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AN EVALUATION OF THE WELFARE IMPACTS OF ELECTRICITY TARIFF REFORMS AND ALTERNATIVE COMPENSATING MECHANISMS IN TAJIKISTAN

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Abstract

This paper analyzes the effects of the energy price reform on household energy consumption in Tajikistan and alternative compensatory mechanisms to support the most vulnerable households. Electricity consumption is low by Western standard, but is also restricted by supply constraints in the from of frequent service interruptions. While improving the service quality would result in an increase in consumption in general, this does not hold for the poorest households because energy tariffs are high relative to their income. The current energy compensation program for the poor is insufficiently targeted. Eligibility is assessed based on reported total household income and the average wage per rayon. Linking the eligibility threshold to the minimum wage and adjusting household income for size would already result in an improvement of the targeting efficiency. Using data from the Tajik Living Standard Survey (2003) we construct a consumption model and simulate alternative compensation mechanisms targeted to support the most vulnerable households. The performance of the current compensation programs for the poorest is compared with alternative options (lifeline tariffs, unified social assistance benefit) and different targeting methods (revised eligibility rules, proxy-means targeting).

Keywords: energy reform, poverty, social assistance, targeting

1. Introduction

Subsidizing energy prices has a long-standing tradition in many countries of the former Soviet Union. The energy sector in these countries is frequently dominated by state-owned enterprises with monopolistic power. The energy delivery at below-cost energy prices puts a heavy burden on the public budget and withholds resources from the energy company to be invested in the production and dissemination of energy services. Different countries use different strategies for reforming the energy sector and creating incentives for the energy producers to improve service delivery. Low domestic energy prices in Tajikistan have been a major drain on public resources and have also resulted in a lack of much-needed investment in the sector. According to World Bank (2004b), the quasi-fiscal deficit of the energy sector in 2003 was estimated to be about 19 percent of GDP. Increasing energy prices is a crucial component of any credible approach to reducing the quasi-fiscal deficit of the energy sector. Unlike for gas, where prices have been raised to near cost recovery levels, electricity prices continue to be heavily subsidized. World Bank (2004b) estimated that electricity prices would have to be increased fourfold to reach cost recovery levels.

Such large increases in electricity prices can be expected to have a substantial impact on the welfare of households, particularly poor households. Although an increase in energy tariffs puts a heavy burden on the budget of poor households, redesigning or cutting subsidies has also potential for positive effects for poor households. Estache et al. (2001) distinguish between micro- and macro-level effects. At the micro level, the increase in energy tariffs may result in an improvement of services, which is also beneficial for the poor. Poor households are willing to pay substantially more for reliable services. At the macro level, a reduction of the (quasi-)fiscal deficit will free public resources that can be better targeted to support poor households.

In this paper we evaluate the likely magnitude and distribution of the direct impact of electricity price increases on households in Tajikistan.[1] In Section 2 we describe the current tariff system and how it has evolved in recent years. In Section 3 we describe the data and the methodology

[1] As well as the direct effect on household incomes, there is also an indirect effect as the higher electricity prices are passed on by producers to other prices in the economy. Incorporating these impacts would obviously result in a higher total impact so that, in this sense, the impacts discussed in the paper should be viewed as lower bounds.

used to estimate electricity consumption. We evaluate the magnitude and distribution of the subsidy implicit in the current tariff system as well as in alternative tariff reform measures, including changes in lifeline limits and both lifeline and above-lifeline tariffs in Section 4. In the absence of an effective direct transfer system, energy price subsidies are often motivated by a desire to protect the real incomes of poor households and enable them to meet basic energy requirements. The current energy compensation mechanism in Tajikistan is described in Section 5. The performance of the current system is compared with alternative targeting methods. Section 6 provides some concluding remarks.

2. The Structure of Electricity Tariffs

In Tajikistan, a single state-owned firm, Barki Tajik, is responsible for the generation and distribution of electricity.[2] Although almost all households have access to the electricity network, the electricity sector has been characterized by supply shortages and poor service quality, outdated technologies, cross-subsidization of residential consumers by industry, large price discounts for “privileged groups” and a widespread tolerance of non-payment of bills. Service quality (e.g. energy rationing) is especially poor in winter and in rural areas where households also rely heavily on traditional energy.[3]

Since 2003 a number of reforms have been introduced. In 2004 the privileged groups were eliminated in two steps: from January 1 the number of categories were reduced to six and from June 1 the remaining categories were to be eliminated. Prior to this, privileged households received discounts ranging from 50-100 percent and these privileged discounts were extended to 213,816 households in electricity (each receiving an average annual subsidy of TS41, to total TS8.9m) and to 117,122 households for gas (each receiving an average subsidy of TS45 for a total of TS5.3m).[4] These subsidies were widely thought to be badly targeted and to dilute the electricity company’s incentives for developing efficient metering and billing mechanisms. In

[2] Since December 2002, Pamir Energy, a private company, has a 25-year concession to generate, transmit and distribute electricity in the Gorno Badakshan Autonomous Oblast (Markandya & Sharma, 2004).

[3] See Klytchnikova (2004) for a detailed discussion on the composition of energy use in urban and rural areas and how it has changed over time.

[4] Privileged groups included World War II veterans of the Tajik forces, family members of veterans, invalid pensioners receiving special merit pensions, military servicemen, judges, prosecutors, custom officials, tax police officials and Chernobyl victims.

addition, lack of total reimbursement of these subsidies by the government to the electricity company exacerbated the financial situation of the energy companies, further reducing their ability to finance much needed investments in generation, distribution, billing and collection activities. There are also concerns that the actual consumption of privileged households was substantially lower than billed in order to boost revenues.

The level and structure of tariffs has also changed substantially since 2002 (Table 1).[5] In 2002 residential consumers were charged a lifeline rate of 0.5 dr/kWh on the first 150 kWh of consumption per month and the above-lifeline tariff was set at 1.1 dr/kWh. In early 2003 the lifeline limit was increased to 250 kWh, the lifeline rate was increased to 1.6 dr/kWh and the above-lifeline rate increased to 2.7dr/ kWh.[6] On June 1, 2003, differential seasonal rates were introduced when the summer rates were decreased to half the winter rates. In spite of these increases, current prices are still substantially below the long-run average incremental cost (LRAIC) of electricity, which has been estimated to be 6.125 dr/kWh (World Bank, 2004b).

[Table 1]

In practice, because of metering and billing problems, the lower lifeline rate is applied to total electricity consumption for many households. Household consumption is based on either metering, or social norms where households are not metered. Around 17 percent of residential consumers (i.e. 155,000 households) do not have meters and are billed according to social norms based on the number of rooms in their house and the capacity of appliances in use. It is widely believed that actual consumption by these households is substantially higher than the amount billed based on norms. For metered households, these meters are generally in poor condition and meter testing and calibration procedures are inefficient. A large number of meters need

[5] The tariff policy is governed by a number of covenants agreed upon with the Asian Development Bank, including the following measures: (i) increase average tariffs for residential consumers from 0.5cents/kWh in 2002 to 0.75cents/kWh by January 2003 and to 1.5cents/kWh by January 2005; (ii) after January 2005, set tariffs at levels sufficient for generating a 6 percent return on average revalued fixed assets in use; and (iii) lifeline consumption of 150kWh/month. These targets have not been met since lifeline rates have increased from 0.5dr/kWh to 1.27dr/kWh (i.e. 41cents/kWh) and lifeline consumption limits have been raised.

[6] The lifeline threshold is fixed at a higher rate of 350kWh/month for households without access to a gas stove. But the numbers qualifying for this higher level are very small and are mainly located in Dushanbe.

replacement due to these deficiencies (e.g. inaccurate registration of consumption with a capacity to register only three-digit consumption, i.e. returning to 000 after 999). [7] In addition, meter tampering and electricity theft is thought to be a widespread problem. However, collection rates have improved to around 92 percent over the first nine months of 2004.

3. Data and Methodology

The data used in this paper are stemming from the Tajik Living Standard Survey 2003. The TLSS 2003 covered 4,160 households and is nationally representative. The sample is selected based on a stratified random probability sample, with the sample stratified according to oblast and urban/rural settlements, and with the share of each strata in the overall sample being in proportion to its share in the total number of households as recorded in the 2000 Census (World Bank, 2004a).

The 2003 TLSS data contain average monthly winter and summer expenditures on market fuels, such as wood, coal, diesel, and other market fuels, but only previous month's expenditures on electricity. Since the survey was conducted in June-July 2003, these expenditures correspond to the consumption of electricity in the spring or early summer. Electricity consumption and expenditures are usually higher during the winter due to increased electricity use for heating and other purposes during the cold period. Since winter electricity expenditures are not available in the survey data, we develop an imputation procedure to predict them based on the available information on the winter and summer expenditures on non-network energy sources.

The imputation procedure uses the difference between the market fuel winter and summer expenditures, and attributes this difference to the higher energy needs during the winter. In order to do this, we assume that the difference in the winter and summer market fuel expenditures can be attributed mainly to the heating needs during the winter. In the subsequent discussion, we refer to this difference and the market fuels expenditures differential. Having calculated this differential for each household that uses market fuels in both the summer and winter, we use

[7] A joint venture with a South Korean firm is manufacturing about 5,000 modern electronic meters per month and 3-5000 are being installed monthly.

multivariate analysis to find correlation between the observable household characteristics with the magnitude of the market fuels expenditure differential. Then, we use the regression coefficients obtained in this procedure to predict winter electricity consumption for households that use electricity for heating. Next, we discuss the details of the procedure and results of the imputation. Chart A1 in the appendix shows schematically the steps we take to obtain the sub-sample for the regression model, as well as the sub-sample for which we impute higher winter electricity expenditures.

Steps in the imputation procedure

First, we calculate the differential between winter and summer expenditures for the following market fuels: wood, coal, diesel and the remaining fuels in the category of “other” energy sources. If fuel prices were collected in the survey, it would be possible to calculate the difference in the actual consumption of energy in the winter and in the summer and express in BTUs or oil equivalents. In such a case, we would obtain the quantities by dividing the stated average monthly summer and winter expenditures on each type of market fuel by its price. Since the price data are not available, we have to proceed with the imputation based on the difference in winter and summer expenditures, rather than quantities. In this approach we assume that the difference in expenditures is attributed to the difference in the physical consumption of fuels due to incremental energy use for heating during the winter, rather than due to seasonal price variation. We calculate the differential for each household that uses at least one type of market fuel in the winter and in the summer as

$$D = \sum_i \left(P_{iw} Q_{iw} - P_{is} Q_{is} \right),$$

where D is the expenditure differential, P_{iw} is the price of fuel i in the winter, P_{is} is the price of fuel i in the summer, Q_{iw} and Q_{is} are the corresponding summer and winter quantities of fuel i; i denotes wood, coal, diesel, and “other” market fuels. Chart 2-a and 2-b show histograms of the calculated expenditure differential for all households with non-missing and non-zero summer and winter market fuel expenditures that use only market fuels for heating. This is the dependent variable in the regression in the next step.

[Chart 1a, 1b]

Second, we run an OLS regression of the expenditure differential on a range of observable household characteristics. We do not include households that use network energy sources (central heating, electricity, or central gas) for heating in this regression, because their winter heating needs can be fulfilled by these network sources. Therefore, for those households we can not assume that the winter-summer market fuels expenditure differential is attributable to the heating consumption, and we exclude them. Table 2 shows the results of this regression for 1,839 rural and 290 urban households.[8] Since the structure of energy consumption is different in Dushanbe and the rest of the country due to differences in the housing structure and energy supply quality, we run separate regressions for the urban and rural areas. In order to control for the regional price and fuel quality differences, we include regional dummies in the regression.

[Table 2]

Regression results are plausible. They indicate that for rural households the strongest correlates between the winter-summer market fuels expenditure differential and the observed characteristics are household size, total income (expenditures), number of rooms, and the type of roofing material. For urban households, the strongest correlates are the household size, total income (expenditures), access to piped water in the dwelling, and the size of the living area. Location, captured by regional dummy variables, is a very important explanatory factor of seasonal market fuel expenditure differential for both rural and urban households. It is not clear why the number of rooms affect the urban and rural households differently, but there may be several reasons for this result. One possibility is that the number of rooms may be capturing other unobservable characteristics.

Third, we use the obtained coefficients to predict electricity expenditures for households that use electricity for heating. We use separate models to predict winter electricity expenditures in

[8] Only about half of the 4,160 households in the survey are included in these regressions, because the remaining households either reported zero or missing market fuels use during the winter or summer, used network energy sources for heating, or reported zero or missing electricity expenditures.

Dushanbe and in the rest of the country due to structural differences in energy consumption between those areas. We also assume that winter and summer electricity expenditures are equal for households that do not use electricity for heating. *This is a crucial assumption that needs to be kept in mind when interpreting summary statistics for the entire population (Table 3). We are able to justify making the imputation only for a small portion of the total survey sample, i.e. households that use electricity for heating.* Charts 2-a and 2-b show the cumulative density functions for the predicted winter and actual summer electricity expenditures for the rural and urban households that are included in the imputation procedure.

[Table 3]
[Chart 2-a, 2-b]

Using this approach, we predict the monthly winter electricity expenditures for households outside of Dushanbe that use electricity for heating. We do this by adding the predicted difference, using coefficients from Model 1 for rural households (Table 2), to their stated actual summer electricity expenditures. Prior to that, we make an adjustment to the predicted incremental winter electricity expenditures. We calculate the ratio of average summer energy expenditures to the average summer electricity expenditures and then divide the predicted expenditures increase by this ratio. This is necessary in order to adjust for the difference in fuel prices. For Dushanbe households, we use coefficients obtained from Model 2 and follow the same procedures as for the rural households.[9] Table 3 shows the actual average summer and winter market fuel expenditures, and the actual summer and predicted winter electricity expenditures that we obtain.

Having obtained predicted winter electricity expenditures, we apply the prevalent tariff structure at the time of the survey to calculate the quantity of electricity consumed using the information on the imputed winter and actual summer expenditures. Physical electricity consumption is calculated by using expenditure data and applying the tariff structure prevalent at the time to

[9] Ideally, we would like to make a prediction for the households in Dushanbe using a model that is based on observations only from Dushanbe, but then the sample size in Model 2 is too small. Only 44 households in Dushanbe report winter and summer market fuels use, which are necessary for constructing the dependent variable in the regression.

calculate quantities. In May, 2003 winter and summer tariff was 1.6 dr/kWh for the lower block, and 2.7 dr/kWh for the upper block, with the threshold at 250 kWh. The survey was conducted in June, 2003, and questions referred to previous month's electricity consumption. Tables 4-a and 4-b show the average calculated monthly electricity consumption for the rural and urban households with and without using household weights. The reported averages are only for households with non-zero electricity consumption. The imputed winter electricity consumption exceeds summer consumption only for those households that use electricity for heating, and they are located predominantly in urban areas.

[Table 4-a, 4-b]

4. Impact of Alternative Tariff Structures

Reducing the quasi-fiscal electricity deficit will require a substantial increase in the average tariff level facing households. However, such an increase can be achieved by a number of different tariff structures (i.e. different sets of lifeline limits, lifeline tariffs and above-lifeline tariffs) and these different structures can distribute the burden of higher tariffs differently across households. In this section we consider a number of alternative structures and evaluate their implications for the magnitude and distribution of the welfare impact as well as tariff revenue.

Our *baseline* scenario reflects the tariff structure as of 2004 (see Table 1). From this baseline, we consider a number of alternative structures (Table 5). Firstly, in *Scenario 1*, we consider the implications of differentiating and lowering the lifeline limit to 100 kWh in summer and 200 in winter, doubling lifeline rates and increasing above-lifeline rates to near cost-recovery level. In *Scenario 2*, we use the same rates as Scenario 1 but now the lifeline limits are applied only to households with total electricity consumption below the limits. In *Scenario 3,* we examine the implications of adding a targeted cash transfer program to Scenario 1.

[Table 5]

To calculate the impact of tariff reforms on household income, we use the information available in the Tajikistan Living Standards Survey for 2003 (TLSS2003). We apply the tariff structure of each scenario to each household's electricity consumption to calculate electricity expenditures. These expenditures are then compared to the expenditures that would be incurred if prices were at cost recovery levels. The difference gives the subsidy implicit in each tariff structure. We also compare electricity expenditures under each scenario to that under the baseline scenario to calculate the income effect of switching from the baseline to the alternative scenarios.

Note that the above approach implicitly assumes that household electricity consumption is constant in the face of substantial price increases. The resulting income effects would be "exact" measures if households were currently rationed and their willingness to pay for current levels of consumption were above the cost-recovery price.[10] However, more generally, households can respond to higher prices by reducing electricity consumption. One expects responses to be greater in the medium run as households purchase more energy efficient products and/or switch to relatively cheaper sources of energy. In this case, one should interpret our estimated income effects as "first-order" estimates and thus upper-bounds on the true estimate.

Table 6 presents the magnitude and distributional impact of alternative tariff structures. The top panel presents the subsidy implicit in each structure as well as the effect on household income and government revenue of switching from the current structure to the alternative scenarios. The first column shows the calculations for the existing structure. On average, the subsidy implicit in the existing system is equivalent to 6.8 percent of household income or 3.7 percent of GDP. The highest impact from a move to cost-recovery prices is for the bottom quintile, which would experience an 8.2 percent decrease in real income. This compares to a lower 5.9 percent decrease for the top quintile. Note that, although the existing subsidy distribution is progressive in that the bottom quintiles receive the largest subsidy in percentage terms, the results in the second panel highlight the fact that the existing subsidies are badly targeted with each quintile

[10] Interestingly enough, World Bank (2004b, p1 and p50) suggests that household electricity consumption may in fact be increasing since 2001 in spite of substantial price increases. It is also the case that households, particularly those residing outside of Dushanbe, face heavy rationing of electricity supplies with supplies being available only for a few hours in the morning and evening.

receiving similar shares of the total subsidy. Equivalently, each quintile would share the absolute burden of a price increase equally. The progressiveness of the current subsidy system reflects the relatively low incomes of the bottom quintiles as opposed to higher absolute subsidies. For example, income data in TLSS2003 (based on total per capita household consumption adjusted for internal price variations) indicate that per capita incomes of the middle and top quintiles are 2.1 and 5.8 times that of the bottom quintile. To get a sense of how badly targeted these subsidies are, a purely random allocation of subsidies across the population (or a so-called “helicopter-drop” or “untargeted” approach) would result in a similar targeting outcome with each quintile receiving 20 percent of the total subsidy.

[Table 6]

The next three columns present the income impacts of the various reform scenarios. One approach often suggested for reducing subsidy levels while maintaining their progressiveness is to increase all tariffs and retain lifeline limits but at reduced levels. The second column shows the magnitude and distribution of the subsidy when the lifeline tariff rates are doubled, monthly lifeline limits reduced to 100 kWh and 200 kWh in summer and winter respectively, and above lifeline rates both increased to the cost-recovery level of 6 dr/kWh. The subsidy implicit in this tariff schedule decreases to 1.9 percent, falling from 2.3 percent for the lowest quintile to 1.7 percent for the highest. This reform results, on average, in a 4.9 percent decrease in household income relative to the existing structure, with the decrease being greater for the bottom quintile (6.0 percent) than for the top quintile (4.2 percent). However, the bottom panel indicates that, as with the existing tariff structure, the (lower) subsidy implicit in this tariff structure would not be better targeted than under the existing structure.

The third column of results presents the impact of applying the lower lifeline limits only to those households with monthly consumption below these limits. This type of reform is often suggested as a way of improving the targeting of the subsidy while simultaneously decreasing its magnitude. The average subsidy falls to substantially less than one percent of household incomes and the subsidy implicit in this tariff structure is similar across quintiles. The average income decrease in moving from the baseline scenario is 6.7 percent and this is highest for the lower quintiles, at 8.1 percent for the bottom quintile and 5.8 percent for the top quintile. In addition, targeting of the subsidy worsens in that the middle-income households receive the highest subsidy share while each of the bottom two quintiles receive less than 20 percent of the total subsidy.

The above results highlight the fact that even targeted lifeline tariffs are not a very effective approach to protecting the incomes of poor households, with a substantial proportion of the total subsidy bill leaking to higher income households. It is therefore likely that a well-designed and implemented social safety net system would be a more cost-effective approach. Although a safety net program dedicated to protecting the poorest households from energy price increases was introduced in 2003, namely, the Energy Compensation Mechanism, little is know about its actual effectiveness and a number of its design and implementation features have been seen as not being conducive to good targeting.

5. Compensating poor households

A reduction or cut in energy subsidies (which is synonymous with increasing the electricity tariffs) is detrimental for poor households, at least in the short run, notwithstanding the stylized facts about energy subsidies as elaborated by Estache et.al. (2001). They argue that (i) utility subsidies mainly benefit the middle class, and (ii) the main effect of subsidies is an increase in inequality rather than a decrease. Although poor households may receive a small share of the subsidies in absolute terms, they form a significant part of the household budget and enable poor households to receive energy services without having to sacrifice their income (World Bank, 2000).

Households are currently compensated for energy expenditures up to a certain threshold limit – based on actual consumption if metered or norms if not. For the electricity compensation, this threshold is fixed at 100 kWh/month per household in summer (April to September) and 150 kWh/month in winter (October to March), which is compensated at 0.8dr/kWh in summer and 1.6dr/kWh in winter. Therefore, the maximum transfer a household can receive is TS0.8 per month in summer and TS2.4 per month in winter (equivalent to TS2.4 and TS7.2 per quarter respectively). Where gas is not metered, this threshold is determined on a per person basis (up to a maximum of 6 persons per household), fixed at 10cm/month per person in summer and 12cm in winter.[11] Therefore, based on an average household size of five members, this implies norms of 50cm/month per household in summer and 60cm in winter. This is substantially higher than when gas is metered, where the limit is fixed at the at 20cm/month per household in summer and 30cm in winter.[12] In 2003, TS 12 million were allocated in the budget for this compensation (2004: TS 20 million).

Based on the beneficiary list received from the local offices, the MOF transfers the resources based on threshold levels to local *Hukumats*, including the coverage of operational expenses. These funds are then transferred to the energy companies on the basis of payment settlement documents submitted by these companies. The household bill is appropriately discounted and any unused discounts (e.g. due to lower than threshold consumption levels) are meant to be offset against future transfers from the MOF. Funds are transferred to the energy companies quarterly.

Table 7 presents data on the number of beneficiaries and the total compensation they receive. The number of beneficiaries of electricity compensation is just over half of all subscribers and the total electricity compensation decreases from the first to the second quarter reflecting both lower electricity in the latter summer months and the lower threshold limit in summer. The numbers for average compensated consumption also suggest that, whereas in winter the consumption of these households is at (or above) the threshold, in summer these households consume substantially below the threshold. Table 8 shows the same data for gas and the pattern

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[11] Apparently those without gas meters can in principle receive the compensation in cash, but this option is not used since it is not advertised. In addition, in principle, where supplies are interrupted the payment should also be made in cash and based on actual consumption. However, given that most households are rationed, with gas being supplied for a few hours in the morning and evening, this would require most transfers to be in cash. This is obviously not the case in practice. Reflecting the fact that compensated consumption based on norms are probably well above actual consumption, it is probably beneficial for the government from a net revenue perspective to cover the cost of metering for poor households.

[12] This higher limit presumably reflects the fact that non-metered households (which constitute over 90 percent of households with gas connections) will consume more than metered households. These households also face higher norms as a basis for billing by companies.

is similar with around 45 percent of subscribers being beneficiaries and gas compensation payments decreasing during the summer months.

[Table 7]

[Table 8]

Household eligibility is linked to average wage levels in the region or town. A household is eligible if its total household income is below the average rayon salary. Targeting is done by means-testing. An applicant has to provide all the relevant documents confirming his assets, income and family size. Application is possible with the local mahalla, housing committees (urban areas) or the jamoat commission. Although there is no quantitative evidence in the form of survey data (the TLSS 2003 did not cover the new compensation), there are indications that the compensations are not well targeted. Currently, total household income is compared to the average wage level in the rayon. There is no adjustment for family size. Therefore, smaller households qualify more easily because the chance that their total income is below the average wage level is higher than in larger families, where more people may contribute to the total family income.

Changing the eligibility rules

According to a proposal currently prepared by the Government, a family will be eligible for energy compensation if its total income per capita does not exceed twice the minimum wage level.[13] Analyzing the change of eligibility rules using data from the TLSS 2003 shows that targeting would not significantly improve under the new rules. The targeting errors would still be considerable. Under the current eligibility rules, 18% of all households qualify for the energy compensation when simulated with the data. There is not much variation between poor and rich households. 23% of the poorest ten percent households are entitled for a compensation versus 19% of the richest ten percent. Taking into account the proposed changes, targeting efficiency increases slightly. A little less than half of all households would now qualify for the compensation. Slightly more poor households would be eligible. However, although the

[13] The minimum wage was 7 TS in 2004.

proposed change of the eligibility rules will improve the targeting efficiency, the remaining targeting error is still considerable. [14]

Changing the targeting method

One major drawback of the current targeting system is the use of predominantly formal income for the eligibility assessment. However, formal income is not a very good welfare indicator in Tajikistan. An alternative targeting method is based on proxy-means-testing, which is becoming a more common approach to selecting program beneficiaries.

Here, in order to highlight the potential gains from having an effective targeting method, we simulate the impact of introducing such a program together with the above-discussed price reforms.

The final column of Table 6 presents the net impact on households' incomes as a result of adding a targeted cash transfer program to the tariff and limit reforms under reform Scenario 1. Using characteristics such as household size and composition, age and education of household head, housing characteristics and household assets, all which are typically highly correlated with household income, it is possible to target the benefit to low income households.[15] Under this so-called proxy-means targeted program, nearly 25 percent of households are beneficiaries and the total transfer budget is 0.2 percent of GDP. The average transfer is TS 48 annually, equivalent to 1.5 percent of the average income of the poorest two quintiles. Like all other practical approaches to targeting, this approach is imperfect in the sense that there is still leakage to non-poor households, but 85 percent of beneficiary households fall into the lowest two quintiles.[16]

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[14] See Klytchnikova, I. (2004), *Note on Poverty and Energy Consumption*, Background paper for the PAU, The World Bank.

[15] See Appendix A for a more detailed discussion of the proxy-means approach to targeting and how we simulate its introduction.

[16] Note that, although targeting under this approach is imperfect, the targeting performance is still relatively good compared to experiences in other developing countries—see Coady, Grosh and Hoddinott (2004) for a review of the targeting performance of such programs. Although this performance may be improved through refining the approach used here, it should also be recognized that implementation problems could substantially worsen performance.

Under such a system, relative to the above approaches, lower income households are provided a greater degree of protection from the adverse income effects of reforms and the targeting of the net subsidy improves. The lowest income quintile still receives a 3.4 percent net subsidy, compared to around 2 percent or less for the top two quintiles and the reforms now decrease their incomes by only 4.8 percent compared to nearly 6-8 percent under the earlier reforms. In addition, the lowest quintile now receives 24 percent of total net benefits, compared to around 20 percent or less under the other reform programs. This protection comes at a revenue cost of 6 percentage points since Scenario 3 results in a 65 percent reduction in the quasi-fiscal deficit compared to the 71 percent reduction in the absence of a compensating transfer program under Scenario 1. Of course, increasing the size of the cash transfer would further improve the distributional impact of the reforms, even if this were financed by further scaling up the tariff structure.

While it may be possible to refine the above proxy-means targeting approach to improve the programs targeting performance even more (e.g. by introducing elements of geographic, community or self targeting) it should also be recognized that the simulation implicitly assumes perfect implementation and empirical evidence clearly indicates that implementation can be as important as design in determining targeting performance. But the central message is clear: there can be substantial cost-effectiveness gains from using a well-designed and implemented safety net program in place of the standard approach of lifeline tariffs. In addition, the introduction of such a direct compensation program allows electricity companies to follow a more efficient pricing and operational structure. Higher prices also promote more efficient energy consumption patterns by both households and other users by reducing unnecessary use and switching to alternative cheaper sources. However, before moving to cash transfers, the additional administrative costs and implementation problems need to be considered, as well as the current poor payment record due to the low number of metered households. It also makes sense to incorporate such a program within a well-integrated safety net system so as to avoid incurring the fixed costs associated with setting up new programs, duplication across programs and inconsistencies in targeting approaches. However, the time and resources to develop an efficient a direct transfer mechanism that effectively reaches the poorest households needs to be balanced with the short-term adverse impact of price increases. Thus, a gradual approach to price increases is probably desirable and lifeline tariffs could also serve as an important transitional measure.

6. Concluding Remarks

The main focus of the present paper has been to evaluate the likely impact of increasing electricity prices on household welfare. In this context, we have also looked at alternative mechanisms for mitigating the adverse impacts on the poorest households. Our analysis suggests that the approach of lifeline tariffs, even if targeted, is not a very effective way of protecting the poor since they result in substantial leakage of benefits to higher income households. A more effective way of protecting the poor would be to use a comprehensive safety net system, which explicitly targets poor households. To the extent that it takes time to develop such a system, a gradual approach to increasing prices in combination with a system of lifeline tariffs is probably desirable.

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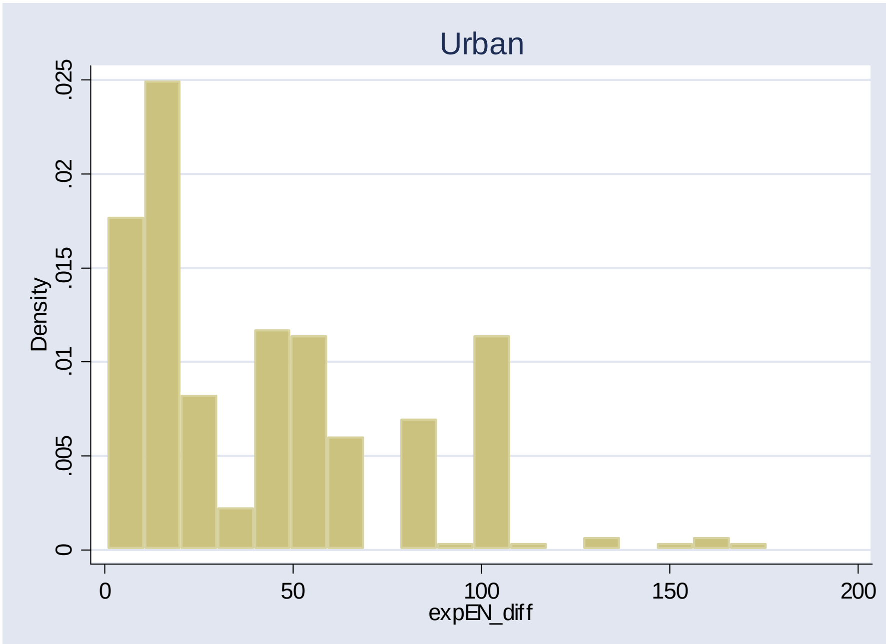
Table 1. Evolution of Electricity Tariff Structure in Tajikistan (all rates in dr/kWh)

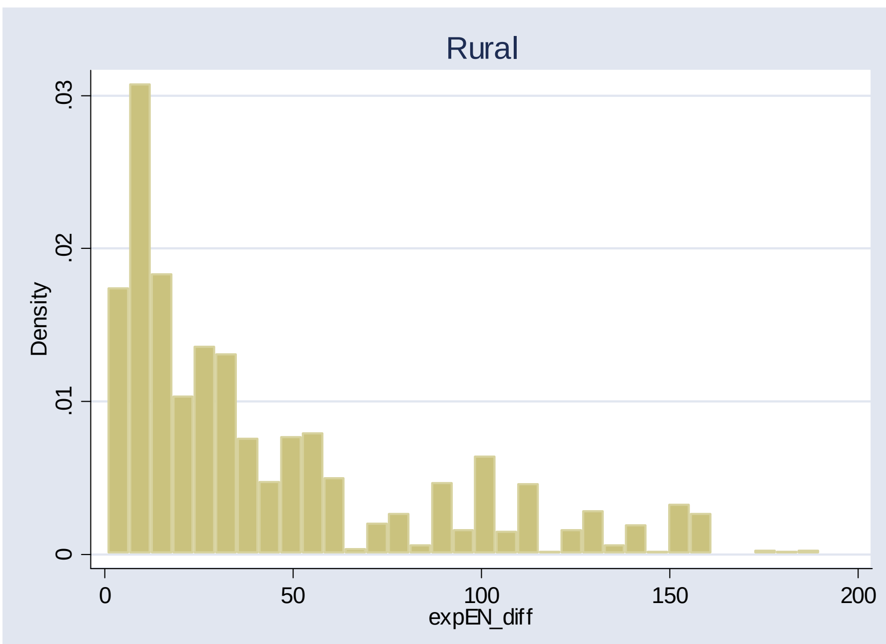
	2002	*2003 (pre-June)*	*2003 (post-June)*	*2004*
Lifeline Limit (household/month)	150	250	250	250
Lifeline Rates				
- *Summer*	0.5	1.6	0.8	0.8
- *Winter*	0.5	1.6	1.6	1.6
Above-Lifeline				
- *Summer*	1.10	2.7	1.35	1.35
- *Winter*	1.10	2.7	2.7	2.7

Note: Note that World Bank (2004, Table 1.6, p8) says that 2003 tariffs were 1.27 and 2.14

Charts 1-a and 1-b: Winter-Summer Expenditures Differential (sub-sample of households that use no central heat, electricity, or central gas for heating)



N=331 households (5 observations exceeding 200 not shown here).



N=2,157 households (60 observations exceeding 200 not shown here)

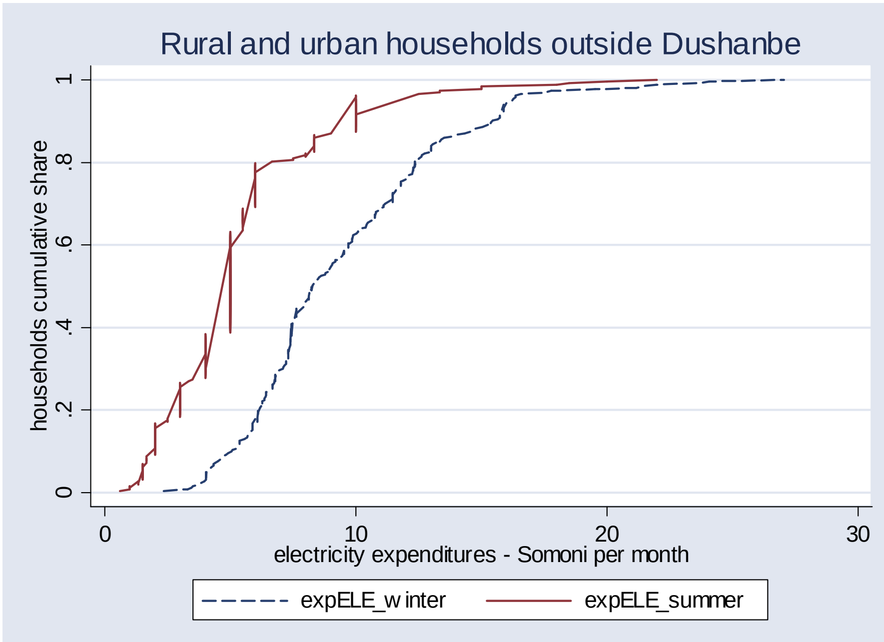
Note: for 58 households, average monthly summer market fuel expenditures exceed those during the winter, therefore the difference is negative. We excluded these households from the analysis.
Source: calculated from 2003 TLSS data. Unweighted data.

Table 2. Regression results for the model of winter and summer energy expenditure differential

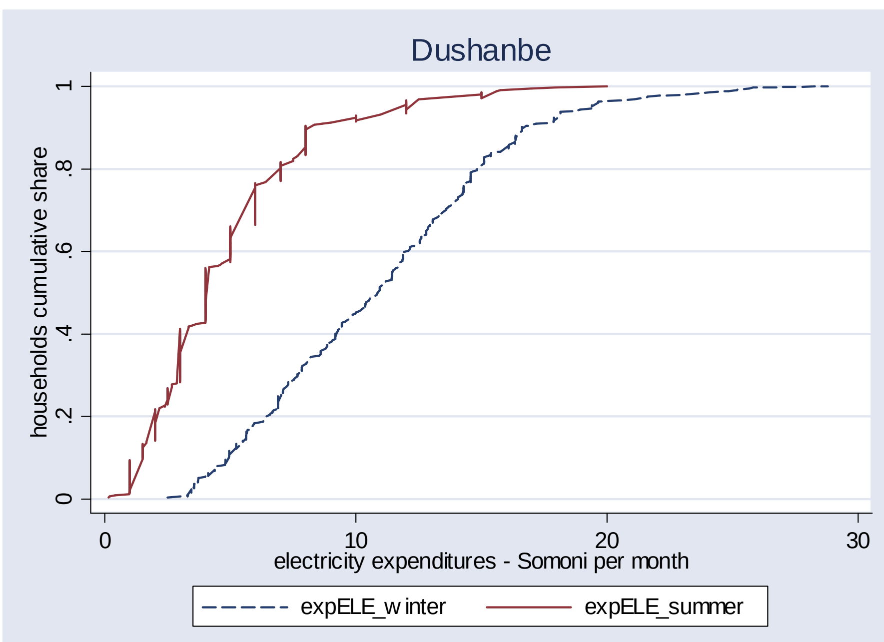
	Model 1: rural households		Model 2: urban households	
	Coefficient	t-statistic	Coefficient	t-statistic
Household size	3.47	(7.37)***	2.58	(2.49)***
Total expenditures (Somoni/month)	0.08	(11.15)***	0.12	(6.86)***
Number of rooms	-6.66	(-5.82)***	1.84	(0.79)
Housing, demographic and regional dummy variables:				
Piped water	4.13	(1.44)	17.42	(2.94)***
Walls made out of mud	0.87	(0.27)		
Roof made out of mud	-10.33	(-3.14)***		
Access to irrigated land	2.26	(0.77)		
Household head is female	7.38	(2.19)**	2.77	(0.48)
House built after 1990	5.87	(2.07)**	7.47	(1.11)
Living area less than 40 sq.m.	-3.42	(-1.06)	-15.9	(-2.52)***
GBAO	-22.37	(-4.39)***	-40.69	(-4.81)***
Sugd	-6.37	(-1.47)	-20.49	(-2.49)**
Khatlon	-30.8	(-8.56)***	-37.40	(-5.28)***
RRS (omitted in Model 1)			-30.46	(-3.84)**
Dushanbe (omitted in both models)				
constant	37.42	(6.16)***	6.79	(0.59)
R-sq	0.23		0.37	
N	1,835		290	

Notes:
1/ Estimated using OLS.
2/ dependent variable is the difference in winter and summer energy expenditures in Somoni.
3/ omitted regional dummy is GBAO in Model 1 (and no observations for Dushanbe), and Dushanbe in Model 2.
4/ *** denotes significance at 1 percent level, ** at 5 percent, and * at 10 percent.
Source:
Calculated from 2003 TLSS data.

Appendix Charts 2-a and 2-b: Cumulative distribution function of average summer (actual) and winter (imputed) monthly electricity expenditures



Note: prediction includes only those households that use electricity for heating and live in rural areas and cities/towns other than Dushanbe
N=263, of which 58 are rural households, and 205 urban (non-Dushanbe)



Note: prediction only includes Dushanbe households that use electricity for heating
N=354

Table 3. Summer and winter monthly energy and electricity expenditures

	Energy expenditures		Electricity expenditures		N 1/
	Summer (actual)	Winter (actual)	Summer (actual)	Winter (imputed)	
(Somoni/month)					
Rural	16.3	60.0	3.3	3.4	2,364
Urban	4.1	16.7	2.9	5.1	1,230
Total	12.1	45.2	3.1	4.0	3,593
(As percent of total monthly household expenditures)					
Rural	5.8%	23.7%	1.6%	1.6%	2,353
Urban	1.5%	6.8%	1.5%	2.4%	1,230
Total	4.3%	17.9%	1.6%	1.9%	3,582
(Somoni/month)					
Do not heat with electricity	14.5	53.3	3.1	3.1	2,900
Heat with electricity	2.2	11.4	3.2	7.5	694
Total	12.1	45.2	3.1	4.0	3,593
(As percent of total monthly household expenditures)					
Do not heat with electricity	5.1%	20.9%	1.6%	1.6%	2,890
Heat with electricity	1.1%	5.3%	1.6%	3.9%	692
Total	4.3%	17.9%	1.6%	1.9%	3,582

Notes:
1/ Number of observations for the winter electricity expenditures. This is lower than 4,160 observations in the sample because of missing values obtained for households for which the dependent variable for prediction could not be created. See model description. Number of observations for other columns in this table is 4,160.
Source:
Calculated from 2003 TLSS data. Weighted data.

Table 4-a. Actual and imputed monthly household electricity consumption (unweighted data)

	Electricity consumption, kWh/month		
	summer (actual) 1/	winter (imputed)	N, summer (winter) 2/
Rural	213	219	2,197 (2,267)
Urban	224	305	1,096 (1,349)
Do not heat with electricity	206	213	2,694 (2,734)
Heat with electricity	259	370	599 (882)
Total	216	251	3,293 (3,616)

Notes:
1/ The "actual" electricity consumption is calculated by using expenditure data and applying the tariff structure prevalent at the time to calculate quantities. In May, 2003 winter and summer tariff was 1.6 dr/kWh for the lower block, and 2.7 dr/kWh for the upper block, with the threshold at 250 kWh. The survey was conducted in June, 2003, and questions referred to previous month's electricity consumption.
2/ The remaining households report missing electricity expenditures, hence consumption can not be calculated for them.
Source: Calculated (summer) and imputed (winter) using 2003 TLSS data. Unweighted data.

Table 4-b. Actual and imputed monthly household electricity consumption (weighted data)

	Electricity consumption, kWh/month	
	summer (actual) 1/	winter (imputed)
Rural	179	190
Urban	160	256
Do not heat with electricity	174	178
Heat with electricity	167	361
Total	173	213

Note: see notes to Table 4-a. Weighted data.

Table 5. Electricity Tariff Structure in Tajikistan (all rates in dr/kWh) – different scenarios

	Baseline	*Scenario 1 (Higher tariffs, lower untargeted limits)*	*Scenario 2 (Higher tariffs, lower targeted limits)*	*Scenario 3 (Higher tariffs, lower untargeted limits, cash)*
Lifeline Limit (household/month)	250	100 (Summer) 200 (Winter)	<100 (Summer) <200 (Winter)	100(Summer) 200(Winter)
Lifeline Rates				
- *Summer*	0.8	1.6	1.6	1.6
- *Winter*	1.6	3.2	3.2	3.2
Above-Lifeline				
- *Summer*	1.35	6.0	6.0	6.0
- *Winter*	2.70	6.0	6.0	6.0

Note: According to our calculations using TLSS2003, approximately 50 percent and 65 percent of households have monthly total electricity consumption greater than 250 kWh in summer and winter respectively. Similarly, 75 percent of households have electricity consumption greater than 100 kWh and 200 kWh in summer and winter respectively.

Table 6. Distribution of Electricity Tariff Reform Burden

Consumption Quintiles	Existing Tariff Structure	Tariff and Limit Reforms	Reforms with Targeted Limits	Reforms with Cash Transfers
Implicit subsidy as percent of income				
Lowest	8.2	2.3 (6.0)	0.2 (8.1)	3.4 (4.8)
2nd quintile	7.1	2.0 (5.1)	0.2 (7.0)	2.7 (4.4)
3rd quintile	6.6	1.9 (4.7)	0.2 (6.5)	2.2 (4.4)
4th quintile	6.0	1.8 (4.2)	0.1 (5.9)	2.0 (4.0)
Highest	5.9	1.7 (4.2)	0.1 (5.8)	1.8 (4.1)
All	6.8	1.9 (4.9)	0.2 (6.7)	2.4 (4.4)
Subsidy/GDP	3.7	1.1	0.1	1.3
Reduction (percent)		71.2	97.7	65.0
Share of total implicit subsidy (in percent)				
Lowest	20.3	19.9	19.9	24.0
2nd quintile	20.0	20.0	18.9	21.5
3rd quintile	20.1	20.4	24.8	19.3
4th quintile	19.4	20.0	18.5	18.1
Highest	20.1	19.7	17.8	17.1

Note: Summer electricity expenditures are taken directly from the 2003 Tajikistan Living Standards Survey and quantities derived by applying the tariff schedule for the relevant period. Winter expenditures are estimated using a simple demand model. The resulting quantities are scaled up to match the residential electricity use available from utility data. The cost recovery tariff (CRT) is taken to be SM 0.06 /kWh. The average tariff under the existing tariff structure is approximately SM 0.0154/kWh, equivalent to nearly 26 percent of CRT.

Table 7. Electricity Consumption and ECM Compensation

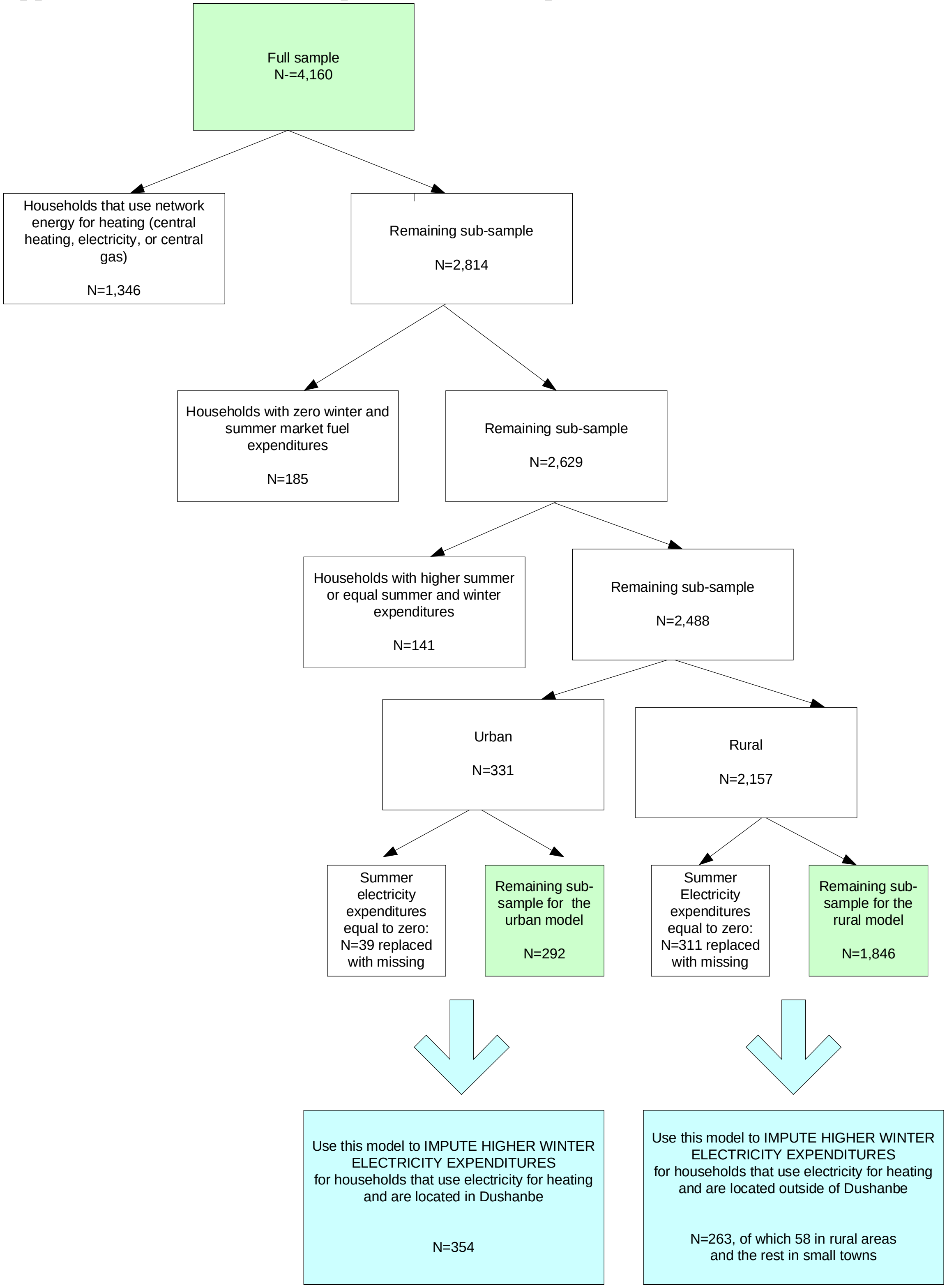
	2004		
	Q1	Q2	Q3
Subscribers (H)	999,788	986,796	
Beneficiaries (H)	527,198	560,846	539,648
percent of subscribers	52.7	56.8	
Compensation (S)	3,756,738	1,803,865	1,313,076
Average transfer (S/H per quarter)	7.13	3.22	2.43
Maximum S/H per quarter	7.20	4.80	4.80
Lifeline threshold (kWh/quarter)	450.0	300.0	300.0
Average compensated consumption/household per quarter (kWh)	445.4	201.0	152.1

Table 8. Gas Consumption and ECM Compensation

	2004		
	Q1	Q2	Q3
Subscribers (H)	284,866	284,866	
Subscribers (P)	768,019	768,019	
Beneficiaries (P)	357,415	357,415	359,889
Percent of subscribers	46.5	46.5	
Compensation (S)	2,235,195	1,835,165	1,968,397
Average transfer (S/P per quarter)	6.25	5.13	5.47
Lifeline threshold (cm/quarter)			
- Metered	90.0	60.0	60.0
- Nonmetered (6 persons)	180.0	150.0	150.0

Note: S=Somoni, H=Households, P=Persons. Total compensation in 2003 was TS3.2 million. Where gas is not metered, the lifeline threshold is determined on a per person basis (up to a maximum of 6 persons per household), fixed at 10cm/month per person in summer and 12cm in winter. Where gas is metered, the limit is fixed at the household level, at 20cm in summer and 30cm in winter. On average, only around 5 percent of beneficiary households with access to gas are metered.

Appendix Chart A1: Sub-Sample Used in the Imputation Procedure



Appendix

Design, Implementation and Performance of Proxy-Means Targeting

The use of proxy-means targeting methods is becoming a more common approach to selecting program beneficiaries. This is a statistical approach, which starts by identifying household characteristics that are highly correlated with poverty. Each of these characteristics is given a numerical *weight* and this is used to calculate a household *score*. This score is then used as the basis for determining eligibility.

For example, consider the case where three household characteristics are used: a binary variable indicating whether or not the house is made of brick (H), a continuous variable capturing the years of education of the head of household (E), and a binary variable indicating whether or not the head of household is female (F). Using a national household survey, one can regress, say, per capita household consumption on these variables. The coefficient estimates (say, h,e and f) are then used to calculate a household score (S) as:

$$S = c + h*H + e*E + f*F$$

where c is a constant in the regression. A high score indicates a high per capita consumption level. If the program is expected to cover the poorest 40 percent of households, then households that fall within the lowest 40 percent of households based on S are deemed eligible to participate in the program.

In practice, the model used to calculate the score (e.g. the types and number of household characteristics used to estimate the weights and the statistical procedure used) can be much more sophisticated than the example given above. But a key ingredient to applying the proxy means approach is access to a national household survey data set that contains information on an acceptable indicator of household welfare (e.g. household consumption) as well as a range of household characteristics that are correlated with poverty.

As an illustration, we construct a simple proxy means method based on the Tajikistan Living Standards Survey for 2003. We use per capita household consumption as our welfare indicator. This is regressed on a range of household characteristics to derive a set of regression coefficients that are used as weights. The variables included were household demographics (i.e. household size, and a range of binary variables indicating the number of family members in different age groups), car ownership, access to piped water, housing characteristics (i.e. when constructed, materials used, area and whether shared), whether the head of household is female, the share of working aged members that are unemployed, education levels of head and secondary head of household. By multiplying each of the variables by the associated coefficient and adding across these products, we construct a score for each household – this can be interpreted as predicted household consumption per capita. We then select the poorest 40 percent of households, based on this score, as program beneficiaries.

Because the score is not perfectly correlated with household per capita consumption (our indicator of true welfare), this selection process will not identify the poorest households perfectly. In other words, some poor households (i.e. those in the bottom 40 percent of households based on actual household per capita consumption) will be wrongly included (i.e. “errors of omission”, “type-I errors” or “under-coverage”) while some non-poor households will be included (i.e. “errors of inclusion”, “type-II errors” or “leakage”). To get a sense of the magnitude of these errors, based on the simple model, in Table C1 we present the distribution of beneficiaries across households categorized according to actual household per capita consumption. We consider two different proxy-means models, one that does not include binary district variables (Model I) and one that does (Model II). The latter can be interpreted as indirectly introducing and element of geographic targeting into the beneficiary selection process.

We compare the targeting performance under these alternatives to the targeting outcome when selection is based on per capita household monetary income (as discussed in the main body of the report – see Table 3, Simulation 3). The numbers in Table C1 give the share of total program beneficiaries falling within each quintile, with quintiles based on per capita household consumption. The first column indicates that when beneficiary status is determined based on per capita monetary income then 53 percent of beneficiaries fall within the bottom two quintiles. Compare this to a purely random selection process where one would expect 40 percent of beneficiaries to fall into the bottom two quintiles. Note also the high percentage of leakage to higher quintiles with, for example, nearly 14 percent of beneficiary households falling within the top quintile. The final two columns show what happens under the two proxy means alternatives. In both cases the share of beneficiaries falling within the top quintiles decreases and the share falling within the bottom quintiles increases, i.e. under-coverage of the poorest groups decreases and leakage to the richest groups decreases. In the absence of any geographic targeting, 61 percent of beneficiaries fall within the bottom two quintiles compared to an equivalent 66 percent when geographic targeting is used.

Although the proxy means targeting method simulated above improves targeting outcomes relative to a monetary income based approach, there is still leakage to the higher consumption quintiles and one may think that it should be possible to at least eliminate leakage to the highest consumption quintiles. One way of accomplishing this is to combine the proxy means approach with other approaches. For example, one might introduce an element of self-selection into the application process by requiring households to make an office application and possibly locate offices in the poorest rural and urban areas. Alternatively, one might introduce a second qualifying hurdle by having program officials make a home visit and leaving open the possibility that households selected by the proxy means score could be dropped if the visit suggested that they were clearly much better off than predicted by the model. Or one might introduce more refined geographic targeting of the budget by varying the proportion of households that could be deemed eligible across districts based on known district poverty rates. And, of course, the proxy means model itself may be developed in a more sophisticated manner.

One should also be aware that the above simulations implicitly assume that the targeting approach is effectively implemented in practice. This requires that the application of the eligibility rule be consistently applied, that the information provided by applicants be verified, and that poor households are aware of the existence of the program and the procedures for applying. The need for verification also places limitations on the household characteristics that can be included in the underlying proxy means model; these variables must be observable and not easily manipulated by households in order to gain entry to the program. International evidence has shown that the variation in targeting performance across poverty programs is as much due to poor implementation of the chosen targeting method as to the actual choice of method (Coady, Grosh and Hoddinott, 2004).

Table A1. Performance of Proxy-Means Targeting

Per Capita Consumption Quintiles	Per Capita Monetary Income	Model I (No district variables)	Model II (Including district variables)
Bottom quintile	0.306	0.357	0.411
2nd quintile	0.224	0.251	0.246
3rd quintile	0.188	0.182	0.176
4th quintile	0.143	0.123	0.101
Top quintile	0.139	0.088	0.066

Note: Numbers give proportion of program beneficiaries falling within each consumption quintile. Across all simulations, approximately 40 percent of households were classified as beneficiaries.
Source: Numbers generated based on simulations of selection rules using the TLSS 2003.

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