

## **UC Santa Barbara**

### **Other Recent Work**

#### **Title**

Missing Rice in the Philippines: Measurement and Meaning

#### **Permalink**

<https://escholarship.org/uc/item/0w42h334>

#### **Authors**

Mehta, Aashish

Jha, Shikha

#### **Publication Date**

2010-08-09

Peer reviewed

# Missing rice in the Philippines: Measurement and Meaning

Aashish Mehta<sup>\*,a</sup>, Shikha Jha<sup>a,1</sup>

<sup>a</sup> *University of California-Santa Barbara,*

<sup>b</sup> *Asian Development Bank*

---

## Abstract

This paper provides an empirical and theoretical analysis of theft from opaque food subsidy schemes in developing economies. Some 48% of the subsidized rice distributed in the Philippines in 2006 does not show up in household surveys. Pilferage is suspected, and we introduce several new robustness tests that rule out alternative interpretations of this finding. We argue that finding pilferage in an opaque system does not simply imply that redistribution is costly, as the literature has recognized. It also implies that reducing the amount of product pushed into the distribution system should reduce pilferage one-for-one, and that such reductions and transparency improvements should unambiguously improve consumer and taxpayer welfare. In contrast, reductions in the price subsidy may not be welfare enhancing.

*Key words:* Corruption, Consumer subsidy

---

## 1. Introduction

Food prices and hunger rose world-wide between 2003 and 2008 (FAO, 2009) and the risk of food price spikes remains high (Timmer, 2010). Governments around the developing world are under pressure to keep staples affordable, but face fiscal costs that rise with food prices. Ensuring that subsidies reach their intended beneficiaries at the lowest possible cost is therefore crucial.

Unfortunately, the institutions that governments rely upon to distribute food subsidies to consumers (henceforth the “parastatals”) have been found wanting in at least three respects: First, they are rife with agency problems that preclude

---

\*Corresponding Author

<sup>1</sup>This paper expresses the views of the authors, and not those of the Asian Development Bank, its member countries, or its directors.

the delineation and/or implementation of rules to ensure an orderly clearing of markets. Second, subsidies are poorly targeted, accruing to the non-poor while the poor are not adequately covered. Third, subsidized food is often pilfered - diverted to secondary markets where those who sell it earn rents. The lack of order complicates redistribution, while the fiscal cost of improving nutrition amongst the poor is magnified by poor targeting (Coady *et al.*, 2004) and pilferage (Olken, 2006). This paper estimates the pilferage of subsidized rice distributed by the Philippines National Food Authority (NFA), and develops a simple model to advance the view that this pilferage signals practical opportunities for welfare improvements.<sup>2</sup>

Empirically, our central finding is that in 2006 households did not report receiving some 48% of the subsidized rice that the NFA officially reports distributing outside the National Capital Region. This is the latest estimate in a perennial, but sparse, literature measuring pilferage. Table 1 provides what is intended to be a comprehensive bibliography. We introduce robustness checks to deal with multiple forms of recall bias, sampling error and reporting error, and find that none of these can account for the missing rice. To our knowledge, Olken (2006) is the only previous author to check his estimates of pilferage for robustness.

Our analytical contribution lies in our interpretation of pilferage. Previous studies all emphasize that pilferage increases the costs of redistribution, either through full-blown welfare simulations (Olken, 2006), or back-of-the-envelope calculations of the cost per dollar transferred to the poor (e.g. Jha and Mehta, 2010). We argue that when the parastatal is opaque with respect to how much subsidized food it pushes to which local market, the existence of pilferage has more prescriptive implications as well. It implies that the amount of subsidized food the government attempts (or claims) to push into the marketing channel is a slack variable, exerting no influence on the amount of subsidized rice the parastatal agents choose to sell to consumers at subsidized prices. It can therefore be reduced without reducing consumer welfare, achieving a one-for-one transfer of resources from pilferers to taxpayers. If the welfare of pilferers is discounted (or if they are relatively rich), welfare improvements can be achieved with minimal, perhaps even negative, administrative cost. Quantity reductions are therefore a better way to achieve fiscal savings than reductions in the consumer price subsidy which can reduce consumer welfare. In theory, a 48% pilferage rate implies that costs can be almost halved.

The paper is structured as follows: Section 2 describes the NFA and its operations. Section 3 describes our data. Section 4 presents our estimates of pilferage,

---

<sup>2</sup>See Mehta and Jha (2010) for a theoretical and empirical analysis of agency problems at the NFA, and Jha and Mehta (2010) for empirical analysis of the NFA's targeting problems.

and checks them for robustness. Section 5 develops a theoretical model to substantiate our normative claims. Section 6 concludes.

## 2. Background: The National Food Authority

NFA operations are large and costly. With a high and rapidly growing population to arable land ratio, the Philippines is the world's largest rice importer, and the NFA has held monopoly rice importing authority since 1972 (Rashid et al., 2007). In 2007 it imported 1.8 million metric tons of rice, or 12.3% of national gross supply. Rice subsidized by the NFA also comprises 6-15% of total national rice consumption in a typical year, depending upon whose estimates of NFA rice consumption are considered. The lower figure comes from the household survey data we analyze in this paper, while the higher figure reflects official distribution statistics. NFA rice consumption rose sharply with global food prices in 2008, and the NFA's operating losses that year are estimated at approximately 0.9% of GDP (Jha and Mehta, 2010).

While the NFA is tasked with achieving multiple objectives and managing multiple programs, we limit discussion here to its subsidized rice distribution operations.<sup>3</sup>The NFA sells rice through accredited retailers, who purchase and sell it at fixed, below-market prices. Customer purchases of NFA rice are not officially rationed, and all Filipinos are eligible to buy it.

Some statistical studies of these subsidized rice marketing operations exist. Most focus on targeting and cost. Jha and Mehta (2010) document significant targeting problems in 2006: 75% of people below the poverty line did not consume NFA rice, and 48% of NFA rice consumers were not poor. The World Bank (2001) conducted a small survey and likewise found that poorer regions had less access to NFA rice and outlets. UN-ESCAP (2000) also notes that poor regions do not receive more subsidized rice. The report shows that targeting errors lead to costs per dollar of subsidy actually delivered to a poor person of \$2.54-\$4.19 depending on the year. Jha and Mehta (2010) argue that if rice is pilfered, the cost per dollar of subsidy delivered will be commensurately higher.

Mehta and Jha (2010) emphasize the chaos and agency problems that are usually attendant to subsidy schemes. They present evidence that notwithstanding the official position on rationing, significant ad-hoc rationing of NFA rice takes place. They also argue that agency problems within the NFA are severe, and support this claim with evidence that the quality of rice and/or retail service is significantly lower in poorer localities and those experiencing higher rice prices.

High rates of pilferage are perhaps the most direct evidence of agency problems. The present study therefore measures pilferage to examine the view that

---

<sup>3</sup>Broader institutional and literature reviews of the NFA are provided by Clarete (2008) and Jha and Mehta (2010).

the NFA is substantially not in control of its distribution channels. As we will demonstrate, this lack of control alters the ranking of different policy options for reducing the fiscal cost of its consumer subsidy program.

### 3. Data

#### *3.1. Household survey data used to estimate consumption*

The 2006 Family Income and Expenditure Survey (FIES) is a multi-stage stratified random sample covering 38,483 households collected by the Philippines National Statistical Office (NSO). Each household was visited twice, once in July 2006 and once in January 2007, responding each time to the same survey instrument. The publicly released FIES datasets contain only annual aggregates of household variables based on these two visits. Each household was asked to self-report the amount of each major food group (including rice subsidized by the NFA) consumed in an average week, as well as unit prices. Unfortunately, only food group expenditure (not quantity or price) data are distributed to the public, precluding estimation of the quantity of subsidized-rice consumed. However, because most NFA rice was sold at a fixed price of 18 pesos/kg, and the rest was sold for a higher price, dividing expenditures by 18 pesos/kg yields usable overestimates of the quantities of subsidized rice consumed.

The FIES stratification ensures maximal representation of the population in terms of geography, livelihood, provincial government and community income. Strata are divided into primary sampling units (PSUs), each of which is comprised of either one Barangay of 500 households or more, or multiple smaller Barangay's put together to reach that figure. The Barangay is the smallest unit of governance in the Philippines. PSUs and households within them were randomly sampled. Overall, this implies that the sample design is unlikely to yield biased estimates of rice consumption because of systematic exclusion of households according location, neighborhood income, or governance arrangements.<sup>4</sup> We use sampling weights in all our calculations that are adjusted to correct for non-response, and to ensure that the total population estimates match census population estimates.

The FIES has three weaknesses. First, a handful of Barangays were excluded from the sample frame because they were too remote to sample. These contain less than 0.4% of the national population. Second, 13.6% of households selected for the sample failed to complete one or both interviews. We will therefore examine whether selective non-response or exclusion can plausibly account for the missing rice. Third, a fire destroyed 58% of the surveys collected for the National Capital Region (NCR) in January, and the NSO extrapolated these

---

<sup>4</sup>See Barcenas (2003) for a detailed description of the FIES sampling scheme.

missing survey responses based on the July surveys of the same households and January-July variations of those households in the same region whose January surveys had already been recorded electronically. We therefore exclude the NCR when calculating our central estimates of pilferage. However, as noted below, one robustness test had to be run with these data included. Because the fire was a random event with respect to the surveys (if there was foul play, the timing of the fire, on the eve of elections, suggests voter rolls, not household surveys were the target), no bias is expected from this procedure, although some loss of precision is implied.

### *3.2. Official distribution figures*

We combined two official sources to estimate the amount of rice distributed. One is a spreadsheet provided to us by the NFA of subsidized rice distribution by month in 14 administrative regions in 2006.<sup>5</sup> We utilize it to eliminate rice officially sent to the NCR, to implement a test to see whether missing rice results from timing recall bias, and to provide some crude insight into where, geographically, rice is pilfered. The other is the NFA's official 2006 Accomplishment Report, which breaks up the amount of rice distributed that year by outlet type, though not by region or month. We use figures from this report to net out rice distributed through school feeding programs, which is not expected to appear in household surveys. The report contains some obvious internal inconsistencies, and the total distribution figures differ slightly from those in the spreadsheet. NFA officials we contacted were unable to resolve these inconsistencies or secure more disaggregated data for us to use. We therefore make conservative assumptions in resolving these inconsistencies and combining the two official datasets: in all cases, our assumptions err on the side of underestimating the amount of rice officially distributed outside the NCR through channels other than school-feeding programs.

### *3.3. Other sources*

We also utilized data downloaded from the Philippines Bureau of Agricultural Statistics' (BAS) CountrySTAT database to assess the accuracy with which general food consumption is reported in the FIES.

## **4. Pilferage**

### *4.1. Central Estimate*

According to official figures, the NFA distributed 1.135 million tons of subsidized rice outside of the NCR in 2006. Nationwide, no more than 85,300 tons

---

<sup>5</sup>These data are not in the public domain, but may be released at the discretion of the NFA to researchers for specific purposes.

was distributed through school feeding programs. Assuming, conservatively, that none of this was distributed through school-feeding programs in the NCR, we estimate annual per capita rice distribution of 14.16 kg/person that should appear in the survey data. Against this, our estimates from the FIES come to 7.29 kg/person, with a standard deviation (adjusted for clustering) of only 0.26 kg/person. This is consistent with an estimated 48.5% of NFA distributed rice not reaching the consumer.<sup>6</sup>

#### *4.2. Robustness tests*

We now test whether our estimates of pilferage are robust to three types of measurement errors. Our tests differ from Olken’s (2006) because our data on official distribution are less disaggregated, and because our household survey data measure expenditures on subsidized rice, while his only measure whether and how often households received subsidized rice.

##### *4.2.1. Recall Bias*

Our NFA rice consumption estimates from survey data could be subject to three forms of recall bias (Deaton, 1997, pp. 24-26). First, there might be a tendency for respondents calculating weekly average consumption to include consumption for periods preceding the recall period (“boundary” or “start-up” bias). This would bias our estimates of NFA consumption up, not down, and cannot explain the missing NFA rice. Second, responders might, for whatever reason, underestimate the aggregate quantity of food consumed in general. Third, they might remember recent purchases better than older purchases, so the timing of NFA rice purchases relative to interview dates could cause problems. We consider the latter two in turn.

To see if underestimation of food consumption is a general problem, not limited to NFA subsidized rice, we compare total rice consumption reported in the FIES data to national figures from the BAS. Because the BAS does not provide sub-national estimates of rice consumption, we use national figures that include the NCR. The BAS reports total rice consumption of 118.7 kg/capita in 2006. Unfortunately, the publicly available FIES data provide only rice expenditures, not quantities. To be conservative, we therefore measure total regional rice expenditures from the FIES, and then divide them by the regional retail price of Well Milled Rice (from the BAS). This procedure yields an underestimate of quantity consumed because Well Milled Rice is more expensive than both NFA rice and the Regular Milled Rice that many households consume. Aggregating up to the national level, weighting by regional population, we underestimate the quantity of

---

<sup>6</sup>Our estimates of pilferage would be even higher if the NCR were included.

rice consumed, at 100.3 kg/person. Thus, under conservative assumptions, FIES underestimates general rice consumption by no more than 15.5%. A generalized tendency towards underestimation of food consumption cannot account for 48% of the rice going missing.

Recall bias due to the timing of the surveys is also unlikely to be the source of the discrepancy, because the July survey coincides with the period of peak NFA rice distribution, per official statistics. To put the argument numerically, we propose a counterfactual in which the amount of NFA consumption that households remember is a weighted average of the true consumption levels ( $c_t$ ) in the current month and each of the five preceding months. The weights may shrink as time passes, so that the weight given to last month's consumption is  $\beta \in [0, 1]$  times the weight given to this month's consumption. When  $\beta = 0$ , the household reports the current month's consumption as the average for the past six months, and when  $\beta = 1$  each month's consumption is faithfully recorded. The weights are scaled down by a factor of  $A = \sum_{t=1}^6 \beta^{t-1} = (1 - \beta^6)/(1 - \beta)$  to ensure that they add up to one.<sup>7</sup> Thus, in a counterfactual world with timing recall bias but no pilferage, reported rice consumption for the year should be

$$C(\beta) = \sum_{T=Jul, Jan} \sum_{t=1}^6 \frac{\beta^{t-1}}{A} c_{T-t+1} \quad (1)$$

The upper line in Figure 1 depicts  $C(\beta)$ , while the middle line depicts  $0.85C(\beta)$  - the subsidized rice consumption level that would be reported in the absence of pilferage if there were timing recall bias, allowing for our 15% maximum estimate of general recall bias. Even both types of recall bias combined cannot account for the missing rice.

#### 4.2.2. Sampling Error

Section 3 detailed three potential sources of sampling error. We have circumvented problems arising from the imputation of data for the NCR by excluding the NCR from our calculations. This leaves the 0.4% of the population was not sampled, and 13.6% of selected households did not respond to at least one of the two surveys. If respondents and non-respondents had similar sampling weights, around 14% (=0.4%+13.6%) of the country's population was excluded. From this we calculate that non-sampled households would have to consume 56.4 kg/person, or 7.7 times what sampled households consumed if survey non-response is to explain the missing rice. Given that survey non-response rates tend to be positively correlated with income (Pyatt, 1999) and that NFA rice is an inferior good, this explanation of the missing rice appears highly implausible.

---

<sup>7</sup>If the weights did not add up to one we would be conflating general recall bias (some consumption gets forgotten) with timing recall bias (averages are based on recent experience).



### *4.2.3. Information Problems*

Survey respondents could underreport consumption of subsidized rice if they are unaware that they are consuming it. We consider two scenarios that can give rise to this situation.

In the first scenario, household members have different preferences and act on them. In this case, it is possible that the shopper might bill the household for regular rice, buy NFA rice, and keep the proceeds for their own ends. If the survey respondent is not the shopper, they would then be unaware of these NFA rice purchases. The social narrative suggests that this is far more likely when men head the household and women do the shopping. If this were even a partial explanation, we would expect it to be absent from female-headed households. In addition, prior literature suggests that women are somewhat more responsive to household nutritional needs than men (Kennedy and Peters, 1992). Given that NFA rice is nutritionally equivalent to regular rice, female-headed households should have a bias towards NFA rice. Therefore, if female-headed households report buying the same amount or less NFA rice than male-headed households, this would suggest that the non-unitary household explanation of missing rice is at least inadequate, if not incorrect. In fact, FIES data reveal that female-headed households, who comprise almost 18% of the FIES sample, buy slightly less NFA rice per capita than male-headed households, and are less likely to buy NFA rice at all.

In the second scenario, the primary food-shopper responds to the survey, but has unknowingly purchased NFA rice. This too seems unlikely, as NFA rice is, by law, clearly labeled as such, and, according to provincial price data from the BAS, was sold everywhere for between 0.54 and 7 pesos per kilogram less than regular milled rice in 2006.

### *4.3. The distribution of pilferage*

Figure 2 presents 95% confidence intervals for estimates of missing rice by NFA region. The wide range of estimates and non-overlapping confidence intervals lend further confidence to our assertion that rice is not missing from the FIES due to some generic reporting error. Generic reporting errors, one might think, would lead to similar estimates of missing rice across regions.

The wide regional disparities in missing rice do not, however, indicate that the problem can be brought under control if pilferage in particular regions could be curtailed. Figure 3 provides a Lorenz curve for the distribution of missing rice across regions. If pilferage rates are unequally distributed across regions, the curve will lie far from the 45° line. The data suggest that while some regions are outliers, most rice is officially sent to regions where rather similar fractions of it disappear.

To gain a sense of where rice goes missing, Table 2 provides the across region population-weighted correlations between estimated pilferage and a range of other variables. These are obviously too crude to represent causal effects, but it is nevertheless worth noting that rice goes missing less often in poorer regions, and that pilferage increases with the amount of rice pushed into the system per capita.

## 5. Policy Implications

It is well established that pilferage increases the average cost of redistribution. Here we argue that the existence of pilferage in an opaque distribution system has even sharper implications for policy: so long as agents determine pilferage levels via a marginal benefit-cost analysis, it implies that budget cuts can be accommodated while increasing consumer welfare. The two strategies for doing this are to improve transparency and to reduce the amount of food the parastatal pushes into its marketing channel. So long as these two options are available, they should be utilized first, before the reduction of price subsidies is considered. This is because: reducing the amount of food pushed into the channel reduces pilferage one for one, raising social welfare (so long as pilferers' welfare is not given much weight); transparency improvements will raise social welfare if they are not costly to implement; and reducing price subsidies can reduce consumer welfare.

A simple and general model demonstrates these points. Assume that the parastatal's agents are interested in maximizing profits. To fix ideas, think of these agents as accredited retailers in a local market, although, with minor notational changes, the model would apply equally to employees further upstream. They are allotted  $N_A$  units of rice per potential customer, and must choose how much of this to sell at the subsidized price ( $N$ ). The remainder,  $N_A - N$ , is pilfered and sold on the regular market at price  $p_R$ . They must purchase their allotment at some procurement price, and the subsidized price is  $p_N < p_R$ . The amount of rice they can sell at subsidized prices may be constrained by their allotment or by the finite demand for subsidized rice,  $N_D$ .

Now, clearly, under these circumstances, the unconstrained agent would find it optimal to divert their entire allocation to the regular rice market (i.e. to choose  $N = 0$ ). Yet, this is not what happens in reality. Consumers receive over half of the subsidized rice nationwide, and between 13% and 100% of it in each region. Previous studies of pilferage all report similar findings (Table 1). It follows that agents must be restrained in the pursuit of arbitrage opportunities. Institutional arrangements and anecdotal evidence supports this view. The NFA has procedures for renewing retailers accreditation (NFA, 2006), and it appears that this accreditation is sometimes not granted if consumers complain enough.<sup>8</sup>

---

<sup>8</sup>To illustrate, one former NFA retailer interviewed for this study claimed that the group of

Consumers also regularly line up outside NFA shops awaiting rations and make their displeasure known when supplies run out. Such opprobrium may have direct costs on retailers, or may harm the reputations of local politicians with whom the retailer is known to be associated.

To capture these sociopolitical risks and costs, we therefore presume a general social penalty function  $S(N, N_A)$ . The penalty decreases in the amount of rice delivered and, holding this constant, increases in the amount of rice that should have been delivered. Assuming diminishing marginal penalties:  $\partial S/\partial N_A > 0$ ,  $\partial^2 S/\partial N_A^2 < 0$ ,  $\partial S/\partial N < 0$ , and  $\partial^2 S/\partial N^2 > 0$ .<sup>9</sup>

The Lagrangian function for this problem is:

$$L = p_N N + p_R (N_A - N) - S(N, N_A) + \lambda_D [N_D - N] + \lambda_A [N_A - N] + \mu N \quad (2)$$

We assume that the penalty for delivering no rice at all is sufficiently stringent that  $S(0, N_A) > (p_R - p_N), \forall N_A$ . In this case  $\mu = 0$  and the Kuhn-Tucker conditions are the two remaining complementary slackness conditions, plus:

$$(p_R - p_N) + \lambda_D + \lambda_A = -\frac{\partial S(N, N_A)}{\partial N} \quad (3)$$

Ignoring, for expositional convenience, the difficult to engineer knife-edge case  $N_A = N_D$ , there are three possible solutions, depicted in Figures 4a-b.

1. The unconstrained solution (Figure 4a;  $\lambda_A = \lambda_D = 0$ ): The amount of rice sold at subsidized prices equates the marginal benefit of such sales (reductions in penalties) with their cost (the foregone arbitrage opportunity). We label this quantity  $N^*$ . In this case  $N_D - N^* \geq 0$  is the excess demand for subsidized rice, and  $N_A - N^* \geq 0$  is pilfered.
2. The demand constrained solution (Figure 4b;  $\lambda_A = 0, \lambda_D > 0$ ): This occurs when  $N^* > N_D$  and  $N_A > N_D$ . In this case  $N = N_D$ , there is no excess demand, and  $N_A - N_D > 0$  units are pilfered. This solution requires, oddly, that substantial social penalties would be imposed on the agent for failing to provide subsidized product in excess of the quantity demanded. This case is therefore intuitively unlikely, but we consider it in the interests of rigor.

---

accredited retailers to which she once belonged had their accreditation revoked. This followed an investigation of the group, allegedly triggered by numerous consumer complaints that the head of the group was selling insufficient subsidized rice.

<sup>9</sup>Permitting the penalty to vary with prices or demand does not qualitatively alter our policy conclusions

3. The allotment constrained solution (Figure 4b;  $\lambda_A = 0, \lambda_D > 0$ ): This occurs when  $N^* > N_A$  and  $N_D > N_A$ . In this case  $N = N_A$ , excess demand is  $N_D - N_A > 0$ , and there is no pilferage.

Now, suppose that the parastatal is completely opaque with respect to its allotments. In this case,  $N_A$ , being unknown, cannot trigger consumer complaints, alter the level of antagonism towards retailers, or effect the reputations of local politicians. Certainly penalties exist in such a world, but they are far more likely to be based upon the amount of subsidized rice delivered to consumers, than upon some unknown amount of rice that is not delivered to them.

Allotments to local markets by the NFA are not public information. As noted, we could only obtain data disaggregated to 15 administrative regions, and these data are not in the public domain. Only one previous study (UN-ESCAP, 2000) appears to have accessed data on distribution by region. In any case, 15 regions is hardly informative when 84 million people live on more than 7,000 islands. Moreover, these allocations are not only invisible, they are also unpredictable. The only public statement we could find on the allotment of rice to dealers is that it is based on several criteria, including “stock inventory, rice allocation, distribution target, supply/demand situation, commercial stocks and prices, etc.”<sup>10</sup> Even if these criteria imply did imply allocation rules, these rules, and the variables they take as arguments, are unknown.

Because, in an opaque system,  $N_A$  does not effect social penalties, it no longer enter the first order conditions in cases 1 and 2. Allotments therefore only alter the amount of subsidized rice received and consumer welfare in case 3, but in this case there is no pilferage. It follows that in a completely opaque system with pilferage, the allotment to a local market is a slack variable and can be cut without harming consumers. Such cuts will, however, reduce pilferage one for one. Thus, they represent a pure transfer from pilferers to taxpayers. The savings from reduced allotments could even be partially applied to deepen the subsidy, thereby benefiting both consumers and taxpayers. Pushing the argument harder, if a smaller program is easier to manage, reducing the amount of food pushed into the system could save on government overheads, and the reductions could save the government more than a peso for every peso the agent gives up in pilferage revenues. A 48% pilferage rate implies that the same level of consumer welfare could be achieved at almost half the subsidy bill.

It is of course possible, in general, that retailers rely on pilferage revenues to cover the fixed costs of marketing subsidized rice. In this case, reducing pilferage by reducing allotments could cause agents to stop selling subsidized rice, which would harm consumers. This appears unlikely in the case of the NFA program:

---

<sup>10</sup>NFA Distribution Flowchart. <http://www.nfa.gov.ph/image/distribution.jpg>. Accessed 3 June 3, 2009.

provincial price estimates from the BAS indicate that in 2006, retail-wholesale markups averaged 1.74 pesos/kg for Regular Milled Rice and 2.16 pesos/kg for Well Milled Rice, while the subsidized NFA price was 3 pesos/kg higher than the procurement price agents pay for it.

Another obvious policy option is to improve transparency. If making information on the allotments to local markets public permits consumers or their representatives to exert larger penalties on the margin, (i.e. if it increases  $|\partial S/\partial N|$ ) the amount of rice sold at subsidized prices will rise. This represents a transfer from pilferers to consumers. However, to the extent that collecting and disseminating this information and imposing penalties are costly, the transfer is less than one for one.

The effects of reducing the price subsidy ( $p_R - p_N$ ), on the other hand, are case specific. In case 2, where demand is binding, subsidy reductions result in movements up the demand curve and welfare is reduced unambiguously. However, not only is case 2 intuitively unlikely, Mehta and Jha (2010) present evidence of excess demand for NFA rice, which rules it out empirically. Case 3 is similarly ruled out by the high rates of pilferage we document. In case 1, subsidy reductions increase the quantity of rice sold at subsidized prices, but the subsidized price itself rises, so that the effect on consumer welfare is ambiguous. In this case subsidy reductions are more likely to be welfare enhancing if marginal penalties decline slowly as quantity is increased. Intuitively, this says that subsidy reductions hurt consumers more where moderate levels of corruption are tolerated because they do not induce large decreases in pilferage.

Our recommendation is therefore that opaque parastatals experiencing pilferage should reduce allotments to local markets while enhancing transparency, and consider reducing subsidies if this is fiscally necessary once the gains from this process have been exhausted. In a second best world, getting prices right need not be the first policy priority.

## 6. Conclusions

We have compared household survey data with official statistics to estimate the fraction of subsidized rice that does not reach consumers in the Philippines. Around 48% of the subsidized rice disappeared. We have introduced new robustness tests that are suitable for use in investigating more opaque schemes - those that do not release disaggregated records showing how much subsidized rice was sent where.

We have also enquired as to the determinants of pilferage. We could not do this empirically, because the organization we study releases too little disaggregated data to permit this. Instead, we have looked into the pilferage decision theoretically. We have argued that when agents' decisions about how much to

pilfer are rational at the margin, and the amount of subsidized rice allotted to different markets is not public knowledge, reducing allotments reduces pilferage one for one, without harming consumers. Reducing and publicizing these allotments therefore is more likely to lead to welfare gains than is reducing the price subsidy itself. This is an important and inadequately appreciated argument - the newly elected Philippines government, in an effort to reduce the fiscal burden of the National Food Authority, is currently considering deep reductions in the rice price subsidy.

Our results are fully compatible with previous authors' argument that corruption increases the cost of redistributive efforts in developing countries. However, our normative analysis proposes a reinterpretation of these costs. Whereas Olken (2006, p.583) concludes that they "may help explain the low level of transfer programs in developing countries", the fact that program size and cost could be reduced, almost by half, without harming consumers, suggests a slightly different conclusion. While corruption may explain why these programs are small, independent of their institutional design, the enormous scope for corruption may also help explain why they are often so much larger than is appropriate given their institutional opacity, and why they are so opaque in the first place.

### **Acknowledgements**

We are deeply indebted to Pilipinas Quising for outstanding research assistance and to Amelia Esteban for helping us to understand and document the functioning of local markets for NFA rice. We are also grateful to Jon Sonstelie for his careful reading of a draft, Dax Maligalig for answering queries relating to the FIES sampling scheme, and to Susannah Hoffman, Heather Royer, P.V. Srinivasan and Ashish Thapliyal for excellent comments and discussions. All errors are our own.

### **References**

- [1] Ahluwalia, D., 1993. Public distribution of food in India - coverage, targeting, and leakages. *Food Policy* 18, 33-54.
- [2] Ahmed, A.U., Bouis, H.E., Gutner, T., Lofgren, H., 2001. The Egyptian Food Subsidy System: Structure, Performance and Options for Reform, in: IFPRI (Ed.), *Research Report*. International Food Policy Research Institute, Washington, D.C.
- [3] Alderman, H., 1988. The twilight of flour rationing in Pakistan. *Food Policy* 13, 245-256.
- [4] Barcenas, M.L., 2004. The Development of the 2003 Master Sample for Philippines Household Surveys, 9th National Convention on Statistics, Manila.
- [5] Clarete, R., 2008. Options for National Food Authority Reforms in the Philippines, in: Rashid, S., Gulati, A., Cummings, R. (Eds.), *From Parastatals to Private Trade: Lessons from Asian Agriculture*. Johns Hopkins University Press, Baltimore, pp. 174-204.
- [6] Coady, D., Grosh, M., Hoddinott, J., 2004. Targeting Outcomes Redux. *World Bank Res Obs* 19, 61-85.
- [7] Deaton, A., 1997. *The Analysis of Household Surveys: A Microeconomic Approach to Development Policy*. Johns Hopkins University Press, Baltimore.

- [8] FAO, 2009. The State of Food Insecurity in the World 2009. Food and Agriculture Organization, Rome.
- [9] Jayne, T.S., Strauss, J., Yamano, T., Molla, D., 2001. Giving to the poor? Targeting of food aid in rural Ethiopia. *World Dev.* 29, 887-910.
- [10] Jha, S., Mehta, A., 2010. Inclusiveness through food security: the case of the Philippines National Food Authority, in: Zhuang, J. (Ed.), *Inequality and inclusive growth in Asia: Measurement, policy issues and country studies*. Anthem Press.
- [11] Kennedy, E., Peters, P., 1992. Household food security and child nutrition - the interaction of income and gender of household head. *World Dev.* 20, 1077-1085.
- [12] Mehta, A., Jha, S., 2010. *Subsidized Food Distribution with Variable Quality: A Case Study From the Philippines*. UC-Santa Barbara, Orfalea Center for Global & International Studies.
- [13] Murgai, R., Zaidi, S., 2005. Effectiveness of Food Assistance Programs in Bangladesh. *Journal of Developing Societies* 21, 121-142.
- [14] National Food Authority, 2006. 2006 Accomplishment Report, Manila.
- [15] Olken, B.A., 2006. Corruption and the costs of redistribution: Micro evidence from Indonesia. *Journal of Public Economics* 90, 853-870.
- [16] Pyatt, G., 1999. *The Distribution of Living Standards Within Countries: An Historical Perspective on a New International Data Base*. Institute of Social Studies, The Hague.
- [17] Rajagopalan, R., 1989. *Indian Sugar Economy: Policy Issues and Impacts*, Working Paper. Indian Institute Of Rural Management.
- [18] Rashid, S., Cummings, R., Gulati, A., 2007. Grain marketing parastatals in Asia: Results from six case studies. *World Dev.* 35, 1872-1888.
- [19] Reyes, C.M., Sobrevinas, A.B., Bancolita, J., de Jesus, J., Dp, 2009. Analysis of the Impact of Changes in the Prices of Rice and Fuel on Poverty in the Philippines. *Philippine Institute for Development Studies*.
- [20] Timmer, C.P., 2010. Reflections on food crises past. *Food Policy* 35, 1-11.
- [21] UN-ESCAP, 2000. *Social Safety Nets in the Philippines: Analysis and Prospects*. United Nations Economic and Social Commission for Asia and the Pacific, Bangkok.

Table 1: Previous Estimates of Pilferage of Subsidized Staples

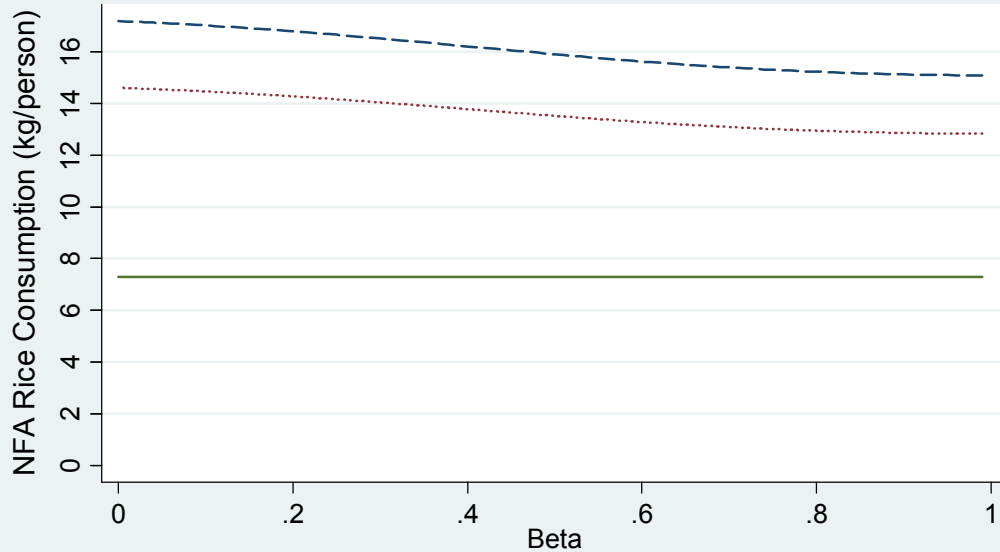
	Country	Product	Percent Pilfered
Olken (2006)	Indonesia	Rice	18%. Lower Bound.
Murgai and Zaidi (2005)	Bangladesh	Food Grains	10-65%. Estimate varies by program.
Jayne et al. (2001)	Ethiopia	Food-aid	18%. Upper Bound.
Ahluwalia (1993)	India	Wheat	32%
		rice	31%
		sugar	34%
		edible oils	51%
Ahmed et al. (2001)	Egypt	Wheat flour, baladi bread, sugar and edible oils	2-47%. Estimate varies by product and location
Rajagopalan (1989)	India	Sugar	44-62% rural. 10-16% urban.
Alderman (1988)	Pakistan	Wheat	69%.

Table 2: Table 2: Where does rice go missing?

Variable	Correlation
Per Capita Rice Allotment to Region	0.217
Poverty headcount index	-0.572
Retail price of regular milled rice - Average for 2006	-.004
Retail price of regular milled rice - July 2006	.090
Retail price of well milled rice - Average for 2006	-.119
Retail price of well milled rice - July 2006	.052



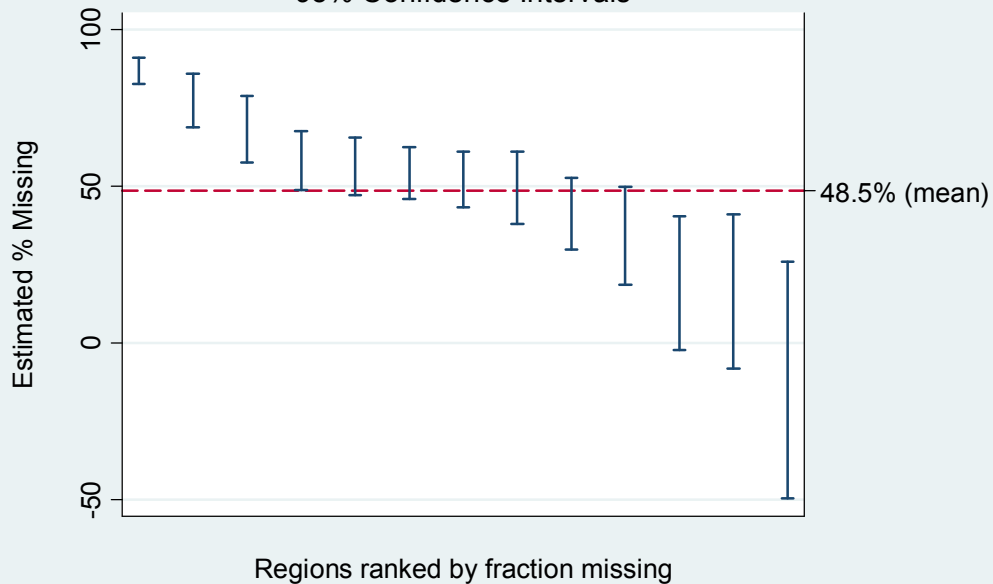
Figure 1. Can timing recall bias account for missing rice?



Note: Top line is counterfactual rice consumption with no pilferage and timing recall bias. Middle line is counterfactual with no pilferage, but with timing recall bias and 15% general recall bias. Counterfactual consumption calculated per equation (1). Bottom line is measured consumption from the FIES.

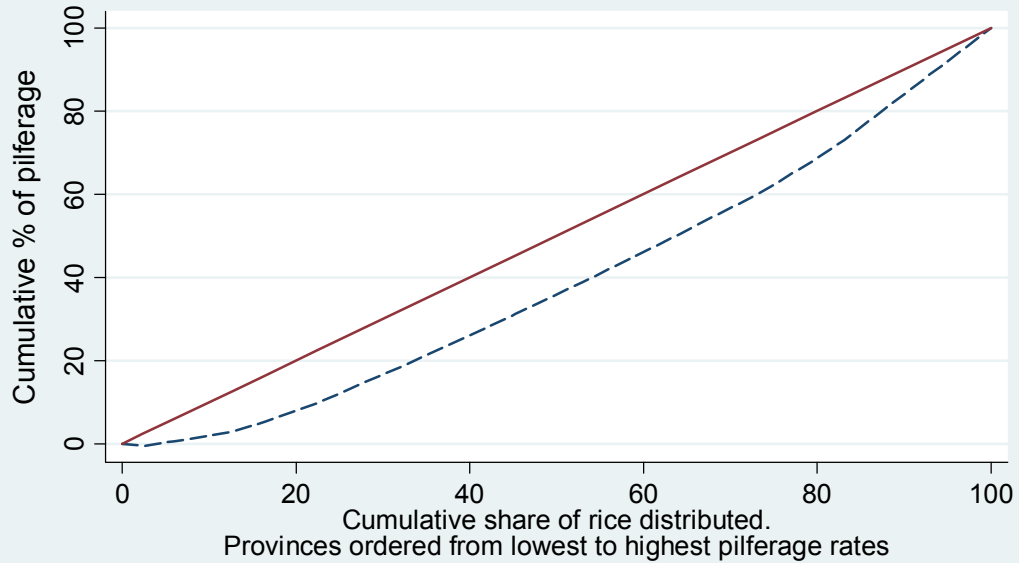
Figure 2: Missing Rice by NFA Region

95% Confidence Intervals



Note: National Capital Region Excluded.  
Source: Authors Calculation from FIES and official NFA distribution data

Figure 3. The distribution of pilferage across provinces



Note: Data from 13 NFA administrative regions, excluding the National Capital Region, but including rice distributed through school feeding programs. Distribution is from official records. Pilferage is estimated as the percentage of official distribution figure not appearing in the FIES data. Solid line is  $y=x$ .

Figure 4: Optimal Subsidized Rice Sales

