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Estimating the Welfare Costs of Reforming the Iraq Public Distribution System: A Mixed Demand Approach

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ABSTRACT *Through three decades of conflict, food rations delivered through the public distribution system (PDS) have remained the largest safety net among Iraq's population. Reforming the PDS continues to be politically challenging, notwithstanding the system's import dependence, economic distortions, and unsustainable fiscal burden. The oil price decline of mid-2014 and recent efforts to rebuild and recover have put PDS reform back on the agenda. The government needs to find an effective way to deliver broad benefits from a narrow economic base reliant on oil. The study described here adopts a mixed demand approach to analysing household consumption patterns for the purpose of assessing plausible reform scenarios and estimating the direction and scale of the associated welfare costs and transfers. It finds that household consumption of PDS items is relatively inelastic to changes in price, particularly among the poor. The results suggest that any one-shot reform will have sizeable adverse welfare impacts and will need to be preceded by a well-targeted compensation mechanism. To keep welfare constant, subsidy removal in urban areas, for example, would require the poorest and richest households to be compensated for, respectively, 74 per cent and nearly 40 per cent of their PDS expenditures.*

1. Introduction

Globally, countries with high social safety net spending are often those characterised by fragility and conflict and those that include universal programmes in their safety net portfolio (World Bank, 2018). Iraq is among a set of fragile and conflict-affected states with relatively large social safety net programmes relative to gross domestic product (GDP). The bulk of Iraqi social safety net spending, equivalent to 2.6 per cent of the country's GDP (2011 purchasing power parity), flows through the public distribution system (PDS).[1] The PDS provides in-kind transfers through food rations to nearly every household in Iraq at negligible cost to the households.[2]

Like Iraq, some other fragile and conflict-affected economies, including South Sudan, Timor-Leste, and the West Bank and Gaza, also provide in-kind transfers that represent substantial shares of total public spending (World Bank, 2018). In contrast, many fragile and conflict-affected states, including Afghanistan, Myanmar, and Somalia, spend little on social safety nets. There is no doubt that the former set of jurisdictions are more well placed to deliver basic transfers to the poor and vulnerable; yet, this often occurs at a high opportunity cost. In-kind transfer programmes tend to be expensive and inefficient because they typically involve large-scale operations for import and procurement, transport, storage, and distribution and allocate resources to the relatively well-off, as well as the needy. Such

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programmes can crowd out spending on health, education, and productive investment, which are arguably more progressive. This implies that the value of PDS benefits to Iraqi households is a fraction of the cost of delivering the programme. However, long-standing universal in-kind programmes, such as the PDS, are difficult to scale back, especially if strong fiscal constraints affect the economy and social spending. The need to manage public sentiment means that alternate mechanisms of social protection must be established before major programme reforms can be undertaken.

Despite its shortcomings, Iraq's PDS has remained in place through three decades of conflict and insecurity, has long been seen as one of the few tangible benefits delivered by the state, and has increasingly become viewed as a general entitlement. The PDS is the only safety net programme that covers all the poor and vulnerable in a country where other social protection programmes, such as the social security network, serve at most one fifth of the poor. The value of transfers from the PDS singlehandedly accounts for 13 per cent of the income of the average Iraqi household (World Bank, 2014), and the programme's relative importance to the poor is even greater. According to the 2012 Iraq Household and Socio-Economic Survey (IHSES), PDS transfers accounted for as much as 16.5 per cent of the total expenditure of households in the bottom 10 per cent of the consumption distribution, while the PDS provided roughly 70 per cent of the calories consumed by the bottom 40 per cent of households. One third of the calories consumed by the richest household quintile were also supplied through the PDS in 2012.

The sharp decline in oil prices and the Islamic State insurgency since mid-2014 have severely constrained Iraq's fiscal environment and strengthened the imperative to reform the PDS. While politically sensitive, the need to reform the PDS is well recognised, and various proposals have been put forward since 2003. Even in oil-rich Iraq, the PDS represents a large fiscal burden, accounting for ID 1 trillion, or 5 per cent of the country's GDP (Silva, Levin, & Morgandi, 2013). While the PDS provides a level of broad food security to the poor and vulnerable in Iraq, it also covers more than 95 per cent of the nonpoor and costs considerably more than a targeted safety net. In its current form, it suffers from large inefficiencies in procurement, distribution, and management and implies significant macroeconomic distortions because of its heavy reliance on food imports and its universal nature.

In the context of the widespread dependence on the PDS for basic food needs, the recurrent, unpredictable exposure of the Iraqi population to shocks, and the growing recognition of the necessity of reform, this report considers an ex ante simulation to quantify the welfare impacts of various PDS reform scenarios using a mixed demand approach. The objective of this ex ante assessment of reform scenarios is to estimate the direction and likely scale of the associated welfare impacts and required compensating transfers. Accordingly, the report examines distributional impacts and identifies how the poorest parts of the distribution may fare relative to the more well off, compares rural areas with urban areas, and attempts to assess differences in welfare impacts spatially and over time through a robustness exercise (Kurdistan versus the rest of Iraq). In the absence of census information on the access to and the consumption of PDS items, it is not possible to identify individual or household impacts. Rather, the goal is to characterise the population subgroups that will require greater compensation and protection in the setting of potential PDS reform. Similarly, attention is restricted to a regional comparison rather than a provincial (governorate) assessment.

At the time this analysis was undertaken, the political economy of PDS reform appeared favourable, and the government of Iraq was considering options for a broader safety net system, the establishment of which will likely be a precondition for any major reforms to the PDS.[3] There had been steady shifts in policy and programming away from in-kind and categorically targeted safety nets towards cash-based, means-tested approaches. The war against the Islamic State disrupted this reform agenda. However, as Iraq now rebuilds and recovers, the state will have to find, through service delivery and safety nets, a more effective way to share more broadly the benefits of a narrow, but lucrative economic base reliant on oil.

A limited literature documents the evolution of the PDS (United States Government Accountability Office, 2006; World Bank, 2011) and the impact of the PDS on food security, with some suggestions for possible system reforms (Woertz, 2017; World Bank, 2005). Already in 2005, a World Bank report suggested the elimination of the PDS, proposing a universal cash transfer or means testing to target the PDS as possible avenues for reform. Other reforms weighed by the government include

reducing the number of ration products, socioeconomic targeting to exclude the rich, and work-for-food vouchers (Alzobaidee, 2015; Woertz, 2017). To inform the change agenda, it is extremely important to understand and quantify the potential welfare impact of a change in the PDS across the distribution of consumers. Incorporating the behavioural responses of households to reforms is essential, given that the population may have come to consider the PDS transfer as a constant, unchanging benefit that is provided at almost zero cost. Additionally, in designing alternatives, it is important to quantify the adverse welfare impacts and to estimate the size of a cash or equivalent transfer that would hold utility constant, at least for the lower parts of the distribution.

This report seeks to fill this gap in the literature by simulating the ex ante impacts of plausible, hypothetical PDS reform scenarios on consumer welfare. The choice of scenarios draws on the existing literature, and the scenarios presented are considered politically feasible based on discussions with the government. Using the most recently available household survey, the IHSES 2012, the analysis estimates income and price elasticities to model the behavioural responses of households to potential reforms. The Iraqi food subsidy system involves partial rationing, whereby the PDS food items are available at subsidised prices until a quantity quota is reached. For larger quantities, consumers can purchase the free-market counterparts of these ration items at the free-market price. The mixed demand approach allows the partial rationing of the PDS and the associated dual price system to be explicitly considered. Such a demand system incorporates rationed quantities for a subset of goods at predetermined prices, in addition to free-market goods, and has been applied in similar contexts, including Egypt (Hosni & Ramadan, 2018; Ramadan & Thomas, 2011). The estimated income and price elasticities are used to measure the impact of reforms on consumption and, therefore, welfare (Houthakker & Tobin, 1952; Huffman & Johnson, 2004; Madden, 1991; Moschini & Rizzi, 2007; Ramadan & Thomas, 2011).

This report differs from others in this special issue in that it focuses on a long-standing universal programme that has been functioning in an emergency context. Because of the unique nature of the PDS, an examination of the contribution of the PDS to household welfare and an assessment of the implications of the withdrawal of the PDS constitute a distinctive addition to the literature comparing the various types of protection.

The report is organised as follows. Section 2 describes the data and issues related to the valuation of subsidised and rationed goods in the Iraqi context. Section 3 details the methodological approach of the mixed demand model. Section 4 discusses estimations and results. Section 5 presents the welfare analysis. Section 6 concludes.

2. Data and valuation of ration items

The mixed demand model is estimated using the IHSES 2012. The IHSES covers roughly 25,000 households and is designed to be representative at the provincial (governorate) level. The survey collects detailed data on all aspects of household income and expenditure and a wide variety of socioeconomic indicators (World Bank, 2013). The PDS includes 13 ration products: rice, brown wheat flour, white wheat flour, children's food, powdered milk, vegetable fat, vegetable cooking oil, dry white beans, chickpeas, lentils, sugar, salt, and tea. These ration items differ in importance. For instance, 36 per cent of total ration expenditure is spent on brown wheat flour, compared with almost 0 per cent in the case of salt and tea. The other highly consumed ration products are sugar (26 per cent of total ration expenditure), vegetable cooking oil (22 per cent), and rice (14 per cent). Taken together, brown wheat flour, rice, vegetable cooking oil, and sugar represent almost 98 per cent of total ration expenditures. Hence, the analysis focuses on the consumption of these four ration items and their free-market counterparts.

To ensure that all those who consume exactly the same amount of a ration item are assigned the same expenditure (and thereby utility) and that this expenditure increases with greater consumption, the methodology followed in this report uses the national median values of the prices reported by ration agents to value ration items (World Bank, 2013). Details of survey information on PDS and the

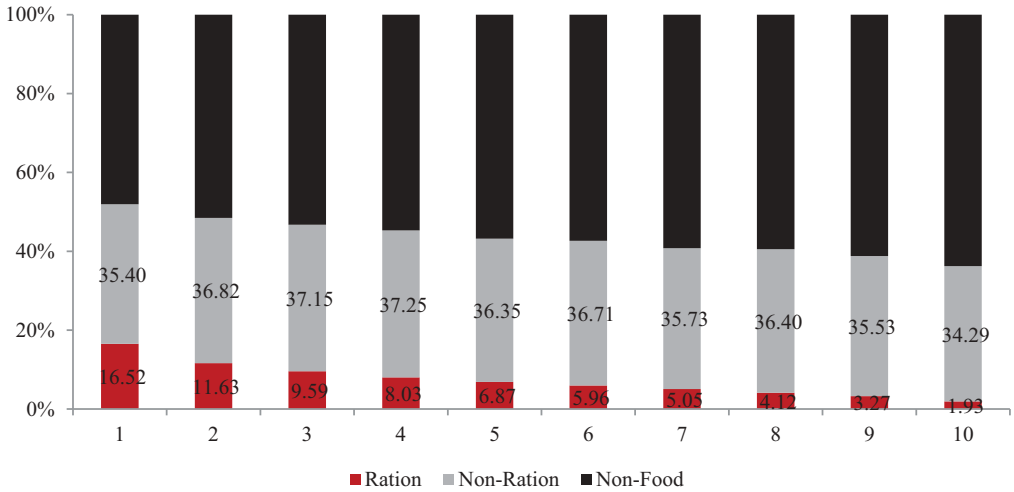

Figure 1. PDS expenditures, food and nonfood expenditures, by consumption quintile, 2012.

methodology used for valuing PDS consumption can be found in Supplementary Appendix A in the online Supplementary Materials.

Based on the quantities and ration agent prices for these ration items, one may estimate that, on average, only 6 per cent of total expenditure was allocated to this type of product by Iraqi households in 2012. However, this aggregate statistic masks considerable heterogeneity across the consumption distribution. PDS expenditures accounted for 30 per cent of the food expenditures and around 17 per cent of the total expenditures among the poorest 10 per cent of Iraqi households in 2012. The share of PDS expenditures declined as total household expenditures rose. For instance, this share shrank to 12, 7, and 2 per cent for the second, fifth, and top deciles of the consumption distribution, respectively (Figure 1). Table 1 shows the average shares of ration expenditure with respect to total food expenditure by consumption quintile in urban and rural areas. In urban areas, the richest spent almost 9 per cent of their total food expenditure on ration products, compared with 44 per cent among the poorest quintile. These shares are slightly higher in rural areas: 9.4 per cent and 47.0 per cent for the upper and bottom 20 per cent of the consumption distribution, respectively.

3. Mixed demand model

Estimating the behavioural responses of households to changes in the availability of goods requires the estimation of the demand functions of these goods. In this setting, the most common empirical specifications involve expressing the quantity demanded as a function of total expenditure (as a proxy for income) and market prices (Moschini & Rizzi, 2006). However, this standard specification of a direct demand system relies on the implicit assumption that prices are predetermined or, in other

Table 1. Average share of ration expenditure in total food expenditure, by consumption quintile, urban and rural areas (%)

Location	Poorest	2	3	4	Richest
Rural	47.3	26.5	20.1	15.1	9.4
Urban	43.8	26.9	20.3	14.9	8.8
Total	45.9	26.8	20.2	15.0	8.9

Source: Estimations based on IHSES 2012.

words, that quantities vary according to changes in prices that can be considered as exogenous. This assumption is not likely to hold in the context under consideration here, where nominally priced PDS rationed products account for a significant part of expenditures on food and are widely consumed. An alternate approach treats quantities as predetermined, and prices are adjusted so that demand and supply are equalised in the aggregate. This inverse demand function approach, while appropriate for perishable and rationed products, is unsuited to the scenario considered in this study. A third approach, first introduced by Samuelson (1965), considers mixed demand functions. In this approach, while, for some goods, prices are given and the quantities vary based on supply and demand, for others, such as rationed goods, quantities are given (Supplementary Appendix B). This allows for more flexibility in assumptions regarding whether prices or quantities are held exogenous for each good, and this is the approach followed in this report.

In this dual system, households have access to subsidised goods up to their designated quota, but, if demand exceeds this quota, households have to purchase free-market goods with the same or a different quality and, of course, a different price. Hence, a consumer has to choose simultaneously the consumption segment, that is, a quantity above or below the allocated subsidised quota, and the free-market consumption level, which introduces nonlinearities in the demand functions (Ramadan & Thomas, 2011).

Following Moschini and Rizzi (2007) and Ramadan and Thomas (2011), the analysis estimates a normalised quadratic mixed demand model wherein there are n free-market products and m subsidised products. Let $X = [x_1 \ldots \ldots x_n]$ be the vector of goods the prices of which are determined on the market, that is, free-market goods in this case, and let $Z = [z_1 \ldots z_m]$ be the vector of goods the quantities of which are predetermined (quotas of rationed products in this case); p and q are the price vectors associated with X and Z, respectively. The structural estimation equations of the mixed demand system can be written in terms of budget shares, as follows:

$$W_i = \left[\delta_i + (\mu' z)a_i + \left\{\beta_i + \sum_{j=1}^{n}\frac{\beta_{ij}p_j}{a'p} + \sum_{k=1}^{m}\lambda_{ik}z_k + a_i\left[\gamma' z - 0.5\left(\frac{p'Bp}{(a'p)^2}\right) + 0.5(z'\Gamma z)\right]\right\}V^M\right]\frac{p_i}{y} + \varepsilon_i \tag{1}$$

$$-W_k = \left[(a'p)\mu_k + \left[(a'p)\gamma_k + (a'p)\sum_{s=1}^{m}\lambda_{ks}z_s + \sum_{j=1}^{n}\lambda_{jk}p_j\right]V^M\right]\frac{z_k}{y} + \xi_k \tag{2}$$

where $i = 1,2,\ldots n$ for the free-market products and $k = 1,2, \ldots m$ for the quantity-determined products. The W_i's and the W_k's are the budget shares of the free-market goods and rationed goods, respectively; y is income, and $V^M(p,z,y)$ is the mixed utility function, such that:

$$u(x^*,z) = v(p,q^*,y) \equiv V^M(p,z,y) \tag{3}$$

where u and v are the optimum direct and indirect utility functions, respectively; γ and μ are $m \times 1$ vectors of parameters; $B = [\beta_{ij}]$ is the $n \times n$ matrix of parameters; $\Gamma = [\gamma_{ks}]$ is the $m \times m$ matrix of parameters, and β_i and δ_i are parameters to be estimated. $a = [a_1, a_2, \ldots, a_n]'$ is a vector of arbitrarily chosen coefficients to ensure the homogeneity property. ε_i and ξ_k are error terms.

The share Equations (1) and (2) of the mixed demand model are estimated using a system of nonlinear seemingly unrelated regression criteria by applying iterated feasible generalised least squares.[4] The model is estimated by imposing cross-equation restrictions, such as symmetry, adding up, and homogeneity constraints. Given that the share equations sum up to 1, one equation is dropped to avoid singularity of the residual covariance matrix. Parameters of dropped equations are recovered through the homogeneity and symmetry constraints (Moschini & Rizzi, 2007; Poi, 2008).

This model differs from that of Ramadan and Thomas (2011) in two ways: (a) the types of products included and (b) the difference in the nature of the subsidy system. In the current study, the predetermined quantities, Z, consist of the four ration products: brown wheat flour, rice, sugar, and vegetable cooking oil. These four rationed items represent 98 per cent of ration expenditure.[5] For the free-market goods, X, the decision was taken to include the free-market product groups that can be considered counterparts of the rationed goods. Other free-market products might be included in the model, that is, not only the free-market counterparts of the rationed goods. However, the choice of only these items is justified by the importance of these items in the Iraqi household consumption basket. In comparison, looking at Egypt, Ramadan and Thomas (2011) included only two rationed products (sugar and oil) as the X products, while, for the predetermined products, they include the free-market counterparts, bread and flour, that are subsidised, but not rationed by quantity, along with other free-market products, such as beans, fish, and meat.[6]

The free-market goods are aggregated into four groups: wheat, sweets, rice, and cooking oil.[7] The model therefore includes eight items, which represent, on average, 35 per cent of household food expenditure. Total expenditure on the eight food items is used as a proxy for income because measurement errors may be important with the latter and because the analysis concentrates on the consumption of these eight items only (Löfgren & El-Said, 2001). All prices are included in the logarithmic form. For the aggregate free-market food groups, the share-weighted Stone formula is used to compute composite price indices, as follows:

$$PI_I = \sum_{i=1}^{m \in I} w_i *.\ P_i \tag{4}$$

where PI_I is the price index for the Ith food group (I = free-market wheat, free-market rice, free-market sweets, and free-market cooking oil); w_i is the share of each product included in group I from the total expenditure of I, and P_i is the price in logarithmic form.

Given that consumption is heterogeneous across commodity groups, the analysis follows Ramadan and Thomas (2011) to solve the issue of frequent zero expenditures for some food items. The share of expenditure of each item is the average share at the stratum level for the different quintiles in urban and rural areas, instead of the household level. Conducting the analysis at the region and income level generates a loss in information in the data compared with an analysis at the household level, but it avoids the need to adopt more sophisticated procedures for dealing with multiple corner solutions in demand systems (Millimet & Tchernis, 2009; Ramadan & Thomas, 2011; Shonkwiler & Yen, 1999).

All explanatory variables are normalised by their sample mean. The coefficients of vector a in the two sets of Equations (1) and (2) are set to the mean share of the different nonrationed product groups. Using the estimated parameters from the mixed demand model, the analysis computes price and income elasticities at the mean of the prices, the quantities, and the total expenditure of different quintile levels in urban and rural areas.[8] These elasticities are used to estimate the quantity response for items with predetermined prices and the price response for those with predetermined quantities. These allow the measurement of the impact of hypothetical reform scenarios on consumption and therefore on welfare.

The analysis is conducted by comparing population subgroups because of a lack of data at a sufficient level of disaggregation. Census-level information on the access to and consumption of PDS items is unavailable, preventing an assessment of individual or household-level impacts. The analysis aims instead to characterise the subgroups that will need greater compensation and protection in the context of PDS reforms. Similarly, as noted, the focus is on a regional comparison rather than a provincial assessment.

4. Results

The estimated elasticities of free-market products are low among all quintiles in both urban and rural areas (Supplementary Appendix E).[9] This is expected, given the importance of these products in the Iraqi household consumption basket. The consumption of cereals (primarily wheat) and rice are

inelastic with respect to any changes in price, and they are considered substitutes in both urban and rural areas across households at all income levels.

Compared with cereals/wheat and rice, both free-market sugar and cooking oil exhibit higher elasticities across all quintiles in both urban and rural areas. However, in absolute terms, the consumption of the latter two is inelastic with changes in their own prices. Free-market cooking oil is the least inelastic item among the three; own-price elasticity is higher than 0.5 among the two lowest quintiles in both urban and rural areas. Sweets and cooking oil are more important among higher-income groups; the price elasticities of these two free-market products fall among the higher quintiles. For instance, in urban areas, a 1 unit increase in the price of cooking oil decreases consumption of the item by 0.84 among the poorest quintile, while, among the richest quintile, consumption falls by 0.31 units.

For the rationed PDS goods, as previously described in the literature (Moschini & Rizzi, 2006; Ramadan & Thomas, 2011), the own-quantity elasticities are low among all income levels in urban and rural areas. This shows that all income groups are benefiting from the PDS. However, the consumption of the rationed products is more inelastic among the poorest quintiles compared with the richest quintiles, given the importance of these products in terms of the caloric contribution to the diet of the less well off (75 per cent among the lowest quintile compared with 33 per cent among the highest quintile).

Based on the rations classification of Madden (1991), rationed brown flour in both rural and urban areas may be considered a substitute for free-market cereals that are primarily composed of wheat.[10] Meanwhile, rationed rice complements the consumption of free-market rice. The consumption of rationed sugar may be complemented by the consumption of free-market sweets. Hence, these results show that, despite the quality difference between rations and free-market goods, Iraqi households may substitute rationed products for free-market products if the price increases. On the other hand, for some products, such as sugar and rice, Iraqi households complement their rationed-goods consumption with free-market products if consumption increases. These results are not surprising. Households will first consume their quota of rationed items, such as sugar and rice, and will have to complement these supplies by consuming free-market products only if the rationed quota is not sufficient to satisfy household needs (Supplementary Appendix E).

For expenditure (income) elasticities, the results of the analysis show that free-market cereals, rice, and sweets are normal goods across all income levels in both urban and rural areas (Supplementary Appendix E). Expenditure elasticities for these three products decrease with income level. In other words, less well-off households would increase their consumption of these three free-market goods to a greater degree if they experience an increase in incomes. For instance, in rural areas, a 1 unit increase in income increases the consumption of wheat, rice, and sweets by 0.086, 0.353, and 0.359, respectively, among the lowest income group, compared with an increase of 0.033, 0.072, and 0.166 units, respectively, among the highest income group.

Free-market cooking oil is considered an inferior good among all income groups in rural areas. An increase in income raises subsidised cooking oil consumption and decreases the consumption of free-market cooking oil, a result that requires investigation. Subsidised or rationed brown flour is also an inferior good among urban households, showing that an increase in income will yield a decrease in the consumption of PDS brown flour and an increase in the consumption of free-market cereals.

One way to understand behaviour over time is by exploiting cross-sectional spatial variation. In other words, consumer behaviour in more well-off regions may be a rough approximation of how less well-off regions today will behave in the future as their welfare levels improve (if other factors are held constant). Using this approach, the analysis considers how households would adjust their consumption patterns over time if welfare levels rise. It thus compares current demand responses in Kurdistan and the rest of Iraq. Kurdistan – defined as three north eastern governorates, Erbil, Duhok, and Sulaimaniya – is used as the reference region because this area's current consumption of rationed items is the lowest in the country, while its per capita expenditure is the highest, on average.

Similar consumption responses to changes in the own prices of rationed and free-market goods are seen in Kurdistan and in the rest of Iraq relative to previous findings in urban and rural areas (Supplementary Appendix F). Overall, most goods are ordinary goods. The demand for ration items is much less elastic than the demand for free-market goods. However, all response levels are higher in Kurdistan than in the rest of Iraq, and Kurdistan's levels are also higher than the estimates on urban areas shown above. At the same time, well-off households in the Kurdistan region are much more responsive to variations in the prices of ration goods, compared with the rest of Iraq and with urban Iraq, while the opposite is true for the free-market equivalents of rationed goods. In other words, in line with higher welfare levels in Kurdistan relative to urban Iraq and in urban Iraq relative to rural Iraq, the flexibility of consumer demand to changes in prices increases. Thus, as the economy grows, consumers in Iraq will likely enjoy a larger set of options and the ability to substitute away from ration items and increase their consumption of free-market goods. Similarly, if economic conditions worsen, consumer dependence on rations and their inelasticity of response will likely rise.

This pattern of consumer behaviour is quite clear if one examines how the demand for goods responds to variations in total household expenditure. In general, most ration items are marginally inferior goods in the Kurdistan region, irrespective of the level of per capita consumption. As household expenditures increase by 10 per cent, demand falls by between 0.4 per cent and 3.4 per cent for brown flour and by around 0.7 per cent for rice (Supplementary Appendix F). Opposite responses are obtained in the rest of Iraq, where ration items are considered normal goods. The hypothesis is therefore that, as the economy evolves and incomes rise across the distribution and as the rest of the country approaches the higher welfare levels now found in Kurdistan, these types of ration goods would be less in demand.

5. Welfare analysis

The study next uses the estimated elasticities to compute changes in total expenditure across various household subgroups, along with changes in the shares of various products in total expenditure, if the PDS were removed. The implicit assumption is that the withdrawal of any of the subsidised products will yield a change in the consumption of the free-market counterparts of these products, as well as in the corresponding free-market prices. This will be associated with a change in total household expenditure and in the respective shares of the various products consumed.

The scenarios now presented are by no means exhaustive. They have been selected based on discussions with the government on their political feasibility as reforms. Reform options currently under discussion include the use of socioeconomic characteristics and income to target the PDS more effectively and the gradual withdrawal of the PDS to mitigate the negative impacts on the welfare of excluded groups. For this reason, the suggested scenarios rely on geographical locations and income levels as targeting criteria. In particular, scenarios are considered that limit the benefit eligibility to the bottom 60 per cent of the income distribution in urban areas and to all households in rural areas.

The first set of scenarios (the A scenarios) use geographical location and income to determine system eligibility. Under this model, the top 40 per cent of the income distribution in urban areas would not be eligible to benefit. The second set of scenarios (B scenarios) use only geographical location as a targeting criterion. Under the B scenario models, only rural consumers have access to the PDS items. Justification for such an approach include the argument that urban households generally enjoy relatively better initial conditions than rural households, which might ease the implementation of the reform.[11] Urban households also presumably have better access than rural residents to free-market products. This would make the implicit assumption reasonable that PDS goods can be replaced with the free-market counterparts.

The individual scenarios are now described in detail. The A scenarios focus on withdrawing the ration products only from the top two income quintiles in urban areas. The implementation of such an approach assumes the ability to target PDS beneficiaries in urban areas accurately to exclude only the top 40 per cent of the welfare distribution. This extreme case would have no impact on rural areas or

on the urban poor. Given that the prominence of the ration goods in total household expenditure differs, the various quotas would be removed progressively according to the importance of the share of each rationed item. First, only the rice quota is eliminated (scenario A.1; Figure 2). Second, rice and vegetable cooking oil quotas are removed (scenario A.2; Figure 3). Third, rice, vegetable cooking oil, and sugar quotas are eliminated (scenario A.3; Figure 4). Scenario A.4 consists of the withdrawal of all four rationed products included in the model from the two upper quintiles in urban areas (Figure 5).

Given the interchangeability and complementary relationship between the ration products and the free-market products, the prices and quantities of each product will change based on the estimated elasticities. Under the A scenarios, the removal of the quotas for each of the subsidised products will result in an increase in the shares of the other subsidised products and free-market products in total

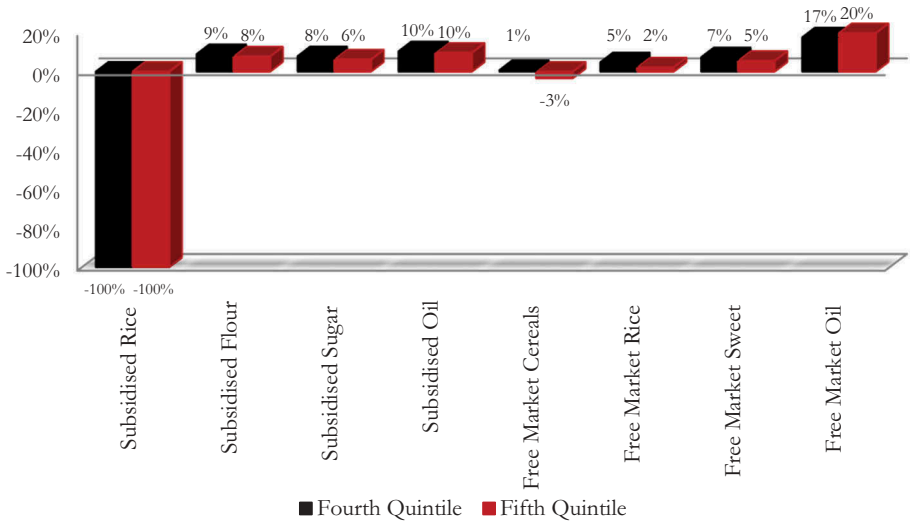

Figure 2. Average change in product shares, scenario A.1, urban areas.

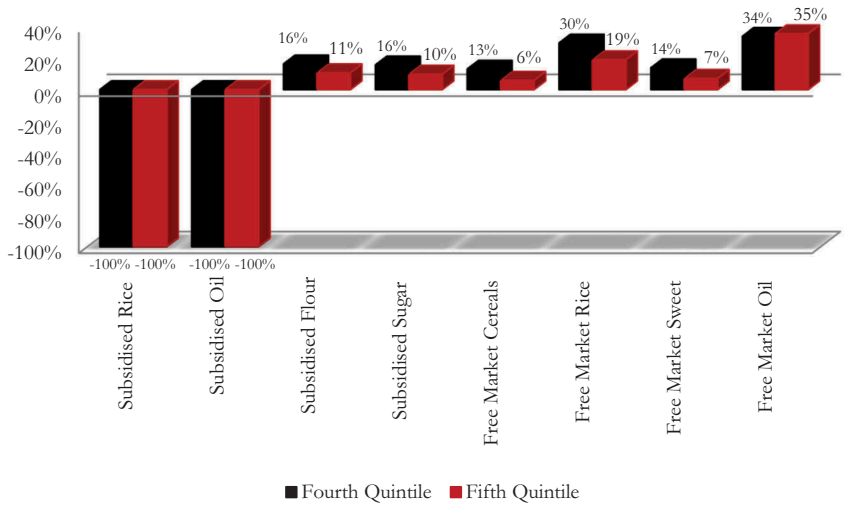

Figure 3. Average change in product shares, scenario A.2, urban areas.

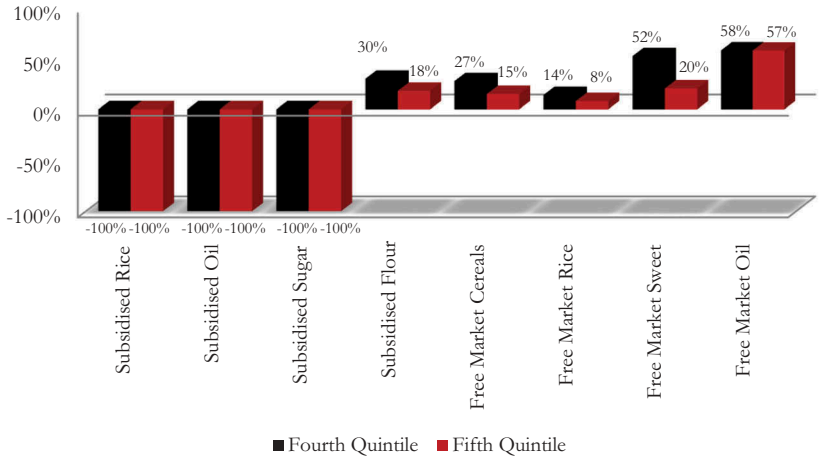

Figure 4. Average change in product shares, scenario A.3, urban areas.

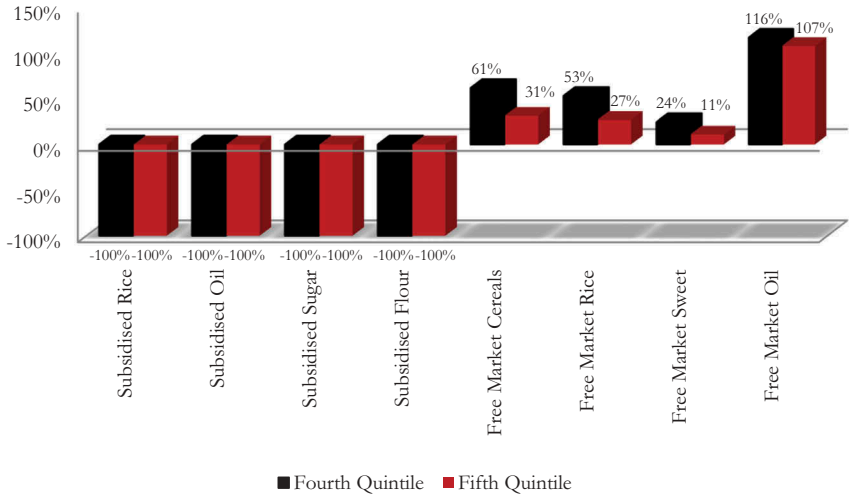

Figure 5. Average change in product shares, scenario A.4, urban areas.

expenditures. The removal of the quotas for each subsidised product represents a decrease in the share of the product in total expenditures of 100 per cent, computed with respect to the initial value of expenditure on the product.

Overall, the highest increase in expenditures as a result of the removal of subsidies is observed in free-market cooking oil. Under scenario A.1, in which only the rice quota is removed, the free-market cooking oil share increases by 17 per cent and 20 per cent among the fourth and fifth quintiles, respectively. Under scenario A.4, in which all subsidised products are withdrawn, the shares of free-market cooking oil increase by 116 per cent and 107 per cent, compared with the original share, among the fourth and fifth quintiles, respectively. This substantial impact is not surprising, given the large cross-price elasticities of free-market cooking oil with respect to all subsidised products.

Under scenario A.1, the removal of the rice quota will raise the expenditure shares on the free-market counterpart by 5 per cent and 2 per cent among the fourth and fifth quintiles, respectively.

Given the complementarity between rationed rice and free-market cereals, the removal of the rice quota increases the free-market cereal share by 1 per cent among the fourth quintile, while it deceases by 3 per cent among the fifth quintile. At the same time, the share of expenditures on subsidised flour will increase because subsidised flour is a substitute for PDS rice.

The removal of subsidised sugar (scenario A.3), in addition to subsidised rice and cooking oil, results in an increase in the share of the free-market counterpart by 52 per cent and 20 per cent among the fourth and fifth income groups, respectively. As expected, if the quotas for all four subsidised products are eliminated (scenario A.4), households will have to compensate for the removal of the subsidised products through an increase in expenditures on the free-market counterparts. Among the fourth quintile in urban areas, the shares of free-market cereals, rice, and sweets increase by 61 per cent, 53 per cent, and 24 per cent, respectively. The impact is less marked in the case of the fifth quintile, among which the shares of free-market cereals, rice, and sweets increase by 31 per cent, 27 per cent, and 11 per cent, respectively. This is not surprising, given that households in the highest quintile consume the fewest subsidised products, and the impact of subsidy removal on expenditure in the highest quintile is thus expected to be less substantial.

The B scenarios target only rural areas, where poverty in Iraq is concentrated. The B scenarios involve the gradual removal of access to ration products among all income quintiles in urban areas. Under the B scenarios, all urban areas are assumed to be affected, with no impact in rural areas. This is a strong assumption, given that markets are interlinked, and it may therefore prove difficult in practice to prevent changes of this type from affecting rural areas. Moreover, if such policies are applied, black markets and leakages might result. Acknowledging these limitations, the assumption of no impact in rural areas remains useful by simplifying the analysis.

In the B scenarios, as in the A series, the quotas will be removed in steps according to the importance of the share of each ration item. First, the rice quota will be eliminated among urban households (scenario B.1). Second, rice and cooking oil quotas will be removed (scenario B.2). The third scenario (scenario B.3) eliminates rice, cooking oil, and sugar quotas. Scenario B.4 removes the quotas of all four ration products among all urban households.

Under the B scenarios, the urban poor are most affected, given the importance of the subsidised products in their diets. Eliminating rice subsidies will increase the expenditure share of the free-market counterpart by 10 per cent among the poorest households, compared with only 2 per cent among the richest households (Table 2). Removing the quotas for all four ration products will increase the share of the free-market counterparts by more than 200 per cent among the lowest

Table 2. Average change in subsidised product shares, scenarios B, urban areas and consumption quintiles

Scenario	Product	Poorest	2	3	4	Richest
B.1	Rice	−100%	−100%	−100%	−100%	−100%
	Oil	15%	13%	11%	10%	10%
	Sugar	13%	11%	9%	8%	6%
	Flour	14%	12%	10%	9%	8%
B.2	Rice	−100%	−100%	−100%	−100%	−100%
	Oil	−100%	−100%	−100%	−100%	−100%
	Sugar	31%	25%	20%	16%	10%
	Flour	31%	25%	20%	16%	11%
B.3	Rice	−100%	−100%	−100%	−100%	−100%
	Oil	−100%	−100%	−100%	−100%	−100%
	Sugar	−100%	−100%	−100%	−100%	−100%
	Flour	67%	50%	38%	30%	18%
B.4	Rice	−100%	−100%	−100%	−100%	−100%
	Oil	−100%	−100%	−100%	−100%	−100%
	Sugar	−100%	−100%	−100%	−100%	−100%
	Flour	−100%	−100%	−100%	−100%	−100%

Source: Estimations based on IHSES 2012.

quintiles, compared with an increase of less than 50 per cent among the richest group, except for cooking oil, the share of which increases by more than 100 per cent among the richest quintile (Table 3).

Holding incomes constant, such increases in expenditure shares imply that affected households will likely have to cut back on other food and non-food expenditures. A more direct measure of the utility or the welfare impact of the removal of the PDS can be estimated by computing the compensating variation (CV). The CV measures the difference between the minimum expenditure required to attain an original level of utility at the new price and the initial expenditure (Ackah & Appleton, 2007; Huang & Huang, 2009). As explained by Huang and Huang (2009), holding the utility level constant, the CV reflects the change in expenditure necessary to compensate consumers for the effects of the change in prices from p_0 to p_1. The CV can be written as follows:

$$CV = C(p_1,\ u_0) - \ C(p_0,\ u_0) \tag{5}$$

The advantage of such an approach is that it provides policy-makers with an estimate of the size of the cash transfer needed to compensate households. In Iraq and other countries in the region, reforms of existing safety net programmes are contingent on maintaining the welfare of less well-off households. In Iraq, the expansion of the cash transfer programme could similarly be informed by this estimate of the compensation needed to hold utility constant.

Following Ramadan and Thomas (2011), the subsidised price is the initial price p_0, while p_1 is the new price after the removal of subsidies. Positive change represents an increase in expenditure with the new prices to keep the same initial utility. This means there is a decrease in the welfare of the consumer (Ackah & Appleton, 2007; Huang & Huang, 2009).

Assuming that households will continue consuming the same quotas, but that the subsidised price will increase if the quotas are removed, households will have to increase their total expenditure to keep the utility level constant. The CVs are positive among all households under the B scenarios (Table 4). This implies that the removal of subsidies will result in a decrease in the welfare of these households, as expected.

The two lowest income quintiles are the most affected by this reform, given the importance of the subsidised products in their total expenditures. The elimination of access to subsidised rice will require compensation among the poorest households by 0.10 per cent of total household expenditure

Table 3. Average change in free-market product shares, scenarios B, by consumption quintile, urban areas (%)

Scenario	Product	Poorest	2	3	4	Richest
B.1	Cereals	7	5	3	1	−3
	Rice	10	8	7	5	2
	Sweets	12	10	9	7	5
	Oil	21	19	17	17	20
B.2	Cereals	28	23	18	13	6
	Rice	29	23	19	14	8
	Sweets	29	23	18	14	7
	Oil	48	41	36	34	35
B.3	Cereals	62	48	36	27	15
	Rice	66	49	39	30	19
	Sweets	59	43	33	24	11
	Oil	94	76	63	58	57
B.4	Cereals	220	152	84	61	31
	Rice	212	113	80	53	27
	Sweets	207	106	74	52	20
	Oil	284	180	133	116	107

Source: Estimations based on IHSES 2012.

Table 4. Compensating variation, households in urban areas, B scenarios (%)

Scenarios	Poorest	2	3	4	Richest
If subsidised prices increase because of a decrease in subsidy quantities by 100% (based on the elasticities)					
B.1	0.10	0.11	0.10	0.09	0.09
B.2	0.14	0.15	0.14	0.13	0.13
B.3	0.24	0.25	0.23	0.23	0.23
B.4	0.29	0.30	0.29	0.28	0.29
If subsidised prices are set equal to free-market prices					
B.1	7.50	7.50	7.15	6.62	5.16
B.2	1.63	2.45	3.02	3.27	2.85
B.3	16.96	17.03	17.30	16.44	13.47
B.4	74.36	71.44	63.42	53.86	38.90

Source: Estimations based on IHSES 2012.

to maintain the level of welfare, compared with 0.09 per cent among the richest group. On the other hand, the simultaneous removal of all the subsidies would have almost the same impact on all income groups; they would need to be compensated by around 0.3 per cent of the total household expenditure. This low CV can be explained by the fact that the rise in price resulting from the quota decrease by 100 per cent is small, given the low own-price elasticities.

The analysis followed the initial set of scenarios proposed by Ramadan and Thomas (2011), whereby the researchers eliminated the subsidies by setting the price of subsidised products – in this case, wheat flour and bread – equivalent to the free-market price of these products, assuming that households will consume the same amounts. However, an increase in the price of cereals is not allowed because the analysis of Ramadan and Thomas (2011) was conducted in the context of the food crisis of 2008, while the current Iraqi context is different. Thus, here we assume that subsidised products will only be available at the prices of the free-market counterparts. Such price increases will yield a rise in the total expenditure of households to keep utility constant. As a result, the compensating variation among poor households is 74.4 per cent of household expenditures, compared with about 40 per cent among the richest (see Table 4). This large decrease in household welfare, reflected in the high positive value of CV, derives from the substantial price differential between official/subsidised prices and free-market prices. The large CV also underscores the importance of the rationed products in consumption among low-income Iraqis, as well as among the more well off.

6. Discussion and conclusions

Iraq's PDS is unique among safety net programmes in that it is universal and long-running and has been functioning through decades of crises as the only safety net in the country. It is widely seen as an entitlement, and the political economy of reform continues to be difficult. Yet, fears of low or falling oil prices and exposure to the risk of conflict imply that Iraq must find alternate mechanisms to deliver widespread benefits from a narrow economic base dominated by oil. Even during years of substantial economic growth, such as 2007–2012, Iraq's oil-driven economy provided few additional economic opportunities for a population that has repeatedly experienced welfare reversals (World Bank, 2015). In this context, the PDS is the only means to deliver benefits to citizens, though at a high opportunity cost. The heavy fiscal burden of managing and implementing such a large-scale in-kind transfer programme, as well as the associated leakages, suggests that the ultimate benefit to households, while critical, is a fraction of the fiscal cost of the programme. As Iraq rebuilds and recovers from yet another episode of violent conflict, reforming the PDS and shifting towards a broader set of social protection instruments will be vital to a strengthened relationship between citizens and the state. This study presents objective evidence to inform this politically difficult but important debate.

This study attempts to fill the gap in the literature on how reforming the PDS may affect the welfare of Iraqi households. The study thus examines distributional impacts and shows how poorer Iraqis may fare relative to the more well off as reforms proceed. Because any reform has to be accompanied by other mitigation policies, such as cash transfer programmes, the study provides an estimate of the compensation needed among different income groups to maintain utility at constant levels.

Given the long-standing nature of the programme, the lack of widely available market substitutes at similar prices, and the widespread dependence on PDS items in the Iraqi diet, the analysis finds that the size of the transfer required to protect the welfare of vulnerable groups may be substantial. Demand for food items distributed through the PDS is generally inelastic to changes in price, especially among the poorest population segments. In addition, for much of the population, these goods are not inferior, but rather normal goods. Taken together, these findings imply that any one-shot reform of the PDS will have sizeable adverse welfare impacts. The removal of all subsidies in urban areas, for instance, would require compensating poor households by 74 per cent of the expenditures of the households. Hence, the gradual withdrawal of the rationed products is needed to avoid jeopardising household welfare, especially among low-income groups.

The feasibility of this scenario, which withdraws PDS transfers from all urban households, depends in large part on the establishment of a well-targeted, compensating safety net system prior to the removal of the PDS benefits. In addition, the restoration of peace and security and broad-based economic growth would likely ease the transition. Cross-sectional spatial variation suggests that, with improvements in welfare levels and with access to well-functioning markets, some segments of the population may substitute away from the PDS and increase their consumption of market substitutes. For instance, most ration items are marginally inferior goods in the Kurdistan region, irrespective of the level of per capita consumption, while the opposite situation prevails in the rest of Iraq, where ration items are considered normal goods.

The study findings also suggest that a targeted eligibility criterion can safeguard the less well-off segments of the population, while generating savings. One of the scenarios considered here limits eligibility to the bottom 60 per cent of the distribution in urban areas, a cut-off that was set in discussions with the government because it was considered sufficiently above the poverty line to eliminate the risk of excluding households in substantial need. Such a reform could be implemented even in the current context, provided it is well managed and carefully communicated, because even the more well-off households in the population would experience a welfare loss from the elimination of the PDS.

The main contribution of the study is the provision of evidence to inform the policy-making process. The conservative reform of eliminating the PDS among the upper 40 per cent of the population in urban areas is feasible even in the difficult political and economic context of Iraq. Moreover, the study findings suggest that the removal of all ration items in urban areas would be feasible if a proper, well-targeted, and functional compensation mechanism were established prior to the withdrawal of the PDS.

Ideally, the analysis undertaken here should be complemented by the incorporation of the costs of importing, storing, and transporting PDS items, which would allow for a full accounting of cost savings and a full budgeting of a transfer system. Data are currently lacking on the costs of implementing and delivering the PDS and on the associated leakages. Such data would be a critical input to a full estimate of potential cost savings, and these would need to be considered, along with the welfare costs, in designing an appropriate substitute safety net. The available data have not allowed the impacts on supply channels and net results to be tackled by comparing both demand and supply. Similarly, in the absence of detailed information on domestic production, farmgate prices, and agricultural subsidies, alternative safety net scenarios could not be considered.

In future, with greater clarity on the nature of policy reforms under consideration by the government, the analysis can be extended to achieve the more detailed identification of winners and losers, which will be fundamental in designing an appropriate substitute for the PDS. Notwithstanding its

limitations, the current analysis offers the only quantitative, empirically, and behaviourally based estimate to date of the scale of welfare impacts likely to be associated with the withdrawal of the PDS. In the context of a programme that is viewed as an entitlement and a politically difficult but seemingly inevitable need for reform, objective evidence can play an important role in moving the reform agenda forward.

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Data that support the findings of this study are freely available. See Organisation for Statistics and Information Technology (COSIT) and Kurdistan Regional Statistics Office (KRSO), 2012, *Iraq Household Socio-Economic Survey 2012* [Dataset], Ref. IRQ_2012_IHSES_v02_M. World Bank, Microdata Library, Central Microdata Catalogue, Living Standards Measurement Study; Retrieved from http://microdata.worldbank.org/index.php/catalog/2334.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. The origins of Iraq's PDS are in the sanctions era of the 1990s, when the PDS began as a programme to distribute domestically produced food. In 1996, the United Nations agreed to allow food imports under the Oil for Food Programme, and, since then, the PDS has been almost entirely sourced through imports.
2. A family's allocation is determined by the size and composition of the family as registered on the ration card, which can be acquired at a negligible cost.
3. These options include the establishment of a social fund programme and the expansion of a means-targeted cash transfer programme.
4. The model is estimated using the nlsur command in Stata 13.
5. The average share of each ration product in the expenditure of the four ration items included in the model is represented in Supplementary Appendix B.
6. These items are the main components in the expenditure of Egyptian households.
7. For more details about the items included in each group, see Supplementary Appendix C.
8. The estimated parameters from the mixed demand model were removed to save space, but are available upon request.
9. Formulas of computed elasticities are available in Supplementary Appendix D.
10. According to Madden's (1991) rations classification, one may define complementary or substitute rationed goods depending on their price elasticities, as follows. Let $z_k$and z_s denote two quantity-constrained goods, with respective prices of q_k and q_s. z_k and z_s are substitutes if $\left(\delta_{q_k}/\delta_{z_s}\right)(z_s/q_k) < 0$ and complements otherwise. Let x_m be an unconstrained good with unit price p_m, z_k and x_m are substitutes (respectively, complements) if $\left(\delta_{q_k}/\delta_{p_m}\right)(p_m/q_k) > 0$ (respectively, < 0) and $(\delta_{x_m}/\delta_{z_k})\ (z_k/x_m) < 0$ (respectively, > 0) (Ramadan & Thomas, 2011).
11. Although poverty reduction was significantly greater in rural areas than in urban areas between 2007 and 2012, rural poverty rates remain double those in urban areas (World Bank, 2014).

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