several years apart and some commodities have not witnessed any price changes over the recent period to facilitate calculating a price elasticity (say because they had been/still are subsidized).

We begin by computing an LPI based on the 12 commodity groups for which we have price and expenditure data, similar to CAPMAS's CPI, to serve as a "benchmark" against which we compare the TCLI estimates. An LPI is a fixed-weight index where the base period consumption patterns are used as weights, to track price changes over time. The index for the current year *t* and base year 0 ($I_{t,0}$) has the following general form:

$$I_{t,0} = \frac{\sum_{i=1}^{n} Q_{0i}P_{ti}}{\sum_{i=1}^{n} Q_{0i}P_{0i}} \; X \; 100 \qquad [2]$$

where $Q_{0i}$ is the quantity of good *i* consumed during the base period *0*, and $P_{0i}$ and $P_{ti}$ are the prices of good *i* in periods *0* and *t*, respectively. For comparability with CAPMAS's CPI series, we use the weights derived from the 2008/2009 HIECS.

*Computing the welfare effect using TCLI across regions and expenditure groups*

The true cost of living index proposed by Konüs (1936) compares "the monetary cost of two different combinations of goods which are connected solely by the condition that during the consumption of these two combinations, the general status of want-satisfaction (the standard of living) is the same" (p.10). A TCLI is defined as the ratio of minimum expenditure levels required, under two different price regimes, to stay at a base period utility level. Defining $m(U, P)$ as the minimum level of expenditure required to reach a particular level of utility *U*, at prices *P*, the TCLI could thus be calculated as:

$$TCLI(P_1, P_0) = \frac{m(U_b, P_1)}{m(U_b, P_0)} \qquad (3)$$

where $P_1$ is a vector of current period prices, $P_0$ is a vector of reference period prices and $U_b$ is the utility level of the base period, at prices $P_b$ and expenditure $M_b$. If the base period is the same as the reference period, the denominator in (3) becomes the actual expenditure $M_0$. Therefore, the Konüs-TCLI is defined for a specific utility function: it is 'true' in the sense that it is defined for

price changes along a particular indifference curve that provides the same utility level, rather than a fixed bundle. There exists a separate 'true' cost of living index for each possible indifference surface (Diamond 1990: 740).

Equation (3) assumes that the consumer utility function or preference structure is fixed. Fisher and Shell (1968) argued that the TCLI should incorporate the possibility of a variable consumer preference structure:

$$TCLI(P_1, P_0) = \frac{m(U_b, P_1; U(x,\theta))}{m(U_b, P_0; U(x,\theta))} \qquad (4)$$

where $U(x, \theta)$ is the consumer's direct utility function, $x$ represents the consumer's commodity mix, and $\theta$ represents all the factors that can affect the consumer's preference structure. $m(U_b, P_0; U(x, \theta))$ and $m(U_b, P_1; U(x, \theta))$ are the minimum expenditures required for the consumer to reach the utility level *U* when they face the price vector $P_0$ in period 0, and when they face the price vector $P_1$ in period 1, respectively. As such, if we assume variable preferences, the TCLI could be calculated using either the base period preference structure (substitute $\theta_0$ into equation (4), which yields a TCLI that we henceforth refer to as TCLI(0)); or the current period preference structure (substitute $\theta_1$ into equation (4), yielding TCLI(1)).

TCLI is an alternative way to calculate the compensating variation (Basmann et al. 1984,1985a,b among others). The first challenge in calculating the TCLI is to find a particular utility function that captures consumer preferences well. Second, in practice when calculating the parameters of the model, one has to make restrictions on the total number of model parameters given that the estimation has to be performed on a limited number of aggregated commodity groups. These complications have meant that in practice statistical agencies around the world, including CAPMAS, have resorted to fixed-weight CPI to compute cost of living changes.

TCLI is an alternative way to calculating the compensating variation under one set of prices versus another, aimed at sustaining consumers' utility level under a specified utility function. A very convenient form of utility function that rationalizes the construction of a TCLI is the Generalized Fechner-Thurstone (GFT) direct utility function (Basmann et al. 1988). We follow AlAzzawi (2020) and AlAzzawi and Hlasny (2020) we compute TCLIs based on the GFT direct utility function. The advantage of the GFT-based TCLI is that it can be easily calculated without making any restrictive assumptions about the preferences of consumers. It does not require statistical estimation of the parameters of a system of demand functions that fit a specific utility function, and the TCLIs are therefore termed non-parametric. In addition, they have an important advantage in that the only data required for their estimation is the prices and expenditures for both the base and current periods.

The GFT direct utility function has the generalized form

$$U(X;\theta) = \prod_{i=1}^{n}(X_i)^{\theta_i} \qquad [5]$$

$$\theta_i = \sim\theta_i \ (p, M; \Phi)e^{u_i} > 0, i = 1,..,n, with\ \theta = \sum_{i=1}^{n}\theta_i \qquad [6]$$

Where $\theta_i$ is a function of the factors that would affect consumer preferences including prices $p$, expenditure $M$, and a vector of specified observable non-stochastic variables ($\Phi$) affecting consumers' indifference curves. $u = (u_1, u_2, .., u_n)$ is a latent taste-descriptive random vector that has zero mean and finite positive definite variance matrix $W_0$. When this utility function is maximized subject to the budget constraint, it gives the following demand function and expenditure share for commodity $i$:

$$x_i = \left(\frac{\theta_i}{\theta}\right)\left(\frac{M}{p_i}\right), i = 1,..,n \quad [7]$$

$$S_i = \frac{M_i}{M} = \frac{\theta_i}{\theta} \qquad [8]$$

$M_i$ is the expenditure for commodity $i$, and $S_i$ is the share of commodity $i$ expenditure in total expenditure. The TCLIs can thus be easily derived from the GFT utility function (detailed derivation presented in AlAzzawi 2020). In this study we rely on two GFT-based TCLIs. The first uses the base period preference structure $U(x;\ \theta_0)$ and utility level $U_0$, giving TCLI (0):

$$GFT - TCLI(0) = \frac{m(U_0,P_1;U(x,\theta_0))}{m(U_0,P_0;U(x,\theta_0))} = \prod_{i=1}^{n}\left(\frac{P_i^1}{P_i^0}\right)^{\theta_i^0/\theta^0} = \prod_{i=1}^{n}\left(\frac{P_i^1}{P_i^0}\right)^{M_i^0/M^0} \qquad [9]$$

The second GFT-based TCLI uses the current preference structure $U(x;\ \theta_1)$ and utility level $U^* = U(x_0,\theta_1)$, which is the utility level that the consumer would have attained if they had consumed the base-period consumption bundle $x_0$, with the current period preference. This yields TCLI (1):

$$GFT - TCLI(1) = \frac{m(U^*,P_1;U(x,\theta_1))}{m(U^*,P_0;U(x,\theta_1))} = \prod_{i=1}^{n}\left(\frac{P_i^1}{P_i^0}\right)^{\theta_i^1/\theta^1} = \prod_{i=1}^{n}\left(\frac{P_i^1}{P_i^0}\right)^{M_i^1/M^1} \qquad [10]$$

Here $P_i^1$ and $P_i^0$ are current and base-period price levels, $M_i$ is the expenditure on the $i$th commodity and $M$ is the total expenditure in the period under consideration. The superscript 0 is for the base period and 1 is for the current period. Thus, the non-parametric GFT-based TCLIs can be simply calculated from only price and expenditure data. GFT-TCLI(0) is a TCLI where changes in taste between the base and the current periods are not considered. In the GFT-TCLI(l), these taste changes are taken into consideration. The difference between the two reflects the effect of changes in taste due to price changes.

Under an assumption of constant preferences, TCLI(0) is the compensating variation required to maintain the original level of utility given the base period parameter vector $\theta^0$ as the price vector changes from the base period ($P^0$) to the current period ($P^1$). Under an assumption of variable preferences, TCLI (1) is the compensating variation required to maintain the original level of utility

given the current parameter vector $\theta^1$ as the price vector changes from the base period ($P^0$) to the current period ($P^1$) (Basmann et al. 1988: 88).

Consumption patterns and preferences vary both across regions within Egypt, and also across expenditure groups. Given the short period under study we will focus on TCLI(0) that assumes a fixed preference structure and examines the changing costs of attaining the base period (January 2022) utility level. We also calculate these indices for ten different expenditure deciles within each region. This allows us to examine the impact of the price shock both geographically as well as across the income distribution.

We use the 2017/2018 Household Income, Expenditure and Consumption Survey (HIECS) to derive the expenditure shares used as the weights for each commodity subgroup in the cost of living indices. These data are collected by CAPMAS as part of nationally representative random sample, covering sub-regions within urban and rural Egypt. The datasets provide a wealth of information on household expenditure and income, as well as composition and other attributes of family members. We construct the expenditure shares for each household separately and then calculate percentile and decile means based on household per capita income to take household size into consideration, separately for rural and urban areas given the large differences in their distributions. Figures A1 and A2 in the appendix plot the expenditure shares of each main commodity group by decile. Food and beverages clearly decline with income while other items such as housing and transport rise slightly.

The price data are from the CPI price series published by CAPMAS on a monthly basis from January to August 2022 for Urban and Rural Egypt separately. We use data for 22 commodity groups.[7]

[7] The commodity groups are the 11 subcategories of Food and non-alcoholic beverages: Bread and cereals; Meat; Fish and seafood; Milk, cheese and eggs; Oils and fats; Fruits; Vegetables; Sugar, jam, honey, chocolate and confectionery; Other food items; Coffee, tea and cocoa; and Mineral waters, soft drinks, fruit and vegetable juices; as well as 11 other main categories: Alcoholic Beverages, Tobacco and Narcotics; Clothing and Footwear; Housing, water, electricity, gas

## IV. Results

Figure 5 shows the inflation rates for the bottom, middle and top expenditure deciles, for urban and rural households separately, using the standard Laspeyres price index that assumes a fixed basket of goods and services. Figure 6 reports the inflation rates using TCLI(0) that assumes a fixed utility level. Both figures clearly show the wide degree of inflation inequality both by region of residence but also by expenditure decile within each region. Until May 2022, when international prices were rising the fastest, the median household in rural areas endured almost 2 percentage point higher inflation compared to the median household in urban areas. Moreover, households in the bottom decile in each region faced 2 percentage points higher inflation than households in the top decile in the same region. For rural households, the bottom decile's cost of living rose by 11.9% while that of the top decile rose by 9.9% between January and May of 2022. In urban areas the bottom decile's cost of living rose by 9.9% while that of the top decile rose by 7.4%. The gap between the bottom decile in rural areas and the top decile in urban areas, at 4.5 percentage points, was even more pronounced. Since then, however, prices have stabilized somewhat and while there is still a noticeable difference between top and bottom decile within each region, the difference between median households across regions almost disappeared. Moreover, in July the gap between households in the bottom decile and the median household disappeared, but it started to rise again in August. It is still the case that households in the top decile in urban areas faced 1.6 percentage points less inflation than those in the bottom decile in rural areas when considering the eight-month period between January and August 2022 overall, reflecting the highly uneven impact of this crisis on households depending on their area of residence and position along the expenditure distribution.

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and other fuels; Furnishings; Health; Transport; Communications; Recreation and Culture; Education; Restaurants and Hotels; Misc. Goods and Services.

Tables 1 and 2 show the compensating variation as a percentage of initial consumption that is needed to keep households at their January 2022 welfare level. There are slight differences between those computed by the fixed basket Laspeyres price index (Table 1) and those computed by the TCLI(0) that assumes a fixed utility level, given the short period under study. However, both clearly point to the large gap in welfare changes both between rural and urban areas and by expenditure decile.

*Robustness and research extensions*

Our study followed well-accepted and robust methodologies, and led to results that have strong consistency properties and are statistically significant. Nevertheless, our discussion above suggests several areas where research extensions would be invaluable. One, an important policy question concerns the effect of the cost-of-living changes on the position of households relative to the poverty threshold, and their transition in and out of consumption poverty. Two, given our strong results about regional and expenditure-quantile differentials of welfare effects, the incidence of cost burdens due to inflation should be assessed across additional demographic divides including sex, age, employment status and educational level of households. Three, the analysis should be undertaken by households' economic activity, including job type and sector of employment. This is important because inflation affect households' consumption and welfare not only through expenditures, but also through households' market and non-market earnings. These extensions will provide more complete evidence regarding the distributional effects of price increases across the Egyptian society.

## V. Summary and Concluding Remarks

This study offered policy makers critical information on the pass-through of the unexpected rapid and severe rise in commodity prices over the last several months on the cost-of-living and welfare burden on households, and its incidence across socio-economic groups. We estimated the distributed lag effects of commodity inflation on households' consumption patterns and welfare. We identified socio-economic groups that were affected most adversely by the shock, in terms of expenditure level, and region of residence.

The price changes induced by the Ukraine–Russia crisis have had substantial welfare effects through increases in the Laspeyres' type CPI and cost of living indices for households across the Egyptian population. Moreover, the devaluation-induced price changes produced systematic disparities across households in different regions and at different positions on the expenditure scale. We found systematically higher welfare changes for those at the lower end of the distribution as well as those residing in rural areas, particularly during January and May of 2022, when international prices were rising the fastest.

The median household in rural areas endured almost 2 percentage point higher inflation compared to the median household in urban areas. Moreover, households in the bottom decile in each region faced 2 percentage points higher inflation than households in the top decile. Specifically, between January and May of 2022, the bottom decile of rural households saw an increase in their cost of living of 11.9% while that of the top decile rose by 9.9%. In urban areas the bottom decile's cost of living rose by 9.9% while that of the top decile rose by a less severe 7.4%. In sum, these results raise a concern over food security in the times of rapidly rising prices, particularly in rural Egypt.

By identifying the welfare losses among the poorest households and by region, we aimed to inform the policymaking agenda, and to spur discussion on how to channel public support to vulnerable groups in a targeted, effective manner. In response to the cost-of-living crisis, we contend

that the Egyptian government should recommit itself to strengthening all elements of its social protection system, namely: labor market protections, social insurance, social assistance, and local schemes to protect particularly vulnerable communities. While social protection programs – including Takaful and Karama – have provided an important safety net since pre-COVID times, these programs should be expanded vertically (increased cash and in-kind transfers, and pensions) as well as horizontally to additional population groups, especially to informal workers who were not previously targeted. The government should also put in place mechanisms necessary to prevent people slipping and becoming trapped in poverty.

Finally worth noting, in light of the onslaught of several successive shocks – including the rapid currency devaluation of 2017, COVID-19, and the Ukraine–Russia conflict – the Egyptian government should strive to open its fiscal space in an efficient and sustainable fashion to pave the way for flexible and continuous investment in adequate social protection. This approach is crucial for supporting the country's citizens in weathering the ongoing challenge as well as future shocks.

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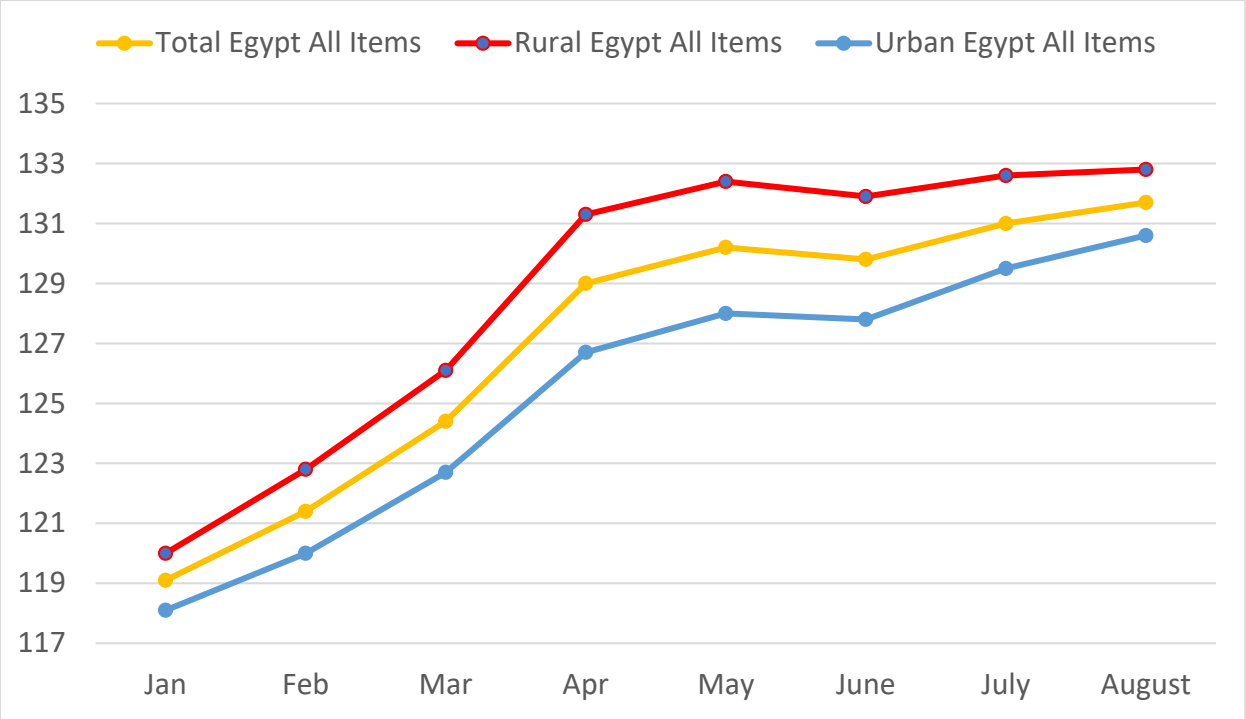
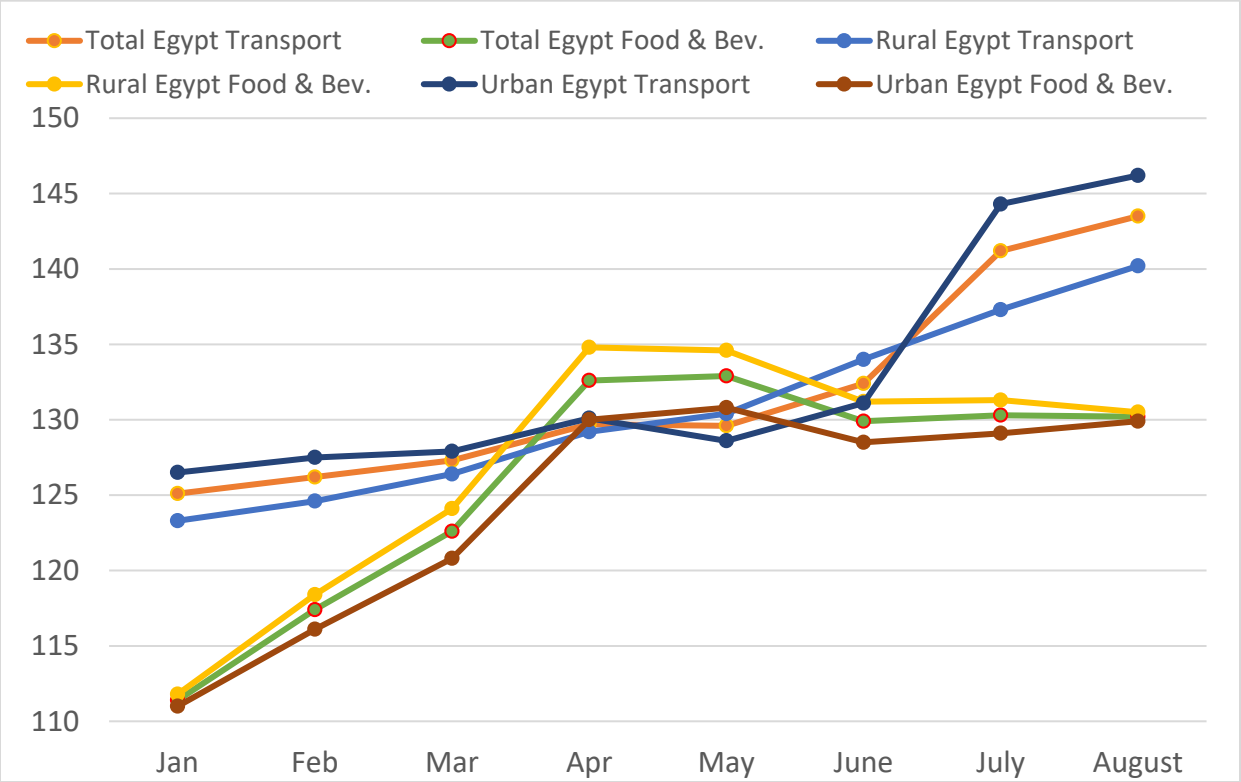
Figure 1: All items CPI (Jan-August 2022)



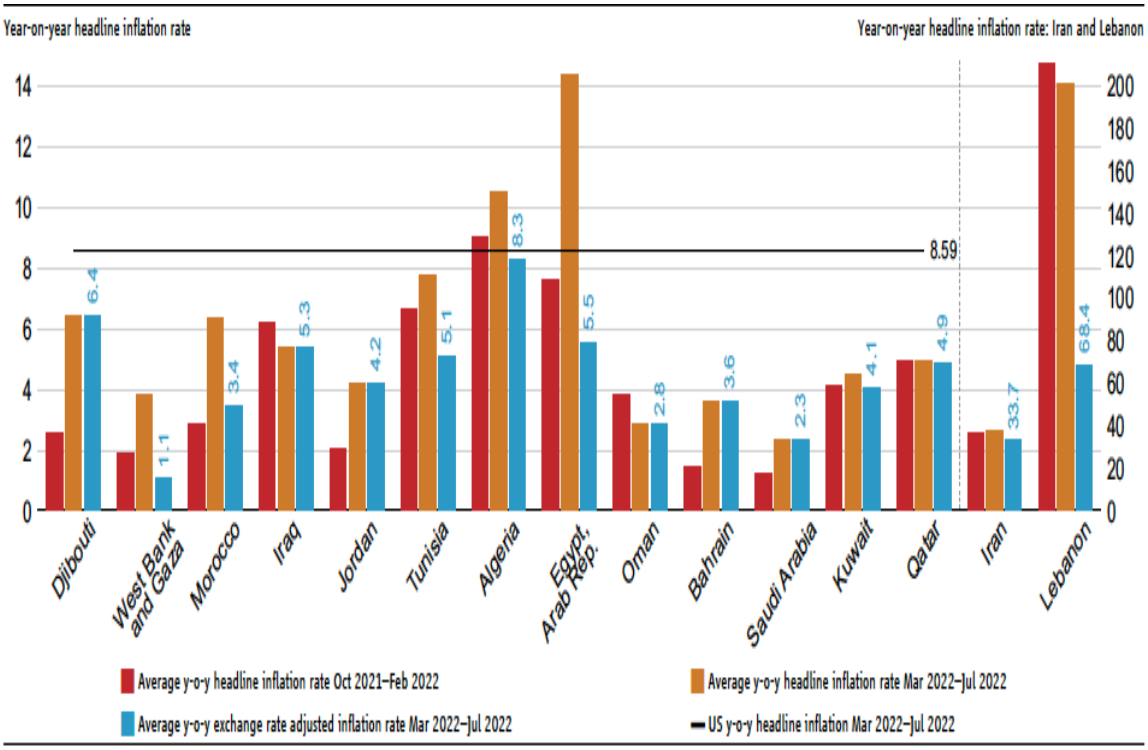

Source: authors' compilation based on CAPMAS Monthly CPI bulletins.

Figure 2 Food and Non-alcoholic Beverages as well as Transport CPI (Jan-August 2022). 2018-2019=100.




Source: author's compilation based on CAPMAS Monthly CPI bulletins. 2018-2019=100

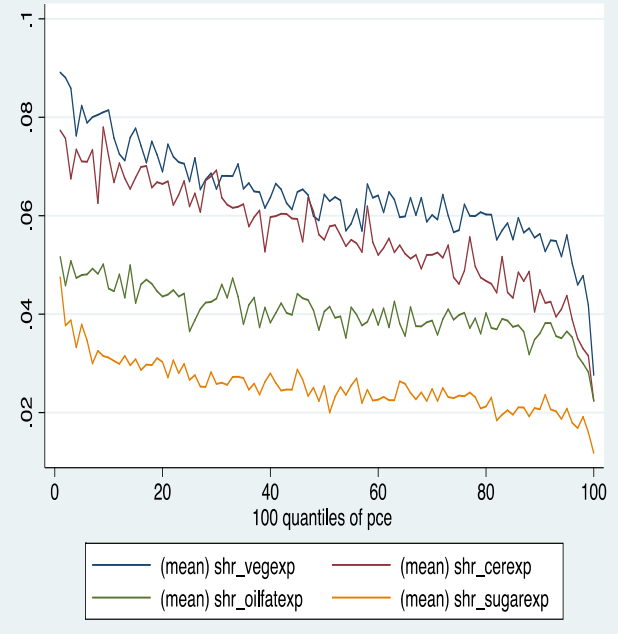
Figure 3: Egypt's much higher inflation rates compared to the rest of the region



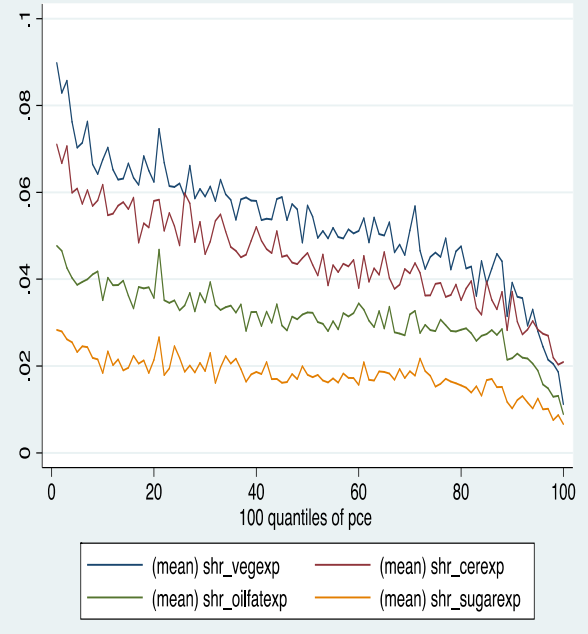

Source: World Bank (2022)

Figure 4 Expenditure Shares by percentile of household per capita expenditure, key food items, rural and urban areas

Rural

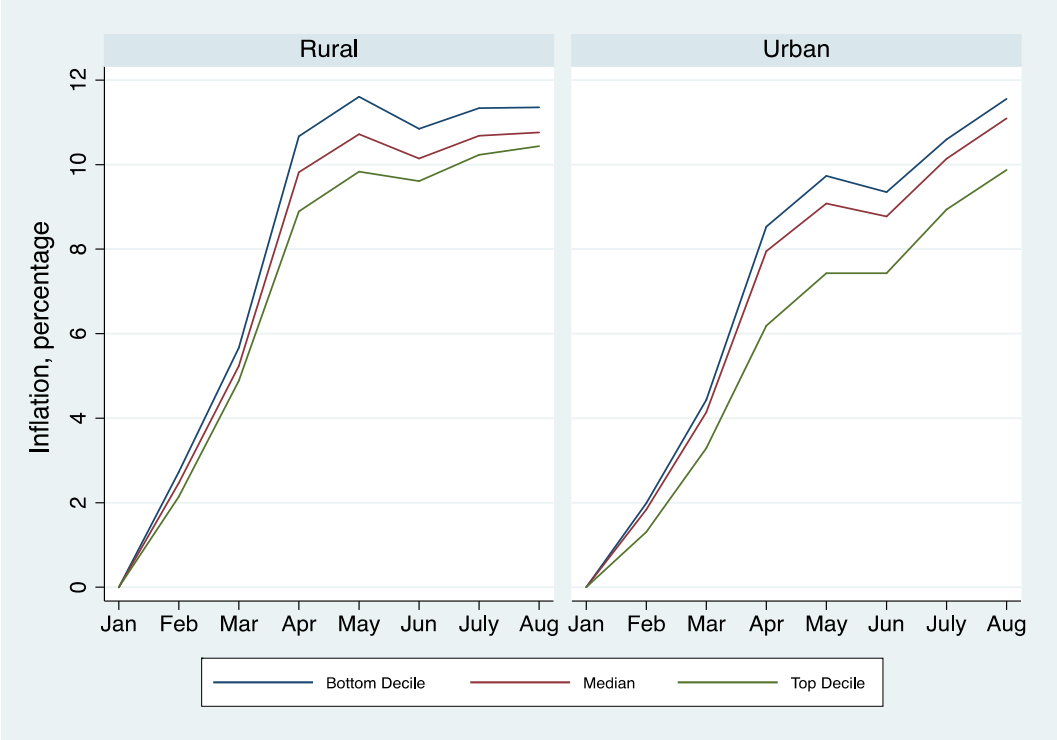



Urban



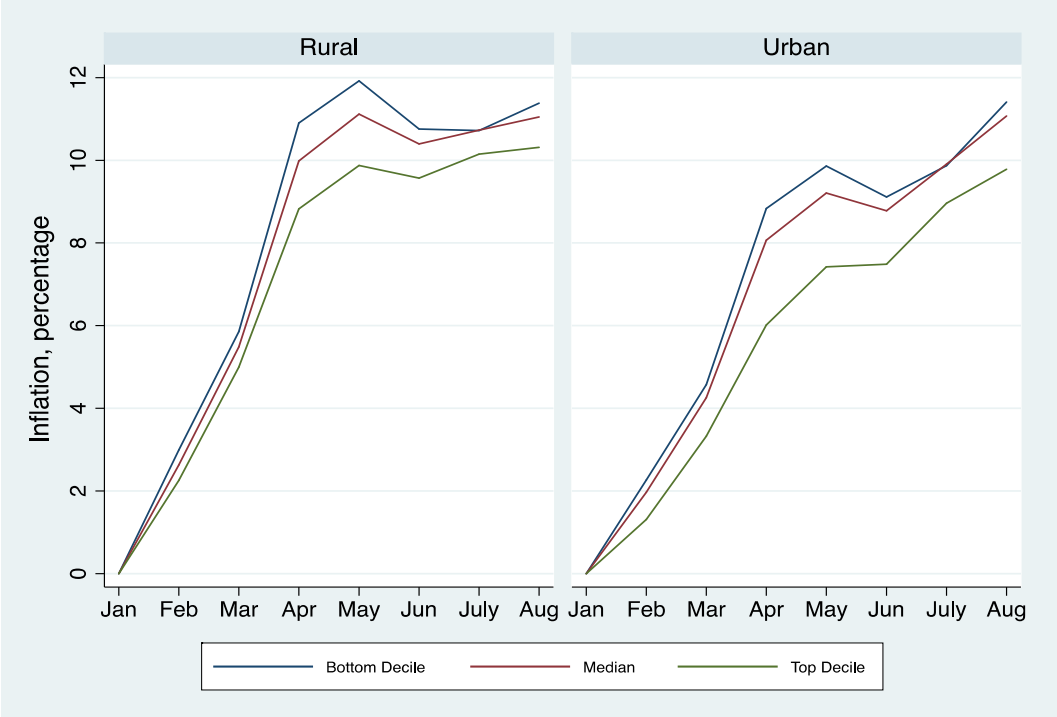

Source: author's calculations based on Household Income, Expenditure and Consumption Survey (HIECS) 2017/2018, CAPMAS.

Figure 5 Inflation by Decile (Laspeyres index), (Jan 2022=100)




Source: Author's calculations as described in the text.

Figure 6 Inflation by Decile (TCLI(0)) using detailed food expenditure categories, (Jan 2022=100).




Source: Author's calculations as described in the text.

Table 1 Compensating Variation required to keep HH at January 2022 by region and decile of per capita expenditure, using the LPI

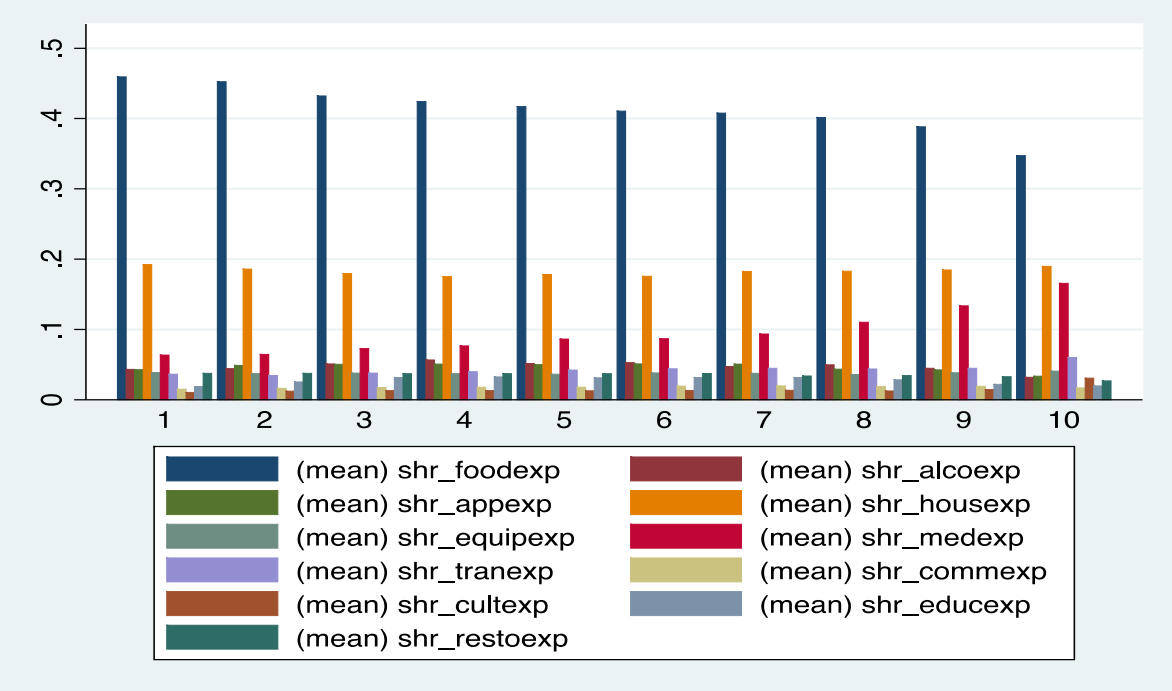
| Region | Month | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rural | 2 | 2.73 | 2.67 | 2.55 | 2.50 | 2.47 | 2.44 | 2.42 | 2.40 | 2.35 | 2.14 |
| Rural | 3 | 5.67 | 5.58 | 5.37 | 5.31 | 5.24 | 5.19 | 5.13 | 5.09 | 5.03 | 4.89 |
| Rural | 4 | 10.67 | 10.50 | 10.08 | 9.94 | 9.82 | 9.72 | 9.64 | 9.53 | 9.38 | 8.89 |
| Rural | 5 | 11.61 | 11.41 | 10.98 | 10.84 | 10.72 | 10.63 | 10.54 | 10.45 | 10.32 | 9.83 |
| Rural | 6 | 10.85 | 10.67 | 10.33 | 10.22 | 10.14 | 10.08 | 10.00 | 9.94 | 9.87 | 9.61 |
| Rural | 7 | 11.34 | 11.16 | 10.85 | 10.76 | 10.68 | 10.63 | 10.54 | 10.49 | 10.44 | 10.23 |
| Rural | 8 | 11.35 | 11.18 | 10.90 | 10.83 | 10.76 | 10.72 | 10.63 | 10.59 | 10.56 | 10.44 |
| Urban | 2 | 1.99 | 1.88 | 1.89 | 1.87 | 1.84 | 1.77 | 1.78 | 1.71 | 1.64 | 1.31 |
| Urban | 3 | 4.43 | 4.23 | 4.23 | 4.18 | 4.14 | 3.97 | 4.01 | 3.86 | 3.76 | 3.29 |
| Urban | 4 | 8.53 | 8.12 | 8.16 | 8.04 | 7.95 | 7.66 | 7.71 | 7.42 | 7.19 | 6.19 |
| Urban | 5 | 9.73 | 9.27 | 9.30 | 9.18 | 9.08 | 8.78 | 8.87 | 8.59 | 8.38 | 7.43 |
| Urban | 6 | 9.35 | 8.94 | 8.95 | 8.84 | 8.77 | 8.49 | 8.58 | 8.33 | 8.18 | 7.43 |
| Urban | 7 | 10.60 | 10.27 | 10.23 | 10.18 | 10.14 | 9.82 | 9.89 | 9.68 | 9.53 | 8.94 |
| Urban | 8 | 11.55 | 11.23 | 11.18 | 11.14 | 11.10 | 10.75 | 10.82 | 10.61 | 10.45 | 9.88 |

Table 2 Compensating Variation required to keep HH at January 2022 by region and decile of per capita expenditure, using the TCLI(0)

| Region | Month | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rural | 2 | 3.0 | 2.9 | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 2.3 |
| Rural | 3 | 5.9 | 5.8 | 5.6 | 5.6 | 5.5 | 5.5 | 5.4 | 5.3 | 5.2 | 5.0 |
| Rural | 4 | 10.9 | 10.7 | 10.4 | 10.2 | 10.0 | 9.9 | 9.8 | 9.7 | 9.4 | 8.8 |
| Rural | 5 | 11.9 | 11.8 | 11.5 | 11.3 | 11.1 | 11.0 | 10.9 | 10.7 | 10.5 | 9.9 |
| Rural | 6 | 10.8 | 10.8 | 10.6 | 10.5 | 10.4 | 10.3 | 10.2 | 10.1 | 9.9 | 9.6 |
| Rural | 7 | 10.7 | 11.0 | 10.8 | 10.8 | 10.7 | 10.7 | 10.6 | 10.5 | 10.4 | 10.1 |
| Rural | 8 | 11.4 | 11.4 | 11.2 | 11.1 | 11.0 | 11.0 | 10.8 | 10.7 | 10.5 | 10.3 |
| Urban | 2 | 2.3 | 2.1 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 1.8 | 1.7 | 1.3 |
| Urban | 3 | 4.6 | 4.4 | 4.4 | 4.3 | 4.3 | 4.1 | 4.1 | 3.9 | 3.8 | 3.3 |
| Urban | 4 | 8.8 | 8.4 | 8.4 | 8.2 | 8.1 | 7.7 | 7.7 | 7.4 | 7.1 | 6.0 |
| Urban | 5 | 9.9 | 9.4 | 9.5 | 9.3 | 9.2 | 8.9 | 8.9 | 8.6 | 8.4 | 7.4 |
| Urban | 6 | 9.1 | 8.8 | 8.9 | 8.8 | 8.8 | 8.5 | 8.5 | 8.3 | 8.2 | 7.5 |
| Urban | 7 | 9.9 | 9.8 | 9.9 | 9.9 | 9.9 | 9.6 | 9.7 | 9.5 | 9.4 | 9.0 |
| Urban | 8 | 11.4 | 11.2 | 11.1 | 11.1 | 11.1 | 10.7 | 10.7 | 10.5 | 10.3 | 9.8 |

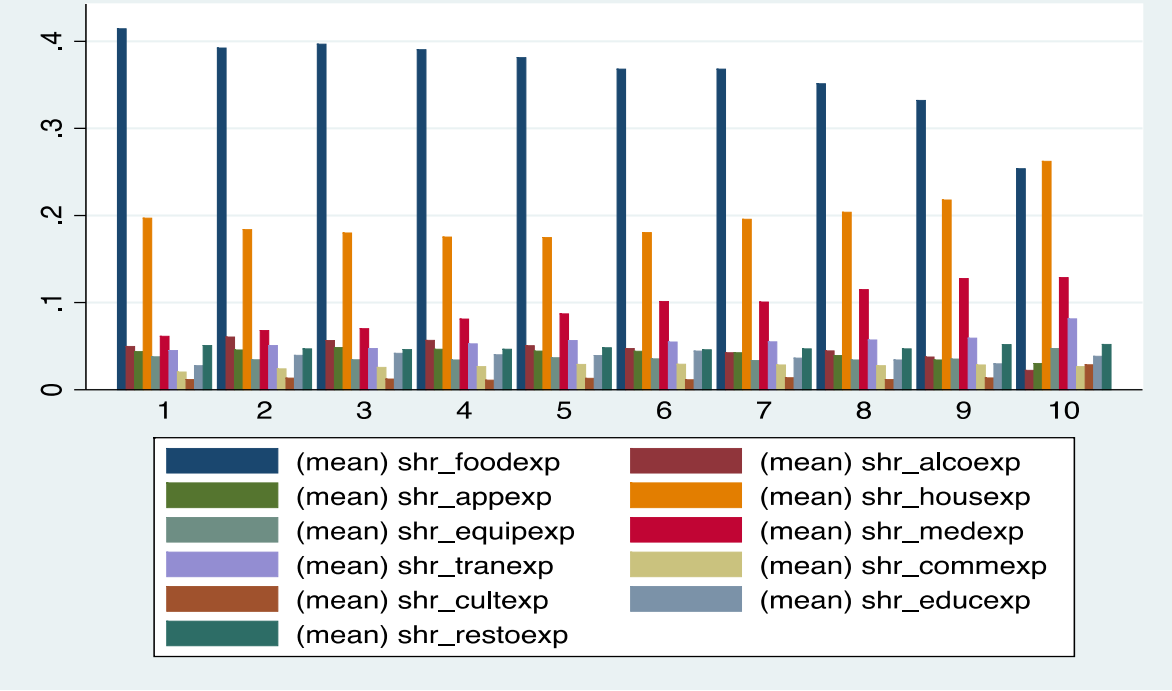
## Appendix

Figure A1 Rural expenditure shares by major commodity group and decile of per capita expenditure




Source: Authors' calculations as described in the text.

Figure A2 Urban expenditure shares by major commodity group and decile of per capita expenditure




Source: Authors' calculations as described in the text.